Indirect Human Cost of implementing the OV-chipcard in the Netherlands

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Master Thesis Economics & Informatics

Master programme
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27 June 2011

ERASMUS UNIVERSITEIT ROTTERDAM

Abstract

In this master thesis, the research question: what are the Indirect Human Costs (IHC) of the OV-chipcard is answered. This thesis provides a case study for IHC and the effect of IT on the society for the OV-chipcard implementation. The following IHC drivers were detected: training fees, resistance from outside the company, integration time, customer learning, staffs turn over, loss of productivity & recruitment cost. This thesis shows that most IHC drivers of the investigated companies were not estimated and not managed even though some of these IHCs had a significant effect on the total cost budget (e.g. negative news). Therefore, this OV-chipcard research case shows that most IHC drivers of the investigated public transportation companies were not estimated and not managed even though some of these IHCs had a significant effect on the total cost budget. Early identification of IHCs can help these companies to better control their total implementation cost, improve their human resources management in the organization and increase effective service delivery.

Acknowledgements

This master's thesis presents the results of my final project at the Erasmus University Rotterdam.

Firstly I would like to thank my supervisor Prof. Dr. Ir. Uzay Kaymak who has advised and supported me during the creation of this thesis and Dr. Tommi Tervonen to be my co-reader.

Furthermore I would like to thank my family and friends who have supported me. I really appreciate your kindness, specially, Jos Vollering and his family who have been the main supporter from the start until finish my graduation. I would also like to thank my friends, Susanne, Layla, Natascha, Kadesia, Noi, Nui and others who have always support me in good and bad times.

Thanks to the members of the E-transport forum members and the board members and employees from Connexxion, TLS, HTM and RET who gave their valuable time for the interviews. I really appreciate your help sincerely.

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1 Introduction

Until recently the Netherlands has used paper tickets ("strippenkaarten") as the only payment method in the Dutch public transport system. In 2009, the electronic payment system OV-chipcard that can replace the paper tickets was introduced. It will be used in the entire public transport system of The Netherlands such as bus, metro, tram and train.

Trans Link Systems (TLS) was started as a joint-venture of several Dutch public transport companies that are involved with the OV-chipcard. OV-chipcard companies that are involved are currently Connexxion, GVB, RET, HTM, NS, Arriva. Veolia, QBuzz, Syntus. TLS is responsible for the central implementation and exploitation of the OV-chipcard. TLS organizes and leads the meetings with the involved parties. The public transport companies are responsible for all customer facing OV-chipcard applications (e.g. for ticketing and customer service). The OV-chipcard itself is a contactless smart card. Contactless smartcards are now widely used in public transport systems across the world. Other examples of these are the Oyster card in London and the Octopus card in Hong Kong.

The goal of the introduction of the OV-chipcard is to create a single payment system for the entire public transport of the Netherlands. This includes tram, metro, bus and train. According to Cheung (2004), the main benefits of the OV-chipcard are for the customer:

- A convenient way to use the public transportation
- Additional loyalty schemes
- A payment system for other consumer products

Benefits for the public transportation company are:

- Easy introduction of fare differentiation
- Easy income division for public transport companies.
- A better estimation of the use of public transport per day/hour. This information can increase its efficiency.
- Reduce the number of non-paying passengers.

The new OV-chipcard could improve the Dutch public transport system and save costs for the OV-chipcard companies. However, after the implementation of the OV-chipcard several problems have arisen. There have been technical failures, privacy and security problems, and other problems as described by Haan (2008) and De Winter (2010). These problems could lead to more costs than expected. Especially Indirect Human Cost (IHC) drivers are hard to define before the implementation. Therefore, this thesis uses the theory of the main IHCs by Mohamed (2003) and Key Performance Indicators (KPIs) framework by Mohamed and Guah (2010) to define the IHC of the OV-chipcard.

Problems with the OV-chipcard could also lead to a bad reputation of the OV-chipcard in the society, resulting in non-acceptance and resistance to the use of the OV-chipcard. To investigate how Information Systems are adopted and used, it's

important to understand that Information Systems are socially constructed. One needs to understand how people view technology and understand the meaning of technology as described by Weilbach and Byrne (2009). This thesis also investigates the social perspective to the OV-chipcard implementation. The impact on society is determined by investigating the effect it has on employees and customers.
To identify all causes of IHC of the OV-chipcard and the effects of using OV-chipcard system to the society, this thesis is done by interviewing people who are involved in managing, monitoring, operating and using the OV-chipcard. In the case of the OV-chipcard we investigate the effect it has on employees and customers.The conclusions in this document are based on the empirical data gathered from different groups below.

The types of the interviewees are:

1. CEO's and board members of the companies that responsible for OV-Chipcard implementation
2. Employees of public transportation companies
3. Conductors of public transportation companies
4. Working people
5. Students
6. Specialists

The IHC is important to identify because it is part of the investment justification structure. Farrell (2004) identifies all investment elements associated to an investment justification to support decision makers in IT systems. Farrell (2004) also summarizes all the investment elements which make it easy to understand all investment processes in one whole picture.

1.1 Importance of research

The goal of this research is to identify if IHCs have occurred during the implementation of the OV-chipcard in the Netherlands and investigate the IHC of the OV-chipcard implementation. This research also verifies the main causes of the additional IHCs and the main problems that affect the total cost budget of the OV-chipcard companies. Moreover, it describes the effects of using the OV-chipcard system to society.

This research may prove valuable for IS managers to help improve their human resources management in the organization, increase effective service delivery and control their total implementation cost. This thesis provides a case study on IHC and IT effect on society. This research addresses IHC drivers that are rarely seen in popular studies and applies this theory to a real-life situation.

The results of this thesis may be useful for the implementation of OV-chipcard companies that are already involved in the OV-chipcard as well as future transport companies that are going to introduce the OV-chipcard. These companies can use the results of this thesis to support decision making and this can help to prevent cost over-run of the OV-chipcard implementation. The report also shows the effect of the OV-

chipcard to society. The more OV-chipcard companies understand what society want, the better service they can provide and the more successful they can become. A bad reputation of the OV-chipcard could also lead to non-acceptance and resistance by society.

1.2 Main questions & sub research questions

This thesis investigates the IHC for the OV-Chipcard implementation in The Netherlands. The main research question is therefore:

- *What are the IHCs of implementing the OV-chipcard in the Netherlands?*

To answer this question we will also investigate the following sub-questions:

- *What are the main causes of the additional IHCs of the OV-chipcard?*
  This question helps to understand whether or not IHC drivers are estimated and whether the IHC are managed.
- *What main problems affected the total cost budget of the OV-chipcard companies?*
  This helps to understand the importance of the IHC drivers in relation to the total cost budget.
- *How the OV-chipcard affects to society[1]?*
  The effect on society can be used to identify causes of IHC. E.g. what causes resistance from employees and customers to the OV-chipcard.

1.3 Scope

This thesis provides a research case for the effects of IHC in the transportation sector. The case applied is the implementation of the OV-chipcard in The Netherlands. The investigation was done based on the theory of Mohamed and Guah (2010) and Mohamed (2003). This research case uses their framework of cost factors to investigate the different IHC drivers. The theory of Du Plooy (1998) is used to support the identification of IHC drivers. The research case is based on interviews with stakeholders within the OV-chipcard public transport companies, employees, specialists and users of the OV-chipcard.

1.4 Methodology

This thesis uses interviews to investigate the research questions. The interviewees are people who are involved in using and implementing the OV-chipcard in the Netherlands. The interviewees are selected following the theory of the human environment of IT adoption described by Du Plooy (1998). The theory explores the

[1] *In this thesis society is represented by employees and customers*

different dimensions of the socio-economic context and in which dimensions the process interacts with the society.

To identify all the IHC that has occurred during the start of the project, the implementation and current operation, this research relies on the framework of Mohamed and Guah (2010) and combines with main drivers of IHCs described by Mohamed (2003) to investigate the real-life situation of the OV-chipcard in the Netherlands. Empirical data is still needed in service sectors to verify these frameworks. This thesis contains the OV-chipcard case study for these frameworks.

1.5 Thesis outline

The outline of the thesis is as follows. Chapter 2 contains a summary of relevant literature related to the OV-chipcard. Chapter 3 describes the IT cost framework and the position of IHC in this. Chapter 4 focuses on theories that describe the effects on society. In chapter 5, the research design is outlined. In chapter 6 the selected theories of IHC and the effect of IT on society applied to the OV-chipcard in Netherlands. It shows the research results and its interpretation. Chapter 7 describes the conclusion and possible further research on the OV-chipcard and selected theories.

2 The OV-chipcard in The Netherlands

This chapter describes what the OV-chipcard technology consists of, the different research that has been done the OV-chipcard and the problems that can be identified from the research.

2.1 OV-chipcard technology

TNO report 34643 (2008) describes that the OV-Chipcard uses a contactless smart card. There are three types of OV-Chipcard:

- **A personalised card**: based on Mifare Classic 4K support by manufacturer NXP, initially created by Phillips Semiconductors.
- **An anonymous card:** has the same characteristic as a personalised card.
- **A disposable card:** based on Mifare Ultralight but a less sophisticated version than a personalised and an anonymous card.

Contactless smart cards are currently being used for electronic payments e.g. in the public transportation companies and by banks and retail as described in Olsen (2007). Jacobs (2009) asserts that the OV-Chipcard in the Netherlands uses the RFID Mifare Classic because it was cheap and has been widely used around the world, including in other public transport systems in London, Boston and Beijing.

According to Heck, Li and Vervest (2009), the Octopus card in Hong Kong, the Oyster card in London, and the OV-chipcard in the Netherlands have different value strategies. Octopus is focused on expansion into new service areas, the Oyster card is focused on a price differentiation strategy, and OV-chipcard is centered to the baseline strategy (providing access and fare collection). The smart card has been introduced between 1997 and 2006 and the authors compare the ticketing technology to show the advantages and disadvantages of different ticket types.

2.2 OV-chipcard research in the Netherlands

In December 2005, the OV-chipcard was successfully introduced in the public transport system of Rotterdam, The Netherlands. The OV-chipcard is still being used to date. A study has been conducted to analyse the customer and operator cost and benefits of the introduction of the OV-Chipcard as reported in Cheung (2004). Another study analyses the customer satisfaction after introduction is described in Cheung (2007). However, the approaches used in these studies make limited use of cost benefit analysis and indirect costs are not described. Several changes and issues have been in the news since the introduction in 2005 (e.g. security concerns). For these reasons, a further investigation and an update of the cost and benefits analysis is reasonable.

Jacobs (2009) research informed that the OV-Chipcard privacy is not good enough at many levels. TNO (2008) exposed many weaknesses of the Mifare Classic 4K used for the OV-Chipcard with the help of the German Computer Club in November 2007. After this, the TLS Company asked the Dutch independent research company TNO to investigate the vulnerabilities of the OV-Chipcard. The conclusion of TNO commission was that the current of the OV-Chipcard security has to be replaced with more vigorous security.

Even though a lot of research was done to the OV-Chipcard, there is no specific research about what IHCs are of implementing the OV-chipcard and the root causes of problems are. This provides an opportunity for investigation in order to better govern the total costs of the implementing of OV-Chipcard.

2.3 OV-chipcard problems

2.3.1 Indirect human cost (IHC)

The cost of the OV-chipcard can be direct and indirect. Examples of direct cost are the Information System (IS), chip cards, card detectors, the introduction project, etc. Indirect costs are the cost associated with the development of the IT system that was not in the IT budget as reported in Mohamed et al. (2002). For example additional privacy, security hacks and integration cost. Some of this cost can be identified but the effect of this on individuals and organisation is not fully clear. It is difficult to identify and calculate cost that is indirectly related to the human involvement within the process. These IHCs have impact on the success of IT projects as shown in Irani et al. (2001).

In January 2008 the plan was to implement the OV-chipcard in all transportation systems of the Netherlands but this project was delayed because of problems such as: technical failures, customer interaction, privacy and security problems as described by Haan (2008), Badcock (2009) and De Winter (2010).

2.3.2 Security

All OV-chipcard problems can lead to extra IHC. However in the research there are no reports of what the extra cost are to make the OV-chipcard better. Following are examples of security problems.

On May/June 2007, two students of the University of Amsterdam (UVA) identified a security problem that gives unlimited free travel to customers because the software in the toll gates was easy to hack. A mistake in the RFID implementation also allowed free travel in the Dutch public transportation system as described by System & Network Engineering (2006) and Siekerman and van der Schee (2007). After this

Trans Link Systems (TLS) immediately changed their software architecture. However, there is no report about the amount of extra costs for the company.

In December of 2007, two Germans revealed another weakness in the chip of the OV-chipcard which enabled a spoofing attack and sampling errors in the hardware. They identified the region of the chip implementing this. TNO investigated this matter for TLS (TNO, 2008). Research reveals that all the OV-chipcard security rules have to be adjusted to create a better encrypted card. The additional research and changes in security resulted in unidentified extra IHC for the OV-chipcard implementation.

In January 2011, the OV-chipcard was hacked again. At this time, hackers published an application to the general public that allows customers to manipulate information on the card by using a RFID reader/writer. Customers could use this to travel for free as reported by Dekker (2011)

2.3.3 Increased cost

In January of 2009, a monthly business journal on public transportation, the Railway Gazette International, Badcock (2009) criticised the OV-chipcard implementation in the Netherlands. Their criticism concerned the budget overrun, implementation delays and lack of clear leadership.

Badcock (2009) reported that in July 2003, the East-West consortium contract of Thales, Accenture and Vialis with the government was signed for the initial development cost of more than €120m. This is more than the budgeted €80m cost for implementation in the Netherlands. The implementation of the OV-chipcard has been delayed for 5 years and the cost of the project has now increased to more than €1bn.

Badcock (2009) describes that in May 2008, the government assigned a commission to evaluate the potential increase of the cost budget. The result of the research shows that the original starting budget of the OV-chipcard was €249m but the extra overrun cost €100m in 2006-08. 75% of the extra cost was caused by the introduction in Connexxion, RET and GVB. In addition to this, the NS has spent €726m for the introduction of the OV-chipcard on the rail network. This results in a total cost of almost €1.1bn.

Research has shown that on average, the cost of travel by bus, tram, metro or train for customers has increased significantly as described in Trouw (2010).

2.3.4 Implementation delays

The original plan was that the OV-chipcard would be used instead of the paper ticket strippencard by 2008. Reports claim that extra cost was caused by added complexity, fraudulent travel and under estimation of the project complexity. Currently, an extra cost of €18m per year is needed for the project until 2017. This is contrary to the initial calculations that expected that the annual cost of €33m were outweighed by benefits of €55m per year as shown in Badcock (2009).

2.3.5 Lack of clear leadership

Another problem of implementing the OV-chipcard is lack of clear leadership.

The OV-chipcard project was started and is governed by the public transport companies Connexxion, RET, GVB and NS with each an equal stake in the Trans Link Systems (TLS) company and therefore an equal vote in the decision making.

Even though Connexxion claims that it still supports the OV-chipcard, they decided to stop its project team and sold their stake in TLS. They are still involved as they did roll out the OV-chipcard in their public transport. RET, GVB and NS have bought the Connexxion stake. After this, the remaining companies have tried to find the reimbursement for the missing partners share of the costs from the Transport Ministry.

Badcock (2009) reported that during this period, a commission has given the recommendation to improve a number of organizational policies. It concluded that there were too many thinkers and talkers but absence of noticeable leadership. At the same time TLS, 19 regional governments, large numbers of operators and 8 consumer deputy groups have expressed concerns of the project in the discussions over the years. All of these problems could lead to extra costs, delay of operation and less trust. The consequences could be loss of benefits and failure of implementation of the OV-chipcard.

2.3.6 Customers dissatisfaction

A research document from Meijers research (2009) shows that 39% of customers dislike the OV-chipcard. The reason for this is associated to the image of the public transport. If people have a positive image and are interested in a new system, they are more willing to accept the OV-chipcard system than the people with a negative image of the OV-chipcard which is influenced by media. The acceptance is measured from customer satisfaction. The adoption and use of the OV-chipcard will become when its problems lead to a bad reputation of the OV-chipcard. This affects the success of public transportation in the Netherlands.

2.4 Chapter summary

This chapter provided the literatures reviews about the OV-chipcard technology, OV-chipcard research in the Netherlands and OV-Chipcard problems.

A general overview was given on the OV-chipcard and related problems. There is no specific research available today about what IHCs are and the root causes of problems are of implementing the OV-chipcard.

3 IT cost frameworks

The use of Information Systems (IS) is common nowadays and becoming increasingly important in the service sector to differentiate from competitors. Often, introduction of a new IS has not provided the expected business benefits. The IS solves a problem but creates new problems as described by Berghout and Renkema (2001). The quantification of both the cost and benefits of investments in IS is difficult. Direct costs are usually quantified but often, management gives less attention to the hidden and indirect costs. In most cases there is no framework to evaluate the IT investment as stated by Irani and Love (2000). Examples of 'indirect' cost are: loss in productivity when employees have not been sufficiently trained, management time needed or organizational changes as a result of the change. Overlooking the 'indirect' cost can have large consequences for companies. The identification of the root cause of these additional cost influences the recognition of the importance of this as described by Love, et al (2006).

This chapter describes several different IT cost frameworks, mainly focused on IHC and selects the best fit to use for this case study.

3.1 Investment Framework

Bugamelli and Pagano (2004) argue that an absent component of investment may inhibit as obstacle to investment in ICT. Further, Sauer (1993) reports that many ineffective or failing IS are often caused by managers and users that have little involvement in the IT investment decision but let the decision to IT professionals themselves who will miss key cost and benefit components. The research of Fitzgerald (1998) declares that many companies poorly identify their IT costs. They only include hardware and software in their budget and hesitate to include the other costs into the budget to avoid further responsibility on their department.

According to Farrell (2004), investment in IT and IS is more complex than other investments because they can contain a large amount of intangible and non-financial benefits. Investments are focused on the costs and the benefits. Indirect cost is associated by the use of IT/IS which is difficult to measure. The author states that the traditional methods of valuing IT/IS investments are inadequate with the complexity of information systems. The reason for this argument is that most IT/IS investments require long-term strategic benefits, but the traditional techniques focus on the short term strategic benefits as descried in Lefley (1994).

The author also shows the list of traditional appraisal techniques: mixture of finance and strategic management ones. The last three are intangible ones.

1. Cost Benefit Analysis (CBA)
2. Return on Investment (ROI)
3. Return on Capital Employed (ROCE)
4. Payback

5. Net Present Value (NPV)
6. Internal Rate of Return (IRR)
7. Compliance to Standards
8. Risk Avoidance
9. Scare Tactics

Farrell (2004) also shows the framework to identify elements associated to an investment justification to support decision makers in IT systems. Further, the author states that if an investment is not justified then the project cannot be implemented and an attempt must be made to identify further benefits. This forces the management of the justification of the investment. This framework is not as complex as traditional investment techniques. Figure 1 presents these components.

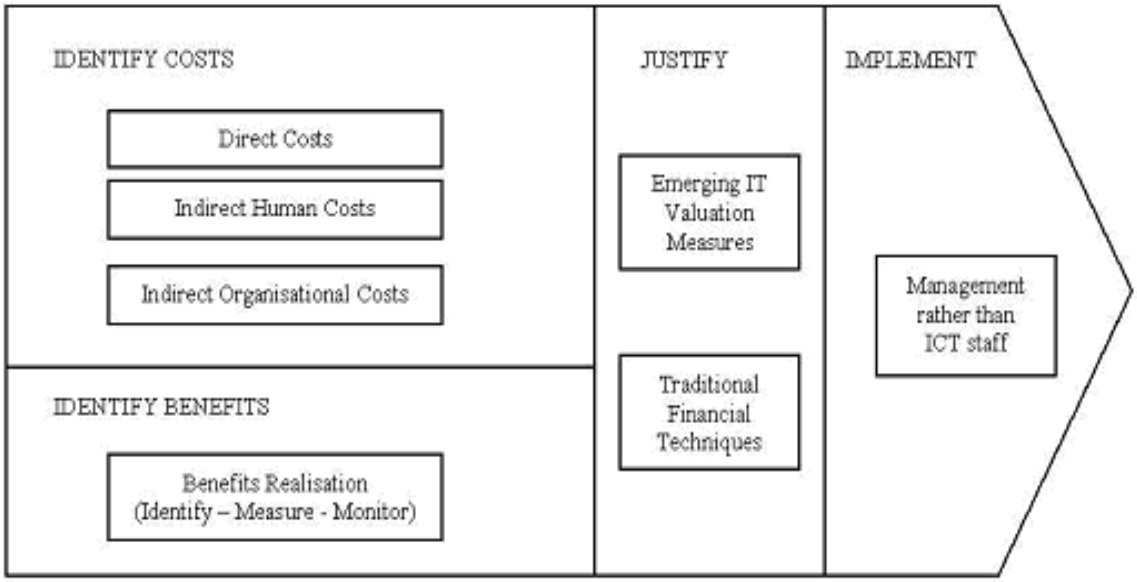


Figure 1: An investment justification framework by Farrell (2004).

3.2 IHC frameworks

The model needed for this research document must have a specific focus on the IHC. Several research models could be applied that focus specifically on this type of cost:

3.2.1 Evaluation of investments in manufacturing resource planning

Irani & Love (2001) identifies IT costs, direct costs (Table 1), IHCs (Table 2) and organization costs (Table 3) as follows:

IT cost Identification
IT costs are costs associated with the architecture and infrastructure of the system that focus on:

- Hardware and software performance required to process types;
- Data volumes of transactions;

- The development work content needed to provide a given set of functions;
- Shared processing facilities, for example, terminals peripherals and networks;
- Functions that are extra to a given users' immediate requirement. For example, mandatory security facilities;
- System design factors that might protect performance in the long-term but which have short-term development costs;
- Ongoing operating expenses;
- The balance of development costs against eventual maintenance costs;
- Weakest links in the network topography;
- Network architecture and associated hubs, routers and gateways;
- File server facilities, and in particular, dedicated servers; and
- Network security such as firewalls.

Table 1: Taxonomy of direct IT costs by Irani and Love (2001).

Classification of Direct IT Costs	
Environmental operating costs	Un-interruptible power supply
Hardware costs file server	File server, dumb terminals, back up tape streamer, network printer
Software costs	Key vendor software modules, relational database software, additional networking software
Installation and configuration costs	Consultancy support, network wiring, junctions and connectors, installation hardware, 'in-house' customising time, re-engineering of business and processes to suit software
Overhead	Running cost: Electricity; insurance premium rises consumable's, toner cartridges, disks and paper
Training costs	Database software course
Maintenance costs	Yearly service contract (hardware) database user group fees

Table 2: Taxonomy of indirect human costs by Irani and Love (2001).

Indirect Human Costs	IT Cost Factors
Management staff resource	integrating computerised administration and control into work practices
Management time	devising, approving and amending ITrIS and marketing and
	procurement strategies
Cost of ownership: system support	vendor support troubleshooting costs
Management effort and dedication	exploring the potential of the system
Employee time	detailing, approving and amending the computerisation of estimating,
	cost planning, planning and project contract administration
Employee training	being trained to manipulate vendor software and training others
Employee motivation	interest in computer-aided estimating and planning reduces as time passes
Changes in salaries	pay increases based on improved employee flexibility
Staff turnover	increases in interview costs, induction costs, training costs
	based on the need for skilled human resource

Table 3: Taxonomy of indirect organizational costs by Irani and Love (2001).

Indirect organisation costs	IT Cost Factors
Productivity losses	Developing and adopting to new systems, procedures and guideline
Strains on resources	Maximising the potential of the new technology through integrating information flows and increasing information availability
Business process re-engineering	the redesign of organisation functions, processes and reporting
	Structures
Organisational restructuring	covert resistance to change

The framework concentrates on the evaluation process which develops a deeper insight for the research area in the construction industry. Further, the authors also give a review on benefit and cost perspective for IT assessment in the construction industry. However, this framework is not developed to investigate the IHCs in the service sector. This framework should therefore not be used to investigate the OV-chipcard companies.

3.2.2 Indirect ICT costs using the structured case method

Ghoneim et al. (2006) argues that IT managers are incapable of making decision based on the true costs of ICT. They have insufficient knowledge and insight in the ICT cost association. The authors revise the existing framework (CF1) and classify the indirect human and organization costs into an additional framework (CF2). This CF framework focuses on indirect costs and displays a conceptual framework in IT assessment.

The following are the IHC (Table 4), indirect organization costs (Table 5) and indirect cost components (Table 6) according to Ghoneim et al. (2006).

Table 4: CF1: Classification of indirect human costs.

Indirect human costs	**IT cost factor**
Management/staff resource	Integrating computerised administration and control into work practices.
Management time	Devising, approving and amending IT/IS and marketing and procurement strategies.
Cost of ownership: system support	Vendor support/trouble-shooting costs.
Management effort and dedication	Exploring the potential of the system.
Employee time	Detailing, approving and amending the computerisation of estimating, cost planning and project/contract administration
Employee training	Being trained to manipulate vendor software and training others.
Employee motivation	Interest in computer-aided estimating and planning reduces as time passes.
Changes in salaries	Pay increases based on improved employee flexibility.
Staff turnover	Increases in interview costs, induction costs, training costs based in the need for skilled human resource.

Table 5: CF1: Classification of indirect organizational costs.

Indirect organisational costs	**IT cost factor**
Productivity losses	Developing and adapting to new systems, procedures and guidelines.
Strains on resources	Maximising the potential of the new technology through integrating information flows and increasing information availability.
Process re-design	The re-design of organisational functions, processes and reporting structures.
Organisational re-structuring	Covert resistance to change.

Table 6: CF2 Indirect cost components.

Indirect cost components	
Human	**Organizational**
Employee time	Loss of productivity
Training & Skill Development	Strain on Resources
Motivation	process/ Role Redesign
Salary Changes	Organizational Restructuring
Moral Hazard	Staff Turnover
Resistance	Integration
Redundancy	Disruption

CF2 components separate indirect costs into organizational and human costs, and add extra cost factors. However, there are no clear details of how to find the root cause of indirect human and organization costs in CF2 model, this framework could therefore not be the best choice to be used for the investigation of the IHC of the OV-chipcard.

3.2.3 Evaluation cost taxonomies for information systems management

Ghoneim et al. (2006) identify a void in the literature and present a critical analysis of IS-cost taxonomies. The authors state that the cost taxonomies tend to be limited and difficult to use because some frameworks lack specifics in detail. Therefore, the authors develop a deeper understanding of IS- associated cost by making a reference framework to support the evaluation of information systems.

The focus of this research is summarizing the similarities and different cost factors in various taxonomies from different authors. The authors have made the comparison lists of cost taxonomies. The aim is to provide a clear vision for decision-makers to get a better insight in the investment costs involved with information systems.

The authors identified eight IS-cost taxonomies that better help to understand IS-related costs.

1. Initial / ongoing costs
2. Financial/non-financial activities
3. Initial investment/ongoing costs
4. Development/hidden costs
5. Social subsystem costs
6. Direct/indirect costs
7. IS cost divisions: Management, employee, finance, and maintenance.
8. Acquisition/administration: control and operation costs

To evaluate the information system, the author suggests merging the evaluation approaches, for instance the balanced scorecard and information economics. As a result of the integration approaches, the indirect/hidden costs in information systems are accommodated.

Table 7: Mapping indirect human costs to IS divisions by Mohamed and Irani (2002).

Indirect human cost elements	Cost category			
	Management	**Employee**	**Finance**	**Maintenance**
Time	√	√		√
Learning	√	√		√
Resistance	√			√
Control system	√			
Effort and dedication	√			
Re-define roles	√	√		
Training		√	√	√
Allocation of employee		√		
Integration		√		√
Change in salary			√	√
Staff turnover			√	√
Loss in productivity	√	√		√
Displacement	√	√		
Reduction in knowledge	√	√		
Deskilling		√		
Redundancy	√	√		√
Morale hazard	√	√		
Disruption	√	√		
Belief, feeling, and perception		√		

The cost factors listed in Table 7 are not yet included in a single cost taxonomy. According to Mohamed and Irani (2002), the framework enables an organization to allocate IHCs per organizational sections. There are four cost categories: Management, Employee, Finance, and Maintenance (MEFM). The MEFM framework could be used to investigate the root causes of the IHCs of the OV-chipcard.

3.2.4 Key Performance Indicators and indirect human costs

Mohamed and Guah (2010) build a theoretical framework for corporations in the service sector based on their entrepreneurial, administrative, and service delivery demands. This theory is suitable for organizations with a dynamic environment and supports critical services within a straight monitoring setting.

This theory describes the implications of controlling IHCs to IS implementation and managing the delivery processes which is critical for decision-makers. This results in a broad scope of different costs and is considered appropriate for managers in the service sector. The authors state that there is an increasing need to further identify strategies that could be used to better manage indirect costs that are associated with IS implementation.

This IHC theory was developed on the theory originally proposed by Mohamed (2003). It provides a deeper understanding of the IHCs of IS. It classifies them in the

main categories staff turnover costs, introduction of a new system, and training and helps find the key root causes.

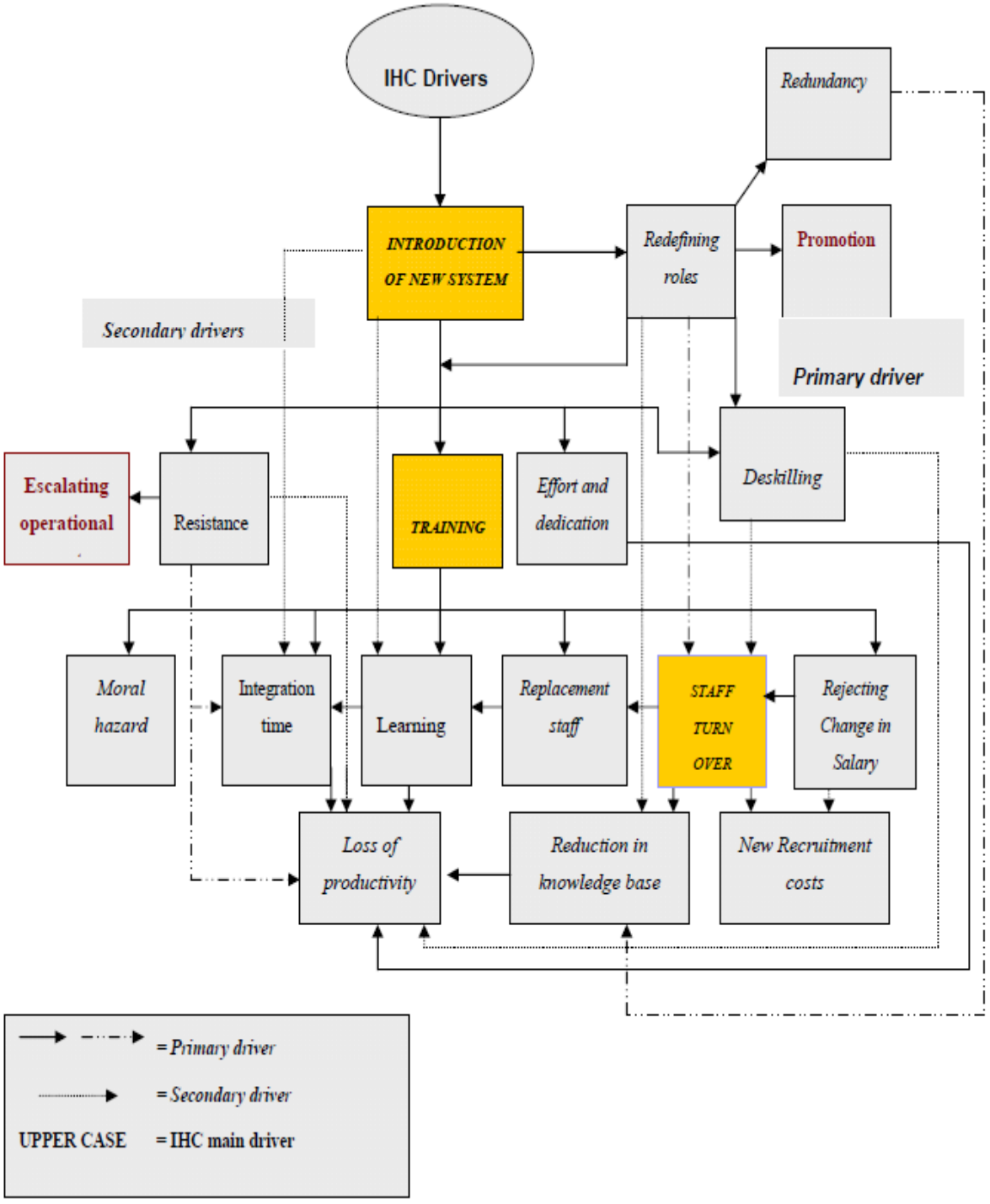


Figure 2: Main drivers of Indirect Human costs by Mohamed (2003).

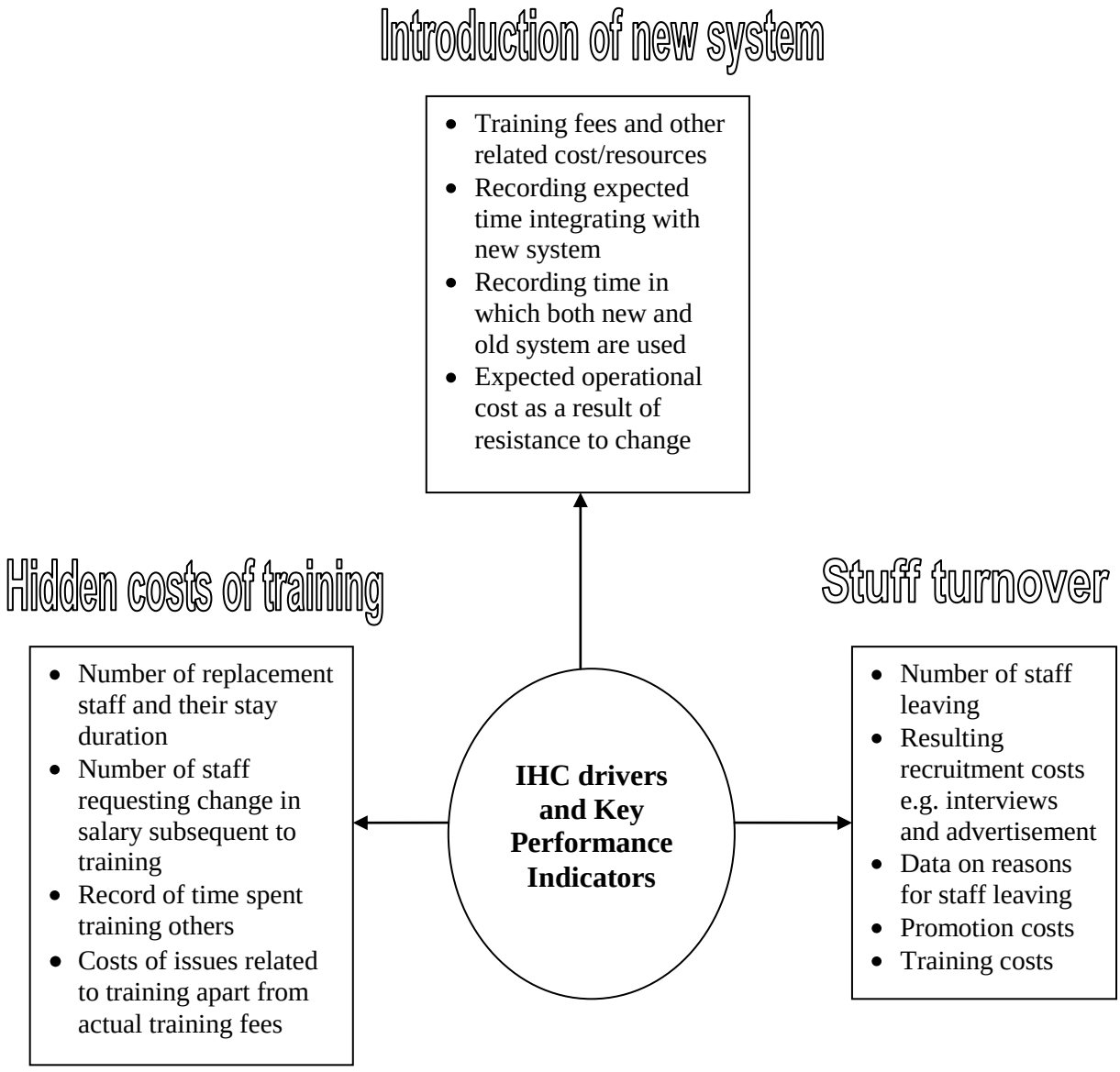


Figure 3: KPIs for IS/IT IHC management by Mohamed and Guah (2010).

Introducing a new System

The impact of introducing a new system in the organization can be monitored. The performance is measured as below.

The organization considers all training costs required for the new system. This includes the actual training fees but also accommodation costs for external training, travel costs and any other costs that the trainee could claim back from the organization. Bannister et al. (1998) have suggested that the organization keep a record of the time used for monitoring, learning, delay and integration costs.

After this, the number of the hours spent training (i.e. not doing their everyday job) can be multiplied by the employee cost. This shows how much the process of transferring the training costs to the organization. Also, the organizations should pre-calculate the time they foresee that the new and old system will be working at the same time. The cost associated with this should be budgeted in the new systems implementation. Additionally, resistance to the introduction of a new system can result in a non-operational working environment and this could lead to expanding operational costs.

Hidden costs of training
To calculate the hidden cost of training, the organization should register and calculate the cost related to training:

- Record the cost of replacement staff required during the training of the IS staff.
- Record of the number of staff salary increases as a result of newly learnt skills and the % added in their salaries.
- A time recording system can be used to monitor additional cost associated with loss of productive hours for training, for instance: delays, learning on the job.
- Additional expenses, e.g. hotel and transportation cost if the training is held off-site.

Staff Turnover
Staff turnover is the number of staff leaving as a result of gaining new skills. This should be registered by the organization. The organization can do this by recording the reasons for leaving. This can indicate if the reason for leaving is related to the introduction of the new system or not. Additionally, the recruitment costs (e.g. interviews & advertisement) for replacing employees should be recorded and added to this.

These performance indicators seem very simplistic. However, they have effect on estimation of the costs in the organization in service industries. The indicators can be used to monitor many of the IHC KPIs in organizations. This framework needs more empirical data for its validation and more constructs for KPIs and root causes of IHCs need to be developed.

3.3 Selected models

During the last years, different research models have been constructed to identify indirect cost and IHC. However, the application of this research has been limited so far. Only few empirical studies have been conducted. The analysis of the IHC case of the OV-chipcard in the Netherlands can strengthen the research models. This research will go one step deeper as it will also investigate the causes behind the IHC of the OV-chipcard implementation and give an overview of the implementation risks of the OV-chipcard on employees, customers and business.

Evaluation of expenditure of IS projects is important for competitive advantage. IS budgeting can be improved by studying IHC of IS implementation in the service sector. The IHC frameworks by Mohamed (2003) and Key Performance Indicators (KPIs) framework from Mohamed and Guah (2010) are selected because combining these two frameworks would help to better understand and identify the IHCs and the root causes for additional cost in the implementing of the OV-Chipcard in the Netherlands.

3.4 Chapter summary

This chapter provides the literatures review about cost frameworks. Cost management areas can be divided in four different areas: direct, indirect, human and organization costs. In order to get insight why the IHC is vital to investigate in an IT project, one should investigate all elements associated to it. Traditional investment frameworks and techniques are sufficient to identify the hidden costs in IT systems which are caused by the indirect human and organization costs. The frameworks on UHC defined by Mohamed (2003) and Key performance indicators (KPIs) as described by Mohamed and Guah (2010) are selected as the frameworks for the case study.

4 IT system effect on society

4.1 Introduction

The effect of IT systems on society can be used to identify IHC drivers for an IS implementation. Investigation of the effect on society reveals the impact that the IS has on its users; in the transportation sector both employees and customers.

The effect of IT on society is described by the IT adaptation framework as published the journal 'A human environmentalist approach to diffusion in ICT policies' Weilbach and Byrne (2009). This model was originally created by Du Plooy (1998) and successfully applied to investigate the Free Open Source Software policy of the South African Government. This model was also widely applied to other IS innovations in other contexts; e.g. Weilbach and Byrne (2009), Ramos (2005) and Marais (2005). This model explores the different dimensions of the socio-economic context in which IT, the organization and the human environment interact.

4.2 IT systems effect on society.

Du Plooy (1998) theory states that the adoption and use of IT is carried by understanding the changes it causes in structure, culture, work processes and power bases in an organization. This theory defines a 'human environment model' to explore the different dimensions of the socio-economic context and in which dimensions the process interacts. The theory is used for qualitative research where the different dimensions of the socio-economic context are investigated in depth. Du Plooy (1998) used this framework successfully to investigate the South African Government Open Source IS innovation.

This theory states that for the successful adoption and use of IT, humans should understand the diffusion in social context of IT and its implementation in its whole picture. The social contexts are: information technology, organizations, groups, environment, tasks and individuals. Applying all six characteristics supports better adoption and use of IT.

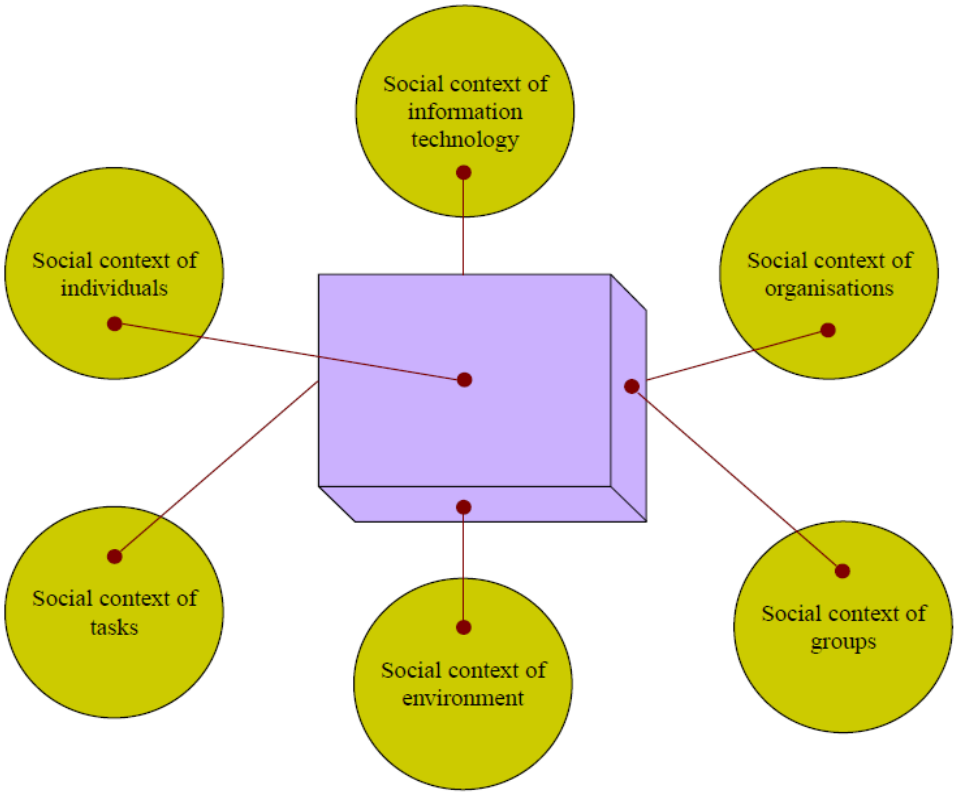


Figure 4: The human environment of IT adoption and use by Weilbach (2009).

Du Plooy (1998) clarifies the human environment of IT adoption and use Model as follows:

1. **Individual characteristics:** Ethnic culture; world views of agent of change and the intended user; technological frames of agents of change; power bases; empowerment and disempowerment; 'sensemaking'; infusion
2. **Innovation characteristics:** Non-deterministic aspects of information systems; determining capabilities of IT; influence of IT on: values and judgment, business processes, organizational learning, internal communication. Empowerment/disempowerment of workers through information systems.
3. **Task characteristics:** Changes in work content. The IT application in different work situations, e.g., individual office work.
4. **Organizational characteristics:** Organizational - culture; politics; learning; norms and values; information politics; emergence. The adoption of organization to the technology.
5. **Environmental characteristics:** The influence of unions; disintermediation; competition from outside IT suppliers; industry innovations; influence of institutions.
6. **Group characteristics:** Powerbase of groups, Technological frames; relevancy; shared understanding by a group of the solution offered by the systems; 'sensemaking'; partnership; resistance to change; ethnic culture; attitudes towards management, users and the IT division; user ownership of systems

When we understand the human environment and its interaction with the adoption and use of processes, we will be able to support and teach an environment to enable the adoption and use of this technology. The adoption and use dimensions cannot be considered apart because these two dimensions contained and embedded in a human environment as described by Du Plooy (1998).

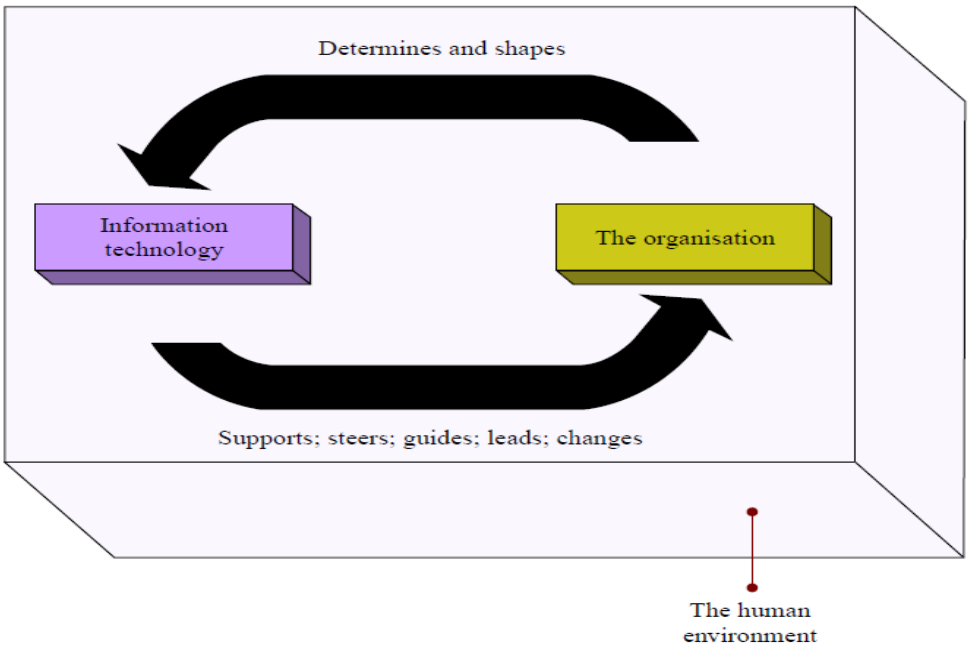


Figure 5: The human environment encapsulating IT adoption and use by Du Plooy (1998).

The Du Plooy (1998) framework from Figure 5 describes the recursive relationship between IT and the organization during the process of adoption. The use of IT is combined with the human environment framework to display that the human environment indeed encapsulates the process of IT adoption and its use. The upper arrow of Figure 5 shows that the IT is socially constructed. Furthermore, the lower arrow displays the effect of IT on the organization. This is dependent on the environment where this is done.

4.3 Selected model

The theory of the human environment of IT adoption by Du Plooy (1998) is used to find the social perspective of IT adoption. This is used to explore the different dimensions of the socio-economic context and in which dimensions the process interacts to society. The IT manager could use this model to realize all social factors that could be managed during the implementation of the IT system. Thus, this model could be used to support the future implementations of the OV-chipcard. The social perspective can be used to analyze the human environment of IT systems and its relation and influence on IHC drivers.

4.4 Chapter summary

This chapter provided the literature review on how the IT systems affect to society. The theory of Du Plooy (1998) is presented in this chapter to show the relationship between the implemention of an IT system and the human environment. This theory can be used for the investigation of the effects of the OV-chipcard technology to society (i.e. both employees and customers). The effect on society is captured by the 'human environment model'. This explores the different dimensions of the socio-economic context in which IT, the organization and the human environment interact. This model can be used to govern the IT system and its social effect.

5 Case study research design

This thesis used qualitative methodology and case studies. See more detail below.

5.1 Qualitative research: Case study

The qualitative research methodology is applied to gather an in depth understanding the phenomenon of the human behaviour. It is used to investigate why and how decisions are made by using small focus samples. Case studies with varieties of evidence from documents, news from websites and interviews are used to make representative cases. An early example of the OV-chipcard implementation could help an OV-chipcard organization to gain understanding, learn lessons and reduce risks during the implementation of their OV-chipcard implementation. The case study results of this study can be used in two ways: (1) to verify/confirm or falsify the IHC and human environment research and (2) as an empirical dataset for the two theories that are investigated.

The reason to choose a case study is to investigate the contemporary events, the introduction of the OV-chipcard in depth. This case study investigates this phenomenon in a real-life situation where there is no control over variables.
A case study protocol by Yin (1994), Stake (1995) and Simons (1980) will be followed to conduct the case studies, prepare for data collection and data analysis.

For this thesis, all the information about the OV-chipcard in the Netherlands in Google Scholar is investigated and also the news about the OV-chipcard. Key search words for this are ”OV-chipcard Netherlands research”, “OV-chipcard Netherlands problems”, “contactless smartcard OV chip card” and “ Risk for society of using contactless smartcard”.

All literature related to OV-chipcard, IHCs and IT impact on society are selected.

5.1.1 Interviews

Semi-structured interview questions are formulated. This gives the interviewer the possibility to use the answers of the interviewee and ask further questions to investigate the research topics. As several different groups of interviewees are identified, each group will have specific questions, but also similar questions which allow the researcher to compare the results between the groups. The structured interviewing technique of Bryman (2001) is used to conduct the interviews.

A pilot test is done to make sure that the interviewees understand the questions. After the pilot test, some questions are adjusted and additional question are added to get a better understanding of the interviewees meaning.

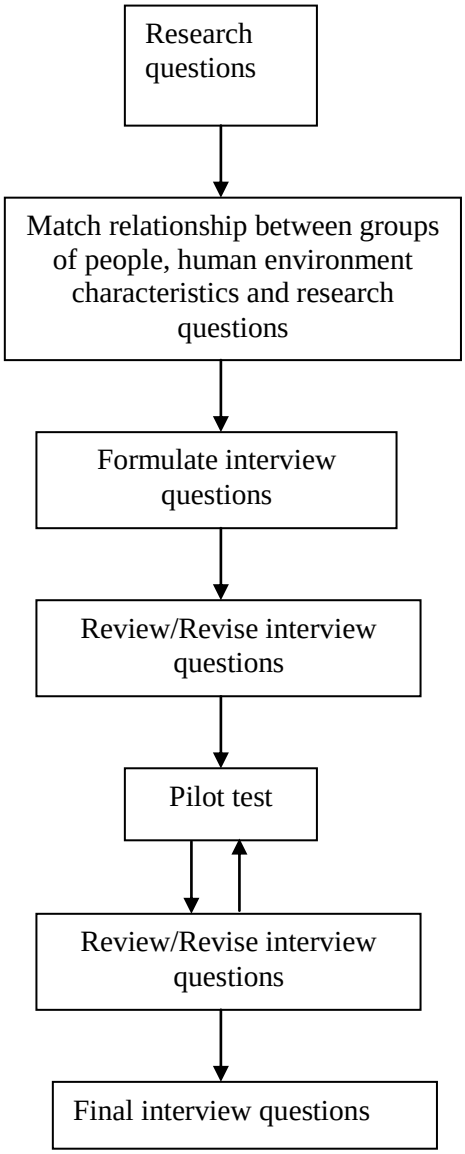
The interview will be conducted face to face because this allows for interaction. A tape recorder will be used during the interview to prevent losing data. The interviewees in this document are anonymous. This allowed them to freely provide information.

5.1.2 Interviews question design

Several groups of people are interviewed. All interviewees within each group get the same interview questions. Some questions are the same over all groups and some questions are slightly modified to match the interviewee group. In some questions the interviewee is asked to rank their answer in a scale. The scale allows interviewees to precisely indicate their opinion on a free scale. The scale will be used to perform a statistical analysis to interpret the results.

The interview starts with an introduction by the interviewer where the interviewer explains the importance and relevance of the interview to the interviewer and interviewee. The interviewee is asked for permission to record the interview. This is done to improve the quality of data in this report and to record the answers for further research. The interview questions formulated are provided in Appendix B: Interview questions.

The following figure shows the research approach:



5.1.3 Interview 6 groups

The theory of Du Plooy (1998) is chosen to categorize all types of people that will be interviewed to understand the human environment and its interaction with the adoption and use of processes. Six types of people are selected for the following reasons:

1. **CEO's and board members of the companies that are responsible for the OV-Chipcard implementation: e.g. TLS, Connexxion, GVB, RET, HTM and NS.** The reason to choose the CEO's and board members is because they manage the OV-chipcard implementation on the strategic level and they have a wide, tactical perspective on their company.

2. **Employees from OV-chipcard companies.** The reason to choose these employees is because they operate in the field and have in dept perspective about the OV-chipcard on the operational level.

3. **Conductors of transportation companies (bus, tram, metro and train).** The reason to choose the conductors of transportation companies is because they operate in the field and have in dept perspective about the OV-chipcard on the operational level.

4. **Working people: Any carrier.** The reason to choose working people is because they are paying users of the OV-chipcard. They give a customer's perspective about the OV-chipcard.

5. **Students.** The reason to choose students is because they are a user of the OV-chipcard (mostly non-paying) and have no or little income. Most students can travel for free and therefore they can have different travel experiences than other users. Therefore this group is separated from working people. This will also give a customer's perspective of the OV-chipcard.

6. **Specialists from e-Transport forum.** The reason to choose the specialists from this cooperation of scientists is that this group of people are independent from OV-chipcard companies. The specialists from this board will give a deeper perspective of OV-chipcard problems and can give advice for the better implementation of the OV-chipcard.

5.1.4 Indirect Human Cost interview groups

The interview contains questions that are focused on receiving answers on the effect of IHC on the OV-chipcard implementation. The main audiences of these questions are the CEO's and board members because they can best answer questions related to cost of investments during the OV-chipcard implementation. The other interview groups do not have this information but in some cases their answers may give insight in additional IHC.

5.1.5 Human environment theory interview groups

The human environment characteristics stated by Du Plooy (1998) are the different characteristics types that interact and adopt IS (see section 4.2). A set of questions are created for each specific human environment characteristic type. The different interview groups interact in different ways with the IS and can therefore address only specific characteristic types. This paragraph describes what human environment characteristics types are most relevant for each interview group.

	CEO's and board members (group 1)	Employees (group 2)	Conductors (group 3)	Working people (group 4)	Students (group 5)	Specialists (group 6)
1. Individual characteristics				**x**	**x**	
2. Innovation characteristics		**x**	**x**	**x**	**x**	
3. Task characteristics		**x**	**x**			
4. Organizational characteristics	**x**					
5. Environmental characteristics	**x**					
6. Group characteristics	**x**	**x**	**x**	**x**	**x**	**x**

5.1.6 Research questions and interview groups

This table shows the relevance between the research questions and the different groups of interviewees.

	CEO's and board members (group 1)	Employees (group 2)	Conductors (group 3)	Working people : (group 4)	Students (group 5)	Specialists (group 6)
What are the IHCs of implementing the OV-chipcard in the Netherlands?	**x**					
What are the main causes of additional IHCs of the OV-chipcard?	**x**					
What main problems affected the total cost budget of the OV-chipcard companies?	**x**					
How does the OV-chipcard affect the society (Employee, Customers)?	**x**	**x**	**x**	**x**	**x**	**x**

The interview results from the 6 groups of people are used to provide answers to all research questions as follows:

Interview questions group 1:

These interview questions are made for CEO's and board members to give answers to all research questions in this thesis, specially about the IHC and main causes of additional IHCs in their companies, their perspective on implementing the OV-chipcard and how inside parties and the other parties influence their working processes.

Moreover, they also provide the answers to research questions: which main problems affected the total cost budget of the OV-chipcard companies and how does the OV-chipcard affect the society (Employees)?

Interview questions group 2

These interview questions are made for employees from TLS, Connexxion, GVB, RET, HTM and NS) to give the answers to the research questions: How does the OV-chipcard affect the society (Employees)? Additionally, their answers also show their individual, innovational, task, organizational and group perspective related to their job.

Interview questions group 3

These interview questions are made for conductors of the OV-chipcard companies (bus, tram, metro and train) to give the answers to the research questions: How does the OV-chipcard affect the society? In this case the employees. Additionally, their answers also show their individual, innovation, task, organizational, group perspective related to their job.

Interview questions group 4

These interview questions are made for working people of any carrier and are to give answers to the research questions: How does the OV-chipcard affect the society? In this case the customers. Then, their answers also show their individual and group perspective related to their job and life.

Interview questions group 5

These interview questions are made for students to give answers to the research questions: How does the OV-chipcard affect the society? In this case the customers. Furthermore, their answers also show their individual and group perspective related to their life and experiences.

Interview questions group 6

These interview questions are made for specialists. To give answers to the research questions: How does the OV-chipcard affect the society? Further, their answers also show their individual and group perspective related to their life and experiences.

5.1.7 Reasons behind interview questions

The interview questions are related to the research questions and the different OV-chipcard problems that are displayed in section 2.3 such as IHC, security, increased

cost, implementation delays, lack of clear leadership and unsatisfied customers. This section shows the relation between interview questions and interview question group.

Research questions 1 and 2:
The interview questions for the CEO's/board members of OV-chipcard companies provide answers to research question 1 and 2. CEO's from OV-chipcard companies are interviewed to identify IHC and root causes of problems. All questions are derived from the different IHC drivers of the theory of Mohamed (2003) and Mohamed and Guah (2010). See Appendix B: Interview questions, group 1 for these individual questions.

Research question 3:
The main problems that occurred during the implementation of the OV-chipcard resulted in a single question to the CEO's/board members. They were asked to identify a maximum of 4 main problems and describe the effect that the problem had on the total cost budget. This question can identify additional IHC and its impact on the budget. See Appendix B: Interview questions, question 18 for group 1 for this question.

Research question 4:
The interview questions for employees (CEO/board, employees, and conductors) and customers (working people and students) and specialists provide answers to research question 4. The reasons behind the questions are:

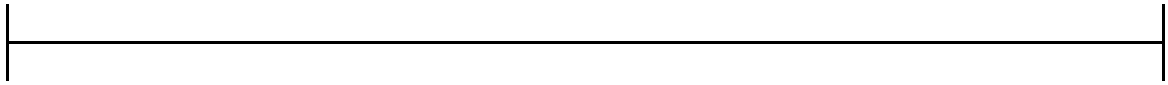
- Individual characteristics: To identify what has changed for users before and after using the OV-chipcard system.
- Innovation characteristics: To determine if the OV-chipcard adds any extra value to the public transportation.
- Task characteristics: To identify if the OV-chipcard system has Changed in work content to employees
- Organizational characteristics: To verify if there were any problems working together with different organizations.
- Environmental characteristics: To identify how other parties are involved with OV-chipcard implementation.
- Group characteristics: To identify the satisfaction and improvements from different groups. To understand how the IS is used and to identify if there is any resistance in society.

Appendix B: Interview questions, contains an overview of the all interview questions and to whom they are relevant and to what human environment characteristic they relate.

Some questions are recorded in scales. An interviewee can choose any position on a scale. For example choosing a word or choosing between two words. This allows for collecting the data with fine granularity. The result is translated into a value between 0 (left side of scale) and 100 (right side of scale).

> (To CEO) How satisfied are you of implementing the OV-chipcard? Could you please put X in this scale or mark the checkbox?

Not satisfied	Little satisfied	Somewhat satisfied	Satisfied	More than satisfied	Very satisfied	Extremely satisfied



☐ I don't know

The Interpretation of the selected value for satisfaction:

From	To	Satisfaction
0	14	Not satisfied
14	29	Little satisfied
29	43	Somewhat satisfied
43	57	Satisfied
57	71	More than satisfied
71	86	Very satisfied
86	100	Extremely satisfied

5.2 Refinement of indirect human cost framework

In the previous section, several questions are created that relate to the "resistance" driver of the IHC theory.

- Was there any resistance INSIDE your company against the OV-chipcard DURING or AFTER the implementation?
- Was there any resistance OUTSIDE your company against the OV-chipcard DURING or AFTER the implementation? (e.g. media, customers, other companies)

There are two distinct types of resistance that can be identified. Resistance from within the company originates from its employees. This is about the cost that is associated with employees that work less efficient because they oppose the new system. Resistance from outside the company can come from for example: customers, shareholders, government, partners, organizations, etc. This has an indirect affect on different IHC drivers. Outside resistance can result in delays of introduction of the new system, addition training & learning, etc.

Resistance is measured by customer satisfaction. If more customers or other parties are satisfied then less customer resistance occurs and vice versa. Also if more employees are satisfied less employee resistance occurs and vice versa.

5.3 Data analysis technique

The qualitative data analysis technique from Miles and Huberman (1984) will be used to analyze all the data in two main forms and 3 step processes of data analysis as following.

There are two main forms of data analysis.

1. **Within-case analysis:** Comparing empirical data, each type of group people against the theories: the main IHCs by Mohamed (2003) and Key performance indicators (KPIs) framework from Mohamed and Guah (2010) and The human environment of IT adoption and use Du Plooy (1998)

   Case 1: Compare the interviews data of CEO's and board members with the IHCs theory by Mohamed (2003) and Key performance indicators (KPIs) framework from Mohamed and Guah (2010) and the theories: The human environment of IT adoption and use Du Plooy (1998). The data results are then compared with each other to find the similarities and differences within the data.
   Compare the interview data with this theory for:
   Case 2: Employees
   Case 3: Conductors
   Case 4: Working people
   Case 5: Students
   Case 6: Specialists

2. **Cross-case analysis:** Data in one case is compared to the other cases data.

The main steps of data analysis are:

1. ***Data reduction***
   In this step, the data is organized to sharpen, verify, sort, focus or discard the data. The data is reduced and transformed, selection, summary, paraphrasing. Within-case analysis is used to determine how the empirical data fits with the theory.

2. ***Data display***
   The data is reduced, compressed and displayed in organized way. This process makes it easier to draw conclusions. Cross-case analysis is used to develop matrices to manage various data sets and compare one case to the other cases. This process could help to find the similarities or differences between the cases.

6 OV-chipcard case study empirical data

The interviews that form the basis of this empirical study were conducted in a period of 3 months, from January to March of 2011. The empirical data was collected from six groups of people as described in the previous chapter. A total of 49 people accepted and responded to the interview request but only 48 interviews were used because one interviewee lived abroad and had never experienced the OV-chipcard system.

Group	**Interviewees**	**Average duration of interview**
CEO, boardmembers	2 board members of the companies accepted: TLS, Connexxion	60 min per person
Employees	8 interviewees: 2 HTM helpdesk, 1 RET helpdesk, 1 metro driver of RET, 2 tram drivers of RET and 2 tram & bus drivers of RET.	Helpdesk: 45 min per person Drivers: 10 min per person
Conductors	RET accepted interviews: 7 conductors of tram	10 min per person
Working people	15 working people	20 min per person
Students	15 students	20 min per person
Specialists	4 from e-transport forum (3 were used)	30 min per person

Interviews with CEO's were important for this study because they were the main people who could help identify IHC.

The interview was collected on a recording device and transcribed in tables which can be found in Appendix D: Interview results. This chapter displays the reduced results of the data reduction after within-cases analysis. Regularities, patterns and observations are collected in order to interpret the results. Conclusions are made per paragraph. The overall conclusion can be found in chapter 7 Conclusions.

In the following paragraphs the answers to the interview questions are grouped together per relevant research questions.

6.1 Indirect human costs of implementing OV-chipcard

The main topic of the interviews to the group of CEO's was to identify whether and how the involved companies applied IHC drivers within their planning and what the role of IHC was during implementation.

6.1.1 Interviews with Connexxion and TLS

The interviews were held with board members of Connexxion and TLS.

Connexxion:
The interview was conducted with a member of the executive board of Connexxion. Connexxion is one of the national public transport companies of the Netherlands and uses they use the OV-chipcard as a means of payment throughout the Netherlands. Connexxion was one of the first shareholders of the TLS cooperation but are no shareholder at this moment.

TLS Company:
The interview was conducted with one of the directors of TLS. TLS makes the OV-chipcard, provides customer services to 9.5 million customers and process all transactions and divide revenues. TLS also manages all transport operators and other parties involved of the OV-chipcard so make sure they all follow the same standards and rules. TLS is responsible for the central system. This is based on the Hong Kong and London systems. Operators are responsible for all OV-chipcard machines and other systems in the field.

Detailed results of the interview can be found in the Indirect Human Cost section of Appendix D: Interview results.

6.1.2 Data reduction and interpretation

The following table summarizes the interview results for each of the IHC drivers:

IHC drivers	Connexxion	TLS
1. Introduction of new system	-	-
1.1. Training fees and other related cost/resources	No fees	Planned. No additional cost.
1.2. Recording expected time integrating with new system	-	No old system
1.3. Recording time in which both new and old system are used	Measured	No old system
1.4. Expected operational cost as a result of resistance to change	-	No change
2. Redefining roles	No	No change so not applicable
3. Redundancy	No	No change so not applicable
4. Promotion	No	Planned. No additional cost.
5. Deskilling	No	No change so not applicable

IHC drivers	Connexxion	TLS
6. Training	Not planned. Driver training was within regular schedule. Conductor received extra training. More cost than planned	Planned. No additional cost.
6.1. Number of replacement staff and their stay duration	None	No change so not applicable
6.2. Number of staff requesting change in salary subsequent to training	None	None
6.3. Record of time spent training others	-	No change so not applicable
6.4. Costs of issues related to training apart from actual training fees	-	-
7. Effort and dedication	Planned. In the beginning additional work.	-
8. Resistance	-	-
8.1. Inside company	No	No
8.2 Outside company	Questions/complaints from media and customers. Increase customer service. More cost than planned	Resistance from media, customers and politicians. Tens of millions additional cost.
9. Escalating operational	-	-
10. Moral hazard	No	No
11. Integration time	Recorded. More cost than planned	Not applicable. New application.
12. Learning	Planned. Roll-out per province resulted in extra cost for customer marketing.	Planned. Customer information. No extra cost.
13. Replacement staff	Planned. No additional cost	No change so not applicable
14. Staff turn over	-	No change so not applicable
14.1. Number of staff leaving	None	None
14.2 Resulting recruitment costs e.g. interviews and advertisement	Not planned. Extra cost. Additional IT staff because of problems in project.	Planned. No additional cost.
14.3 Data on reasons for staff leaving	Not recorded	Not recorded
14.4 Promotion costs	No	No
14.5. Training costs	Planned. No additional cost	Planned. No additional cost
15. Rejecting change in salary	No	No
16. Loss of productivity	Planned. Additional cost. Conductors use paper card and chipcard simultaneous.	No change so not applicable
17. Reduction in knowledge base	No	No change so not applicable
18. New recruitment costs	Planned. Additional cost for hiring extra IT-staff.	No

The introduction of the OV-chipcard has changed the companies that are involved with public transport. Before the OV-chipcard introduction they used a paper based ticketing system (the strippencard). The results of the interviews with Connexxion and TLS give a different perspective on the IHC theory. Connexxion was able to describe what the consequences were of this change to the company. TLS, on the other hand, didn't exist before introduction of the OV-chipcard. This thesis applies the theory both on a new 'green-field' implementations (as for TLS) but also on a company (Connexxion) that has an existing environment that changes through the implementation.

Both companies were not aware of the IHC theory. They also didn't take many of the IHC drivers into consideration during the planning phase as can be seen in the table above. TLS only had cost on a few IHC drivers. Their main additional expenditures were a result from outside resistance to the OV-chipcard. Connexxion had cost on about half of the IHC drivers. For most of these drivers they also had additional cost.

One board member expressed surprise and appreciation when interview questions were asked relating to IHC drivers that they did not include in their planning. He thought that these could be valuable additions to future planning.

6.2 Main causes of the additional Indirect Human Costs

The following table describes the main causes for addition IHC for the OV-chipcard and how this relates to the IHC drivers.

IHC driver	Company	Cause of additional IHC
6. Training	Connexxion	Extra training and learning on the job was needed for conductors to get used to working with the new system. More cost than planned here.
8.2. Outside company resistance	Connexxion	Additional customer service: Customers and media had a lot of questions and complaints so Connexxion had to increase customer services. This resulted in a lot more cost than planned
	TLS	Delays in roll-out by the government resulted in tens of millions additional cost because of the delay in roll-out.
	TLS	There was resistance from customers, media and politicians. TLS invested in additional communications to solve this.
11. Integration time	Connexxion	Measured for every concession / contract. The old strippencard and new OV-chipcard system are used together for more than 3 years instead of the estimated 3 months. More cost than plan here. Additional cost in addressing the specific OV-chipcard needs of the provinces and cities for the tenders complicates the processes and therefore creates additional costs.

12. Learning	Connexxion	Customers were taught to use the system by using websites and templates. Because this is done province by province and not all at once, this resulted in additional marketing cost.
14.2 Staff turnover - Resulting recruitment costs e.g. interviews and advertisement	Connexxion	No recruitment cost but Connexxion had to hire additional IT staff because they were the one of the first involved and major hardware and software changes occurred during the project.
16. Loss of productivity	Connexxion	Conductors have to check both strippencard and OV-card so they need more time. This reduces their productivity. Since this double system is longer needed than planned, this gives additional cost.

The only additional IHC for TLS came from outside resistance. These costs were caused by additional customer services and delays in roll-out. The main additional IHC were spent on: delays in roll-out, additional customer support and training.

6.3 Main problems affecting the total cost budget

Question 18 CEO: What do you see as the main problems that occurred during the implementation of the OV-chipcard. How does the problem affect your total cost budget?

Problems that are marked with a value in the table below are considered to be the main problems for the Connexxion and TLS.

Connexxion	**Effect on cost budget *)**	**TLS**	**Effect on cost budget *)**
50 million of extra investment cost is not covered.	77	Lack of decision making from government to abandon the paper ticket system.	66
Working with different back-office systems as the NS.	76	Complex landscape of politics and media which damaged the success story.	45
Fraud. People copying the card or incorrectly reimbursing cost.	21	Operational problems during start-up in 2005/2006	30
Using two payment methods in parallel – customers use the cheapest	Not valued	Negative publicity because of exaggeration of customer problems	65

Government postponed introduction because of issues.	Not valued	Many different parties involved (government, authorities, media and customer organisations) with many different requirements.	Not valued
Slow decision making between OV-chipcard companies.	Not valued		

*) The values in this chapter were derived from the position that interviewees selected in a scale in their answer of the questions (see paragraph 5.2 for a detailed explanation of this scale and its interpretation).

The following figure shows how the main problems affected the cost budget:

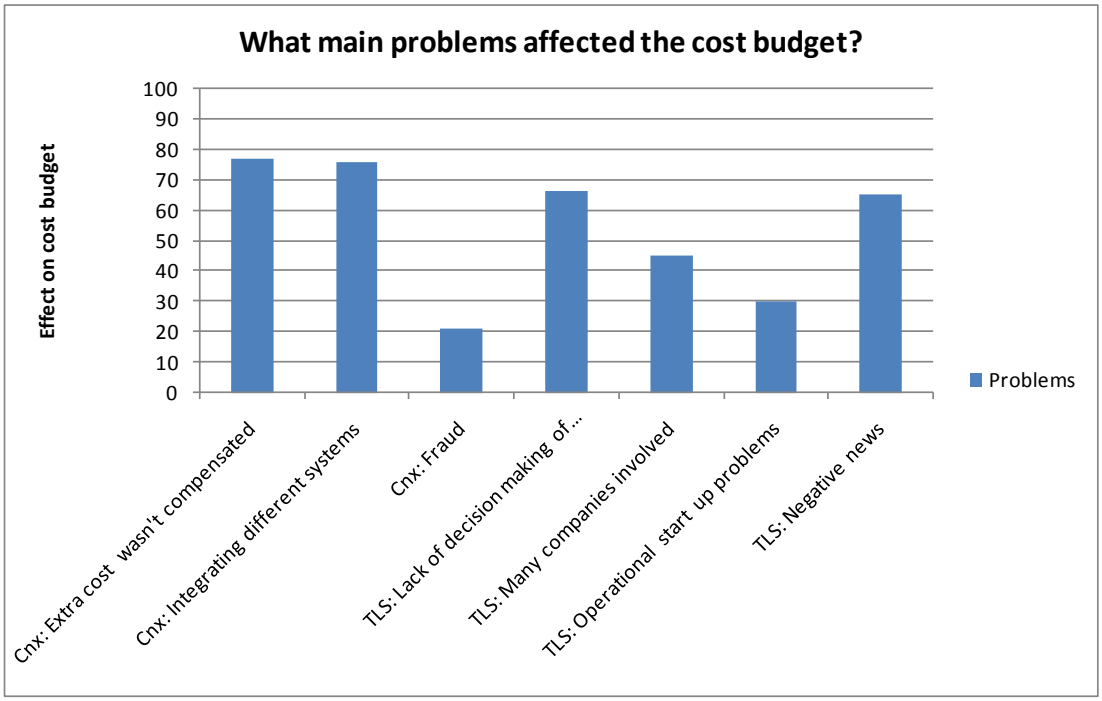


Figure 6: Main problems affecting cost budget.

The problems that affected the cost budget of the OV-chipcard companies were of many different types and were different for the two companies interviewed. The two main problems of each company had a great or very great effect on the total cost budget. The 'Negative news' resulted in additional IHC. Customer support needed to hire more people than planned because customers requested more information and more support in using the OV-chipcard.

Question 20 for CEO: How has the total cost of implementing the OV-chipcard changed?

Company	Effect on cost budget
Connexxion	77
TLS	86

The total cost of implementation of the two OV-chipcard companies was higher to a lot higher than was originally planned. The reasons for this are displayed in previous question.

6.4 The OV-chipcard effect on society

This section contains the answers of employees, customers and specialists on the effect of the OV-chipcard on society. Detailed answers to all these questions (the interview results) can be found in section IT effect on society of Appendix B: Interview questions.

6.4.1 Individual characteristics

To identify what have changed before and after using the OV-chipcard system for users.

Question 3 for working people & students: Do you use the OV-chipcard? If, yes. How often do you use it? (……per week, …….per month) *Question 4 for working people & students: What type of OV-chipcard do you have?* *Question 12 Are there differences in the usage between the OV-chipcard and strippencard / paper card? If, yes. How?* *Question 9 Does the cost of travelling change to you?* *Question 10 How does the changing cost effect you?* *Question 11 How the OV-chipcard changes the way you use the public transport?*

The interviews were conducted with random public transport users on train stations in Rotterdam, Amsterdam and Tilburg and in the library of Rotterdam Blaak. The students were randomly selected on the University of Rotterdam. The results do not answer the opinion of people that don't use the OV-chipcard. The first questions were intended to understand what types of users are interviewed. The other questions focus on what the user experiences.

User demographics
30 responses were collected from working people & students regarding the frequency of use of the OV-chipcard. Some of the interviewees gave more than one answer:

Frequency of use	**Nr of users**
A lot, everyday a week (7 days)	8
Many times a week (4-6 days)	12
Sometimes (1-3 days)	10
Rarely (1-5 per month/ year)	3

This means that almost two third of interviewed users use the OV-chipcard regularly (a lot or many times a week). Only one sixth of the users rarely use the OV-chipcard.

The following card types are used by the 30 user interviewees. Some of the interviewees gave more than one answer:

Type of card	**Nr of users**
Anonymous card	5
Personal card	11
Student	16
Company card	2
NS train card	2
Multiple cards	*6*

The anonymous card is only used in one sixth of the cases. One fifth of the users have more than one type of OV-chipcard.

User experience

Differences in the usage between the OV-chipcard and strippencard and paper card

The differences between are summarized in the following table:

Classification	**Nr of working people**	**Nr of students**	**Comments**
Strippencard better	4	6	More transparent, cheaper, easier to use
OV-chipcard better	8	6	No zones, easier, safer
Neutral	3	3	No difference, never used strippencard

Comments that were mentioned several times:

1. OV-chipcard is more convenient because it's just one card: no more zone calculation which is confusing.

2. OV-chipcard is more expensive than strippencard. Many people sometimes forget to checkout. People forget / don't know / are lazy to ask for money back. Check in-out machine broken so need to buy new, more expensive ticket.

3. Strippencard is more transparent about the price and clear on how much to pay from destination A to B. With the OV-chipcard, customers have worries about how much money is taken from their card.

4. With strippencard it's easier to combine travelling with others transportation companies. With OV-chipcard you have to check out-in or buy a different ticket. This is often forgotten and costs money or unclear where to do this.

5. Strippencard is more difficult to understand for tourists

6. Cannot see how much money is left on the OV-chipcard.

The opinions of both user groups; the working people and students are not very different. Users are very much divided in whether they like the OV-chipcard or strippencard better. 10 select strippencard and 14 select OV-chipcard of the 30. In general, the OV-chipcard is regarded as the more convenient card to use for all types of users but it is considered to be more expensive than the strippencard.

Change in cost of travelling and its effect on the users

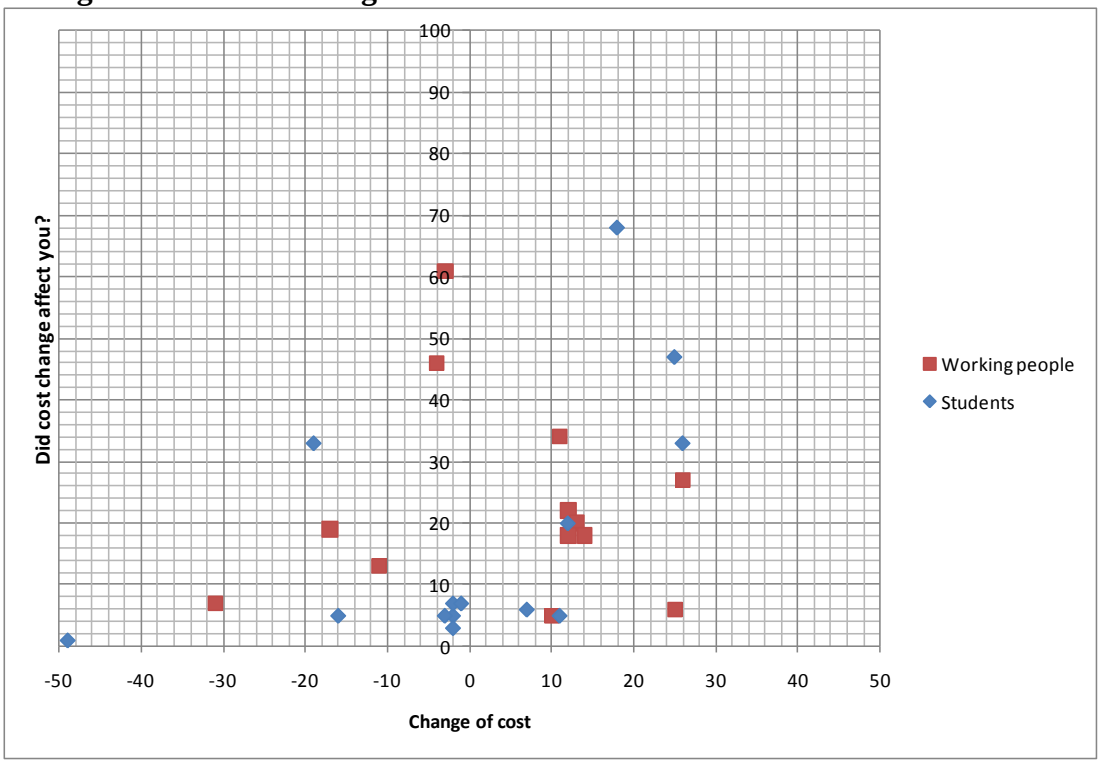


Figure 7: Changing cost and its effect.

Interpretation of horizontal and vertical axes:

From	To	Change of cost
-50	-36	A lot lower
-36	-21	Lower
-21	-7	Somewhat lower
-7	7	Same
7	21	Somewhat higher
21	36	Higher
36	50	A lot higher

From	To	Effect
0	14	No effect
14	29	Little effect
29	43	Some effect
43	57	Moderate effect
57	71	Great effect
71	86	Very great effect
86	100	Extreme effect

The figure shows the effect of the change in cost to working people and students. In general, students thought there was no change in cost and working people thought the cost was somewhat higher. This can be explained because most students have a 'free' student OV-chipcard so there is no cost change for these students. Some students and most working people have to pay for themselves so change in cost can have an immediate effect for them. The figure shows the obvious fact that people that experience low cost change also experience no effect of this change. Apart from this, no clear correlation can be made on the relation between cost change and effect of cost change. Overall, the cost change of the OV-chipcard had little to no effect on both user groups.

The way users use the public transport

The way users changed their use of public transport is summarized in the following table:

Classification	**Nr of users**
No change in usage	28
Use more	1
Use less	1

Most users have not changed the way they use the public transport because of using an OV-chipcard.

6.4.2 Innovation characteristics

This investigates if the OV-chipcard adds any extra value to public transportation.

6.4.2.1 Effect on employees

Question 3: Does the OV-chipcard system (=computer programs) provide you with more or less abilities to do your work?
Question 4: How does the change from strippenkaart / paper card to OV-chipcard affect the way you work? Any positive or negative effect?

Ability of employees to go to work
How the OV-chipcard system provides the employees and conductors with more or less abilities is described in the following table:

Ability to do work	**Nr of employees**
More abilities	9
Less abilities	5
No difference	1

Change in the way employees do their work
The following table displays how employees change the way they work with the OV-chipcard system:

Change of work	Nr of employees
Positive	7
Negative	3
No change	3

Of the 13 employees that were interviewed most of employees think that the OV-chipcard system (i.e. the computer programs) provide them with more abilities to do their work. 3 of the 13 people think the change is overall negative. Most of interviewed employees think that using OV-chipcard system gives them both positive and negative effects to their work (8 of the 13). More employees mention negative effects than positive effects (12 vs. 9) of the OV-chipcard.

Main positive effects of using an OV-chipcard system:

1. **Easier and more efficient working for drivers:** bus and tram drivers don't have to sell tickets during their work. No more confusion about zones, less ticket verification, less processes, drivers can work faster and it allows drivers to concentrate on driving.
2. **Easier and faster working for conductors:** using the OV-chipcard system made their job easier and faster than before because of easier ticket verification and less confusion about zones.
3. **Easier for tourists**: no more confusion about zones.
4. **More working processes**: customer services get more working processes but in general they feel positive about the OV-chipcard
5. **Work didn't change:** metro drivers are content that they still have the same duties without additional customer contact.

Main negative effects of using an OV-chipcard system:

In the beginning customers were not satisfied and were less friendly because they didn't understand the system very well. Also, technical problems made customers lose time and money. This has improved over time. Here are some negative effects of using the OV-chipcard system for the employees.

Negative effects directly related to the work of the employees:

1. **Old system is better**: The strippencard system had easier processes and fewer procedures than OV-chipcard: customer service only sold tickets and gave information about tickets.
2. **Customers need more information and time per service**: many customers have problems and questions e.g. to claim money back after the introduction of the OV-chipcard system which causes longer queues. Customer services need more working procedures to help customers. The OV-chipcard companies hired more employees to give service to customers.
3. **Technical problems**: the charging machine doesn't work or a customer card is broken and this is fixed only at the end of the day. If the check in-out machine doesn't work drivers let customers travel for free. The OV-chipcard company loses money.

4. **Customer problems:** Customers ask many questions which requires more time from them and are sometimes angry and aggressive to conductors and drivers about paying problems.

Negative effects on customers noticed by employees:

1. **Many customer complaints:** about increasing price, technical problems like check in out doesn't work and gates don't open, no recharge money machine in a public transport. Long waiting times for claiming money back because they have to use more expensive tickets in the mean time.
2. **OV-chipcard companies don't work well together**. This matter makes customers confused about their services.
3. **The OV-chipcard is less transparent:** customers can't see or forget how much money they have on their card.
4. **Security problems:** the news reports about security problems which makes the employees worry about fraud.

The employees are positive about the fact that the OV-chipcard systems make their work more efficient because ticket verification is easier and there is no more confusion for customers about zones. However, employees also report many negatives: the system is too complex, the complexity of their work increases and customers come to them with more and different problems than before which requires more time from them. Also, technical problems that they experience cause the company to lose money e.g. when there are problems with the chipcard readers and customers are allowed to travel for free.

6.4.2.2 Effect on customers

*Question 5 for working people & students: Does the OV-chipcard system provide you with more or less abilities to go to work (**Worker**) / to study (**Student**)?*
Question 6 for working people & students: How does the OV-chipcard affect the way you work? Any positive or negative effect?
Question 7 for working people & students: Are there any problems after using the OV-chipcard?

- *What are the problems?*
- *How did you solve the problems?*
- *Where did you solve the problem?*
- *How long did it take to solve the problem? …..day, ……Weeks, …….Months,……Years, Other*

Ability of customers to go to work or study
How the OV-chipcard provides customers more or less abilities is described in the following table:

Ability to go to work/ study	Nr of working people	Nr of students
More abilities	6	9
Less abilities	1	0
No difference	8	6

About half of the interviewed working people and students think the OV-chipcard provides them with the same possibilities and the other half thinks the OV-chipcard provides them with more possibilities to go to work/study. Nearly none of these customers think that the OV-chipcard system provides them with less ability the same or more abilities to go to work or study. There is no large difference in perspective between working people and students on this topic.

Change in the way customers do their work/study

The following table displays how employees change the way they work with the OV-chipcard:

Change of work	Nr of working people	Nr of students
Positive	3	7
Negative	3	3
Neutral	9	5

About half of the working people and students think that the OV-chipcard doesn't have a clear positive or negative effect on them. Working people were equally positive and negative and students are in general more positive than working people on how the OV-chipcard has changed their ability to do their work.

Positive effects of using an OV-chipcard are:

1. Using an OV-chipcard is easier, more convenient and faster to use. Only one card can travel with almost all public transports in many cities in the Netherlands.
2. When a customer loses an OV-chipcard, people can easily return it back because many cards are personalized.
3. Users can check where they travelled in the past. Users can easily claim money back from their employer.
4. Never have any problem with using an OV-chipcard.
5. Users can recharge money on their card in many shops.
6. OV-chipcard companies get benefits of using an OV-chipcard system.
7. Some customers think that makes going to work/study more efficient.

Negative effects of using an OV-chipcard are:

1. Customers forget to check out and then paying maximum price.
2. Process to receive money back difficult: long waiting times at customer service, unaware of this process, too lazy to get money back. This costs time, money and stress for customers.
3. Technical problems: can't recharge or check in/out during travel. As a result they have to buy the more expensive paper tickets.

4. Unclear information: can't see how much money is on the card, OV-chipcard website doesn't provide clear (discount) information.
5. Switching transportation (companies) difficult. Need to check out-in. Difficult to see where to do this. People need to plan more for this. This is inconvenient.
6. Too little recharging money machine. No recharging possible in trams and at small stations.
7. Difficult to understand and use for tourists from inside and outside the Netherlands

Conclusion: The results show that most of the interviewed users think that using an OV-chipcard gives them both positive and negative effects. The positive innovation effects are that the OV-chipcard system makes it easier, more convenient and faster to use the public transport. Customers can receive back lost cards and verify travel history.
The negative innovation aspects are that customers have to check out and this is sometimes forgotten, the processes to subsequently receive money back are more difficult. Switching transportation companies is one major topic that makes the OV-chipcard less convenient.

6.4.2.3 Effects on different groups

The following questions were asked to the different groups: employees, conductors, working people and students:

Question 8 for working people & students, *Question 10 for employees & conductors: How often did the problems happen to you?*

The first figure shows the frequency of problems for each person interviewed of the user groups. The second figure shows the box plot per user group which can be used for statistical analysis of the problem frequency data.

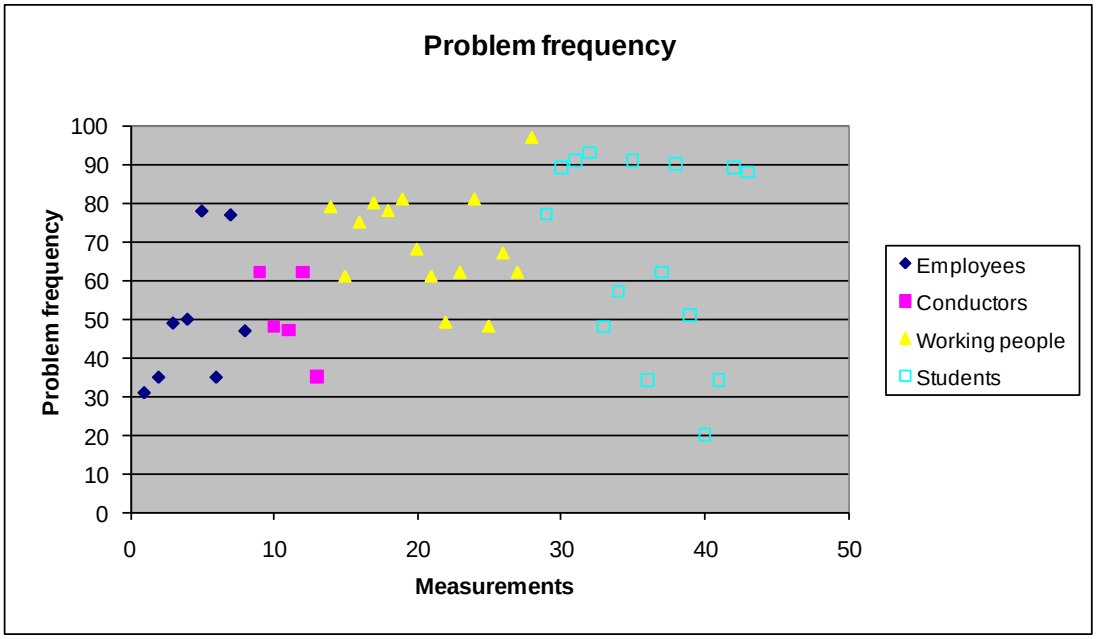


Figure 8: Problem frequency per individual measurement.

From	To	Frequency
0	14	Always
14	29	Very frequently
29	43	Frequently
43	57	Occasionally
57	71	Rarely
71	86	Very rarely
86	100	Never

In general, the employees and conductors experienced more problems than the working people and students: on average 'occasionally' respectively 'rarely'. 3 of the 8 interviewed employees frequently encountered problems. Only about half of the working people and students stated that they very rarely or never had problems and about 25% have occasional or more problems.

6.4.3 Task characteristics

Task characteristics are investigated to identify whether the OV-chipcard system has changed the work content of the employees.

Employees
Question 5 How does the OV-chipcard affect the way you work?

How the OV-chipcard system affects the way employees work is described in the following table:

Affects their work	Nr of employees
Positive	2
Negative	4
Neutral	7

Summary of feedback from employees:
Positive:

- Conductors have easier job duty; just checking the validity of card
- Tram and bus driver have less work processes: no more zone checking and more concentration on driving

Negative:

- Customer services have more work processes. It takes longer to give service per one customer.

Conclusion: About half of the interviewed employees indicate that the OV-chipcard doesn't affect their work. Conductors and drivers describe positive effects as their work has become simpler. The work of customer service has become more difficult though.

6.4.4 Organizational characteristics

To investigate if there are any problems between the different parties involved in the OV-chipcard.

Question 21 How do the 6 companies work together? (TLS, Connexxion, GVB, RET, HTM and NS)
Question 22 How are decisions taken in this 6 company's cooperation?

- *Who makes the decisions?*

Question 21 Are there any problems in decision making among the 6 companies: TLS, Connexxion, GVB, RET, HTM and NS? If yes, what are the problems?

Working together with other OV-chipcard companies

TLS organizes a customer board once or twice a month with all OV-chipcard companies involved: Arriva, Veolic, Qbuzz, Syntus, NS, HTM, RET, GVB, Connexxion. Decision making is dependent on the subject. Sometimes share holders (HTM, RET, GVB, NS) made decisions in the share holder meeting and sometimes decisions are made in the customer board. Decisions are made by consensus. Each party has an equal vote.

The interviews were with board members of Connexxion and TLS. Both companies have a different background. Connexxion is a nation-wide transportation company and TLS provides services to the transportation companies.

Conclusion: Within the organisational structure each member has an equal vote. Sometimes this takes a lot of time, discussion and preparation before decisions can bee made. On some topics (e.g. the central OV-system) TLS can force decisions.

6.4.5 Environmental characteristics

To identify how other parties are involved with the OV-chipcard implementation.

Question 24: How have the other parties influenced the OV-chipcard implementation?
Question 25: How has the government influenced the implementation of the OV-Chipcard?

There are about 20 governmental bodies involved with the OV-chipcard: media, different customer organisations, privacy/competition/banking authorities have many different wishes and requirements.

The OV-chipcard is not a governmental project. This project is initially started by transport operators but they oblige to the government. Transport operators have a contract with the central government who decides when they should abandon the paper based ticket (e.g. strippencard). Only if the transportation company meets the criteria level, the government decides to stop the paper ticket (or not). If not, the company has to operate two payment systems at the same time. This increases the cost of the OV-chipcard company.

The central government has a big involvement in the OV-chipcard implementation because the OV-chipcard is used in the everyday life of many people. If there is a problem, it will be written in newspapers, draw the attention of politicians and start debates on the issue. E.g the OV-chipcard company from Den Haag HTM had to postpone the full implementation (no more strippencard) of OV-chipcard because of a governmental decision. This delay resulted in additional cost for HTM as they had to continue to operate both systems at the same time.

Conclusion: Many different governmental organizations and authorities are involved with the OV-chipcard with all different requirements and whishes. This complicates the decision making process and has a major influence on the planning and cost of the introduction and operation of the OV-chipcard.

6.4.6 Group characteristics

Group characteristics are used to identify the satisfaction and improvement from different groups, to make sense of using the information system and to identify if there is any resistance in society.

Question 9, 14, 26 How satisfied are you of using the OV-chipcard? Then please put in scale.
Question 10, 15, 27 What is your suggestion to improve the OV-chipcard system?

Question 26 for CEO's: How satisfied are you of implementing the OV-chipcard?
Question 9 for employees & conductors: How satisfied are you of using the OV-chipcard system?
Question 14 for working people, students and specialists: How satisfied are you of using the OV-chipcard?
Note that these questions are slightly different for each group.

Satisfaction on using the OV-chipcard

Employees and conductor satisfaction is measured on how well of OV-chipcard system is working and how customers react to them. The satisfaction of users is measured from how well OV-chipcard companies provide services to them.

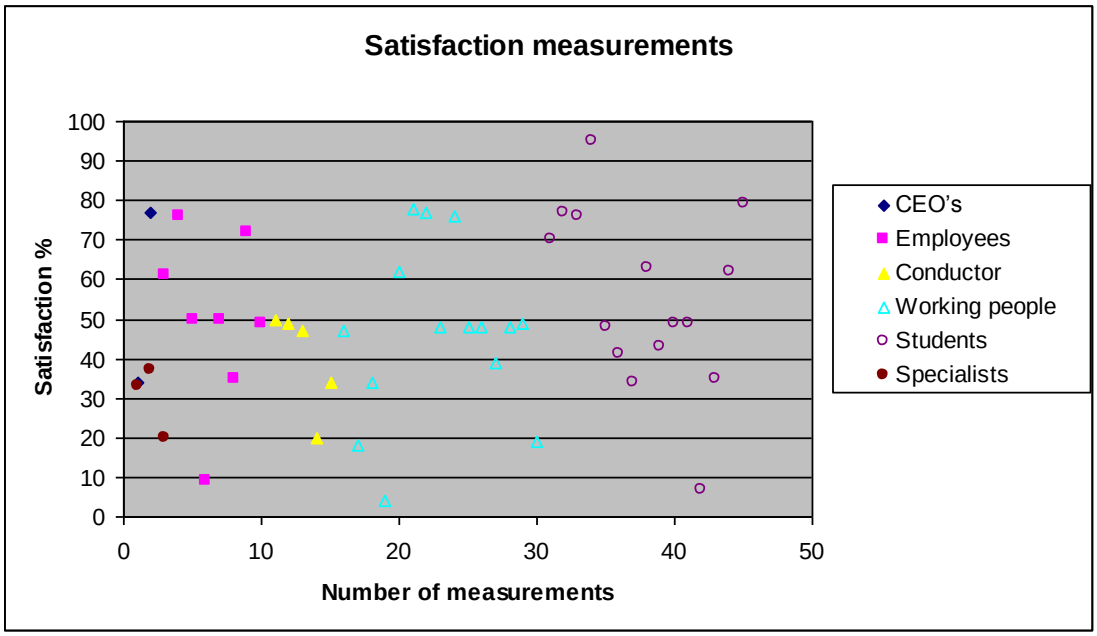


Figure 9: Satisfaction per individual measurement.

From	To	Satisfaction
0	14	Not satisfied
14	29	Little satisfied
29	43	Somewhat satisfied
43	57	Satisfied
57	71	More than satisfied
71	86	Very satisfied
86	100	Extremely satisfied

In general, the CEO/board is satisfied of the OV-chipcard implementation. Employees and conductors are satisfied of using the OV-chipcard systems. Working people and students are satisfied users. The spread of the level of satisfaction is higher for students than for the other groups. Specialists are somewhat satisfied using the OV-chipcard.

Suggested improvements:

CEO's:

- Improve governance structure for OV-chipcard (Connexxion). Use one national leader for the OV-chipcard companies who decides quickly, organizes to make it work and who is the face of the project. The government could have this role. This will however be impossible as long as nobody wants to pay for the extra cost of the last years.
- Keep the OV-chipcard systems and changes to the system as simple as possible (TLS). Try to limit the involvement of different parties.
- Move faster to a single payment system as this saves a lot of money (Connexxion).
- Transport companies should work with the same back-office systems (Connexxion). This makes it easier for customers to travel with different transport companies.

Employees

- Customers should be more careful on when they move between different transport companies so they don't lose money or time for claiming back this money.
- Repair the check in-out machines more quickly. People travel for free while they are broken.
- Better cooperation between transport companies so people can use customer service whenever and wherever they want.
- Use only one payment system. It is less efficient to work with double systems and this saves cost.
- OV-chipcard companies should give more and clearer information to customers. The better customers understand the OV-chipcard system, the higher the satisfaction will be.
- Allow discount options on anonymous cards.
- Reduce fraud by using a new chip in the OV-chipcard that is harder to hack.

Customers

- Improve security and privacy. Prevent hacking of the OV-chipcard. Anonymous cards are not really anonymous. Stop monitoring money transfers to the card. Prevent tracking where customers are going. Educate customers better on privacy matters.
- Improve customer service: queues are too long and the waiting time for solutions (2-3 weeks) is too long.
- Prevent fraud. Customers worry about fraud and security and understand that there are applications available that can increase and decrease the balance of the OV-chipcard.
- Solve technical problems: no more check in-out problems. Often check in-out machines are broken.

- Make it easier for people to check in and out. People often forget to check out. Use different sounds for checking in and checking out.
- More transparency in cost of travel. It is unclear how much customers have to pay when they travel from A to B.
- Customers need more recharging machines: With cash money: not all people (want to) use ATM cards. On small stations.
- Adopt one OV-chipcard throughout the Netherlands.
- Possibility to check the balance of a card via the Internet.
- Provide all ticketing possibilities on OV-chipcard as before. Now some discounts are not available (e.g. discounts on chipcard used in a train).
- Better cooperation between transport companies. Travelling between different cities is confusing. People need to check out-in during their travel to another area
- Create a system with less check-in, check-out.

Specialists

- Provide all ticketing possibilities like discounts on OV-chipcard as before.
- Improve privacy. Anonymous cards are not really anonymous.
- Create a national customer service where all customers can go to. Now customers have to visit the city where the card operates.
- Improve security in the OV-chipcard without additional cost to customers. Or allow customers to select and pay for additional security.
- Adopt one OV-chipcard throughout the Netherlands and introduce this fast.

Conclusion: All different customer groups have a lot of improvements. The board members argue for a better governance structure between the OV-chipcard companies. All user groups suggest that it should become easier to travel between cities. Board members suggest integrating the systems of the different travel companies. This makes it easier to travel between cities / with different transportation companies as suggested by employees and customer groups. These groups also suggest integrating the different customer services to one customer service.
Prevention of fraud, security and privacy are mentioned by employees, customers and the specialist as an area of improvement.
The following are mentioned as cost saving measures for the chipcard companies: Fix the check in-out machines faster; one payment system makes work of employees more efficient. Various miscellaneous suggestions are given by customers to improve the usability of the OV-chipcard.

7 Conclusions

In this masters thesis the research question: what are the IHCs of the OV-chipcard is answered. This thesis provides a case study for IHC and the effect of the OV-chipcard system implementation on society. The methodologies used in this study are: a literature study and 49 interviews to retrieve the case data.

7.1 Research questions applied to OV-chipcard case

The thesis provides lessons learned specifically for the IHC of the implementation and how the OV-chipcard system influences the society.

IHCs of implementing OV-chipcard (section 6.1)
Both TLS and Connexxion didn't take many of the IHC drivers into consideration during the planning phase. TLS only had cost information on a few IHC drivers. Their main additional expenditures were a result from outside resistance to the OV-chipcard. This was also one of their main problems affecting their cost budget. Connexxion had cost on approximately half of the IHC drivers. For most of these drivers they also had additional cost.

Main causes of the additional IHCs (section 6.2)
The only additional IHC for TLS came from outside resistance. These costs were caused by extending the customer services department and by delays in roll-out. The main additional IHC of the two companies interviewed were spent on: delays in roll-out, additional customer support and training.

Main problems affecting the total cost budget (section 6.3)
The problems that affected the cost budget of the interviewed OV-chipcard companies were of many different types and were different for the two companies interviewed. The two main problems were for Connexxion: extra cost from implementation delays wasn't compensated and integration of different systems and for TLS: Lack of decision making and negative news. These problems had a great of very great effect on the total cost budget. The negative news resulted in IHC as additional training and marketing was needed.

The OV-chipcard effect on society (section 6.4)
User experience: In general, the OV-chipcard is regarded by interviewed users as the more convenient card to use for all types of users but it is considered to be more expensive than the strippencard. The opinions of both customer groups; the working people and students are not very different. Customers are very much divided in their opinion of the OV-chipcard. They either like it or don't like it at all. The cost of travelling with the OV-chipcard is considered to be a little higher but this change had little to no effect on the usage of the card.

***Innovation characteristics**:* Most of the interviewed employees think that the OV-chipcard systems that they use provide them with more abilities to do their work. These employees are positive about the fact that the OV-chipcard systems make their work more efficient because ticket verification is easier and there is no more confusion for customers about zones. However, employees also report many negatives: e.g. the system is too complex and the complexity of their work increases.
In general, the interviewed customers think that the OV-chipcard provides them with the same or more possibilities to go to work/study. The positive innovation effects are that the OV-chipcard system makes it easier, more convenient and faster to use the public transport. Customers can receive back lost cards and verify travel history.
The negative innovation aspects mentioned are that customers have to check in and out and this is sometimes forgotten. The process to receive money back is regarded as difficult. Also, switching transportation companies is one major topic that makes the OV-chipcard less convenient for customers.
Interviewed employees and conductors occasionally experienced problems and interviewed customers rarely experienced problems. Nearly half of these employees frequently encountered problems though.

***Task characteristics**:* About half of the interviewed employees indicate that the OV-chipcard doesn't affect their work. Conductors and drivers describe that their work has become simpler. The work of customer service has become more difficult though.

***Organizational characteristics**:* Within the organisational structure each member has an equal vote. Sometimes this takes a lot of time, discussion and preparation before decisions can be made. Decisions are made by majority.

***Environmental characteristics**:* Many different governmental organizations and authorities are involved with the OV-chipcard with all different requirements and whishes. This complicates the decision making process and has a major influence on the planning and cost of the introduction and operation of the OV-chipcard.

***Group characteristics**:* Only a small amount of the interviewed employees and customers are not satisfied. The interviewed specialists are somewhat satisfied. The other people of the investigated groups (board members, employees, conductors, working people and students) are satisfied of the OV-chipcard. Employees and conductors state that the OV-chipcard systems give them more ability to do their work. On the other hand, some of them are less satisfied due to unsatisfied customers. Working people and students are satisfied because the OV-chipcard makes it easier, more convenient and faster to use the public transport. A small portion of them is not satisfied owing the problems to the OV-chipcard system and customer service.
All different customer groups have a lot of improvements. To improve the leadership problem as mentioned by Badcock (2009) board members argue for a better governance structure between the OV-chipcard companies. All user groups suggest that it should become easier to use the OV-chipcard when travelling between cities. Board members, employees and customer groups suggest integrating the systems of the different travel companies. This will make it easier to travel between cities / with different transportation companies. Employees and customer groups also suggest integrating the different customer services to one customer service. Prevention of fraud, security and privacy are mentioned by employees, customers and the specialist

as an area of improvement. The following are mentioned as cost saving measures for the chipcard companies: Fix the check in-out machines faster; one payment system makes work of employees more efficient. Various miscellaneous suggestions are given by customers to improve the usability of the OV-chipcard.

7.2 Main findings

The following IHC drivers were detected: training fees, resistance from outside the company, integration time, customer learning, staff turnover, loss of productivity & recruitment cost. This thesis shows that most IHC drivers of the investigated public transportation companies were not estimated and not managed even though some of these IHCs had a significant effect on the total cost budget (e.g. negative news). Early identification of IHCs can help these companies to better control their total implementation cost, improve their human resources management in the organization and increase effective service delivery.

The results of this thesis can be used to support decision making during the implementation of the OV-chipcard and by future transport companies in and outside the Netherlands that are going to introduce similar contactless smart cards. As unplanned IHCs had a significant effect on the cost budget the interviewed public transportation companies, others should consider using the framework of Mohamed (2003) and Mohamed and Guah (2010) to improve their budget planning. However, more interviews can be done within OV-chipcard companies to solidify the findings even more.

7.3 Research theories

Several case studies have been conducted using the IHC theory of Mohamed (2003) and Mohamed and Guah (2010) in the service sector. This thesis provides another application of this theory in the service sector.

IHC theory in practice
The part of the case study where the focus was on IHC, the information was gathered by interviews. The interviews give an understanding of the IHC and additional cost of this in the organisation of the interviewees. In the OV-chipcard study, several IHC areas were detected that were not part of the original OV-chipcard planning of the introduction. If the IHC is detected in the early stage of the implementation, the company can create more accurate budgets and save cost during the implementation. This will improve the chances on successful introduction of the chipcard systems in the future. Using the IHC theory on TLS and Connexxion proves that the Mohamed and Guah (2010) and Mohamed (2003) framework can be used to find evidences of IHC in the transportation sector which is part of the service sector. Early identification of IHC improves cost planning within an organization.

The IHC theory was applied to both a new, ‘green-field’ implementation (TLS) and also a company that went through a transition (Connexxion), i.e. the introduction of

the OV-chipcard as new payment method. The results show that the theory can be applied on both TLS and Connexxion but is better suited for companies that have an existing environment that changes through an implementation such as the OV-chipcard.

Refinement of IHC theory: impact on society

The human environment model of Du Plooy (1998) was successfully applied to investigate the FOSS policy of the South African Government. This thesis shows an additional case where this model is applied on the OV-chipcard project. The results retrieved are qualitative. The IT manager can use this model to monitor and manage all social factors during the implementing IT system. Thus, this model could be used to support the implementation of the OV-chipcard system.

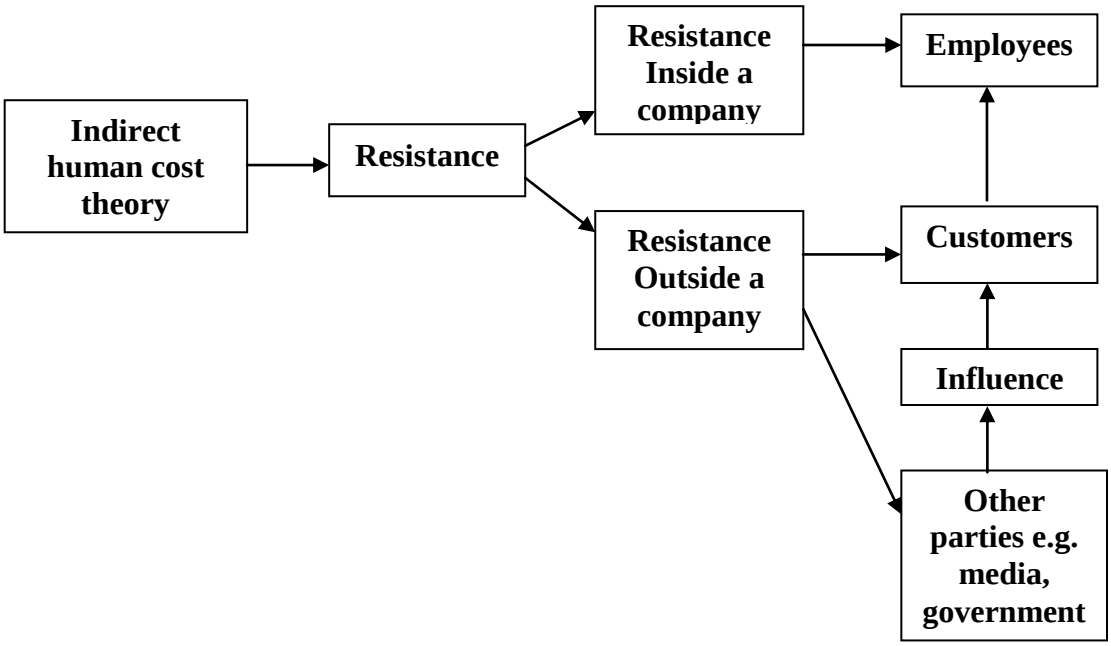
Apart from the investigation of the IHC drivers, this thesis also used an indirect way to investigate IHC: the analysis of the impact of the OV-chipcard on society by using the framework of Du Plooy (1998). This theory has proven to deliver comprehensive feedback on the effect of the OV-chipcard on society. Du Plooy theory also helps identify problem areas and help detect IHC. Several IHC drivers were detected for the OV-chipcard: e.g. increase in customer service resulting in additional employees, delays because of lack of leadership and increase in complexity of work resulting in additional training. The Du Plooy (1998) theory, however, did not identify IHC drivers that were not already found via the IHC driver questions but it did provide a deeper understanding of the IHC drivers.
The difference between the Du Plooy (1998) theory and the IHC described by Mohamed and Guah (2010) and Mohamed (2003) is that the first focuses on employees and customers and the second specifically on all IHC drivers on the board members. The Du Plooy framework can be used as verification of the IHC theory.

Refinement of IHC theory: outside resistance

There are two distinct types of resistance that can be identified. Resistance from within the company originates from its employees. This is about the cost that is associated with employees that work less efficient because they oppose the new system. Resistance from outside the company can come from for example: customers, shareholders, government, partners, organizations, etc. This has an indirect affect on different IHC drivers. Outside resistance can result in delays of introduction of the new system, addition training & learning, etc.

Both types of resistance have a different effect on the organization. Companies can make different plans to handle each type of resistance. Therefore we extend the IHC model with a refinement of the “resistance” driver to “inside resistance” and “outside resistance”.

The figure below shows the types of resistance and how the parties involved interact to each other:



In the OV-chipcard case, board members indicated that outside resistance originated from the media and government. Negative publicity and delays caused by governmental decisions had an influence on the customer's opinion. This is supported by (Meijers research, 2009). Unsatisfied customers, in its turn, have an effect on employees as angry customers influence the employee satisfaction. So outside resistance can result in inside resistance. This can extend the IHC model of Mohamed (2003).

7.4 Further research

This thesis uses a qualitative approach and applies the IHC and effect of IT on society by a case study. The case study focuses on identifying the different aspects of these theories in the OV-chipcard case. The case study identifies missing cost drivers in project cost estimation which are related to IHC. This investigation should be extended to also identify these gaps, i.e. what the effects of these individual gaps are on the total budget. This will give a better understanding of the most important IHC areas that should be included in budget planning. This can be a focus for further research.

Further case studies can also focus on the actual cost of the IHC drivers. This can give better insight in the importance of the different drivers.

In order to identify all IHC, more detailed assessments should be made by involving different stakeholders in various departments of the organisation that can help answer all aspects of the IHC drivers and conduct interviews with them.

The framework of Mohamed and Guah (2010) and Mohamed (2003) focus only on IHC. It is clear that IHC aspects should be part of the planning of projects as awareness of IHC will improve planning and budgeting. An analysis on how to integrate IHC into popular project management methodologies and investment frameworks is an area that can be investigated further.

This case study provides additional empirical data for the framework of Mohamed (2003) and Mohamed and Guah (2010) in the service sector (Transport). However, additional empirical data is needed to validate and develop more constructs for KPIs and find root causes of IHCs.

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Appendix A: Introduction e-mail

Dear Mr. / Mrs.,

To remind you, I attended the meeting "Wetenschapsforum bijeenkomst" on 5 October 2010. My name is Penpak Boonla. I'm a master student of Economics & Informatics department of the Erasmus University where I am working on my thesis. I would like to ask your permission for a follow-up interview on the OV-chipcard. The interview will take 30 to 60 minutes. Can you propose a meeting in the next 2 weeks, or in the beginning of the New Year?

Your interview result is important to help me investigate the effect of indirect human costs (cost which is usually not budgeted) on the project budget and the root causes of indirect human cost during the implementation of the OV-chipcard in the Netherlands. I furthermore investigate in my thesis why identifying the indirect human costs are essential to the successful implementation of the OV-chipcard. This research is valuable for managers to help improve their human resources management in the organization, increase effective service delivery and control their total implementation cost.

The report also shows how the OV-chipcard affects society (Employees and customers of the OV-chipcard). To be successful in implementing the OV-chipcard, society is important to investigate because when you understand what they want, you will be able to support them and learn them to use the new OV-chipcard IT systems.

My thesis is useful for the implementation of OV-chipcard companies (TLS, Connexxion, GVB, RET, HTM and NS). All of these companies could use the results to support decision making and prevent the cost over-run of the OV-chipcard implementations. This investigation aims to support the next implementations of the OV-chipcard throughout the Netherlands. The thesis provides lessons learned specifically for the indirect human cost of the implementation and the influences of the OV-chipcard to society.

The 5 groups of people I'm going to interview:

1. CEO's and management team from TLS, Connexxion, GVB, RET, HTM and NS
2. Advisors of OV-chipcard fromWetenschapsforum
3. General employees from TLS, Connexxion, GVB, RET, HTM and NS
4. Conductors from TLS, Connexxion, GVB, RET, HTM and NS
5. Users

Your name will be anonym in this thesis. Sensitive information is also anonym if requested. Thank you very much for your cooperation.

Yours sincerely, Penpak Boonla

Appendix B: Interview questions

Group 1: Interview CEO's and management

1. What is your name?
2. Could you tell me about yourself? What do you do?
    - What company do you work for?
    - (TLS, Connexxion, GVB, RET, HTM and NS)?
    - What is your position?
    - How long have you been working in this company?
3. How was your company involved in the OV-chipcard implementation?
4. Did you have to reorganize the roles within your company during the OV-Chipcard implementation?
    - If, Yes How? Why?
    - How many times in total?

5. Did you have to lay people off?
    - Why did it happen?
    - Did you save salary cost?
    - Did you have additional cost during laying off people? (**Additional costs are unplanned cost**). E.g. Lay-off compensation.

6. Did you have to hire new employees?
    - Why?
    - Did you have **extra** cost? E.g. recruitment cost, interviews, advertising.

7. People changed roles: did you have to give promotion to some people?
    - Why?
    - Did you have more cost than planned? If yes, why?

8. *Did some work become easier in the new role of people?
    - How?
    - Did you save cost here?
    - Did you have extra cost? If yes, why?
9. *Did you have problems in people rejecting change in salary?
    - Did you have more cost than planned? If yes, why?
    - If yes, what budget was charged for the cost?
10. Was there any resistance INSIDE your company against the OV-chipcard DURING or AFTER the implementation?
    - Please explain what kind of resistance.
    - How did you solve this?
    - Did you have more cost than planned? If yes, why?

11. Was there any resistance OUTSIDE your company against the OV-chipcard DURING or AFTER the implementation? (e.g. media, customers, other companies)
    - Please explain what kind of resistance.
    - How did you solve this?
    - Did you have more cost than planned? If yes, why?
12. How did you train the employees for the OV-chipcard?
    - Did you have more cost than planned in training fees? If yes, why?
    - Did you have more cost than planned in replacing the employees that were in training? If yes, why?

13. How did you teach customers how to use the OV-chipcard?
    - Did you have more cost than planned? If yes, why?

14. *Did or do you use the OV-chipcard and strippencard or paper card at the same time?
    - Did you have more cost than planned? If yes, why?

15. Did you plan time for employees learning on the job about the new OV-chipcard system**?**
    - Did you have more cost than planned? If yes, why?

16. Did you have a loss in productivity after introducing the OV-chipcard? How? (*loss productivity is less efficient working*) Did you have an increase or decrease in productivity of the employees? Was this higher or lower than planned?

17. Are there any hidden costs in your company? If yes, why?

18. What do you see as the main problems that occurred during the implementation of the OV-chipcard?
    - How does the problem affect your total cost budget? Could you please put an X in this scale or mark the checkbox?

Problem 1:

No affect	Little affect	Some affect	Moderate affect	Great affect	Very great affect	Extreme affect

☐ I don't know

Problem 2:

No affect	Little affect	Some affect	Moderate affect	Great affect	Very great affect	Extreme affect

☐ I don't know

Problem 3:

No affect	Little affect	Some affect	Moderate affect	Great affect	Very great affect	Extreme affect

☐ I don't know

Problem 4:

No affect	Little affect	Some affect	Moderate affect	Great affect	Very great affect	Extreme affect

☐ I don't know

19. Is the total cost budget after the implementing OV-chipcard the same as planned? If not, why not?
    - How did you solve the costs budget problems?
    - How much additional cost?

20. How has the total cost of implementing the OV-chipcard changed? Could you please put X in this scale or mark the checkbox?

A lot lower	Lower	Somewhat lower	Same	Somewhat higher	Higher	A lot higher

☐ I don't know

21. How do the 6 companies work together? (TLS, Connexxion, GVB, RET, HTM and NS)

22. How are decisions taken in this 6 company's cooperation?
    - Who makes the decisions?

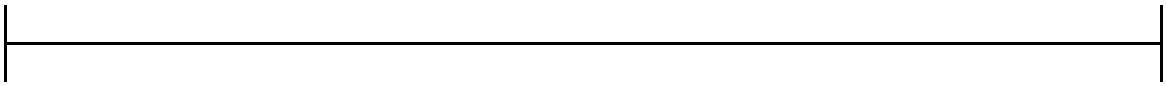
23. Are there any problems in decision making among the 6 companies? If yes, what are the problems?

24. How have the other parties influenced the OV-chipcard implementation?

25. How has the government influenced the implementation of the OV-Chipcard?

26. How satisfied are you of implementing the OV-chipcard? Could you please put X in this scale or mark the checkbox?

Not satisfied	Little satisfied	Somewhat satisfied	Satisfied	More than satisfied	Very satisfied	Extremely satisfied



☐ I don't know

Final question

27. What is your suggestion to improve the OV-chipcard system?

*Some questions are not relevant and therefore not used during the interview of the TLS CEO because TLS were involved during the OV-chipcard implementation and not before the implementation of the OV-chipcard.

ENGLISH: **Group 2, 3: Employees and conductors of 6 companies**

1. What is your name?
2. Could you tell me about yourself? What do you do?
    - What company do you work for?

(TLS, Connexxion, GVB, RET, HTM and NS)?

    - What is your position?
    - How long have you been working in this company?

3. Does the OV-chipcard system (=computer programs) provide you with more or less abilities to do your work?

4. How does the change from strippenkaart / paper card to OV-chipcard affect the way you work?
    - Are there any positive affect?

- Are there any Negative affect?

5. Are there any problems after using the OV-chipcard **system**?
    - What are the problems?
    - How did you solve the problems?
    - Where did you solve the problem?
    - How long did it take to solve the problem? …..day, ……Weeks, …….Months,……Years, Other……...
    - Which system had the most problems?

6. How often did the problems happen to you? Could you please put X in this scale or mark the checkbox?

Always	Very frequently	Frequently	Occasionally	Rarely	Very rarely	Never

☐ I don't know

7. What is the general reaction of customers on the change to OV-chipcard?
8. Are you satisfied of using OV-chipcard system? Why?
9. How satisfied are you of using the OV-chipcard system? Could you please put X in this scale or mark the checkbox?

Not satisfied	Little satisfied	Somewhat satisfied	Satisfied	More than satisfied	Very satisfied	Extremely satisfied

☐ I don't know

10. What is your suggestion to improve the OV-chipcard system?

NEDERLANDS: **<u>Groep 2, 3: Medewerkers en conducteurs van de 6 bedrijven</u>**

1. Wat is uw naam?
2. Kunt u me vertellen over uwzelf?
    - Voor welk bedrijf werkt u? (TLS, Connexxion, GVB, RET, HTM en NS)?
    - Wat is uw positie/rol?
    - Hoe lang werkt u al in dit bedrijf?
3. U gebruikt bij uw werk het nieuwe OV-chipkaart systeem (=computer programma's). Geeft dit systeem u meer of minder mogelijkheden om uw werk te doen?

4. Wat is het effect van de verandering van strippenkaart / papieren kaart naar OV-chipkaart op jouw werk?
    - Positief effect?
    - Negatief effect?
5. Zijn er problemen bij het gebruik van het OV-chipkaart **systeem**?
    - Wat zijn de problemen?
    - Hoe heb je de problemen opgelost?
    - Waar heb je de problemen opgelost?
    - Hoe lang heeft het geduurd om de problemen op te lossen?: … dagen, … weken, … maanden, … jaren, anders……
    - Welk systeem gaf de meeste problemen?

6. Hoe vaak heb jij problemen gehad? Plaats een X op de onderstaande schaal of in het vierkant?

Altijd Zeer vaak Vaak Af en toe Soms Heel soms Nooit

☐ Onbekend

7. Wat is de algemene reactie van klanten op de verandering naar OV-chipkaart?
8. Ben je tevreden over het gebruik van het OV-chipkaart systeem? Waarom?
9. Hoe tevreden ben je met het gebruik van het OV-chipkaart systeem? Plaats een X op de onderstaande schaal of in het vierkant?

Ontevreden Klein beetje tevreden Enigszins tevreden Tevreden Meer dan tevreden Erg tevreden Extreem tevreden

☐ Onbekend

10. Wat is jou suggestie om het OV-chipkaart systeem te verbeteren?

ENGLISH: **<u>Group 4, 5: Working people and students</u>**

1. What is your name?

2. Could you tell me about yourself. What do you do?

3. Do you use the OV-chipcard? If, yes. How often do you use it? (….per week, …per month)

4. What type of OV-chipcard do you have?

5. Does the OV-chipcard system provide you with more or less abilities to go to work (**Worker**) / to study (**Student**)?

6. How does the OV-chipcard affect the way you work?
    - Are there any positive affect?
    - Are there any Negative affect?

7. Are there any problems after using the OV-chipcard?
    - What are the problems?
    - How did you solve the problems?
    - Where did you solve the problem?
    - How long did it take to solve the problem? …..day, ……Weeks, …….Months,……Years, Other……...

8. How often did the problems happen to you? Could you please put X in this scale or mark the checkbox?

Always	Very frequently	Frequently	Occasionally	Rarely	Very rarely	Never

☐ I don't know

9. Does the cost of travelling change to you? If yes. Could you please put X in this scale or mark the checkbox?

A lot lower	Lower	Somewhat lower	Same	Somewhat higher	Higher	A lot higher

☐ I don't know

10. How does the changing cost effect to you? Could you please put X in this scale or mark the checkbox?

No affect	Little affect	Some affect	Moderate affect	Great affect	Very great affect	Extreme affect

☐ I don't know

11. How the OV-chipcard changes the way you use the public transport?
12. Are there differences in the usage between the OV-chipcard and strippencard / paper card? If yes. How?
13. Are you satisfied of using OV-chipcard? Why?
14. How satisfied are you of using the OV-chipcard? Could you please put X in this scale or mark the checkbox?

Not satisfied	Little satisfied	Somewhat satisfied	Satisfied	More than satisfied	Very satisfied	Extremely satisfied

☐ I don't know

15. What is your suggestion to improve the OV-chipcard system?

NEDERLANDS: **<u>Groep 4, 5: Werkende mensen en studenten</u>**

1. Wat is jouw naam?

2. Kan je vertellen wat je doet (werk/studie)?

3. Gebruik je de OV-chipkaart? Als ja, hoe vaak? (….per week, …per maand)

4. Welk type OV-chipkaart heb je?

5. Heeft het OV-chipkaart system jou meer of minder mogelijkheden om naar je werk/studie te gaan?

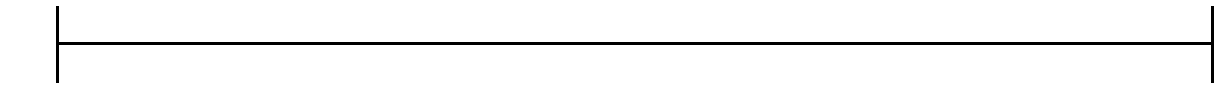
6. Wat is het effect van de OV-chipkaart op jouw werk?
    - Positief effect?
    - Negatief effect?

7. Zijn er problemen bij het gebruik van de OV-chipkaart?
    - Wat zijn de problemen?
    - Hoe heb je de problemen opgelost?
    - Waar heb je de problemen opgelost?
    - Hoe lang heeft het geduurd om de problemen op te lossen?: … dagen, … weken, … maanden, … jaren, anders……

Welke vorm van transport gaf de meeste problemen (trein, metro, bus, …)?

8. Hoe vaak heb jij problemen gehad? Plaats een X op de onderstaande schaal of in het vierkant?

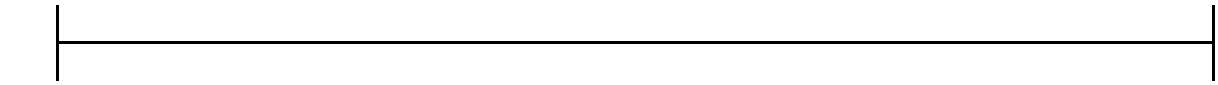
Altijd	Zeer vaak	Vaak	Af en toe	Soms	Heel soms	Nooit



☐ Onbekend

9. Zijn de reiskosten voor jou veranderd? Als ja, plaats een X op de onderstaande schaal of in het vierkant?

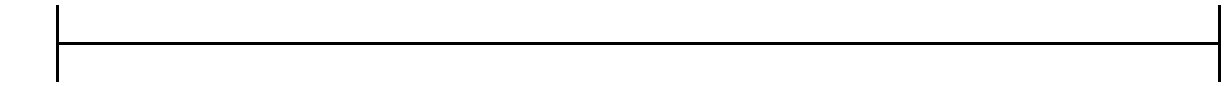
Veel minder	Minder	Iets lager	Zelfde	Iets hoger	Hoger	Veel hoger



☐ Onbekend

10. Heeft de verandering van kosten effect op jou? Plaats een X op de onderstaande schaal of in het vierkant?

Geen effect	Weinig effect	Beetje effect	Gemiddeld effect	Groot effect	Heel groot effect	Extreem veel effect



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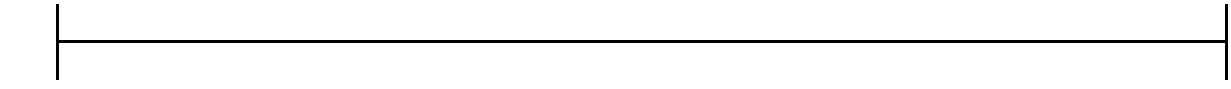
11. Hoe verandert de OV-chipkaart jouw gebruik van het openbaar vervoer?
12. Zijn er verschillen in gebruik tussen OV-chipkaart en de strippenkaart / papieren kaartjes voor jou? Als ja, hoe?
13. Ben je tevreden met het gebruik van de OV-chipkaart? Waarom?
14. Hoe tevreden ben je met het gebruik van de OV-chipkaart? Plaats een X op de onderstaande schaal of in het vierkant?

Ontevreden	Klein beetje tevreden	Enigszins tevreden	Tevreden	Meer dan tevreden	Erg tevreden	Extreem tevreden



☐ Onbekend

15. Wat is jou suggestie om het OV-chipkaart system te verbeteren?

Appendix C: Interview question matrix

The following table shows which interview questions are asked to which interview group. All questions are related to research question 4.

Interview question	**Group 1: CEO's / board**	**Group 2: Employees**	**Group 3 : Conductors**	**Group 4 : Working people**	**Group 5 : Students**	**Group 6 : Specialists**
To specify each type of people						
What is your name?	x	x	x	x	x	x
Could you tell me about yourself? What do you do? Choose (TLS, Connexxion, GVB, RET, HTM and NS)? Others…..	x	x	x	x	x	
How long have you been working in this company?	x	x	x			
1) Individual characteristics:						
Customers *Question 3 for working people & students: Do you use the OV-chipcard? If, yes. How often do you use it? (……per week, …….per month)* *Question 4 for working people & students: What type of OV-chipcard do you have?* *Question 12 Are there differences in the usage between the OV-chipcard and strippencard / paper card? If, yes. How?* *Question 9 Does the cost of travelling change to you? If yes. Could you please put X in this scale or mark the checkbox?* *Question 10 How does the changing cost effect to you? Could you please put X in this scale or mark the checkbox?* *Question 11 How the OV-chipcard changes the way you use the public transport?*				x	x	
2) <u>Innovation characteristics:</u>						
Employees		x	x			

Interview question	**Group 1: CEO's / board**	**Group 2: Employees**	**Group 3 : Conductors**	**Group 4 : Working people**	**Group 5 : Students**	**Group 6 : Specialists**
Question 3 for employees & customers: Does the OV-chipcard system (=computer programs) provide you with more or less abilities to do your work? *Question 4 for employees & customers: How does the change from strippenkaart / paper card to OV-chipcard affect the way you work?* • *Are there any positive affect?* • *Are there any negative affect?* *Question 5 for working people & students: Are there any problems after using the OV-chipcard?* • *What are the problems?* • *How did you solve the problems?* • *Where did you solve the problem?* • *How long did it take to solve the problem? …..day, ……Weeks, ……..Months,……Years, Other*						
Customers *Question 5 for working people & students: Does the OV-chipcard system provide you with more or less abilities to go to work (**Worker**) / to study (**Student**)?* *Question 6 for working people & students: How does the OV-chipcard affect the way you work?* • *Are there any positive affect?* • *Are there any Negative affect?* *Question 7 for working people & students: Are there any problems after using the OV-chipcard?* • *What are the problems?* • *How did you solve the problems?* • *Where did you solve the problem?* • *How long did it take to solve the problem? …..day, ……Weeks, ……..Months,……Years, Other*				**x**	**x**	
Employees and Customers *Question 8 for working people & students,*		**x**	**x**	**x**	**x**	

Interview question	Group 1: CEO's / board	Group 2: Employees	Group 3 : Conductors	Group 4 : Working people	Group 5 : Students	Group 6 : Specialists
Question 10 for employees & conductors: How often did the problems happen to you?						
3) Task characteristics:						
Question 5 How does the OV-chipcard affect the way you work?		x	x			
4) Organizational characteristics:						
Question 21 How do the 6 companies work together? (TLS, Connexxion, GVB, RET, HTM and NS)	x					
Question 22 How are decisions taken in this 6 company's cooperation? • *Who makes the decisions?*	x					
Question 21 Are there any problems in decision making among the 6 companies: TLS, Connexxion, GVB, RET, HTM and NS? If yes, what are the problems?	x					
5) Environmental characteristics						
Question 24 How have the other parties influenced the OV-chipcard implementation?	x					
Question 25 How has the government influenced the implementation of the OV-Chipcard?	x					
6) Group characteristics:						
How satisfied are you of using the OV-chipcard? Then please put in scale.	x	x	x	x	x	x
What is your suggestion to improve the OV-chipcard system?	x	x	x	x	x	x

Appendix D: Interview results

Indirect Human Cost

Indirect human cost factors and the response in the interviews

In this section, the interview results are mapped on the different Indirect Human Cost (IHC) drivers. Further, the table shows if cost were planned for these drivers and if more cost than planned was needed in the end.

Connexxion:

IHC drivers	Plan-ned cost	More cost than plan-ned	Explanation or root causes of problems
1. Introduction of new system	-	-	
1.1. Training fees and other related cost/resources	no	no	Drivers received one day of training. This was not planned at the start in 2001 but before implementation in 2009.
1.2. Recording expected time integrating with new system	-	-	Not discussed
1.3. Recording time in which both new and old system are used	yes	no	This is measured for each concession / contract.
1.4. Expected operational cost as a result of resistance to change	-	-	No resistance to the change from the employees.
2. Redefining roles	no	no	No, the work of the drivers stayed the same. Conductors have to work with the new systems.
3. Redundancy	no	no	No lay offs or voluntary leaving of staff.
4. Promotion	no	no	Drivers and IT staff received extra tasks but no promotion. There was no extra cost.
5. Deskilling	no	no	Drivers and IT staff received extra tasks, not less tasks
6. Training	yes	yes	Drivers received one day of training. This was not planned at the start in 2001 but done before implementation in 2009. There was additional training and learning on the job needed for conductors to get used to working with the new system. They received extra training. More cost than planned here.
6.1. Number of replacement staff and their stay duration	no	no	No additional cost for drivers: the training was part of their yearly training.
6.2. Number of staff requesting change in salary subsequent to training	no	no	None.

6.3. Record of time spent training others	n/a	n/a	-
6.4. Costs of issues related to training apart from actual training fees	n/a	n/a	-
7. Effort and dedication	yes	n/a	There is more work for employees in the beginning, but it will become easier later.
8. Resistance	-	-	-
8.1. Inside company	no	n/a	There was some resistance in the beginning because the system was new and different from what they know. This problem was solved by training the drivers. Unsure if this caused additional cost.
8.2 Outside company	yes	yes	Customers and media had a lot of questions and complaints so Connexxion had to increase the customer service. This resulted in a lot more cost than planned.
9. Escalating operational	n/a	no	-
10. Moral hazard	n/a	n/a	No moral hazard because there were no lay offs and not much inside company resistance. The work didn't change a lot for the employees.
11. Integration time	yes	yes	Measured for every concession / contract. The old strippencard and new OV-chipcard system are used together for more than 3 years instead of the estimated 3 months. More cost than plan here. Additional cost in addressing the specific OV-chipcard needs of the provinces and cities for the tenders complicates the processes and therefore creates additional costs.
12. Learning	n/a	yes	Only one special day training for drivers. Customers were taught to use the system by using websites and templates. Because this is done province by province and not all at once, this resulted in additional marketing cost
13. Replacement staff	yes	no	No additional cost for replacement of drivers: the training was part of their yearly training.
14. Staff turn over	-	-	-
14.1. Number of staff leaving	n/a	n/a	None
14.2 Resulting recruitment costs e.g. interviews and advertisement	no	yes	No recruitment cost but Connexxion had to hire additional IT staff because they were the one of the first involved and major hardware and software changes occurred during the project.
14.3 Data on reasons for staff leaving	n/a	n/a	Reasons for voluntary leave are not recorded.
14.4 Promotion costs	no	no	Not for employees
14.5. Training costs	yes	no	No additional cost
15. Rejecting change in salary	no	no	No rejection in change of salary.
16. Loss of productivity	yes	yes	Conductors have to check both strippencard and OV-card so they need more time. This reduces their productivity. Since this double system is

			longer needed than planned, this gives additional cost.
17. Reduction in knowledge base	n/a	n/a	No lay-offs staff leaving.
18. New Recruitment costs	no	no	No recruitment cost.

Other remarks that are were gathered from the semi-structured interview which was not directly related to indirect human cost:

- Connexxion stopped being a shareholder because opposed to the other shareholders they are privately owned and need to make profit. Sometimes they regret this decision as being a shareholder gives more control of solving important issues with the system. E.g. will we buy a new chip for the OV-chipcard.

TLS:

IHC drivers	**Planned cost**	**More cost than planned**	**Explanation / Root cause of problems**
1. Introduction of new system	yes	No	TLS started with 2-3 people but grew to 120 people, mostly experienced people and a lot of IT people. In the beginning most were externally hired, now only about 10-15. All cost for this was planned.
1.1. Training fees and other related cost/resources	yes	No	Training of TLS employees was planned for.
1.2. Recording expected time integrating with new system	n/a	No	
1.3. Recording time in which both new and old system are used	n/a	n/a	
1.4. Expected operational cost as a result of resistance to change	n/a	n/a	No resistance so no cost planned for this and no extra operational cost.
2. Redefining roles	n/a	no	No reorganization was needed because the company was started during the OV-chipcard implementation.
3. Redundancy	n/a	no	-
4. Promotion	yes	no	Some people got promoted over time. This was planned.
5. Deskilling	no	no	

6. Training	yes	no	TLS has no drivers, conductors, etc. Training of TLS employees was planned for.
6.1. Number of replacement staff and their stay duration	no	no	-
6.2. Number of staff requesting change in salary subsequent to training	no	no	-
6.3. Record of time spent training others	no	no	-
6.4. Costs of issues related to training apart from actual training fees	no	no	-
7. Effort and dedication	no	no	-
8. Resistance	-	-	-
8.1. Inside company	no	no	No resistance because people were hired to work on the OV-chipcard.
8.2 Outside company	n/a	yes	Customers don't always like to change. There was resistance from users, media and politicians. TLS invested in communications to solve this. Delays in roll-out by the government resulted in tens of millions additional cost because of the delay in roll-out.
9. Escalating operational	n/a	n/a	
10. Moral hazard	n/a	n/a	
11. Integration time	n/a	n/a	
12. Learning	yes	no	Customers can get information via brochures, by phone, on the TLS website and also on youtube where demo films are available. All cost was within budget.
13. Replacement staff	n/a	n/a	
14. Staff turn over	n/a	n/a	No lay off of people
14.1. Number of staff leaving	n/a	n/a	
14.2 Resulting recruitment costs e.g. interviews and advertisement	n/a	n/a	
14.3 Data on reasons for staff leaving	n/a	n/a	
14.4 Promotion costs	no	no	
14.5. Training costs	yes	no	General training of IT staff was needed. Not more cost than planned.
15. Rejecting change in salary	n/a	n/a	No
16. Loss of productivity	n/a	no	Not relevant because TLS started during implementation.
17. Reduction in	n/a	n/a	

knowledge base			
18. New recruitment costs	n/a	n/a	No

n/a = not applicable or information not available

Other remarks that are were gathered from the semi-structured interview which were not directly related to indirect human cost:

- The master plan is to implement the OV-chipcard by the end of 2011 for all non-train transport and by the end of 2012 for trains.
- No hidden cost can be identified.
- There is a monthly meeting of customer council between 9 operators and TLS. Each has an equal voice. TLS can override if necessary if this regards the OV-chipcard system.
- TLS' suggestion is to keep the system and all its improvements simple.

Question 20 for CEO: How has the total cost of implementing the OV-chipcard changed?

Problems	**Connexxion**
50 million of extra investment cost is not covered	Connexxion estimated to earn back the OV-chipcard investments within 5-10 years. Because of all the difficulties it is unsure that the extra cost of the OV-chipcard can be earned back. The total investment budget for the OV-chipcard was about 100 million euro. Only half is estimated to be earned back by the OV-chipcard. The rest is hopefully paid back by the ministry of transportation or granters of contracts.
Working with different back-office systems as the NS.	Connexxion and Dutch railway (NS) are working with different back-office systems so that makes it difficult to work together. Also, travelling in between 2 companies should be simpler. Now if you go from NS to use a bus you have to check-in and out twice. Now customers have to pay twice for checking in.
Fraud.	People are copying the card or incorrectly asking for reimbursement of the cost. Fraud damages the image of the OV-companies.
Using 2 payment methods in parallel	Connexxion misses revenue during parallel usage of strippencard and OV-chipcard because people in the Netherlands take the cheapest option of the two for travelling.
Working together with other OV-chipcard companies	Board of TLS and the 9 OV-companies have a customer council once a month or sometime twice a month at TLS. The decisions are made on consensus. Sometimes share holders make a decision in share holder meeting and sometimes decisions are made in customer board. If a problem is not solved during a meeting it will be discussed again during the next meeting. Some discussions have been there for a long time.
Governmental involvement	National government has a big issue if there are problems with the OV-chipcard because OV-chipcard involves everyday life of people. If there is a problem, It will be written in newspaper, draw the attention of politicians who will start a debate. This can create an issue to the new introduction. E.g OV-chipcard discussions have postponed the OV-chipcard implementations more than once. This causes extra cost and Connexxtion expects the government to pay for it.

TLS

Problems	TLS
Lack of decision making from government to abandon the paper ticket system.	OV-chipcard is not government project but from transport operators but they have to oblige to the government. Transport operators have a contract with the central government and they decide when they abandon the paper base tickets. If the company meets the criteria level then the government will make the decision to stop the paper ticket or not. In the mean time the company still has to operate 2 systems at the same time which increases the cost for the company.
Complex landscape of politics and media which damaged the success story.	Complex landscape of organizations involved in public transport, also OV-chipcard. Politics around whole project.
Operational problems during start-up in 2005/2006	In the beginning there were some operational problems. Now TLS service 9.5 million cards. The cards are used over 100 million times per month. In the beginning some customers didn't think that TLS give good service. People didn't find what they are looking for on the website or had broken cards.
Negative news instead of positive news.	Small problems with the OV-chipcard are magnified in the media and give a negative impression to the OV-chipcard and OV-chipcard organization. E.g. there are some people who pay more or less then before but you will hear from the people who pay more. A lot of people are happy with the card compared to unhappy people.
Many different parties involved with many different requirements.	There are 20 governmental bodies are involved, media, different customer organisations, privacy/competition/banking authorities have many different wishes and requirements. TLS organize: Customer council monthly consist of 9 operators: Arriva, Veolic, Qbuzz, Syntus, GVB, HTM, RET, NS, Connexxion It is not always easy to make decision together. Making decisions takes a lot of time, discussion and preparation.

IT effect on society

Question 9 for employees & customers: Does the cost of travelling change to you?
Question 10 for employees & customers: How does the changing cost affect you?

ID	Cost change Scores % 0-100	Effect of cost change Scores % 0-100
W1	75	6
W2	Don't know	18
W3	76	27
W4	62	22
W5	60	5
W6	63	20
W7	39	13
W8	19	7
W9	33	19
W10	47	61
W11	62	18
W12	46	46
W13	61	34
W14	64	18
W15	Don't know	Don't know
S1	Don't know	Don't know
S2	57	6
S3	48	5
S4	1	1
S5	48	7
S6	31	33
S7	61	5
S8	34	5
S9	49	7
S10	47	5
S11	76	33
S12	68	68
S13	75	47
S14	62	20
S15	48	3

Question 3 for employees & customers: Does the OV-chipcard system (=computer programs) provide you with more or less abilities to do your work?

Question 4 for employees & customers: How does the change from strippenkaart / paper card to OV-chipcard affect the way you work?

- *Are there any positive affect?*
- *Are there any Negative affect?*

Customer service, drivers and conductors:

Employees (13)	Ability of working (more/less)	Affect of using of OV-chipcard system(+/-)	Reasons	Customer reaction to employees
EC_HTM1	more	-	No positive affect: e.g. if people have problem with their card, he has to check in the system where the problem has occurred which is taking sometimes more than strippencard. Longer waiting queue, longer time with one customer because of more procedures on his duty. Thus,	Customers need more information, some angry with long queues. More difficult for older people to get use to the new system.

Employees (13)	Ability of working (more/less)	Affect of using of OV-chipcard system(+/-)	Reasons	Customer reaction to employees
			need more colleagues to give services to customers. Esier system, old system is better because need less procedure than OV-chipcard: just sell tickets and give information about a ticket. OV-chipcard needs more procedure on his job.	
EC_HTM2	more	+,-	Positive affect: easier for tourists no need to calculate zones which is confusing for them. Need less time to explain for tourists and easier for some people who can not calculate zone well. Negative affect: some customers complain about increasing prices. When a customer card is broken, then they have to wait for a week, during waiting have to pay more expensive than using an OV-chipcard. OV-chipcard companies don't work together well which make customers confused about their services.	50% happy customers. 50% unhappy customers
EC_RET3	more	+,-	Positive affect: easier and more efficient with OV-chipcard even though more job duties but still feel good. Negative affect: charging machine doesn't work and a customer card is broken.	Most of the time, more happy customers than unhappy customers
ED_RET1	Less	-	Less control on subscription cards when the check in-out machine doesn't work. He just lets customers sit.	Many customers complain that they can't see how much money they have on their card.
ED_RET2	No different, the same	+	Less work, no confusing about zone, just sell tickets to customers.	Most of them happy only some customers complain about higher price
ED_RET3	more	+,-	More positive effects: no more selling of tickets. Can concentrate better on driving Some negative effect because the check in-out machine is sometimes broken which is sometimes fixed at the end of the day that means a whole day many people can travel for free and company loses money.	Some customers complain that the OV-chipcard is more expensive than strippencard
ED_RET4	more	+,-	Positive affect: less control , faster working, can concentrate better on driving Negative affect: customers are not satisfy	Angry about payment problems.
ED_RET5	more	+,-	Positive: OV-chipcard doesn't change his job duty and the feeling	No problem because no contact with customers

Employees (13)	Ability of working (more/less)	Affect of using of OV-chipcard system(+/-)	Reasons	Customer reaction to employees
			is good about the OV-chipcard Negative: worry about fraud	
C_RET1	50%more, 50%less	+,-	Positive: easier working with the OV-chipcard Negative: in the beginning, a lot of customers are not satisfied but now it's a bit better. Customers are less friendly because they don't understanding the system very well and technical problems make them lose time and money.	Per day about 60% of customers are not happy with the OV-chipcard. 5% angry customers.
C_RET2	more	+	Easier working. No more checking and confusing about zone.	Sometimes, customer's angry about check in – out problems.
C_RET3	50%more, 50%less	+,-	Easier working. No more checking and confusing about zone. Negative: Check in- out problems	Customers: 50% happy, 50% unhappy
C_RET4	Less	-	Not sure if there is a positive effect of using OV-chipcard. Complaints that card is more expensive. If check in-out machines don't work then they have to buy a ticket because he can't check if the customer card has enough money or valid subscription.	A lot of people are often angry, complain, or are aggressive. Only few people happy about paying less
C_RET5	Less	-	Negative effect because the check in-out machine often doesn't work and they have to wait a long time before the machine is fixed. He can't check if the customer card is valid. He can't work so many people can travel for free.	Often angry customers and complain about expensive price. Less people are happy about cheaper price.

Question 3 for working people & students: Do you use the OV-chipcard? If, yes. How often do you use it? (…….per week, …….per month)

Question 4 for working people & students: What type of OV-chipcard do you have?

ID	Job/ Major	Type of OV-chipcard		Frequency of using Per week			
				A lot, everyday a week 7	Many times a week 4-6	Sometimes 1-3	Rarely 1-5 per month/ year
W1	Auditor finance	A	7	√			
W2	cleaner	S, A company paid	7	√			

ID	Job/ Major	Type of OV-chipcard		Frequency of using Per week			
W3	researcher	P	5		√		
W4	Manager, student	S	7	√			
W5	Logistic container control	S A company paid	7	√			
W6	Professor assistant	P, A	4-5		√		
W7	Teacher	P	3-6		√	√	
W8	Saler	P	4-5		√		
W9	Recruitment officer	P	3			√	
W10	Working in fabric	A	1-2			√	
W11	Cleaner	S	5		√		
W12	Researcher	S	5-6		√		
W13	Researcher	P	2			√	
W14	Saler	P	2-3			√	
W15	General officer	P	7	√			
S1	Mater ICT	A, P, NS	1-2			√	
S2	Master Finance	S	3-4		√	√	
S3	Master criminal law	S	1 month				√
S4	PHD student	S	4-5		√		
S5	Bachelor Economics	S	2-3			√	
S6	International Master Finance	A	5-6		√		
S7	Master Financial law	S	7	√			
S8	Master Physical Economics	S	5 times month				√
S9	Master Economics Law	S, NS	1-2			√	
S10	Bachelor Psychology	S	1 month				√
S11	Master Economics	S	5		√		
S12	Master ICT	P	7	√			

ID	Job/ Major	Type of OV-chipcard		Frequency of using Per week			
S13	International Master Financial Economics	P	5-7	√	√		
S14	Master ICT	S	4-5		√		
S15	Bachelor Operational research	S	2			√	

ID	Job/ Major	Type of OV-chipcard	Frequency of using (per week)
W1	Auditor finance	A	A lot, everyday a week
W2	cleaner	S, company paid	A lot, everyday a week
W3	researcher	P	Many times a week
W4	Manager, student	S	A lot, everyday a week
W5	Logistic container control	S company paid	A lot, everyday a week
W6	Professor assistant	P, A	Many times a week
W7	Teacher	P	Many times a week, Sometimes
W8	Saler	P	Many times a week
W9	Recruitment officer	P	Sometimes
W10	Working in fabric	A	Sometimes
W11	Cleaner	S	Many times a week
W12	Researcher	S	Many times a week
W13	Researcher	P	Sometimes
W14	Saler	P	Sometimes
W15	General officer	P	A lot, everyday a week
S1	Mater ICT	A, P, NS	Sometimes
S2	Master Finance	S	Many times a week, Sometimes
S3	Master criminal law	S	Rarely
S4	PHD student	S	Many times a week
S5	Bachelor Economics	S	Sometimes

ID	Job/ Major	Type of OV-chipcard	Frequency of using (per week)
S6	International Master Finance	A	Many times a week
S7	Master Financial law	S	A lot, everyday a week
S8	Master Physical Economics	S	Rarely
S9	Master Economics Law	S, NS	Sometimes
S10	Bachelor Psychology	S	Rarely
S11	Master Economics	S	Many times a week
S12	Master ICT	P	A lot, everyday a week
S13	International Master Financial Economics	P	A lot, everyday a week Many times a week
S14	Master ICT	S	Many times a week
S15	Bachelor Operational research	S	Sometimes
Total 30 people		A= 3 P= 9 S = 15 S,NS= 1 P, A= 1 A, P, NS =1	A lot, everyday a week=7 Many times a week=9 Sometimes= 8 Rarely = 3 A lot, everyday a week or many times a week = 1 Many times a week or sometimes =2

A= Anonymous card
P= Personal card
S= Student card, subscription per month / year
NS= train card

*Question 5 for working people & students: Does the OV-chipcard system provide you with more or less abilities to go to work (**Worker**) / to study (**Student**)?*

Question 6 for working people & students: How does the OV-chipcard affect the way you work?

- *Are there any positive affect?*
- *Are there any Negative affect?*

ID	Ability of travelling (more/less)	Effect of using OV-chipcard (+/-)	Causes	Consequences	Most transportation problems	OV-chipcard change the way of using public transport	The diffence between strippencard and OV-chipcard
W1	No different	+,-	Positive effect: using an OV-chipcard. Negative effect: Forget to check out	Easy to use it Paid maximum price but lazy to ask for money back	No specific	No change because of no choices	No Difference
W2	more	+,-	Positive effect: using OV-chipcard. Negative effect: check in-out problems, it takes too long to get money back	More efficient working on his job. + easy to travel Check out but still got money deducted from card. It took 3 weeks to get 1 euro back. Waiting queues too long so sometime didn't ask money back because of that	tram	No change because of no choices	Strippencard is better than OV-chipcard. It's:easier and cheaper Strippencard can combine travelling with others transportations which is cheaper
W3	No different	+,-	Positive effect: More benefits for company not for customers Negative effect: In old system (Strippencard) it is clearer how much to pay from destination A to B.	Customers get confused about how much to pay	bus	No change because there are no choices	With strippencard it is clearer how much to pay from destination A to B.
W4	No different	-	Negative effect: Sometimes check in-out problem. Gates problem: didn't open	Then it takes longer to travel.	No specific	No	Strippencard is better than OV-chipcard: easier, cheaper and more transparent about price. Strippencard can combine travelling with others transportations which is cheaper
W5	No different	+	Positive effect: Using an OV-chipcard. Negative effect: Sometimes charging machine was broken	Easier to travel. When you lose an OV-chipcard, people can't easily return back. Then can't get into the metro and have to use a taxi which is more expensive	No specific	No	OV-chipcard is easier and safer than strippencard.
W6	More	+	Positive effect: using an OV-	Easier to use and more convenient to	No specific	Yes, I travel more because of	OV-chipcard is easier and safer

ID	Ability of travelling (more/less)	Effect of using OV-chipcard (+/-)	Causes	Consequences	Most transportation problems	OV-chipcard change the way of using public transport	The diffence between strippencard and OV-chipcard
			chipcard	travel with. One card for most transportation.		OV-chipcard	than strippencard. Strippencard is more difficult to understand for tourists
W7	No different	-	Negative effect: Technical problems: can't check out during travel.	Pay maximum for one trip travel	No specific	No	No difference
W8	less	-	Negative effect: Using an OV-chipcard	Can't check how much money you have on a card that makes him worry when he travels. Traveller from another city needs to buy an expensive tourist card. Feels stress to asking money back, waiting in a long queue, take too long plus 2-3 weeks waiting. Stress: need to plan before travelling because he doesn't know how much money has in a card. It's not everywhere you can charge your money. Sometimes, inside a tram it charges more money than normal because the tram was used in another line but forgot to change the installation inside the check in-out system. It costs time and energy to always check if the amounts are correct.	tram	No	Strippencard is better than OV-chipcard. Eeasier, cheaper and more transparent about price. With trippencard you can combine travelling with other transport companies which is cheaper
W9	More	+ ,-	Positive effect: using OV-chipcard Negative effect: Check in-out	Easier to use Need to get used to the new system: didn't ask money back because	tram	No	OV-chipcard is easier and safer than strippencard. No more zone calculation.

ID	Ability of travelling (more/less)	Effect of using OV-chipcard (+/-)	Causes	Consequences	Most transportation problems	OV-chipcard change the way of using public transport	The diffence between strippencard and OV-chipcard
			problems	didn't know that I can get the money back and now just need to make time to do it. It's is difficult for a tourist who cannot get a discount from travelling with student card or get discount card. It's quit expensive for tourists from inside and outside the Netherlands.			
W10	No different	+, -	Negative effect: Forgot to check out many times Technical problem: check in-out doesn't work well. Too many procedures to ask for some services. Too few charging machines.	Easier to use. Lost maximum money per one trip but don't know that I can ask money back, Lazy to ask money back just let it go.	bus	No	OV-chipcard is easier and just one card.
W11	No different	+	Positive effect:	Easier to use	No specific	No	OV-chipcard is easier and just one card.
W12	More	+,-	Positive effect: using an OV-chipcard	Easier to use Confusing system if you use it to travel between 2 cities because they are different companies. One city uses completely OV-chipcard system (Rotterdam) but another city (Den haag) is using OV-chipcard with strippencard system. More difficult for tourists. Travelling different cities bought 3 new OV-chipcards for Rotterdam. Denhaag,	No specific	No	OV-chipcard is easier

ID	Ability of travelling (more/less)	Effect of using OV-chipcard (+/-)	Causes	Consequences	Most transportation problems	OV-chipcard change the way of using public transport	The diffence between strippencard and OV-chipcard
				Amsterdam.			
W13	No different	+,-	Negative effect: forget to check out	Didn't ask money back many times because he thinks that it was his fault	bus	No	OV-chipcard is easier
W14	More	+,-	Negative effect: Forget to check out	Didn't ask money back many times because don't know that I can get money back.	No specific	No	OV-chipcard is easier
W15	More	+ -	Positive effect: using an OV-chipcard Negative effect: Using an OV-chipcard	Easier to use, Never have problem with OV-chipcard. More concerned about privacy issues.	No specific	No	No difference
S1	No different	+,-	Positive effect: NS has a clear overview on website about travelling. Negative effect: Personal card: Bad information on OV-chipcard website You can't see how much money you have on your card. Sometimes when you don't travel everyday you forget how much money is on the card and sometimes money on a card is not enough to check out	Can easily claim money back from employer. Need to order NS card to get discount. Personal card not used anymore because I don't get a discount Then I have to walk back again to the charging machine and charge but sometimes you can't find the charging machine. It costs time and energy. Especially in the rush hours.	No specific	No	Strippen card is better.
S2	more	+	Positive effect: Using an OV-chipcard	Easier to use and a more integrate system. Never had any problem using the OV-chipcard	No specific	No	OV-chipcard is better and more convenient
S3	more	+	Positive effect:	Use OV-chipcard to avoid traffic jams. Never have any problem.	No specific	No	OV-chipcard is better. No thinking of zones
S4	more	+	Positive effect:	Free travelling. Never have any problem with OV-chipcard.	No specific	No	OV-chipcard is better: easier.
S5	more	-	Negative effect: OV-chipcard didn't	Waiting too long for a new OV-	train	No	OV-chipcard is easier because

ID	Ability of travelling (more/less)	Effect of using OV-chipcard (+/-)	Causes	Consequences	Most transportation problems	OV-chipcard change the way of using public transport	The diffence between strippencard and OV-chipcard
			work. Asking a new card sometimes takes 2-12 weeks waiting. Check in- out problem, didn't check out.	chipcard Didn't ask money back, too lazy			there are more money charging machines at station than strippen card.
S6	more	-	Negative effect: Can't recharge money on tram Forget to check out sometimes.	This is needed to buy another ticket which doubles the price compared to an OV-chipcard. Pay maximum. Need to claim money back.	tram	No	No experience with strippencard.
S7	No different	+	Positive effect: Using an OV-chipacrd	Easier to use Never have any problem.	bus	No	OV-chipcard is easier and safe time because it's faster than strippencard.
S8	more	+	Positive effect:	Easier to use Only in the beginning had problems but now is ok.	tram	No	No different, because get used to it now.
S9	No different	+,-	Positive effect: Negative effect: Forget to check out many times Switching transportations: didn't recognize the difference so I didn't check out	One good thing about OV-chipcard is that you can check where you travelled in the past. Didn't ask money back because lazy. Paid maximum. Still buys a paper ticket because afraid of checking out problem. So paid maximum which is more expensive than tram, bus, metro.	No specific	No	Strippencard gives less worries than OV-chipcard about how much money it costs.
S10	No different	+	Positive effect:	Can upload money at a shop.	Metro	No	No comment, don't travel a lot with public transport.

ID	Ability of travelling (more/less)	Effect of using OV-chipcard (+/-)	Causes	Consequences	Most transportation problems	OV-chipcard change the way of using public transport	The diffence between strippencard and OV-chipcard
S11	No different	+, -	Positive effect: Negative effect: Check in-out doesn't work.	Easier to use Have to buy a ticket even though your card works but the check in-out doesn't work.	bus	No	Strippencard is better because it's cheaper than OV-chipcard.
S12	No different	-	Negative effect: Need more money charging machines at small stations. Sometimes customer service desk can't help that much when the money charging doesn't work. If check in –out machine doesn't work then have to pay expensive ticket.	Feel stressful because of many procedures to get money back and waiting to long to get money back. It costs time and energy. If have choice will use a car or bicycle because it's cheaper.	Metro	Yes, trying to use it less because of a lot of problems.	Strippencard is better because it's cheaper than OV-chipcard.
S13	more	+,-	Positive effect: Negative effect: Forget to check out. Sometimes check in-out doesn't work. Sometimes don't know if it's just a tram or metro because it went up and down in one trip in Amsterdam. Too long to wait for money back just for small amount of money: 1 month waiting. Not good for tourist: need to buy a new ticket and too expensive.	More convenient Sometimes didn't ask money back because I'm lazy Didn't check out because I didn't know if I switched companies or not	tram	No	OV-chipcard is more expensive than strippencaes.

ID	Ability of travelling (more/less)	Effect of using OV-chipcard (+/-)	Causes	Consequences	Most transportation problems	OV-chipcard change the way of using public transport	The diffence between strippencard and OV-chipcard
S14	more	+ ,-	Positive effect: Negative effect: Too long waiting to get a new OV-chipcard: waiting 3 weeks.	Convenient, easier, faster to use During this time have to pay expensive price.	No specific	No	OV-chipcard is more expensive than strippencard. But OV-chipcard is easier and faster.
S15	more	+	Never have any problems.	Easier, faster to use	No specific	No	OV-chipcard is easier and faster, no zone calculating.

Question 8 for working people & students,
Question 10 for employees & conductors: How often did the problems happen to you?

ID	Employees	Conductors	Working people	Students	Specialists
EC_HTM1	31				
EC_HTM2	35				
EC_RET3	49				
ED_RET1	50				
ED_RET2	78				
ED_RET3	35				
ED_RET4	77				
ED_RET5	47				
C_RET1		62			
C_RET2		48			
C_RET3		47			
C_RET4		62			
C_RET5		35			
W1			79		
W2			61		
W3			75		
W4			80		
W5			78		
W6			81		
W7			68		
W8			61		
W9			49		
W10			62		
W11			81		
W12			48		
W13			67		
W14			62		

ID	Employees	Conductors	Working people	Students	Specialists
W15			97		
S1				77	
S2				89	
S3				91	
S4				93	
S5				48	
S6				57	
S7				91	
S8				34	
S9				62	
S10				90	
S11				51	
S12				20	
S13				34	
S14				89	
S15				88	
Sp1					80
Sp2					48
Sp3					80

Satisfaction of OV-chipcard system：

ID	CEO's %	Employees %	Conductor %	Working people %	Students %	Specialists %
Connexxion	34					
TLS	77					
EC_HTM1		61				
EC_HTM2		76				
EC_RET3		50				
ED_RET1		9				
ED_RET2		50				
ED_RET3		35				
ED_RET4		72				
ED_RET5		49				
C_RET1			50			
C_RET2			49			
C_RET3			47			
C_RET4			20			
C_RET5			34			
W1				47		
W2				18		
W3				34		

ID	CEO's %	Employees %	Conductor %	Working people %	Students %	Specialists %
W4				4		
W5				62		
W6				78		
W7				77		
W8				48		
W9				76		
W10				48		
W11				48		
W12				39		
W13				48		
W14				49		
W15				19		
S1					70	
S2					77	
S3					76	
S4					95	
S5					48	
S6					41	
S7					34	
S8					63	
S9					43	
S10					49	
S11					49	
S12					7	
S13					35	
S14					62	
S15					79	
Sp1						33
Sp2						37
Sp3						20

EC_HTM = Employee: customer service of HTM
EC_RET = Employee: customer service of RET
ED_RET = Employee: driver of RET
C_RET = Conductor of RET
W = Working people
S = Students
Sp = Specialists

Suggested improvement for the OV-chipcard system of the different groups:

ID	Improvement
CEO's	**Connexxion**: To improve the OV-system there should be only one central owner of the system: "1 national boss for OV-chipcard companies". OV chipcard companies need a boss for a system who can make quick decisions. This person should be the face of the project and who is responsible for the project. However, it's not possible to have a national boss because nobody wants the responsibility and take the risks. E.g. to pay for all the cost in the last 10 years that still need to paid back. The government doesn't want to pay for the debt because they are not the person who started the project. However the government has become an issue in the decision making process. TLS: To improve the OV-chipcard system: create one simple system. The more simple, the more successful of the OV-chipcard system will be. Simplicity makes it easier to use and this results in more satisfied people. OV-chipcard system is complicated because of it's involved with many parties requirements': 9 operators, 20 governmental institutions and customers. OV-chipcard implementation in the Netherlands is different from Hong Kong and London. The concept is the same that you have gates, card readers, back office. The Netherlands did not copy the whole system from Hong Kong, only the back office is copied. The reason why not the whole system is implemented is that suppliers offered a whole combination of the systems, back office from Hong Kong and other parts from other countries Hong Kong and the Netherlands have different card technology. Ostercard, London has the same card concept and the same technology but a different supplier and a different back office.
EC_HTM1	Customer should concentrate more on which transportation company they are travelling with because when they switch they should check out before they use another transportation company. This prevents that they lose their money and have to spend time to ask money back. To give more information to customers. OV-chipacrd companies should work better together e.g. if the OV-chipcard was bought from RET Rotterdam, customers can't ask to fix their problems in HTM Den Haag. They have to travel back to Rotterdam to fix it. It's difficult for customers to understand this.
EC_HTM2	If you use only one system, the OV-chipcard and no more strippencard system, then customers are more aware about check in- out and then there will be less complaints from customers. There is no discount for older and younger people who buy an anonymous card.
EC_RET3	No need to improve. The OV-chipcard system works well
ED_RET1	OV-chipcard should be stopped. Go back to the strippencard or back to white tickets as 30 years ago.
ED_RET2	Use a new chip in an OV-chipcard which is hard to hack and fraud with.
ED_RET3	Don't know
ED_RET4	If the check in-out machine is broken, don't wait to fix it; sometimes we have to wait for 1 day. 1 week or more than 1 week before the machine is fixed.
ED_RET5	Don't know
C_RET1	Don't know
C_RET2	Don't know
C_RET3	The check in- out machine should work better. Sometimes it takes 2-3 hours to a whole day before the fixing team arrives. So he can't check the customer's card. He just stands in a tram without checking customers until the check in-out machine is fixed.
C_RET4	The OV-chipcard should work well as in Japan.
C_RET5	The check in- out machine should work better than now. No waiting until the end of the day.
W1	More aware of his information privacy of travelling, don't know if the company will use personal data for something else.
W2	No more technical problems Now waiting queues at customer service are too long and not too long to get money return.

ID	Improvement
	Difficult to know how much to pay before travelling from A to B, don't know how much money I should have in OV-chipcard. At the station there should be a board explaining how much one has to pay from destination A to B, etc. Need more recharging machine with coins at a station. Normally I don't carry an ATM card and I do not trust the OV-chipcard system because of some technical problems I saw on TV.
W3	More transparency about the price of travelling from destination A to B. It's difficult to calculate how much you have to pay per destination. OV-chipcard company should better check the picture on a card if it matches the user e.g. he used his girlfriend's card but it was ok for the conductor. Bad news from TV did not affect him because he doesn't have much problems.
W4	No check in- out problem. No gates problem More charging money machines at small station, not only on a big station.
W5	Need more money charging machine at more stations
W6	The OV chipcard system should be adopted everywhere in the Netherlands. OV-chipcard companies should also work together better.
W7	Less technical problems. Need more charging machines at stations.
W8	Need a cheaper card for traveller from another city of the Netherlands. A queue needs to be shorter and waiting to get money back is sometimes too long: 2-3 weeks. Need more money charging machines at stations, Then a customer can charge and check money on a card.
W9	It's is difficult for a tourist who can get a discount from travelling with student card or get a discount card then they have to buy a paper ticket instead of using an OV-chipcard which is already bought on their holiday. Thus it's quite expensive for tourists from inside and outside the Netherlands.
W10	OV-chipcard should be able to check amount of money on a card from internet.
W11	No need to improve, OV-chipcard works well.
W12	- Confusing system if you travel between 2 cities because they are different companies. One city uses completely OV-chipcard system (Rotterdam) but another city (Den Haag) is using OV-chipcard with strppencard system. More difficult for tourists. When travelling in different cities they bought 3 new OV-chipcards.; Rotterdam. Den Haag, Amsterdam. No confusion. Let the companies work together. Not too long waiting queue for paying monthly personal subscription.
W13	Need a system without too much check in-out many times during travel in many cities in the Netherlands.
W14	Need more money charging machine at stations. Then a customer can charge and check money on a card.
W15	Improve security and privacy.
S1	Improve security. OV-chipcard should be combined with banks card. That would be more convenient and will people will use an OV- chipcard more. The politics should not hesitate with fully implementing the OV-chipcard everywhere. Bad news about OV-chipcard influences his opinion about using OV-chipcard, especially fraud and security. There is cheap software that intruders can use to steal money from people who sit next to you or break your card. And you can never prove this because there is no trace what causes the fraud. This software can also increase and decrease an amount of an OV-chipcard.
S2	Use only one whole system everywhere in the Netherlands.
S3	No need to change, perfect system
S4	More concerned about people who don't have student card that have to pay more Need more money charging machines at small station. He can't see how much money he has in a card; need to buy a new card which is more expensive than using an OV-chipcard.
S5	Need a system that doesn't need to check in-out all the time.
S6	Need more money charging machines in a tram.
S7	No need to change, perfect system

ID	Improvement
S8	Need more money charging machine at stations. Need more convenient in train system because he can't use an OV-chipcard in weekend and need to buy a paper ticket.
S9	OV-chipcard should work well as the Oyster card in London.
S10	Solve technical problems: check in and out machine because some people don't need to pay when they travel because they have subscription card e.g. student card but still have to pay when the check in-out machine doesn't work.
S11	Need more money charging machine at stations. Then there is no need to buy an extra ticket.
S12	Need more money charging machine at stations. Then there is no need to buy an extra ticket. Solve technical problems: check in –out machine Not too long waiting queue for paying personal monthly subscription.
S13	The check in-out machine should make a different sound then you know that if you are checking in again or not. For tourist tickets: there should be a return ticket for long stay tourists.
S14	Solve technical problems: check in–out machine should work perfectly.
S15	Improve security so nobody can hack the OV-chipcard system.
Sp1	The OV-chipcard system should be able to allow customers to choose all the possibilities of ticketing that was available before the OV-chipcard system: anonymous card is still not really an anonymous card. Train system still doesn't have reduction system for some people who can get a discount on an OV-chipcard.
Sp2	Introduce plan C in case the check in- out doesn't work. Privacy should be addressed. There should be a national customer services that customers can go to directly. Now customers still have to go to OV-chipcard company where they have bought an OV-chipcard to check their problems.
Sp3	Use a better chip inside an OV-chipcard with a better security but not too expensive for customers. Customers should be able to choose how much security they want. More security can be made more expensive. Fast implementation using one card for the whole system. Improve security, privacy. An anonymous card is not really an anonymous card because with this OV-chipcard it is still possible to re-identify the owner of a card. You still can track where customers went. An anonymous card should not be able to track all money transactions. E.g. an anonymous card is bought or recharged by internet banking. Then the OV-chipcard company knows who made the transactions on that anonymous card.