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NATALIA SAUKKONEN

FACTS AND FEELINGS BEHIND INVESTMENT DECISIONS IN ROAD TRANSPORTATION

Master of Science Thesis

Examiners: Professor Petri Suomala and Assistant Professor (tenure track) Teemu Laine. Examiners and topic approved by the Faculty Council of the Faculty of Business and Built Environment on 9 September 2015.

ABSTRACT

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The conventional approach in economics has assumed business decisions to follow rational and logical reasoning. Management accounting (MA) has been defined as information, which is designed to enable rational decision makers to make optimal decisions. However, the recent MA literature has shown that managerial decisions rely also on feeling and intuition. Institution theory has been applied to illustrate the observed bounded rationality in organizations, but it does not explain why and when investment discussions culminate to investment actions. More research is needed to understand the decision making process in organizations and how the intertwined facts and feelings of the decision affect the process. When the influence of fact and feeling driven criteria in decisions is recognized, the actual role of MA in decision making must be reconsidered. Alternative fuel vehicle investments offer a complex and appealing context to study the topic, as the investment discussions are influenced by a diverse set of facts and feelings ranging from fuel cost savings to environmental values.

The thesis focused particularly on the engagement of facts and feelings related to investment decisions on natural and bio gas vehicles. The topic was covered by creating a framework explaining the interaction of facts and feelings in decision making process. It also described how the discussions eventually lead to actual investment behaviour and how to recognize the role of MA in the process. The research material was gathered through an interventionist case study setting by creating MA tools for a case company and interviewing B2B customers about their natural gas vehicle investment decisions.

The findings contributed to the discussion on factors affecting investment decisions in road transportation. The study suggests that the investment decision requires both a factual grounding and support from the decision maker's values in order to form a real investment possibility. The fact and feeling driven decision criteria varies with the nature of the investment. Therefore, also the role of MA is different depending on the hierarchy of the criteria. Calculations alone do not determinate the outcome of the investment decision in the road transportation context.

TIIVISTELMÄ

NATALIA SAUKKONEN: Investointipäätökseen vaikuttavat faktat ja tuntemukset maaliikenteessä
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Perinteisesti taloustiede on olettanut liike-elämän päätösten perustuvan rationaaliseen ja loogiseen päättelyyn. Laskentatoimi on määritetty informaatioksi, joka on suunniteltu mahdollistamaan rationaalisten päätöksentekijöiden optimaaliset päätökset. Kuitenkin viimeaikainen laskentatoimen kirjallisuus on osoittanut, että liikkeenjohdolliset päätökset turvautuvat myös tuntemuksiin ja intuitioon. Instituutioteoriaa on käytetty kuvaamaan havaittua rajoittunutta rationaalisuutta organisaatioissa, mutta se ei selitä miksi ja milloin investointikeskustelut kulminoituvat investointitoiminnaksi. Lisää tutkimusta tarvitaan, jotta ymmärretään päätöksentekoprosessia yrityksissä ja kuinka päätöksenteon yhteenkietoutuneet faktat ja tuntemukset vaikuttavat prosessiin. Todellista laskentatoimen roolia on harkittava uudelleen, kun faktojen ja tuntemusten ohjaamat päätöksenteon kriteerit on tunnistettu. Vaihtoehtoisien polttoaineiden ajoneuvoinvestoinnit tarjoavat monitahoisen ja houkuttelevan ympäristön tutkia aihetta kontekstissa, jossa investointikeskusteluihin vaikuttaa kirjava joukko faktoja ja tuntemuksia ulottuen polttoainekustannussäästöistä ympäristöarvoihin.

Opinnäytetyö keskittyi erityisesti faktojen ja tuntemusten kytkeytymiseen bio- ja maakaasuajoneuvojen investointipäätöksentekoon. Aihe katettiin luomalla viitekehys, joka selitti faktojen ja tuntemusten vuoropuhelua päätöksissä. Se kuvasi myös kuinka päätökset lopulta johtavat todelliseen investointikäyttäytymiseen ja kuinka laskentatoimen rooli voidaan tunnistaa tässä prosessissa. Tutkimusmateriaali kerättiin interventionistisena tapaustutkimuksena luomalla case-yritykselle laskentatyökaluja ja haastattelemalla asiakasyrityksiä heidän kaasuautoihin liittyneistä investointipäätöksistään.

Tulokset osallistuvat keskusteluun maaliikenteen investointipäätöksiin vaikuttavista tekijöistä. Tutkimus esittää, että investointipäätökseltä edellytetään faktaperustaa ja tukea päätöksentekijän arvoista, jotta se muodostuisi todelliseksi investointimahdollisuudeksi. Fakta- ja tuntemuspohjaiset päätöksenteon kriteerit riippuvat investointikohteen luonteesta. Näin ollen laskentatoimen rooli vaihtelee kriteerien järjestyksen mukaan. Laskelmat yksistään eivät määritä investointipäätöksen lopputulosta maaliikenteessä.

PREFACE

This thesis project has been a part of the Managing Service Impact (MASI) research project in Cost Management Center (CMC) in Tampere University of Technology. MASI project aims at analyzing the interaction between facts and feelings and what they mean for managing customer value and profitability. The research project is funded by Tekes and five case companies involved. I am grateful for these organizations for making this research project possible. Moreover, I want to thank the case company representatives for their support and valuable advice during the journey. Sharing ideas in the steering group meetings was an inspiring, educational and encouraging experience for a young professional.

I would like to thank Professor Petri Suomala for his insightful comments and guidance during the thesis project. I would also like to thank Assistant Professor Teemu Laine for his supportive and positive presence – and for making me to eventually believe this thesis might actually make sense! I also thank the whole CMC crew for great discussions during lunch breaks and sharing thoughts on the MASI project.

It feels both relieving and exciting to finalize this 18-year era of studying. I am thankful to my dear family, who has believed in me throughout the journey: my father and mentor Ari, my mother and most eager supporter Maarit, and my brother and motivator Samuel. And lastly, I warmly thank my dearest boyfriend Niklas for understanding and reminding me to enjoy the adventure. The lifelong journey of learning will continue also after this milestone. I am lucky to share it with many awesome and exceptional people.

Tampere, 23.9.2015

Natalia Saukkonen

CONTENTS

LIST OF ABBREVIATIONS

AFV	Alternative Fuel Vehicle
B2B	Business to Business
B2C	Business to Consumer
BTL	Biomass to Liquid
CH_3	Methane
CO	Carbon monoxide
CO_2	Carbon dioxide
CMC	Cost Management Center
DCF	Discounted Cash Flow
DME	Dimethyl ether
EV	Electric Vehicle
GHG	Green House Gas
IRR	Internal Rate of Return
LCC	Life Cycle Cost
LNG	Liquefied Natural Gas
LPG	Liquefied Petroleum Gas
MA	Management Accounting
MASI	Managing Service Impact (Research Project)
MIRR	Modified Internal Rate of Return
NG	Natural Gas
NGV	Natural Gas Vehicle, the term includes passenger cars, vans, trucks and buses in road transportation and excludes off-road transportation
NO_x	Nitrogen oxides
NPV	Net Present Value
ROI	Return on Investment
TCO	Total Cost of Ownership
VRI	Index indicating the number of vehicles in thousands to number of refueling stations
VRT	Vehicle Registration Tax is an Irish tax that is levied on the purchase of new vehicles

1. INTRODUCTION

1.1 Investment decision making in business

The assumption of rationality has a favored position in economics. It is seen as a self-evident truth, a reasonable idealization and a null hypothesis that the decisions in business contexts are made rationally and built based on objective information (Tversky & Kahneman 1986). The conventional economic-based approach defines management accounting systems and practices as information, which is designed to enable rational decision makers to make optimal decisions. Such an approach focuses on optimal solutions. (Burns & Scapens 2000) One example of this is provided by transaction cost theory: The theory is grounded on the assumption that decision makers are capable of carrying out extremely complex calculations required to estimate the transaction costs with different relational forms, and choosing an appropriate course of action based on those calculations. (Tolbert & Zucker 1999) Although the assumption of rationality may be able to suggest new techniques, it does not assist our understanding on how such techniques come to be used in organizations (Burns & Scapens 2000).

It is commonly assumed that violations of the standard rational model are either restricted to insignificant choice problems, quickly eliminated by learning or irrelevant to economics because of the corrective function of market forces. To some point it is true that incentives can sometimes improve the quality of decisions, experienced decision makers can often make better decisions than novices and the forces of competition or arbitrage can limit some effects of error and illusion (Tversky & Kahneman 1986). However, the recent management accounting literature has also shown that managerial decision making relies also on emotion and feeling, which as a system has been described as automatic, holistic, and primarily non-verbal (Sadler-Smith & Shefy 2004). When decision makers trusts on their views, estimates and automatic judgements, the nature of decision making becomes intuitive (Soll et al. 2015).

Sadler-Smith & Shefy (2004) suggest, that optimal decision making iterates between fact-driven rational thinking and feeling-driven intuition. Allowing the decision making to iterate between rational analysis and intuition allows each mode to reinforce the other until an optimal judgment can be made. This optimal decision satisfies both the "hard" elements, *the facts and figures*, and "soft" elements, *the hunch or gut feel*. According to the definition of Nørreklit et al. (2010), *facts* are based on observation of phenomena or things that exist independently of their observation. They are also social constructs as something can be considered as a fact only when it has been carefully recognized and established as a fact by a group of actors. Individual values, on the other hand, determi-

nate human's preferences and likings. (Nørreklit et al. 2010) These subjective experiences and sensing guided by individual values are defined as *feelings.*

An investment decision is one example of a situation where both facts and feelings are affecting the decision and end-result in a company. The company's willingness to invest in new technology depends highly on its expectations for the future demand. The demand forecast can be made based on trend analysis or other forecast methods that are seen as objective calculations, *facts*, but there are also uncertainties involved when predicting future events. This uncertainty is managed by assumptions that are partly based on intuitive experiences and sensing. If these *feelings* are hidden and ignored, the transparency and reliability of the decision making process are reduced.

Some companies have already recognized that their decision making is also guided by *feelings* (e.g. values, faith in the technology, ambitions, expectations, assumptions, experience and intuition). When these feelings are identified, it is possible to affect them and increase the quality of the decision making process. And going further, when having deep understanding on the facts and feelings behind customers' decision making, the companies can gain growth by developing their solutions to bring the true customer value. (Laine et al. 2015) The reflective process of becoming aware and making visible the facts and feelings behind managerial decision making still lacks empirical investigations in business organizations (Boud et al. 2013, Hildén & Tikkamäki 2013, Jordan et al. 2009, Vince 2002, 2004).

Nørreklit et al. (2010) have studied the connection of facts and values in creating action. They have recognized that facts have an important role in creating possibilities which can lead to action. If the possibility does not have a factual background, it is impossible and thus cannot lead to action. Important is to note that the possibility can only become real when it is supported by decision maker's values. Together the facts and values create real possibilities that together with communication on the facts and values can lead to action. However, this theory does not yet explain any reason why and when the action happens. The Switching Path Analysis Technique (SPAT) of Roos (1999) can give some insight for this. In SPAT, the decision maker can have an active or passive role in searching for information about the current and possible solutions. Also the current and potential supplier can take active or passive role. This influence can be seen to affect the switching behavior of customer, to play as an influential trigger for switch. Additionally to influential trigger, also reactional or situational reasons can make the customer to change action. In the context of this thesis the change in action means to invest in natural gas vehicles.

Management accounting has usually been seen as a practice that provides objective tools for traditional decision makers. Recently Laine et al. (2015) have suggested a new blueprint for management accounting practice: They wish the development of MA tools to go towards management accounting that accommodates both analytical and emotion-

al aspects of value and profitability management. Blueprint of new MA is based on the need for engaging organizational facts and feelings, built on the reflective processes of co-thinking and co-feeling within/across organizations. This perspective is used as a basis for understanding the role of MA in decision making process. It also sheds light on how MA is linked to facts and feelings that are interacting in the decision making process.

Tolbert and Zucker (1999) suggest institution theory as a helpful framework for studying the bounded rationality in decision making. They highlight the role of institutions' normative influence in organizational decision making processes. Institutions represent the "*way things are*", they are norms and rules that are taken for granted in organizations. Concerning the social aspects of decision making could help in approaching the question *how* rationality is bounded and under which conditions a particular choice is possible. When there is some degree of uncertainty in the outcomes of different choices and decision makers will use information gained from observing the choices of others, as well as their own subjective assessments, in determining the best choice. Under these conditions, the more widespread a given choice becomes, the more likely are individuals to view it as an optimal choice, and the less influential will be decision makers independent judgments of the value of the choice. Institutions are affecting the decision making process in several levels: some beliefs and operations in the contexts of natural gas business or vehicle investments can be institutionalized. Also the way management accounting is utilized in the organization can follow a certain learned pattern. The whole investment decision making process in the company can form an institution

The framework of this thesis combines the above mentioned theories explaining decision making in business context. In this way it is possible to create a comprehensive framework explaining how facts and feelings of decision makers lead to actual investment behavior. Decision making is recognized to be led by both facts and feelings and the possibilities they create, and MA has a central role in the decisions as being the language for business. Decision makers are following the norms of the institutions they are in, but these institutions themselves do not start action. The investment decisions actualize through triggers that move the company to start action from the risen real possibilities.

1.2 Natural and bio gas as alternative fuels for Finnish road transportation

The adoption of alternative fuel vehicles (AFVs) has been regarded as one of the most important strategies to address the issues of energy dependence, air quality and climate change. In Finland, the carbon dioxide emissions from road transportation cause approximately 30 percent of the total carbon dioxide emissions per year. (Motiva 2015) This figure contains a large potential for new technologies with a lower carbon econo-

my, especially now when their cost competitiveness compared to conventional solutions has improved. Despite the progress in developing the technologies and infrastructure and the increased public interest in sustainable solutions, there are still challenges in promoting the wider acceptance of AFV's by the general public. (Yeh 2007)

Today there are several alternative technologies available for the conventional gasoline and diesel fuels: electric, bioethanol, hybrid, hydrogen, and gas being the most common solutions currently under discussion. (Yeh 2007) Gas can be divided into natural and bio gas that both consist of identical chemical compounds, methane. The name changes according to the origin of methane: natural gas is a fossil fuel while bio gas is collected from biodegrading processes and is therefore renewable. All natural gas vehicles (NGVs) can utilize both natural and bio gas.

In the context of the ongoing MASI project to study management accounting in decision making processes involving both facts and feelings, natural and bio gas vehicles represent an interesting study environment. Investing in vehicles is a good example of a decision that includes various environmental, financial, technical and safety facts that can be valued differently and set as criteria. The facts related to seem to be able to compete with conventional solutions and other alternative solutions. Consumers and companies are not familiar with using methane as a fuel, as it has not been widely used in households or vehicles before in Finland. By contrast, gasoline, diesel, ethanol and electricity have already been used in powering devices or vehicles or are otherwise used in everyday life. Being unfamiliar with natural gas has fed doubts about its safety, in particular its explosiveness, user experience due to different technology and station availability as many have never registered gas refilling stations. Also the origin of natural gas is vulnerable for critical opinions due to current political tensions with some of the oil and gas provider countries. All in all, natural and bio gas as a road transportation fuel rises up several interesting feelings that together interact with examined and proved objective facts. This interaction can also be noted in business discussions that are usually seen as rational and money-oriented.

Although utilizing hydrogen is also a new concept for Finnish households similarly to natural gas, hydrogen has not yet been developed for commercial use. NGVs are already in commercial use, which enables the researcher to interview investment decision makers about their real actions when switching to or from using natural gas. Instead of asking about opinions and speculation about future fuels, it is possible to discuss the actual decision making criteria that lead to action. NGV investment decision making in companies is an interesting and relevant context to challenge the management accounting practice. Conventionally management accounting has been based on the assumption of rational and objective reasoning in investment decisions, and the chosen context facilitates testing this conventional view and the new blueprint of MA in practice.

Compared to other alternative fuel vehicle technologies, natural gas vehicles (NGVs) have received rather little attention in Finland. To date, natural gas has been applied to a wide range of vehicles globally. In Finland natural gas has been used for example in passenger cars, heavy duty trucks, garbage trucks and delivery vans, but the technology has not been widely adopted. There are no exact measured figures available to illustrate the more limited attention received by natural gas vehicles in Finland, but some understanding can be received by looking at results from search engines presented in Table 1. Search results picture the volume of material available about the searched alternative fuel vehicle type. By using Finnish in the search engines the results were limited to picture the discussion around the AFVs in Finland. However, as words *hybridiauto* and *etanoliauto* were somewhat close to other languages (such as *hybrid auto* and *ethanol auto*), they got more results in some search engines showing results also from non-Finnish webpages.

Table 1 *Search results for different alternative fuel vehicles; search conducted with different search engines in Finnish on 27th of May 2015*

	Google	Bing	Yahoo!
Electric car *(f. sähköauto)*	206 000	38 500	294 000
Hybrid car *(f. hybridiauto)*	26 500	332 000	25 500 000
Hydrogen car *(f. vetyauto)*	17 600	13 000	9 900
Gas car *(f. kaasuauto)*	10 600	8 270	3 220
Bio gas car *(f. biokaasuauto)*	4 350	6 160	4 140
Ethanol car *(f. etanoliauto)*	883	669	2 020 000

Similar to electricity, bioethanol and hydrogen, biogas is possible to be produced domestically. Gas can be stored and distributed, and the technology for utilizing it in commercial use already exists. There are also applications for off-road transportation, such as marine cargo and passenger ships, but only road transportation is included in this study. Compared with diesel buses or heavy-duty and light-duty diesel/gasoline vehicles, natural gas vehicles have the potential to emit lower levels of particulate matter, nitrogen oxides (NO_x), carbon monoxide (CO) and air toxics (Yeh 2007). These benefits are seen particularly attractive in countries where local urban air quality is poor, such as Brazil, India and China (Yeh 2007), but they can be attractive also for countries with ambitious environmental targets, such as Finland. Finland has set a target of reducing greenhouse gas emissions by 80 percent before 2050 (Finnish Ministry of Employment and the Economy 2014) and is aiming at having 20 % of the liquate fuels used in transportation to be renewable by 2020. However, at the moment neither natural gas nor biogas recognized as being a part of this agreement and environmental targets. (Öljy- ja biopolttoaineala ry. 2015)

Earlier literature has recognized factors affecting decision making when purchasing vehicles in consumer context (see e.g. Busse et al. 2013; Caulfield et al. 2010; Greene et al. 2005). Recently, Yeh (2007) has examined how adoption of NVGs depends on policy instruments and factors affecting consumers' choices, including refilling-station density, fuel prices and payback periods. However, no earlier research has been done to investigate the facts and feelings influencing vehicle investment decision making in B2B context. Neither there are studies available about B2B customers' switching behavior in the gas market, except for the recent study of Vigolo & Cassia (2014).

When trying to boost diffusion of a new vehicle technology, supplier can gain more effective outcomes and impact on the total demand when influencing on the B2B decision making processes. The B2B operators have a remarkable role in the adaption of new technology in road transportation, since B2B customers operate with higher volumes. In some segments such as delivery and taxi, used vehicles are quickly released to after-market after few years of intensive driving. In a rather short period of time the new technology is available for other users in after-market with a decreased price lowering the barrier to try the new technology. When companies are renewing their vehicle fleet, one investment decision can include for example tens to hundreds of vehicles, while in B2C sector the decision concerns usually one vehicle at the time.

The level and speed of the vehicle technology adoption guides mobile power supplier companies' decisions on supply infrastructure investments. The built infrastructure network serves both consumer clients and B2B operators such as taxi operators, delivery business, heavy duty and light duty transportation and short and long distance buses. These operators need a developed and widespread supply infrastructure to serve their business. Either demand or supply must increase first: the supplier can invest in infrastructure wishing for increasing demand in the future or users adopt the technology trusting that a wider infrastructure will follow. In earlier literature this has been named as a chicken-egg dilemma (Yeh 2007; Caulfield et al. 2010; Romm 2006). These both perspectives are recognized and covered by creating a research setting where we look at the investment decision making in road transportation from viewpoints of an infrastructure provider and its customer companies. The case company is introduced later in chapter 4.

To conclude, a deeper understanding on the B2B vehicle investment decisions can help politicians and fuel or technology suppliers to adjust their actions (e.g. regulation, incentives, marketing or product development) to reach desired impact on customer companies' decision making processes. A better understanding of the facts and feelings behind investment decisions can also give further understanding about the used and desired nature and content of management accounting information in investment decisions.

1.3 Research questions and objectives

As presented earlier, there is call for understanding better the intertwined influence of facts and feelings on economic decision making processes. When this comprehension is achieved, it is possible to develop MA practice further to better answer the needs of decision makers. Road transportation, in particular natural gas vehicles, offers a relevant and complex case study context to challenge the applicability and usefulness of MA information. Investment decisions on the new vehicle technologies carry with themselves a diverse range of facts and feelings that have not been mapped in B2B context before. Clarifying these factors could especially assist companies that are planning to invest in alternative fuel infrastructure. It can also support policy makers to find correct ways to regulate or incentivize the development of fuel technologies and vehicle models in road transportation. Lastly, this thesis contains a human centered message for those operating in business environment. It gives examples of investment decisions that have not been based only on financial facts or been completely objective and rational.

The topic of the thesis is the investment decision-making in road transportation. It focuses particularly on the engagement of facts and feelings related to investment decisions on alternative fuel vehicles. The research objective is to empirically explore facts and feelings behind investment decision making in road transportation. The thesis aims at answering the following research questions:

Q 1: What are the facts and feelings affecting companies' investment decisions?

Q 2: What role does management accounting (MA) information play when making investment decisions?

Q3: What is the content and nature of MA information that is being used?

The first research question assists in understanding better the context in with management accounting is used. The following questions look into the current roles, content and nature of MA and gives examples also for desired future requirements.

1.4 Research methodology

The study applied interventionist approach in a case study setting (Suomala & Lyly-Yrjänäinen 2012; Suomala et al. 2014; Jönsson & Lukka 2005). This means that the empirical material of the thesis was gathered by co-operating closely with the chosen case company. The researcher made an intervention in the company in order to receive insightful information about the discussions around the infrastructure and vehicle investments. During the intervention the researcher contributed to the long term demand forecasting that supported the supply infrastructure investment decisions in the case company. Also life cycle cost (LCC) calculations were provided to understand better the

factors affecting the profitability of a vehicle investment. In order to understand the current state and problem in the company, several steering group meetings and communication via e-mail and phone were utilized. In addition to this, two interviews were conducted in the company. The purpose of these interviews was to deepen understanding on the supplier's perspective and to recognize internal facts and feelings in infrastructure investment decisions.

Simultaneously with the creation of new calculations for the case company, the researcher conducted interviews in customer companies. The B2B customers were interviewed about their investment behavior in switching to or from using NGVs. The purpose was also to recognize facts such as environmental, technological and financial figures, more specifically management accounting information, and feelings that affected the investment process when considering switching to or from using NVGs. The interviews gave also insights about the actual triggers that led to switching. It was possible to discover the actual role and content of MA information in the decision making process, when the interviews looked into true switching cases.

1.5 Research structure

The thesis seeks to answer the research questions by creating a framework that explains how the decision making process actualizes to an investment action. This framework binds together theories about actor reality (Nørreklit et al. 2010), management accounting in managerial work (Hall 2010; Mouritsen et al. 2009; Wouters & Verdaasdonk 2002; Laine et al. 2015), institutions (Burns & Scapens 2000; Tolbert & Zucker 1999; van den Hoed & Vergragt 2004) and switching behavior (Selos et al. 2013; Roos 1999; Roos 2002; Roos & Gustafsson 2007). Together these theories are linked to the MASI project framework to explain decision making and investment action.

As noticed from earlier literature, the decision processes and outcomes are not always only rationally reasoned. The thesis begins with being aware of the existence of both facts and feelings in decision making processes. Hence, the literature review needs to first define the terms facts and feelings in decision making. After that the review continues to explore the existing literature on different roles of management accounting supporting managerial work in investment decisions. More understanding on the bounded rationality in decisions is gained by studying the impact of institutions. To be able to investigate the actual investment criteria and triggers that lead to investment actions, the interviewees must be evaluated based their actual behavior. Switching Patch Analysis Technique SPAT (Roos 1999) provides means for clarifying and identifying facts and feelings that led to investment actions. The created thesis framework utilizes these existing theories as a basis and is lastly presented in this chapter.

The second part of literature review outlines the current perception of natural gas vehicles as investments. The purpose of this section is to introduce the context of this thesis,

i.e. the current state of natural gas vehicle market in Finland. The framework created in earlier chapter is applied in this context. This part of literature review gives a brief look into the current understanding of natural gas vehicles. It introduces the recognized barriers for the adoption of NGV technology, technical and safety attributes related to natural gas as a fuel and gives some examples of political incentives and regulation that affect the demand of NGVs. As mentioned earlier, there is no earlier research on NGV investment decision making in B2B context. Instead, the thesis presents the current understanding on consumer preferences in vehicle investments.

After the literature review, research methodology is presented. The research methodology presents the work in case company and interviewing strategy. In the last part of this chapter the research strategy is reflected on. The findings are presented according to the created research framework. First the findings from the case company are presented applying the framework. These findings are followed by the findings from customer company interviews. The chapter ends with synthesis, where the findings from the case company and interviews are combined. Lastly, the conclusions discuss the limitations and managerial implications of this thesis and give suggestions for future research.

This thesis project has been a part of the Managing Service Impact (MASI) research project in Cost Management Center (CMC) in Tampere University of Technology. MASI project aims at analyzing the interaction between facts and feelings and what they mean for managing customer value and profitability. To be effective, management accounting (MA) should take into account both the economic facts under examination and the organizational realities as experienced (felt) by the stakeholders. The project extends the MA literature by exploring the feelings of the stakeholders affecting the production and use of MA information. The research project is funded by Tekes and case companies involved. The research period is from January 2015 to December 2017.

There are five Finnish case companies from different fields of industry participating in the research project at hand. All the case companies have enabled the researchers to analyze their timely managerial challenges; the companies represent a variety of industries ranging from providing solutions for waste management, to HPAC (heating, plumbing, and air-conditioning), home care infrastructure, occupational health care and alternative fuel vehicles. Additionally, a company offering IT services for business analytics has participated in the meetings as they have current interest in the topic. To date the co-operation with the companies has included steering group meetings, workshops, investigations on the current MA practices in the companies and conducting several interviews among employees and customers. The research project has already resulted one conference paper (Laine et al. 2015) presenting the idea behind the research project and preliminary findings, which are partly resulting from this thesis project.

2. MANAGEMENT ACCOUNTING IN INVESTMENT DECISION MAKING PROCESS

2.1 Definitions for facts and feelings

2.1.1 Facts

To clarify what the terms facts and feelings cover, the thesis uses the definitions framed by Nørreklit et al. (2010). They rest their framework on pragmatic constructivism claiming that human actions are constructed of four dimensions: facts, possibilities, values and communication. Facts are based on observation of phenomena or things that exist independently of their observation. For instance, when talking about vehicles, one fact is that a vehicle has a certain purchase price in euros. This fact exists regardless of who is observing the vehicle as an investment.

Facts are also social constructs. Nothing can be considered as a fact before it has been carefully recognized and established as a fact by a group of actors. According to Sadler-Smith & Shefy (2004), being exclusively rational requires some measure of agreement about goals, since these will determine what information should be collected and how it should be analyzed. Agreement about cause-and-effect relationships is also needed. For example, the existence of environmental or financial facts related to AFVs depends on their construction being agreed by the business and R&D communities. In this way, being agreed by social groups, the facts become institutionalized. But also institutionally agreed facts require review to ensure they have a sound phenomenological grounding. Facts based on subjective future estimates need to be subject to a process of review and improvement. In one sense, all accounting facts must be considered as social constructs. This is because they are human creations that are articulated in language. (Nørreklit et al. 2010)

Facts carry with them information about possibilities for action. We use logical thinking and reflecting to recognize the factual possibilities, i.e. possibilities that are grounded in physical and economic facts and not only in vision. Logical thinking is also used in finding the possibilities by moving from the existing facts to a possible new set of facts. Possibilities must be grounded in facts as abstract or imaginary possibilities have no practical use. (Nørreklit et al. 2010)

2.1.2 Feelings

Sadler-Smith & Shefy (2004) have studied intuitive executive decision making, which relies on feeling. According to them, intuitive decisions involve the interplay between knowing (intuition-as-expertise) and sensing (intuition-as-feeling). As deliberate rational decision making is not often achievable, for example in situations where sufficient facts or "hard data" is not immediately at hand or available at all, one way of managing the uncertainty and complexity is to rely upon intuition. Gut feelings are inevitable in decision making, and the decision makers are also prone to their fears, emotions and sources of bias during the decision process. Hence, feelings are combined with the decision making even when executives are conducting rational analyses.

Humans' experiences are affected by their individual values. The values provide objectives, which motivate people: they determine humans' subjective preferences and likings. The human values are subjective as they develop differently from human to human in historical and social process. (Nørreklit et al. 2010) According to Nørreklit et al. (2010) human actions realize when values and possibilities are integrated: "*One may have different possibilities for action, but one will act only when one's values are integrated with at least one of the recognized possibilities*" (p.744). They also see that our values reveal themselves through the emotions they create: "*When one benefits from things personally valued, then one feels happy, but when the things one values highly face problems or are even in danger then one feels upset and concerned"* (p.744). When talking about alternative fuel vehicles, one relevant value in discussion is environmental friendliness. A decision maker, who values environment over other aspects and has the possibility to choose the fuel with lowest CO_2 factor, chooses the action of using fuel with lowest CO_2 emissions.

Nørreklit et al. (2010) also emphasize the importance of communication in shaping human actions: Usually the individual is not acting alone, but is member of a social institution, such as business unit, company or industry. To gain mutual understanding among social actors, communication is needed. Without it, only individual reality exists and the social institutions cannot be managed. Communication enables people to cooperate and to access each other's subjective worlds. It allows the facts, possibilities and values to be shared through human interaction. Communication provides the mechanism which leads to the creation of the institutional setting. Institutional rules, regulations and authorities set the institutional boundaries in which the society operates and exists.

Communication is central also in management accounting that is used for producing and distributing information to decision makers. Communication is needed to achieve agreement on the accounting facts, on the possibilities and impossibilities derived from them, on the logic used in information generation and on the values adopted by the institution. For example, the energy industry and research community can discuss the measures for CO_2 emissions and cross-check results from different experiments. As well

the changes in fuel price levels include communication across the energy industry: e.g. what are the accepted price levels, how should the fuel price follow the price of crude oil and what is the norm for the price stability in refueling stations.

Following the definition of Nørreklit et al. (2010), the interaction of facts and values leads to possibilities that can lead to action. In every phase there is communication on facts, values and possibilities. Facts *per se* can be seen as objective measures of some phenomenon, but the value dimension includes subjective experiences that guide human behavior. Values constitute the feelings behind the action, in this case behind the investment decision. The possibilities resulting from the same factual information are different depending on the decision maker: For some decision makers the viable and logical possibilities are limited to fuel solutions within certain price range or with a large refilling station density. Some decision makers do not have limitations and consider all possibilities as reasonable to some extent, but their values guide the final decision. The social reasoning for the decision happens through communication and influences which concepts and models are utilized in practice.

Let's take CO_2 emission factor (e.g. *g CO_2 / fuel liter*) as an example. Different fuels are composed of different chemical compounds, such as hydrocarbons. It is a fact that burning fuels causes carbon dioxide emissions. This phenomenon has other facts related to it, such as the measurable CO_2 factor. The different CO_2 factors for each fuel type carry information that includes possibilities for different actions. The investors can compare the fuels based on the CO_2 factors. If the investors value low emission solutions, they can influence on their CO_2 emissions by choosing the fuel with smallest CO_2 factor. There are also other facts available: the fuels have a certain fuel cost and different number of stations in their supply networks. Also these facts carry information including possibilities for different actions, e.g. for optimizing fuel costs or choosing the fuel with highest station network density. The possibilities stemming from facts actualize to real possibilities, when the values are in line with the facts and supporting the decision. Action is only possible to occur from real possibilities (Jakobsen et al. 2011).

In this thesis, feelings are seen as experiences affecting the decision making process. This includes positive, neutral and negative appreciations, assumptions, judgment, perceptions, interpretations and meanings stemming from values and communication. It is important to distinct the term feelings from human emotions (e.g. feeling happy, angry or disappointed). For instance, one can feel that the benefits received from investing in NVG fleet go below the inconvenience caused by limited fuel supply network and smaller driving range. One will not invest in the fleet based on the facts and feelings affecting the decision, regardless of how happy or sad one is emotionally feeling for the moment the investment decision is made. The fundamental difference is to look at the facts and feelings and recognize those actually having effect on the investment decision.

2.2 MA supporting managerial work

2.2.1 MA in different roles

Today managers have to make complex decisions due to greater variety of products and services, more rapid changes in technology, less heterogeneity of customers and a greater number of different markets and distribution channels (Wouters & Verdaasdonk 2002). Many managerial decisions are made based on intuition, but this is not possible or recommendable in situations where the decision maker cannot intuitively see the "big picture" and decide what the overall best decision is. In these situations MA information – which allows using a single financial unit of measure for all actions and facilitates easy comparisons between the trade-offs of various areas – can be an useful support for the management. (Wouters & Verdaasdonk 2002)

One central role of management accounting is to support the managers in controlling uncertainty. As usually managers' critical task is to respond to unusual and uncertain questions, MA can help in clarifying and structuring the available information (Chong 1996). With the support of MA the managers can prepare for unknown future decisions and activities. (Hall 2010)

Another role for MA is to complete information environment where managers are making decisions. Research has shown that managers are often dissatisfied with the accounting information they receive. Many managers develop their own personal systems for getting the information they want or believe they need. The challenge of MA "*is not to try to get more information to managers faster and in more detail*" Instead, the challenge "*is to improve the information environment in which managers work, while understanding that much of that environment will always be managed by the managers themselves*". (Bruns Jr & McKinnon 1993, p.109)

In accordance with this perception, Hall (2010) found out that managers primarily use accounting information to develop knowledge of their work environment rather than as an input into specific decision making scenarios. Accounting information is just one part of the wider information set that managers use to perform their work. Hall (2010) suggests that the field studies could focus more strongly on examining the practices involved in manager's use of accounting information. We should examine how other sources of information affect the use of accounting information in managerial work. In other words, what do managers actually do when they integrate accounting and other forms of information in decision making?

As one role of management accounting is to complete the information environment, formal techniques and procedures can even inhibit the intuitive and natural way of combining the information for decision making. Bruns Jr & McKinnon (1993) found out that the two major resources for MA information were interpersonal communications

with the staff and distributed reports. The more recent study of Hall (2010) suggests that it is rather through talk than written reports that accounting information becomes implicated in managerial work. In the meetings with top management Laine et al. (2015) found out that top management desires MA information to be user friendly and understandable. It is desired to be communicated in clear, common sense way. The quality and relevance of accounting information should relate primarily to whether it helps managers to carry out their work and less to whether it adequately describes the underlying activities. (Hall 2010)

It can be challenging to create a MA tool that is simultaneously accurate enough to control uncertainty, general as it is completing information environment instead of answering a specific question and simple to use. This practical trade-off between accuracy, simplicity and generality has earlier been noted by Selos & Laine (unpublished). According to them, when creating for example supplier selection methods too often "*the general idea is that the more accurate the theory is the better it is*". Simplicity is closely related with ease of understanding or application, and no explanation can be simultaneously general, accurate and simple. Conversely to their findings, the mass of articles on supplier selection methods seem to continue to provide more and more complicated tools.

Calculations play a notable role when talking about MA information. They support in structuring information and understanding causalities between different actions and meters. Mouritsen et al. (2009) have studied the role of MA calculations in innovation management context. MA calculations can link innovation activity to the firm's operations through two types of translations; short or long term. The length reflects the number of elements taken into account.

In short translations the innovation activities are mobilized by a single calculation and related to a variance from a standard or budget. Short translations mediate between innovation actions and costs and revenues of the firm. To sum up, short translations provide means for controlling. On the contrary, long translations have multiple calculations that reflect and question the role of the innovation. Here the calculations challenge each other and develop organizational tensions and discussions on the innovation activities. The long translations frame considerations about the value of innovation to the firm strategically. To conclude, the long translations are facilitators for wider discussions on the strategic choices. (Mouritsen et al. 2009)

The concept of long and short term translations seem to suit rather effortlessly also to the discussion on MA calculations in investment decision making. In the context of investments, the short term translation can mean a single calculation on the life cycle costs of the vehicle or a single calculation on the profitability of the supply network. The long translation calculations do not only problematize what the investment should be and what parameters should be used. They also question where the investment

should be located in time and space technologically, organizationally and environmentally. (Mouritsen et al. 2009) The long translation calculations create the contexts for the investments.

In line with the presented literature (Laine et al. 2015; Hall 2010; Bruns Jr & McKinnon 1993; Selos & Laine unpublished) the findings of Mouritsen et al. (2009) suggest that MA calculations rarely become meaningful and powerful by appeal to their definitional correctness. Instead, MA calculations are only helpful through the connections with concerns they develop. They emphasize that MA calculations are also able to problematize central strategic properties of the firm, such as its boundaries and capabilities. The interventionist research work conducted for this thesis applies this view. MA calculations are used as facilitators to open commonly shared discussions on understandings and concerns as well as to question the assumptions in the case company. The correctness of the calculations is not in the key focus area but understandably the estimates are required to be in the ballpark to raise interesting and relevant points.

MA has been discovered to help control uncertainty, facilitate discussion and complete information environment. Laine et al. (2015) add emotional aspects to the academic discussion. Laine et al. (2015) have suggested a new blueprint for management accounting practice: They wish the development of MA tools to go towards management accounting that accommodates both analytical and emotional aspects of value and profitability management. Blueprint of new MA is based on the need for engaging organizational facts and feelings, built on the reflective processes of co-thinking and co-feeling within/across organizations.

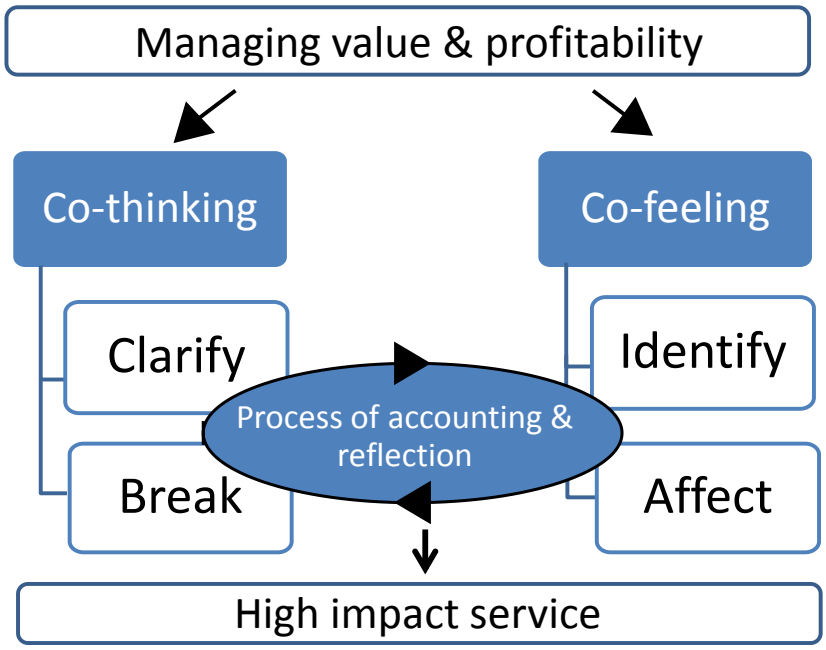


Figure 1 *Blueprint for New Management Accounting (Laine et al. 2015)*

This perspective is used as a basis for understanding the role of MA in decision making process. It also sheds light on how MA enables the communication of facts and feelings that are interacting in the decision making process.

2.2.2 MA in investment decisions – Net Present Value calculation

Net Present Value calculation is an example of a MA tool that is commonly used for investment decision making in companies. The conventional way for seeing investment decisions is to find them as practices for using investment calculation tools. These calculations give a numeric answer that can be used for justifying decisions. When the decision is justified based on the calculation, it can be said to follow logical reasoning and be rational. This view sees MA as a rather narrow concept, as here MA works only as an answer machine for the decision maker. Much of accounting research is focusing on improving the calculation tools and making them as accurate as possible to give the best answer. Although the thesis framework views investments as subjective decisions, it is valuable to have a brief glance on the most common investment evaluation tool.

Net Present Value (NPV) model has a strong support from academic literature as being a useful management accounting tool for evaluating the profitability of an investment. It is an example of a calculation tool that provides insights for the decision maker whether to invest or not. NPV was also chosen for the infrastructure investment calculations in the case company due to its understandable logic, usefulness in picturing the break-even point and the annual development of the value, and researcher's earlier experience in using it for evaluating profitability in investment projects. NPV model uses Discounted Cash Flow (DCF) technique like some other models such as Internal Rate of Return (IRR), Modified Internal Rate of Return (MIRR) and profitability index (PI), DCF is a widely used model in business world, as it takes into consideration the time value of money and is viewed as being theoretically correct. (Bennouna et al. 2010).

Finance theory claims that the NPV is the best method for evaluating capital investment projects (Bennouna et al. 2010). With NPV, the future cash flows are discounted to show present value and are compared with the investment cost. These future cash flows include estimates about the costs and revenues caused by the investment. An investment project is acceptable, if the outcome of NPV is positive. According to Bennouna et al. (2010) NPV is now widely used among large Canadian corporations but a remarkable percentage use IRR as their primary model in capital decision making. Simple capital budgeting decision techniques such as payback period are still in use. The theory-practice gap is a recurrent theme in the capital budgeting literature, in particular with regard to NPV.

The cost of capital is a key parameter in DCF calculation. The discount rate should be calculated based on the weighted average cost of funds from various sources including

debt, preferred stock and common equity (Bennouna et al. 2010). There are two recommended methods to adjust the weighted average cost of capital WACC: either the company can use the pure play or the subjective approach (Ross et al. 2005). When applying the pure play method, company finds firms operating in similar business to the investment project or the division. The WACC can be developed by looking at the market's required returns and using this external information in finding out the right level for the new investment opportunity outside company's existing business. The other option for the management is to rely on judgment. This method consists of recognizing risk groups and classifying the investments into them. High-risk investment projects will be given an upward adjusted WACC, while low-risk investments are adjusted downwards. According to Bennouna et al. (2010) this is a more subjective approach. However, remembering the uncertainty related to the future cash flows of the investments and the unique nature of each investment project, the pure play approach could also be seen as a summary of external subjective approaches.

The capital investment calculations require not only the proper use of DCF techniques, estimated cash flows and inflation, and discount rate valuation, but also risk analysis (Brigham and Ehrhardt 2002). The NPV calculation is exposed to uncertainty due to the estimated parameters needed to compute the result: the project's life time, initial capital expenditure, future cash flows estimates, the discount rates and the payback period. There are methods available to assist in handling the risk (Ho & Pike 1991). The techniques include adjusting the discount rates, building up scenarios and payback period and using probabilistic risk analysis such as sensitivity analysis, decision tree analysis and Monte Carlo simulation. (Bennouna et al. 2010)

2.3 Institutions explaining bounded rationality in decision making

2.3.1 Institution theory

After discussing the ideas for improving the MA calculation tools in detail, Bennouna et al. (2010, p. 237) state: "*Finally, this study, and much of the capital budgeting literature, assumes that managers make rational decisions, carefully using logical, proven techniques. It may well be that other dynamics are at play…*" In other words, the researchers admit that much of the investment planning literature ignores the effects of values and feelings on decision making.

In accounting studies, institution theory has been used to explain the design and use of different management practices, such as budgeting systems and enterprise resource planning systems (ERPs). The theory recognizes that commonly shared understandings, customs, rules and routines in organizational systems and practices form institutions that can change over time. In the process of forming the routines, previously formulated

rules may become modified as the group locates mutually acceptable ways of implementing them. Institutions exist in the actors' understandings and stocks of knowledge and express for the actors "*the way the things are*". The institution guides its members' actions. It is "*a way of thought or action of some prevalence or permanence, which is embedded in the habits of a group or the customs of a people*" (Burns & Scapens 2000, p.7).

Burns & Scapens (2000, p.6) define the relationship between institutions and its actors as two-way interplay, where the individuals are shaping the institutions while simultaneously the institution is guiding their actions: "Institutions evolve through a process of reutilization of human activity. Thus, there is a duality between action (human activity) and institutions which structure that activity." Institutions comprise "*taken-for-granted assumptions*" which inform and shape the actions of individuals. At the same time these taken-for-granted assumptions are themselves the outcome of social actions, i.e. they are socially constructed.

The level of institutionalization can vary. Some patterns of social behavior are more subject to critical evaluation, modification and even elimination than others. There may also be variations in the length of time particular institutions have been in place and how widely they are accepted by members of a group or an organization. The degree to which the patterned behaviors are deeply embedded in a social system varies in terms of their stability and their power to determine behavior. Institutions which are relatively short-lived and/or which have not gained widespread acceptance are more vulnerable to challenge and less likely to influence action. (Tolbert & Zucker 1999)

2.3.2 Institutional entrepreneurs

The individuals and companies, who want to change the current institution, can be called as *institutional entrepreneurs*. For example, a supplier company works as an institutional entrepreneur when it wants to change the decision making process in the customer company. Institutional work is about bringing change to the learned patterns. This institutional work includes technical, political and cultural projects that aim at bringing chance to institution.

Perkmann & Spicer (2007, p.1118) conceptualize the institutional entrepreneur as "*a developing organization seeking to diffuse an innovation that it pioneered"*. Their findings suggest that institutional entrepreneurs can be engaged in political (or interactional), technical and cultural type of projects that aim at changing the ruling institution. *Political* work aims at influencing the development of organization and rules and includes activities such as networking, resource mobilization and organization building. In *technical* work the actors concentrate on studying, analyzing and designing the form. Third, in the *cultural* work the actors seek to justify belief systems and values by establishing or reframing them in ways that appeal to wider audiences. Cultural activities

include framing, propagating, advising and teaching and aim at increasing the diffusion of the new form. (Perkmann & Spicer 2007)

Managing change in general, and MA change in particular, requires a thorough understanding of current context of the organization, especially its routines and institutions. This is much more than just understanding the formal systems; it requires deep understanding of the habits of the organization day activity. For an institutional entrepreneur operating outside the organization making change will have to acquire detailed knowledge on the processes being involved. (Burns & Scapens 2000)

As Burns & Scapens (2000) point out, it is rather challenging to measure the institutions objectively, and they should more be seen as a tool for understanding irrational decisions in the organizations "*rules, routines and institutions are not proposed as empirical variables to be measured in some objective ways. Rather, they are analytical concepts which may not be capable of empirical observation per se. --- it is only actions which are observable.*" This notice supports the methodological choice of interviewing the customer companies about the actual switching actions and used MA information in the investment decisions. Institutions facilitate an interpretation of the actions being investigated but they are not measured themselves.

2.3.3 Institutions in road transportation

Important feature of institutions is their seemingly normative and objective character. They define the behavioral patterns which are expected in certain social group. Members of the group simply take-for-granted the behavioral patterns (Burns & Scapens 2000). In the context of road transportation, such institutions could include, for example, the basic design of the car (four wheels, internal combustion engine and metal bodies), rules in the traffic, standard set for safety and protection of cars and also the network of automotive companies and suppliers. The extent to which people are conscious of these norms and standards in automotive industry varies, but a great deal of these institutions is taken for granted (van den Hoed & Vergragt 2004).

Starting from the position that management accounting systems and practices constitute organizational rules and routines, it can be understood that also different MA practices get institutionalized in companies. For example, a new procedure in calculating the Total Cost of Ownership for a vehicle investment could be defined in a set of rules listed in an "investment manual" or in a standard form excel sheet. Changes to the use of this new calculation may occur unconsciously, for example, when the guidelines are misunderstood or the rules are ignored as being inappropriate to the circumstances. (Burns & Scapens 2000)

In road transportation, although car-makers are affected by their institutional context, they can influence the institutions in their context by proposing new and unorthodox

practices or technologies. In other words, there are situations where individuals or companies have acted as institutional entrepreneurs. For example, the institution of conventional fuels, primarily gasoline and diesel, has ruled the development of automobile industry for decades. The recent developments of alternative fuels have come to rattle this institution. According to van den Hoed & Vergragt (2004), for a new fuel technology to become institutionalized, regulatory support systems are needed. As well there must be commonly agreed on what are the appropriate actions by car-makers in achieving sustainable mobility. For instance, as long as internal combustion engine and liquate fuel tank are perceived as the only unproblematic and safe technologies, it will be very hard to replace it with other alternatives.

New technologies such as electric and gas vehicles question the taken-for-granted assumption that cars can only run on liquate fuel. These technologies previously considered as unrealistic or commercially unviable have become serious options for the rest of the industry and companies investing in vehicle fleets. (van den Hoed & Vergragt 2004) The electric car producer Tesla is one example of an institutional entrepreneur that is shaking the conventional institutions in automobile industry. It is promoting a new approach how we see cars by utilizing political work (e.g. by promoting sustainable energy solutions with the slogan *"Join the Tesla Revolution. Our technology offers the most efficient path to a sustainable energy future. Are you going to just live in the world or help change it?"),* technical work (e.g. by improving the battery life and car's performance), and cultural work when using novel courses of action (e.g. by having neither patent protection nor third party sales agents) (Nicholson 2014).

2.4 Switching Path Analysis Technique in investment actions

The dominant theories in marketing are based on the premise that customers follow a conscious process of decision making in choosing to purchase a certain good or service from a particular provider. However, it is often difficult to trace back the path of "reasoned actions" that lead the customer to end the incumbent relationship; for example; a long-term commitment to a certain provider may end without any apparent evidence of prior consideration. (Roos & Gustafsson 2011)

The earlier presented theory on actor based reality by Nørreklit et al. (2010) lacks clear explanation why some real possibilities eventually actualize to actions and why some do not. It is known that the actions need real possibilities to become true, and these real possibilities are supported by facts and values. In order to gain more understanding on the reasons for customers' actual investment actions, the supplier can investigate the actual behavior. One suitable theory for studying the customers' investing behavior is Switching Path Analysis Technique (SPAT) (Roos 1999). The key idea behind SPAT is to recognize that the switching event is affected by incidents that call for reaction, situational factors and influence of the active and passive roles of both supplier and customer. (Roos 1999) These critical incidents are called triggers.

Earlier work with the SPAT has mainly included consumer customer interviews in telecommunication sector. The switches have consisted of individuals' customer behavior in the Swedish telecommunications retail industry (Roos & Gustafsson 2011). The research has been limited to one industry in one country. Selos et al. (2013) have developed the technique further by applying SPAT in B2B supplier switching processes. Their work increases our understanding on SPAT by implementing the technique in IT-service industry in Finland. According to them, the B2B case narratives could be relatively easily translated into SPAT terminology, without any need for notable sacrifices in content.

In this thesis SPAT is applied in investigating investments in B2B context. A switch is considered as a decision to invest in vehicles using different fuel technology than what the company has earlier used. For instance, a company is switching fuel technology and fuel supplier when investing in alternative fuel vehicles instead of conventional fuel vehicles. SPAT can assist in looking into the switching paths that lead to adoption of NGVs as a part of the vehicle fleet, in other words, switching from conventional fuels to invest in new technology. It is also possible to distinguish the role of MA information in this process when understanding the triggers that lead to the actual purchasing event.

Triggers

A trigger can be any factor that initiates the switching process. It can have various sources, but the main characteristic is that it makes the customers sensitive to switching. In SPAT, triggers have been categorized into three separate groups (Roos 1999):

1) Reactional triggers (such as a supplier having dealt poorly with a customer)

2) Situational triggers (such as a change in the customer companies' organizational settings or something affecting these settings)

3) Influential triggers (such as changes in the markets that have an influence on the competitive situation of the suppliers.)

Active & Passive Roles

According to Roos & Gustafsson (2011) triggers affect customers' evaluations on service in different ways and cause varying kinds of behavior, depending on whether the customers are active or passive in their customer relationships. The distinction between "active" and "passive" comes from the customers' roles in searching for information: Active customers search for information in order to be able to make deliberate and conscious decisions. Passive customers are those who have not searched for information and therefore have fewer conscious reasons for their decisions.

In B2B context the distinction of passive and active behavior can be challenging: Selos et al. (2013) note that the dichotomy to active/passive behavior seems to be too simplistic in B2B context. It can only partly picture the complex switching paths involving multiple decision makers and roles. The interviewees in Roos's SPAT studies are telecom company's consumer clients. Compared to consumer clients, company clients tend to have more knowledge on the available solutions and require their employees to be active in searching for information. Compared to consumers, employees are driven by both intrinsic and extrinsic motivators (Ryan & Deci 2000) for keeping their selves updated on the latest available information.

Together the triggers and active/passive roles of the customer can be seen as sensitivity for switching (Roos & Gustafsson 2011). The sensitivity for switching builds up gradually over time: the customer gathers both consciously and unconsciously experiences of the current solution provider as well as gets information on other providers. The surrounding sources for information can be for example professional and personal network or media.

Loyalty and commitment

Customers need knowledge in order to develop clearer argumentation (Roos & Gustafsson 2011) for or against the current customer relationship. Active customers who are switching can usually explain exactly why they switch to the chosen competitor. They are aware of their situation and are active in searching for suitable alternative solutions. There are also customers who built up sensitivity over time and are aware of their reasons for switching. By the time switching is needed, for example due to reactional or situational chances in business environment, these customers know their criteria. Passive customers might not plan their switch and not search for information, but are still ready to switch immediately contacted. When competitors tempt the passive customers to switch, these customers might not have had enough time to obtain enough knowledge for proper argumentation for or against the switch. Passive customers might not know any good reason for denying the new given offer by the competitor. Passive customers are more likely to respond to influential triggers from the competitors' side, and therefore passivity is associated with instability in customer relationships. (Roos & Gustafsson 2011)

Having more explanatory ability and being active seems to enhance loyalty in B2C context. (Roos & Gustafsson 2011). In B2B context rational reasoning is appreciated in order to consider the decision justified. Knowing the arguments for and against the switch helps also to communicate the decision internally in the organization. Maintaining appropriate communication with current customers is important in order to increase customers' awareness about the advantages in their current relationships. Similarly, the potential customers should to be given information about the competitive solution and

how it could be beneficial for them. Knowledge gives the customer the means for argumentation when considering the switch.

Customers are influenced by the nature of their relationships with the incumbent suppliers. Relationship history matters, and new vendors "*do not start with a clean slate*" (Wathne et al. 2001). Studies about B2B customer's switching behavior show that there is a "status quo bias", a force making the customers being tied to the incumbent supplier (Ganesan et al. 2010). Such force is resulting from both calculative commitment and affective commitment. Calculative commitment is based on rationality and economic concerns, while affective commitment is the result of identification, loyalty and obligation linking the customer to the seller. The affective commitment seems to be highly sensitive to supplier misbehavior (such as opportunism and unethical actions), while customer's calculative investments in the relationship constitute an inertial force toward continuance. (Ganesan et al. 2010)

The study of Wathne et al. (2001) speaks for enhancing calculative commitment: they believe that supplier's best option to retain the customer relationship is to create switching costs at the firm level for customer. The results also show that customers attach considerable weight to immediate price advantages. Price may be the strongest competitive tool available to a new supplier wishing to undermine an existing relationship. In their study Wathne et al. (2001) treated interpersonal relationships as a unidimensional concept. They admit that also other dimensions may also influence the tendency to switch suppliers, such as sociability, approval, prestige, trust, reciprocity and power.

Marketing literature has found also other factors that determinate the switch. The determinants seem to differ across industries: The study of Wathne et al. (2001) from B2C relationships in banking industry claims that marketing variables (such as price and product breadth) are more important determinants of switching intentions than relationship dimensions (such as interpersonal relationships or switching costs). Specifically, price dominated all of the other factors. These findings are in line with the findings of Selos et al. (2013) from B2B switches from different industries. According to them, the traditional supplier selection determinants, cost, quality, and delivery performance are still often the main determinants in the actual B2B supplier switches. In all, the customers may tolerate shortcomings in "higher level" determinants, but the problems in price, quality or delivery times may cause significant problems for the customer itself or for the customer's customer. In this case there are practically no other option than consider a switch, even though normally also the convenience of the purchasing managers matters. Contrary to these two studies, the findings of Lam et al. (2004) propose that customer perceived value, customer satisfaction and switching costs are the antecedents of customer loyalty in a B2B context. They studied the switching behavior in B2B context by investigating data obtained from a courier service provider.

2.5 Research framework

Summarizing the received understanding from the literature, managerial decision making has been recognized to be affected by the intertwined influence of facts and feelings (Sadler-Smith & Shefy 2004; Soll et al. 2015; Nørreklit et al. 2010). Earlier management accounting literature has developed MA tools for investment decision makers (see for example Bennouna et al. 2010) and has recognized several roles for MA in managerial work (Mouritsen et al. 2009; Hall 2010; Wouters & Verdaasdonk 2002; Bruns Jr & McKinnon 1993; Laine et al. 2015). Earlier studies have investigated institutions to explain the learned patterns and bounded rationality in decision making (Burns & Scapens 2000; Perkmann & Spicer 2007; van den Hoed & Vergragt 2004; Tolbert & Zucker 1999), and factors affecting the actual supplier switching behavior have been recognized (Selos et al. 2013; Roos & Gustafsson 2007; Roos 1999). However, the research still lacks a decision making framework that could allow investigating the role of MA in an investment decision making process influenced by both facts and feelings. Neither there are available any frameworks that could also explain when and how the decision making discussions around MA calculations eventually lead to investment action in companies.

The framework of this thesis combines the earlier introduced theories explaining decision making and switching behavior in business context. This created framework helps in bringing structure to a complex phenomenon and supports in understanding the concept of investment decision making. Moreover, it gives explanation why some fact and feeling driven discussions lead to actual investment behavior and why some don’t. The framework is demonstrated in Figure 2.

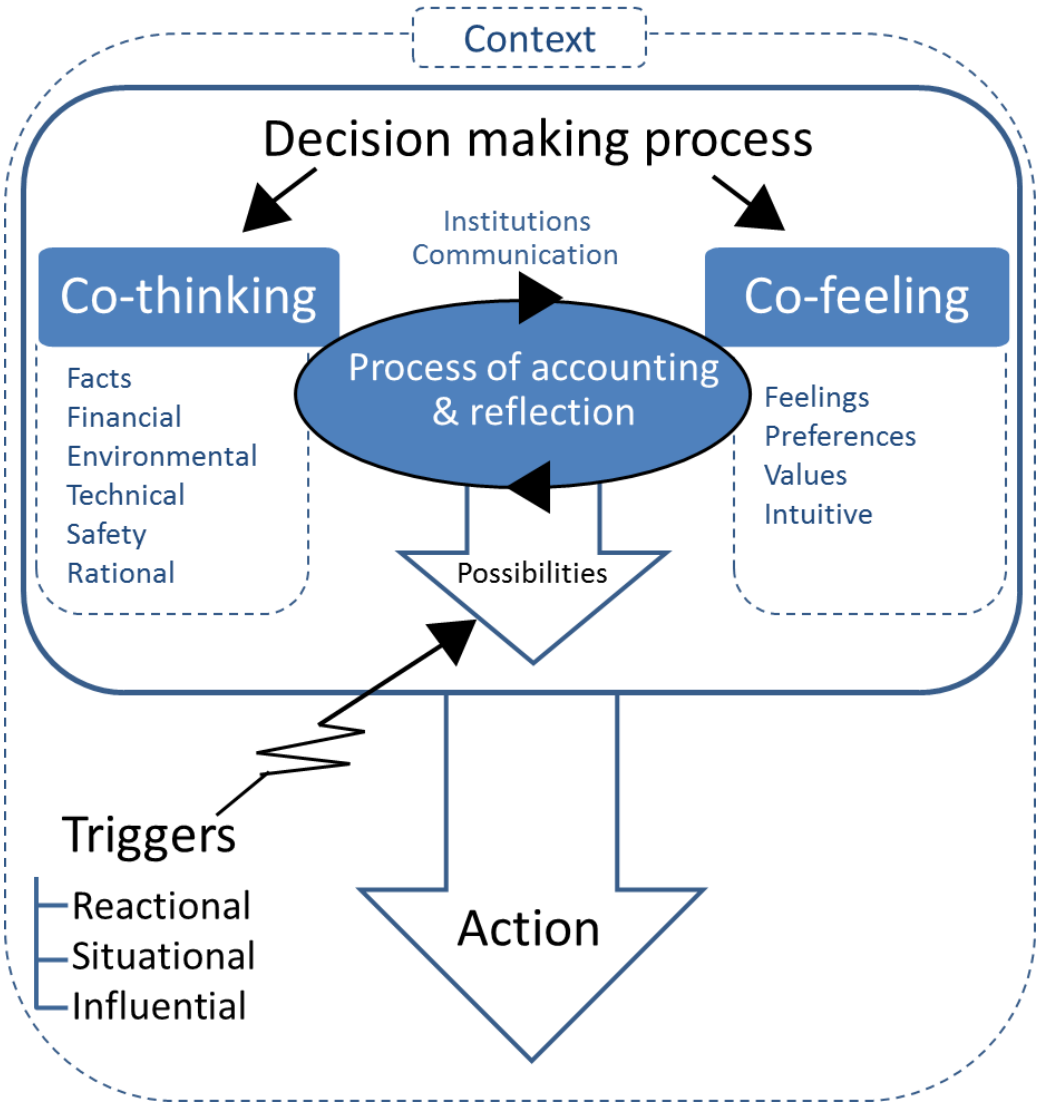


Figure 2 *The framework for understanding the role of management accounting in investment decision making process that eventually leads to action*

The context of this framework is in road transportation. In this context companies are investing in their vehicle fleets in order to keep their operations running with sufficient resources. The companies are considering investing in alternative fuel vehicles, more specifically in natural gas vehicles. The decision investigated with the created framework is the decision to invest in natural gas vehicles.

Academic literature has recognized several roles for management accounting and how it can support management in decision making. Central roles of MA are to facilitate discussion (Mouritsen et al. 2009) and complete the information environment where the management is making decisions in (Hall 2010). Laine et al. (2015) have structured the business decision making as a combination of two sub-processes. The processes of co-thinking and co-feeling are affecting the decision-making, and management accounting has a central role in decisions as being the language for business. The decision making ellipse can be seen as a process for discussing facts and feelings with the support of ac-

counting and reflection. The thesis framework applies this approach by placing the MA as a part of the decision making process, where it supports the discussions on the investment. After placing the MA in the central ellipse, the role of MA can be studied in the context of natural gas vehicle investments.

The investment decisions related to natural gas vehicles are affected by several fact and feeling based factors. In the co-thinking side of decision making, the most relevant facts in this context are related to technical, environmental, economic and safety factors. The nature of co-thinking is rational and logical. In the co-feeling side the decision is affected by values and preferences. In the context of AFVs, there is an active discussion going on about the real facts related to environmental friendliness of different AFV technologies. The industry has not entirely agreed on the most environmentally friendly solution nor is sharing the same facts across the industry. Hence, the decision makers must partly trust also on feeling, in other words on intuition. Intuition is used especially when there is no time, know-how or willingness to take over all the facts in the best possible way (Soll et al. 2015).

During the decision making process, the decision makers are following the norms of the institutions they are in (Tolbert & Zucker 1999). Different institutions set rules for the organizations' internal investment procedures, norms for the whole industry and have effect on both fact and feeling side. Communication about the facts, feelings and MA calculation tools used affects how they become institutionalized. Also facts are social constructs, as they need to be agreed on by the research and R&D community. (Nørreklit et al. 2010)

Institutions, communication or management accounting themselves do not start action. To be able to understand how decision making discussions lead to action, the concepts of possibilities, real possibilities and triggers are brought in the framework. Action is possible to start only from real possibilities that are constructed from facts and values (Nørreklit et al. 2010). First the decision must be factually possible. To be seen as feasible and viable, the factual possibility must be supported by the decision makers' values. This way the factual possibility turns into real possibility.

Investment decisions actualize, when triggers (Roos 1999) activate the company to start action from the risen real possibilities. If no trigger occurs, the decision making process stays at the communication and discussion level about the facts and feelings related to the decision. Triggers are divided into three categories according to the SPAT model of Roos (1999). Trigger can be consequence of e.g. a reaction for unpleasant user experience (reactional trigger), supplier's marketing actions towards the potential customer (influential trigger) or change in regulations and taxation by the government (situational trigger).

The final part of the decision making process, action, can be also externally observed from company's behavior. The actual investment in NGV and the switch to other fuel is eventually the behavior that can be studied afterwards. The picture could also be modified to show the action arrow splitting into two after the influence of triggers: a straight action arrow would then illustrate the normal action naturally starting from possibilities. This would show a "*business as usual*" decision making case. Another arrow would be turning right because of the influence of triggers, which would picture the switching action. This would demonstrate even more that change in action requires always a trigger to spark the switching behavior.

By interviewing companies about their actual investment cases, the researcher has the opportunity to discover the true factors and triggers behind the decision making. The institutions affecting the whole process can appear through the interview discussions. Once they are recognized, the case company also has the possibility to influence on them. Later the empirical findings are structured using this created framework.

3. NATURAL GAS VEHICLES AS INVESTMENTS

3.1 Natural gas vehicle market in Finland

Compressed natural gas vehicles were first introduced to the market in Italy already in the mid-1930s, and they started to gain greater attention during the oil crisis of the 1970s and 1980s. Starting the mid-1990s the interest reducing air pollution and dependence on petroleum imports has raised the governmental support of natural gas vehicles (NVGs) in many countries, such as Argentina and Brazil. (Yeh 2007) At present, the biggest NGV markets are located in South America, Middle East and Asia followed by Europe and North America.

Earlier the usage for natural gas as a fuel was dependent of natural resources, the geographical location and the existence of the pipeline infrastructure. Recently, the development in the technologies for the production and transport of the liquefied natural gas (LNG) has opened the natural gas recourses for global trade regardless of how far the country is from the original natural resource. The new LNG technology can be used for transporting both natural and bio gas to refilling stations outside the existing pipeline infrastructure. In Finland, the import of LNG allows the country to reduce its dependency on imported oil and Russian pipeline gas. It can be seen as one solution to diversify the origin of the country's energy sources.

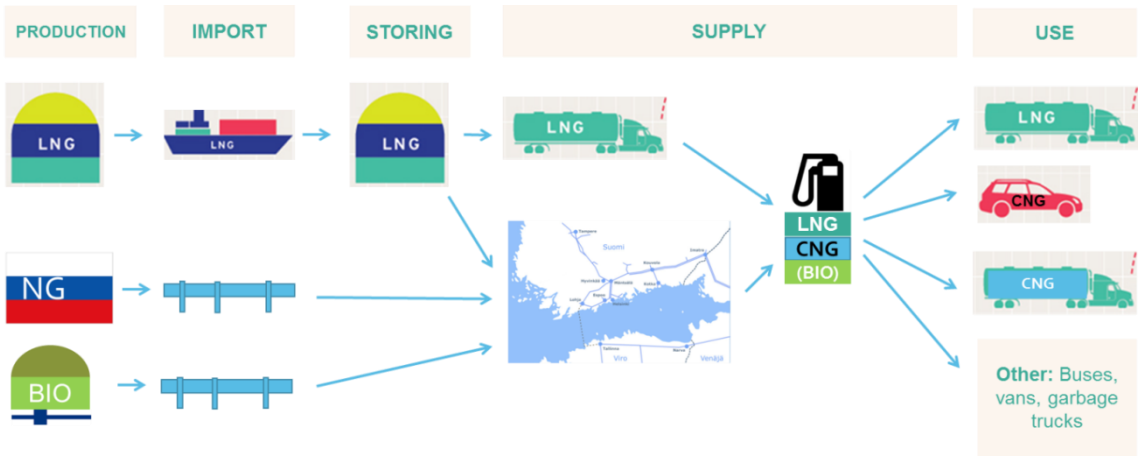


Figure 3 *The supply chain of natural gas as a road transportation fuel*

In Finland NGVs are still rather new technologies: the number of NGVs was around 1 900 vehicles in 2014 representing 0.06 percent of the total fleet of 3 100 752 vehicles. (Trafi 2015) The number of NGVs in Finland equals to one third of the new Skoda Octavias registered in Finland in 2014. Scoda Octavia was the leading car model in new

registrations with the total of 5 868 vehicles registered followed by Volkswagen Golf with 5 265 vehicles and Nissan Quashqai with 4 166 vehicles. (Autoalan tiedotuskeskus 2014) The Finnish automotive industry has estimated 120 111 new vehicles to be sold during year 2015. The aftermarket for used vehicles is larger: about 550 000–600 000 used automobiles are sold each year. Half of these sales take place at authorized dealers, one quarter at independent automobile dealers, and one quarter directly between consumers.

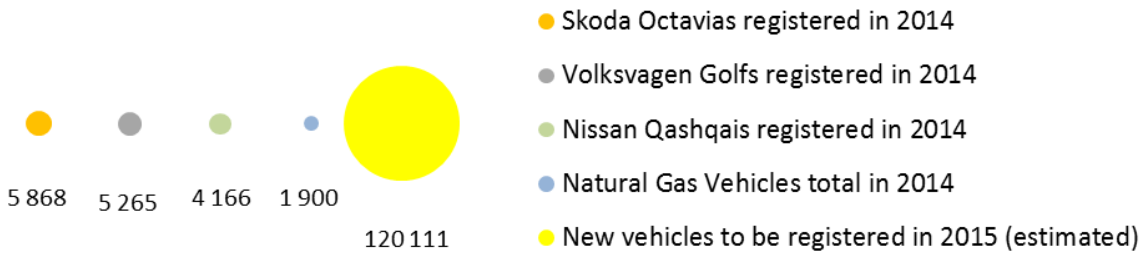


Figure 4 *The three most registered vehicle models, total number of natural gas vehicles in Finland and the estimated vehicle sales for 2015*

To date there are in total 24 natural and bio gas refilling stations in Finland, mostly located in the southern and south-east part of the country. The current vehicle technology allows using the NGVs also outside the existing gas station network, since the vehicles can switch using gasoline from another tank. (Finnish Biogas Association 2015)

VRI indicator (number of vehicles in thousands to number of refueling stations index) is an indicator of two main factors 1) the spatial density of refueling stations provided for drivers and 2) the profitability of refueling facilities for the station owners. In their study, Janssen et al. (2006) found a VRI value roughly equal to 1 (i.e., 1 000 vehicles per a refueling station) for countries with a large number of NGVs, including Argentina, Brazil, India, Italy and Pakistan. They concluded that this is the optimal balance between profitability for refueling stations and convenience to NGV drivers. In Finland the indicator is currently approximately around 0.079 (1.900 / 24) for NGVs, while for conventional vehicles it is around 1.64 (3 100.752 / 1 892) (Öljy- ja biopolttoaineala ry. 2015b). For comparison, the number of NGVs in Sweden is now over 52 000 and VRI indicator approximately 0.33 (52 000 / 156), while for conventional fuels VRI indicator was 1.69 (4 585 000 / 2 716) (NGV Global News 2015; Gasbilen 2015; Svenska Petroleum & Biodrivmedel Institutet 2013). Although the concept of VRI is rather simple, the VRI measure is subject to wide variations when applied in the national level. According to (Yeh 2007), "*factors such as spatial characteristics and socioeconomic differences, including consumer sensitivities to incremental increases in driving distance or waiting time for refueling, capacities of fueling stations and the number of public versus private refueling stations, can contribute to variations within and across countries and add additional variabilities and uncertainties to the analysis.*"

Another measure for comparing refueling density is the ratio of the relative numbers of alternative fuel refueling stations and conventional gasoline stations. Greene et al. (2005), Sperling & Kurani (1987) and Nicholas et al. (2004) have used techniques including consumer preference surveys and travel time/distance simulations to find required levels for the ratio. They found that the sustainable growth of AFVs during transition from initial market development to mature market requires the number of alternative-fuel refueling stations to be a minimum of 10 to 20 percent that for conventional gasoline stations. These studies suggest that at levels greater than 10–20 % of conventional refueling stations, consumers no longer view the availability of fueling stations as a major barrier for the adoption of AFVs. Today the ratios of number of NG refueling stations to number of conventional fuel stations are 1.3 % and 5.7 % for Finland and Sweden respectively.

Figure 5 *The current gas station network in Finland (Finnish Biogas Association 2015)*

There are two alternative approaches for creating market for NG as a fuel in road transportation: either the demand or supply must be increased first. This has been stated to be a typical "chicken and egg" dilemma: the demand cannot grow without good availability and infrastructure. On the other hand, it is risky to invest in large infrastructure network without clear signs of increasing demand.(Caulfield et al. 2010) According to Ogden et al. (2004), supply companies' main reason for minimizing the number of infrastructure changes is the huge cost involved for assets that may have to be retired in a few decades if there is an eventual shift to hydrogen.

The demand for NG as a road transportation fuel can be increased by either boosting the number of NGVs in the market or by growing the volumes used in each NGV. Remembering the environmental reasoning for NGVs, the second alternative does not sound advisable. Instead, the number of NGVs can be increased by using other actions as recognized by Yeh (2007). Such actions could be using governmental purchasing actions, mandatory country/industry targets or affecting the consumer behavior through incen-

tives or companies' aggressive marketing. The supply side can be expanded by, for example, direct governmental incentives or investments in refueling stations and pipeline infrastructure. Ogden et al. (2004)

3.2 Barriers for technology adoption

Flynn (2002) has investigated the barriers for NGV's success in Canada in the 1980's: Back then, the main barrier for the wider adoption was a lack of infrastructure to support converted vehicles. Lack of refueling facilities was particularly critical; failure of existing refueling stations to achieve profitability stalled further investment, which in turn depressed sales of vehicle conversions. Other problems in the industry included excessive parts markup by conversion dealers, exaggerated claims for environmental and economic benefits, and poor design of promotional programs. Fundamental shifts in the relative values of oil and natural gas in the late 1980s removed momentum from sales of conversions. Major players, who had not achieved profitability, exited the market, and natural gas as a vehicle fuel has since remained on the fringe in Canada and the US. Today, the new LNG technologies and driving forces including trends of appreciating fuels of domestic and environmental origin are creating conditions that favor alternative transportation fuels. Many of the issues regarding growth to commercial viability, in particular, the need to build a supporting infrastructure, will be the same as with natural gas in the 1980's (Flynn 2002).

Although researchers have emphasized the lack of wide supply infrastructure being a major barrier for the adoption of NGVs, the energy policy literature has recognized also other factors hindering the adoption of alternative fuel vehicles. These findings are transferable to the context of NGVs, as they represent one of the alternatives for the conventional solutions. For example, Romm (2006) has recognized that there have been historically six major barriers to AFV's success:

1) High first cost for vehicle
2) On-board fuel storage issues (i.e. limited range)
3) Safety and liability concerns
4) High fueling cost (compared to gasoline)
5) Limited fuel stations: chicken and egg problem
6) Improvements in the competition (better, cleaner gasoline vehicles).

Romm (2006) has not commented on the subjectivity related to these barriers. Different investors are in unique decision making situations: the decision makers have different values and possibilities and different institutions guide their decision. The purchase price of the alternative fuel vehicle might be higher than one of conventional vehicle, but the decision makers might still feel that the price is reasonable. They may see the price low as taking into account the environmental values and lower life cycle costs they get for return. Another named major barrier, limited range, is a fact for all the vehicles –

at some point the fuel/gas tank or battery runs out. The subjectivity relies on how the decision maker experiences the fact: is the driving range smaller than needed and therefore a negative fact and a barrier for investing in it? Or if the range is smaller than with the conventional solution but still enough to carry out the normal driving plan, is the fact neutral instead of a barrier? In addition to the subjectivity relying in this barrier list, it must be remembered that the levels of costs, range, infrastructure density and technological performance are not fixed as they are differ in time and are partly country specific.

Yeh (2007) has recognized that the adoption of vehicle technologies and fuels is influenced by

1) Technologies and fuel choices (cost, performance, availability, reliability and safety of the advanced vehicles and the alternative fuels)
2) Context (social, economic, cultural, and spatial characteristics)
3) Impacts (economic, health, environmental, energy and land-use changes).

Yeh's approach has recognized that there are several other factors affecting the decision making than only technical and economic information related to the vehicle. Both Yeh (2007) and Romm (2006) suggest governmental actions as major advice for overcoming the adoption barriers.

There are examples of countries that have supported the adoption of NGVs through regulation or incentives: In Delhi, the Supreme Court issued a series of resolutions instructing the government to ensure that all public transportation, buses, taxis and auto-rickshaws switch to clean alternative fuel. Several hitches including supply uncertainties and long waiting lines at refueling station were faced, but in the end of 2003 more than 87 000 vehicles, mainly public-transit vehicles, taxis, and three-wheelers, were using CNG in Delhi. In China, the primary reasons for moving to larger NGV market were environmental concerns and energy security. During Beijing Olympics 18 000 city buses i.e. 90 percent of the fleet was replaced to CNG-fueled buses prior to the 2008 Olympic Games. Chinese government promoted LPG and CNG fuels using various R&D projects, direct investments, incentive programs and targets. (Yeh 2007)

Yeh (2007) has named five major classes of policy instruments that have been applied to influence the adoption and utilization of transportation technologies. These include:

1) Outcome-based regulation such as emission standards;
2) Technology- or fuel-based regulation, including zero-emission vehicles, catalytic converters, on-board computer-emissions monitoring technology, ultra-low-sulfur diesel, adaption of alternative fuels, bans on leaded gasoline and oxygenates;

3) Incentive-based instruments targeting consumers, such as tax credits and rebates, the term "consumers" including both individual purchasers and fleet operators such as businesses units and government agencies;
4) Incentive-based instruments targeting suppliers, including R&D and government-funded projects and tax credits and
5) Market-creation initiatives such as government procurement preferences or requirements for disclosure of fuel consumption, safety and performance or adoption targets for alternative fuel fleet vehicles, direct investments in refueling stations and the service networks.

Any effective policy-intervention strategy must be designed knowing the stakeholder groups, their decision making and how the intervention would affect that. By first understanding the facts and feelings behind the investment decision making this research can also support policy makers in finding appropriate ways to affect the NGVs', or more widely any AFVs' adoption. Finding the right indicators for studying the performance of the political actions might still be challenging, as it has been found that large time delays exist between strategic policy actions and frequently used market penetration indicators (e.g. car sales and infrastructure expansion). The delays might limit the ability of policy makers to assess the performance of their strategy. (Janssen et al. 2006)

3.3 Technical and safety factors in fuel choice

The information presented in this chapter illustrates the existence of several facts involved in the discussion on fuel choice. For the use of the thesis framework, required level of knowledge is to be aware of this energy engineering research field. The thesis does not comment on the correctness of the measured emission or safety levels.

When making investment decisions on vehicle type, the decision makers also fix their choice on the fuel type being used. The fuel choice has effect on for instance vehicle's technological performance, vehicle's environmental friendliness through exhaust discharge and driver's safety. Technological performance includes facts describing measures such as engine power, efficiency and durability. As presented in the research framework, this kind of factual information serves the co-thinking processes in investment decision making. Facts can be presented in an objective manner, as done in most of the studies comparing fuel technologies, costs and safety. However, the decision makers experience, interpret and value differently the factual information and factual possibilities rising from this information. They might set certain facts as main criteria or hurdles in investment process. Or, the decision makers might not even have all the factual information available. In this case intuition plays a stronger role.

When looking into the environmental aspects, the fuel choice affects the exhaust discharge of a vehicle in two ways: firstly, the fuel type determinates the composition of the exit gases coming from the engine. For example, if the fuel contains aromatic com-

pounds also the exit gases will include aromatic compounds and possibly more health risks. Secondly, some fuels are enabling fuels, meaning they enable the use of post-purification techniques. (Nylund & Aakko-Saksa 2007) Methane (CH_4), of which natural gas and bio gas fuels almost entirely consist, does not produce fine particles or aromatic compounds due to its chemical construction. Also the quality of the conventional fuels has improved recently: the most important actions have been stopping the use of lead compounds in gasoline, reducing the sulfur and aromatic compound levels and adjusting the evaporation attribute. (Nylund & Aakko-Saksa 2007)

If gasoline is replaced with natural gas, the CO_2 emissions are reduced approximately by 20 percent. If natural gas is used for replacing diesel, the CO_2 emissions have been studied to remain almost the same due to the lower fuel economy of natural gas. Well-to-tank greenhouse gas (GHG) emissions are on same level for the conventional fuels and natural gas. Alternatively, the GHG emissions for biogas are remarkably lower than those for fossil fuels. Usually biogas is seen as a CO_2-neutral fuel or is even suggested to have a negative GHG balance: Methane has a 21-times higher GNG impact compared to CO_2. Hence, the methane resulting from the organic decomposition is preferable to be burned than to be released to atmosphere. Other fuels that have the potential to reduce the GHG emissions remarkably are bio ethanol (cellulose or sugar-cane based) and synthesis gases obtained from organic waste or biomass (such as dimethyl ether (DME), biomass to liquid (BTL), methanol). (Nylund & Aakko-Saksa 2007)

The factual information on exit gases may be valuable for an investment decision maker appreciating low GHG emissions or fine particle levels in fuel choice. It is also useful input for companies that compensate their CO_2 emissions though emissions trading. The presented information on fuels can be used in both processes of decision making to justify the investment: in co-feeling (based on environmental values) or co-thinking (based on financial facts on the CO_2 allowance costs).

Similarly, fuel safety is a much discussed topic in vehicle investments. One of the key attributes affecting the fuel safety is explosion sensitivity. The measured inflammability limits in air are for gasoline 1.4–7.6 vol-%, for ethanol 3.3–19 vol-%, for methane 5–15 vol-% and hydrogen 4–75 vol-%. This means that while gasoline can form an explosive mixture with air already in small concentrations it also quite quickly creates a supersaturated mixture unable to inflame. Alternatively, hydrogen can very easily form an inflammable mixture with air. For gas fuels the density of the gas affects the safety: lighter gases such as methane become thinner as they go up in the air while other gases such as DME and liquefied petroleum gas (LPG) are heavier than air and can descend in drainage wells.

Ogden et al. (2004) point out that methanol toxicity can still be a potential barrier for wider adoption of methanol as a transportation fuel and turn out to be a potentially troublesome liability issue for the transportation fuel industry. A fatal dose is 2–7% metha-

nol in a liter of water, which would defy detection by taste. The vehicles using electricity for power transmission have significantly higher voltage levels than conventional combustion engines. Thus electric, hybrid and fuel cell vehicles need to pay special attention on protecting the high voltage components and on predicting accident circumstances. (Nylund & Aakko-Saksa 2007) In order to evaluate the safety risk related to the fuel choice, the decision maker needs to estimate the probability and seriousness of the possible damage caused by the specific fuel. Also this evaluation involves the processes of co-thinking and co-feeling, as the decision maker is combining the factual information with his/her own subjective assessments.

3.4 Crucial factors in vehicle purchases for consumers

Academic literature has studied in detail several crucial factors affecting vehicle purchases in consumer context. The decision is purposely referred to as being a purchasing decision, not an investment decision: In B2B context, investing money on vehicles includes an expectation of future benefits that will actualize within a certain time frame. When consumers make decisions about vehicles, one does not expect income from the investment, but more readily compares the costs and other impacts of the investment

Even though this thesis discusses the decision making in B2B context, it is valuable to understand what is already known about the consumer behavior. The professionals making investment decisions in the companies are also consumers in their personal lives. The decision makers are also vulnerable to pressures coming from the institutions they belong to, e.g. from public opinions, although the business context demands rational thinking.

3.4.1 Fuel economy and price sensitivity

Caulfield et al. (2010) have studied consumer preferences in vehicle attributes in Ireland. The vehicle attributes that respondents rated most highly were reliability, automobile safety, fuel costs, and the purchasing price. Respondents did not rate greenhouse gas emissions or vehicle registration tax (VRT) as crucial attributes when purchasing a new vehicle. The car company's customers place a higher utility on reductions on fuel costs compared to reductions in VRT and CO2 emissions. The majority of respondents agreed that hybrid and electrical vehicles (HEVs) and alternative fuel vehicles (AFVs) are better for the environment and would be the vehicle of choice in ten years' time. There was some dispute as to whether the alternative fuel vehicles are cheaper to run, with nearly as many people agreeing with this statement as disagreeing with it. If the adoption of HEVs or AFV is seen as publicly desirable, the fuel costs of these vehicles will have to be competitive/lower when compared with that available to conventional vehicles. A major concern of respondents was the scarce availability of outlets selling the alternative fuel. Natural gas and bio gas were not included in this study.

The price difference between natural gas and conventional fuels such as gasoline and diesel has often been cited as the most important factor in attracting users to switch to natural gas vehicles (NGVs) (Yeh 2007; Janssen et al. 2006; Gwilliam 2000; Dondero & Goldemberg 2005). An NG pump price of at least 40-60% below the gasoline price is common in most countries that have had successful NGV penetration. While low natural gas fuel prices encourage the displacement of conventional fuels, many countries have encountered the problem of active competition with the diesel fuel due to insufficient price gaps between the two fuels. (Yeh 2007). Currently in Finland biogas costs 40 % less than gasoline and 30 % less than diesel when comparing the price per energy content (Öljy- ja biopolttoaineala ry. 2015c; Gasum 2015).

Busse et al. (2013) have investigated how sensitive consumers are to expected future gasoline prices when they make new car purchases. More precisely, how much does an increase in the price of gasoline affect the consumers' willingness to pay for cars of different fuel economies? In the very short run, when gasoline prices change, drivers can very quickly begin to alter how much they drive. Earlier Goldberg (1998) and Hughes et al. (2008) have investigated three measures of driving responses to gasoline prices. Goldberg (1998) estimates the effect of gasoline prices on vehicle miles traveled and Hughes et al. (2008) investigate monthly gasoline consumption.

On the other extreme, in the long run, automobile manufacturers can change the fuel economy of automobiles by changing the underlying characteristics – such as weight, power and combustion technology – of the cars they sell (Busse et al. 2013) or by changing the fuel technologies to alternatives, such as hybrid, electric or natural gas vehicles. Two papers that address the effect of gasoline prices on car quantities are Klier and Linn (2010) and Li et al. (2008) (Busse et al. 2013). Klier and Linn (2010) found out that increases in the price of gasoline reduce the sales of high consuming cars relative to cars that have small fuel consumption. Li et al. (2008) estimated the effect of gasoline price on the outflow from, as well as inflow to, the vehicle fleet. They found different effects for cars of different fuel economies: a gasoline price increase increases the sales of high fuel economy new cars and the survival probability of high fuel economy used cars, while decreasing the sales of low fuel economy new cars and survival probabilities of low fuel economy used cars. These findings suggest that consumers are sensitive for the fuel price changes when doing car purchasing decisions in long term planning.

The studies of Greene et al. (2005) and Santini and Vyas (2005) suggest that most consumers want a very short payback period – less than 3 years for an investment in fuel economy (Yeh 2007). This is significantly shorter than the lifetime of most passenger vehicles, the average age of passenger vehicles being 11.5 years in Finland (Autoalan tiedotuskeskus 2014). However, it is close to the time period that transportation businesses such as taxi entrepreneurs and delivery companies apply, 2-4 years, according to the interviews conducted for this thesis. The main reasons for this are the limitations to

repair the new car under warranty. The short payback period suggests that consumers have high implicit discount rates when making investments in new technology.

Lastly, Yeh (2007) and Greene et al. (2005) have pointed out that little is known about how consumers estimate the value of improved fuel economy and how they factor that information into their car-buying decisions. In other words, the use of management accounting information in consumer vehicle purchase decisions requires more studying. The created research framework could be tested in the consumer context as well in the future.

3.4.2 Personal preferences

In consumer context, also other factors not directly connected to factual information seem to affect decision making. Factors such as feeling of freshness, attitudes, personality, lifestyle, and mobility type have effect on consumers' vehicle type choices.

Early study of Wykoff (1973) implicates that consumers view new cars as superior to used cars and private transportation as a necessity. Feeling of freshness or newness in automobiles is important to consumers for at least two reasons. One is aesthetic – the feeling of freshness and newest gadgets and safety features, the pride of driving the newest models and so on. Secondly, consumers buying new cars avoid problems associated with used car dealings, such as finding a trustworthy used car dealer, knowing how the car was treated by its previous owner, knowing whether the odometer has been reset and understanding the fine print on the "guarantee". In brief, buying a new car requires less expertise and involves fewer risks than buying a used car. (Wykoff 1973)

The empirical results of Choo & Mokhtarian (2004) state that travel attitudes, personality, lifestyle and mobility factors affect consumers' vehicle type choice. Later the study of Prieto & Caemmerer (2013) have also studied the impact of economic, individual and household characteristics on car segment choice, as well as whether to buy a new or a used car. Their data reflects that age and gender impact on car type and segment purchasing decisions. It was also observed that consumers prefer domestic car brands when buying small cars. In their study Choo & Mokhtarian (2004) suggest that future models of vehicle type choice can be substantially more powerful with the inclusion of travel attitudes, personality, lifestyle, and mobility factors. On the other hand, there are logical reasons why such variables are not more often included in travel behavior models. One reason is that their inclusion makes a survey substantially longer. Secondly, the design and analysis of an attitudinal survey involves skills that are not necessarily standard among travel modelers. Third, the objection is often raised that attitudes and other subjective variables cannot be easily forecast, and hence future demand as a function of those variables also cannot be forecast. According to (Choo & Mokhtarian 2004), these barriers currently limit the practical inclusion of attitudinal factors in large-scale demand forecasting models.

To sum up the recent research, there is academic literature available on the barriers affecting NGV technology adoption (Romm 2006; Flynn 2002; Yeh 2007), but this research only partly explains why some companies invest in NGVs and why some do not. The research on the technical and safety factors related to each fuel type (Nylund & Aakko-Saksa 2007; Ogden et al. 2004) gives information for decision makers about the possible and feasible fuel options. When applied in the thesis framework, this conversation on the technical measures is elaborating and expanding the known details in the factual side of the decision. Several studies have been conducted to investigate the decision-making in consumer context, where the impact of personal preferences and fuel economy have been recognized to affect the decision making (Choo & Mokhtarian 2004; Greene et al. 2005; Wykoff 1973; Busse et al. 2013; Caulfield et al. 2010). However, little is known about the factors that affect companies' vehicle investment decisions in road transportation. The effect of available technical information, personal preferences, fuel economy and the significance of the technology barriers is still unknown in B2B vehicle investment context and, in particular, in natural gas vehicle context. Deeper understanding on the factors influencing B2B vehicle investment decisions can help politicians and fuel or technology suppliers to adjust their actions (e.g. regulation, incentives, marketing or product development) to reach desired impact on customer companies' decision making processes.

4. RESEARCH METHODOLOGY AND MATERIAL

4.1 Research strategy

The research follows the principles of interventionist approach, meaning the thesis worker will contribute to solving case company's real problems in order to make relevant findings for the academic discussion. One advantage of using interventionist approach is that the company representatives are more willing to share information and give resources to the research when they feel like benefitting from the close collaboration themselves. The material received through using interventionist approach is related to the real issues companies are facing, so the research results have a practically relevant background (Suomala et al. 2014) and the new findings have potential to be applied also in practice in the future.

Interventionist research can be seen as one example of a case study, where the researcher investigates a chosen research case thoroughly. Research intervention can work as a part of a researcher's toolbox for gaining more understanding about the phenomenon under investigation. (Suomala & Lyly-Yrjänäinen 2012, s.85). The most remarkable characteristic of an interventionistic study setting is that the researcher purposely uses an active and participating working method in order to receive insightful findings. On the contrary, in a non-interventionistic study setting the researcher aims at observing the case from distance and minimizing the impact of researcher's own work on the case being observed. In the interventionistic study setting the objective is reverse. (Jönsson & Lukka 2005)

The benefit of using the interventionist setting is that it can be used for gathering more subtle and meaningful information than when using conventional research methods. Moreover, the researcher has the possibility to build trust in the case organization and receive deeper knowledge about the organization and issues it is currently working with. The intention is to not only be able to conceptualize the data drawn from phenomena in the organization, but also to understand the problem at hand and find practical solutions for it. (Jönsson & Lukka 2005) Usually also the research questions are related to the theoretical framework behind the intervention (Suomala & Lyly-Yrjänäinen 2012, s.12). This approach was also applied in the thesis. Overall, the topic of the thesis required profound understanding on the industry. The researcher collaborated closely with the case company to be able to recognize subtle signals of institutions and identify facts and feelings behind decision making.

During interventionist study the researcher aims at defining the study setting through observing and making an intervention in collaboration with the case company. Researcher evaluates the process and the outcome and analyses the findings by reflecting them on the existing literature. (Jönsson & Lukka 2005) The purposely active and intentional participating (Jönsson & Lukka 2005) role of the researcher came up in the thesis project through steering group meetings. During the meetings the researcher offered her expertise for the case company's use. First this work was assisting in outlining a relevant research problem in the case company and later the researcher presented an approach for solving the problem and how the created framework could be applied in future.

Typically researchers must earn the access into the organization in some way when the interventionistic study setting is applied. (Suomala 2013) In this thesis project creating two calculation tools and gathering information from several customer company interviews provided new information for the case company. The new information was relevant for practical questions related to marketing strategy and infrastructure network planning. The committed work for the case company showed that the researcher was motivated in learning the business thoroughly and was able to follow the discussions in energy context. The built trust enabled the researcher to join interesting discussions in the company almost as an insider.

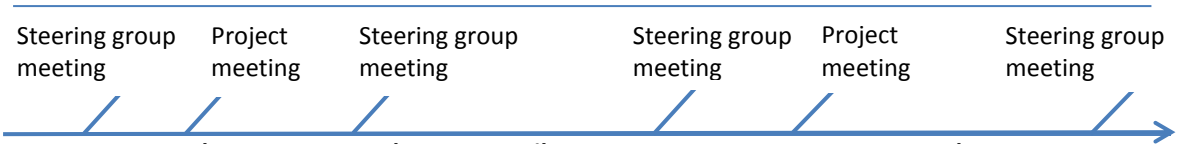
All in all, the empirical work for the thesis consisted of two parts:

1) Designing an investment calculation tool that provided information for the case company's supply network planning. Another tool, comparison calculation for vehicle's life cycle costs with different fuels, was created to better understand the components affecting the profitability of a vehicle investment.

2) Conducting interviews among case company's customer companies. The interviews discussed the switches to and from using NGVs and the role and content of MA information in the switch.

The first phase of intervention in the case company consisted of bringing in new calculations to support the decision making on network investments. The second phase was to present the learned information from customer interviews and reflect on what had been learned.

Additionally to calculation tools and interviews, steering group meetings and informal meetings with case company representatives were used for gathering information. In the first meetings information was shared specifically about the case company and industry. Later the emphasis was on discussing specific topics and making observations from the presented result material. The timeline presented in Figure 6 illustrates all the main actions carried out during the thesis project.



January	February	March	April	May	June	July	August
Understanding context Current state and problem in the case company Gathering information on the fuel and vehicle industry Presenting ideas for possible calculation tools Presenting the MASI project framework	Information gathered on Finnish transport First version of network investment calculation introduced First version of vehicle life cycle cost calculation introduced	Development of calculation tools Interviewing Sales Manager Exploring the current marketing tools: Collecting information from earlier customer surveys and TCO calculation tools Contacting the customer companies Starting the interview round	Interviewing Network Development Manager Interviews in customer companies	Presentation of first findings from interviews Introducing SPAT and institution theory as basis for further analysis	Analysis on research material Writing the thesis	Analysis on research material Writing the thesis	Presentation of created research framework, concluding findings and managerial implications Preliminary agreement on organizing a workshop for the personnel and publishing the thesis results in customer magazine

Figure 6 *The timeline of the thesis project: meetings, creation of MA tools, interviews and presentation of findings*

The actions presented in the timeline supported the researcher in picturing the practical research problem in the company and creating a framework to solve it. While doing so, the activities along the time period made also possible to exchange views on topics relevant for academic discussion.

On the whole, the research material consisted of documented email, phone and face-to-face meeting discussions with the case company representatives, customer survey and marketing material provided by the case company, customer companies' own Excel calculation tools used in vehicle investments, two interviews with the case company personnel, eight interviews among customer companies and interviews with a hybrid taxi entrepreneur and a CEO of a taxi agency. In total 12 interviews were conducted for the thesis. During the research period from January 2015 to August 2015 the researcher also followed closely the public discussion on alternative fuel vehicles.

The material gathered from the case company was analysed using the created research framework. The framework was also applied in analysing the material from customer interviews. The qualitative analysis was done by utilizing Atlas.ti program, which is a program for coding and grouping quotations from transcribed interviews. The coding was piloted first with one transcript and the notes were cross-checked with another researcher. After discussing the interpretations of the meanings in each selected quotation in the trial, researchers agreed on the code families being used for the analysis. The findings from the qualitative analysis are presented in chapter 5, and the code list used in the analysis can be found from appendix 2.

4.2 Intervention in the case company

4.2.1 Current state and problem

The case company is a relatively large player in the Finnish energy industry with little more than 300 employees and net sales of over €1.2 billion. The company offers biogas and natural gas for use as a transportation fuel, natural gas for electricity and district heat production as well as industrial processes and energy production, liquefied natural gas (LNG) for use as a shipping fuel and liquefied natural gas (LNG) or biogas (LBG) transported by truck to customers outside the natural gas pipeline network.

Transportation operators are considering new fuel technologies and fuel suppliers due to the recent changes in regulation, public opinion and costs arising from additional taxes and emission allowances. The case company is willing to offer the road and maritime transportation operators LNG, biogas and natural gas products that could replace the conventional oil-based solutions as being more economical and environmentally friendly. For the case company, there are incentives for creating volume and economies of scale to better utilize the existing natural gas distribution infrastructure as well as gaining growth from a new business. The case company joined the research project as it was interested in utilizing the management accounting research to gain information supporting the discussion around the topic "gas in transportation".

Currently, the energy company at hand is planning to make big investments in supply infrastructure. However, the profitability of the network investment is highly dependent on the future demand of NGVs that are not yet widely adopted. The supply infrastructure investment is an so called irreversible investment; it is very specific and has a long lifetime. If this kind of project fails, it binds the corporate resources for a long time, and it is difficult to get rid of it at moderate costs (Kärri 2007).

The company needs support in ensuring the quality of the coming large network decisions. Assistance is needed in understanding better the decision making processes in demand side as well as in identifying and questioning the institutions guiding the internal processes. For the case company the recognition of feelings as having a role in deci-

sion making is a relatively new concept. They are hoping to identify meanings and assumptions affecting decision making in a business environment bearing a conventional engineering mind-set. This wish was clearly stated in a meeting with the company's CEO, Technology Manager, Development Manager, Business Development Manager and Vice President of Strategy and Public affairs: *"This is a new angle for us to discuss about feelings. We are a quasi-rational and engineer-lead company. It would be valuable for us to comprehend that both have their place."*

4.2.2 Investment calculations

The practical MA work in the company consisted of creating NPV and LCC calculation tools. The tools were developed in order to truly understand the elements affecting the profitability of a supply infrastructure investment and the life cycle cost structure of a vehicle when using different alternative or conventional fuels. The two MA calculation tools were used as facilitators in meetings to open discussion, question the dominating understandings and enable development by shedding light on concerns and uncertainties concerning the network infrastructure.

The two calculations were accomplished in close co-operation with the case company. The representatives provided a share of the numerical data and commented on the required parameters and improvements. The calculations were created using Microsoft Excel. The input was received from different sources varying from company's internal confidential data to public sources including the statistics of Central Statistical Office of Finland (f. Tilastokeskus), Finnish Information Centre of Automobile Sector (f. Autoalan tiedotuskeskus), Finnish Transport Safety Agency (f. Trafi) and catalogues provided by several different car manufacturers.

All the meetings discussing the development of calculations carried out similar message that more should be known about customer companies' investment decision making. This view was also supported by the two interviews on the case company personnel. Instead of speculating on customers' investment criteria and building the demand forecasts and marketing argumentation on it, the company could ask the customers about the true reasons for their switches. Interviews were together agreed to be a suitable method in approaching the customer companies. According to Jönsson & Lukka (2005), interventionistic research setting allows the researcher to organize interview rounds, and they are often also utilized during interventions.

4.3 Interviews about investment decision making

During the meetings it came out that especially B2B customers have a remarkable role in the adaption of new technology. Compared to consumers, customer companies operate with higher volumes and release the used vehicles quickly to after-market where

they are available for other users. In after-market the decreased price is lowering the barrier to try the technology.

Based on recommendations from the case company, the following operators having experience on NGVs were invited for interviews: one state and two private owned delivery operators, two taxi entrepreneurs, a driving school, a waste management operator and a church welfare foundation. To broaden up understanding on taxi business, one hybrid taxi entrepreneur and a CEO of a taxi agency were interviewed as well.

Eventually seven interviews were chosen for the analysis. Other one of the private delivery companies was willing to give some information about the switch in fuel and triggers that led to the switch, but did not want to participate in the research project. The answers received from this interview worked as useful background information but were not sufficient for deeper analysis or drawing conclusions. The interviews conducted with the hybrid taxi entrepreneur and the CEO of the taxi agency helped the researcher to identify the dominating institutions in taxi business. However, the answers were not comparable with other interviewees having experience in investing in NGVs. Hence, these three interviews were eventually left out from the final analysis and presentation of findings. Finally, in total seven customer company interviews constituted the sample for the analysis.

The interview round was executed for the most part during April 2015. The nature of the interviews was semi-structured: the researcher followed a question list prepared for the interviews but the interviewees were encouraged to tell their views using their own words and structure. The question design followed the idea of SPAT (Roos 1999), where the interview questions lead the interviewee to memorize the switching event. Eventually the discussion twines around the decision criteria and triggers. The interviewer received the answers from the interviewee in a subtle way instead of asking directly the criteria behind vehicle investment. If asked directly, the interviewer would most probably have received a standard pre-recorded answer drawn from company annual report without any real reflection on the process. One of the interviewees commented the use of SPAT in her own words: "*It was a quite good experience to start reflecting on this decision again. This interview has brought up for discussion many things that I didn't even remember. Some answers popped up during the next question as the interview went on: Oh and then there was also this factor affecting too…!"*

The interview was divided into four themes:

1) Background information about i) the decision maker: experience and role in company`s investment decision making and ii) the organization: company's business, industry, regulation, customers, technology used in operations and strategy

2) Switching situation: the process of investment decision making, description of the switching situation, criteria for choosing the vehicle and fuel, uncertainties in decision making, influence of suppliers in decision making

3) Role of MA information in decision making: the content and source of information used during the investment decision making and how the information was utilized

4) Refuelling network: habits for refuelling, how the network should be serving and how the refuelling station or supplier company is chosen, opinions about network density and possible barriers for the adoption of NGVs in the future

The complete list of the interview questions is presented in appendix. The duration of the interviews varied from 1 hour to 2.5 hours, majority of the interviews lasting around 2 hours. Usually the interview was held with two participants, the interviewer and interviewee, but in three cases the interview included more participants. The interviewed people are presented in table Table 2.

Table 2 *Interviewees*

Company	Title	Relation to the case company	Interview type
Case Company	Sales Manager	-	Face to face
Case Company	Network Development Manager	-	Face to face
Waste Management	Head of Fleet	Customer	Face to face
Delivery State Owned	Head of Sustainability, Development Manager, Senior Asset Manager, Heavy Duty, Asset Manager, Category Manager	Customer	Group discussion
Delivery Private	CEO	Customer	Face to face
Delivery Private	CEO	Former customer	Phone interview
Church Welfare Foundation	Cheaf Financial Officer	Customer	Video interview
Driving School	1. Owner & CEO, 2. Owner	Customer	Group interview
Taxi A	Entrepreneur	Former customer	Face to face
Taxi B	Entrepreneur	Former customer	Face to face
Taxi Hybrid	Entrepreneur	No relation	Face to face
Taxi Agency	CEO	No relation	Face to face

All the interviews were held in customer company's premises except for the taxi entrepreneurs, who utilized the premises of their agency or refuelling stations. The interviews were recorded, transcribed and later analyzed using the Atlas.ti program for coding the quotations.

4.4 Reflection on the research methodology

For the interventionist research to succeed, it is vital that the researcher gets in the organization as an "insider". The researcher should be seen as a competent and reliable person in the organization where the research is performed. This allows the researcher to communicate and operate closely with the other actors in organization. (Jönsson & Lukka 2005) It is not self-evident that the researcher will become an insider, but e.g. presenting first results can advance it (Suomala & Lyly-Yrjänäinen 2012, p.113). Without access to the inner circle researchers may be considered as "tourists on field" and are not taken seriously. (Jönsson & Lukka 2005) This risk was taken into account from the early start of the project by open and honest communication, being a trust worthy partner in cooperation and doing the needed background research to be able to suggest relevant research topics.

The case company representatives raised an important question about the chosen methodology in interviewing individual decision makers in customer companies and drawing conclusions out of these individual options. The concern was that the individual opinions in customer companies have a rather strong influence on the case company's infrastructure investment decisions. How can the researcher ensure that the interviewees' answers represent the customer company's view and not only individuals' viewpoints?

The strength in using SPAT model is that it relies on investigating the actual actions and switching behavior. The design of the model guides the interviewee to answer the questions from the organization's point of view. Thus the methodology of discussing through the actual investment situation and actions implemented gave information about the actual behavior in the customer organization. All the interviewees were holding a position responsible for the vehicle investment decisions in the organization. Hence, it can be assumed that the views, opinions and calculations guiding the organization's vehicle investments were to a great extend or even alone governed by the interviewed decision maker. Moreover, the planning of the case company's infrastructure investment is dependent on the demand information and forecasts, and the interviews work as qualitative input also to this discussion. This gained information deepens the understanding behind the forecast figures. Instead of pondering only on the demand growth percentages, the case company also receives knowledge about the customers' actual decision making processes.

Using semi-structured interviews in the field worked as the primary research method. Visiting the managers in their offices and conducting the interviews in the natural work environment brought about positive and discussing atmosphere. Mutual trust was vital in getting honest answers and this was gained through open description of the aims in both the research project and the point of view of the case company. The managers interviewed were all interested in what they do and they were willing to share their views on alternative fuel vehicles, experiences on the switches and investment calculations

supporting the decision making. Two interviewees, the CFO of the church welfare organization and taxi entrepreneur A, even sent the researcher their own Excel tools that had been used during the investment decision. These calculation tools included company specific information on the actual fuel consumption, fuel cost, purchase and leasing cost as well as annual driving distances. All the interviewees were interested in hearing and questioning the researcher's views on possible ways to apply MA tools in decision making and/or marketing as well as getting more information about the costs and environmental impacts of each fuel type.

The interview questions were planned to last approximately 1.5 hours in order to get the busy CEOs and top managers to agree on short meeting. However, even those managers with tight schedules seemed to relax and open up for reflecting their earlier investment choices. They even extended the interview time to elaborate more points. Also the interviewees were all fine with the recording, and they even expressed their frustrations and critique on the tape. Similar observations about the interview behavior of the top management have been found also in other MA studies, Bruns Jr & McKinnon (1993) being one example.

The topic brought up a lot of vibrant discussion on the future of transportation. The interviewees got even excited about the case and many were spontaneously giving ideas for improving case company's services and marketing. The interview was also mentioned to serve customer companies' own internal reflection, as mentioned by the development manager in the state owned delivery company. Taxi entrepreneur B had taken a look at the financial figures of the NGV investment for the first time after accepting to be interviewed. The entrepreneur wanted to prepare well for the interview, which in entrepreneur's own words "*forced*" the entrepreneur to "*reflect on the decision for once*" even though not feeling comfortable with figures.

To meet the test of reliability – demonstrating that the operations of the study can be repeated with the same results – all the interviews used the same set of semi-structured questions, were all recorded and later transcribed and reviewed by using Atlas.ti program. The study was always described the same way to each interviewed customer company as well as to each case company representative. The case company and customer company files contain meeting notes, all the received documents and notes prepared immediately after each visit. All the company files include variety of information that allows other researchers to make same conclusions and summaries.

To meet the requirements on validity the researcher used multiple sources of evidence. In the beginning of the interview round, other researchers from the same research group also participated in the first interviews. In total three interviews were conducted collectively with the other researchers participating as observers in the interview. Afterwards the notes and conclusions made by the interviewer and each observer were compared. Almost in all cases the findings and interpretations were equivalent to each other. In

addition to this gross check between researchers, another gross check was done with one of the interviewed companies. This largest conducted group interview included in total 10 participants and was both recorded and documented on the spot by one of the observing researchers. These on the spot notes were completed by the rest of the research group after the interview. After the internal round the notes were handed to the customer company and the interview participants reviewed and commented the notes. The notes came back with only minor adjustments to word choices. It can be said that the 10-people-group shared the same understanding on the messages and key points of the interview.

5. FINDINGS

5.1 Findings from the case company

Creating an investment infrasturcture calculation tool for the company gave the researcher "the right" to participate in discussions on the planned investment decisions. It turned out that the investment decision making in the company is affected by the internal processes of co-thinking (e.g., internal profitability calculations, investment cost evaluations and demand forecasts) and co-feeling (e.g., courage to take risk, faith in the product and assumptions about the customer's decision making). Moreover, the investment decision was affected by several external stakeholders including consumers, other customers' customers, inhabitants, municipalities and politicians (e.g., through land use planning, complaints, regulation and tax on motive power). Most importantly, the creation of the tools illustrated both for the company and to the researcher team the importance of growing demand in order to turn the investment profitable. This notion also demonstrated how vital it was for the case company to understand customers' decision making logic.

To understand the logic behind vehicles' life-cycle costs with different fuels, another calculation tool was created. The outcome from this tool was that among fuel cost, there are other significant costs affecting the vehicle's life cycle cost. One significant cost for vehicle investor was the decrease in vehicle's value, which had not been mentioned by any of the company members in former meetings. The cost from decrease in value does not remind of itself during the use vehicle's lifetime, whereas fuel cost reminds of its existence each time when the vehicle is refuelled. It is also notable that final fuel cost consists of two components: fuel consumption and fuel price. Even though the supplier's fuel price was low, either driving style or engine technology can be consuming and rise the final fuel cost.

The tool allowed to test the vehicle cost structure with different variables. The total cost of ownership of the vehicle was noted to vary depending on fuel, lifetime, driving distance, fuel consumption and weight and CO_2 emissions that affected on vechicles' taxation. The calculation also estimated the annual cost for driving to and from a refuelling station. The results from this estimations showed clearly that the fuel comsumed during refuelling round is minor or negligible compared to other costs.

Before the creation of the calculation tools, the company has had a certain impression on the customer's decision making criteria for applying the NGV technology. Hypothetically the customers' investment decisions are made rationally based on facts

such as life-cycle cost (LCC) analysis where fuel costs play a remarkable role. The company has tried to boost the demand by founding its marketing argumentation on the hypothetical criteria. Calculations on the Total Cost of Ownership (TCO) or yearly fuel costs have been demonstrated to let the potential customers compare the costs in using conventional or gas vehicles. Rather simplified and clear Excel-calculations, as seen from the examples in Table 3 and Table 4, have been used to prove the cost benefits gained when switching to gas vehicles. According to management, "*If the customers were entirely rational, the facts related to the natural gas vehicles should speak for themselves*".

The leasing costs represented in Table 3 have been used for illustrating the investment decision maker in potential customer company all the costs related to owning a vehicle. In sales meetings, it has been important to be able to present the Total Cost of Ownership (TCO) figures for the potential customer. When only fuel costs have been presented in sales meetings, there have been doubts weather the total costs would be lower than the used conventional solutions. When the sales team has been able to submit also a leasing company's offer for all costs exept for the fuel, the leasing price being the same for gas and conventional vechiles, the sales team has been able to better convince the customer.

Table 3 *An example of a typical TCO comparison between gas and conventional vehicles presented in sales meetings*

	Gas	Conventional
Monthly (leasing) cost	600	600
Monthly fuel cost	200	400
Total Cost of Ownership (TCO)	**800**	**1 000**

Table 4 *An example of a fuel cost comparison calculation between gasoline, diesel and gas to illustrate savings in fuel cost*

	Gasoline	Diesel	Gas
Number of vehicles	4	4	4
Yearly driving *km / a*	35 000	35 000	35 000
Consumption *l or kg / 100 km*	6	5	3
Fuel price *€ / l or kg*	1	1	1
Tax on motive power *€*	0	400	218
Service time *a / vehicle*	4	4	4
Total fuel cost	49 728	34 020	25 323
Total tax on motive power	0	6 400	3 488
Total cost	**49 728**	**40 420**	**28 811**

In addition to argumentation on lower TCO and fuel costs, the case company has been active in selling the gas ideology to companies by using marketing arguments on environmental friendliness compared to conventional solutions and on the domestic origin

of the biogas. Also the current network has been told to be better available in the future as the supply infrastructure is widened.

The arguments seem to be proven facts in the internal discussion within the organizations: The gas vehicle is truly seen as a clearly more cost efficient and environmentally friendly solution due to lower fuel cost and CO_2 emission factor. However, the case company is not entirely sure how the customers see the NGVs as investments. In general, the perception is that most of the customers invest in the NGVs due to lower fuel costs and rest due to environmental friendliness. Parts of the decision process have remained unclear, for example the triggers and how effect of co-feelings in the decision. One of the managers stated: ‘‘*There is some sort of a black box in the investment process that we do not understand. Something happens after the door closes and we leave the sales meeting. Even though we had agreed on facts during the meeting and there have been interest on lower fuel costs, the deal does not always realize in the end.*’’

Another manager reflected on the current procedures the following way: ”*When we go to the first sales meeting with the customer we usually load the potential client full with factual information. Sometimes it could work better if we went to ask about the customers' operations and genuine customer needs. Then we could see if there was any place for adopting the gas option.*”

5.2 Findings from the interviews

5.2.1 Investment decision

In order to clarify the link between theory and practical findings from interviews, the research framework is presented again. A descriptive figure is attached to each chapter presenting customer interview findings. Orange circles are drawn to illustrate the part of the decision making process which the ongoing discussion is linked to. Chapter 5.2.1 discusses the context of vehicle investment decisions in the customer companies, as presented in Figure 7.

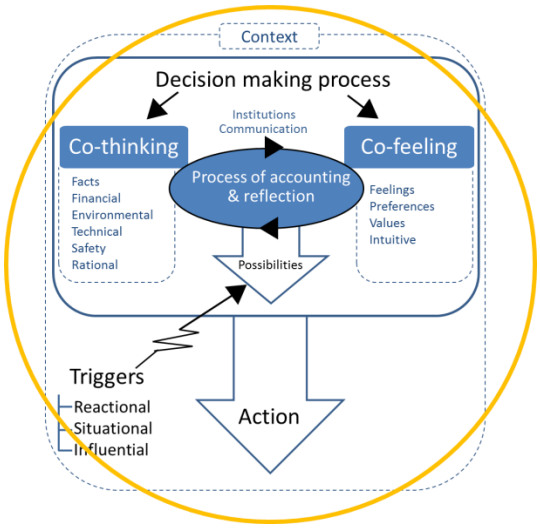


Figure 7 *The context of the investment decision*

As one example of all investments the interviewed companies make in their business, vehicle investments represented meaningful decision for all. Vehicles are an essential part of business for waste management, delivery companies, driving school and taxis. They provide services for transporting waste, goods and people, which is possible only by using vehicles. In the church welfare foundation vehicles had been bought for transporting foundation's employees between client households. The key business was to provide home care services, but it was equally essential for the company to be able to move its personnel efficiently, flexibly and safely.

As road transportation was close to interviewed companies' operations, it was also closely connected to their strategies. Vehicles were linked to companies' competitive advantages through enabling cost competitiveness, reliable and flexible service, environmentally friendliness, differentiation as a domestic operator using domestic fuels, and outstanding customer service by offering an effortless, clean, spacious and safe way to travel. The competitive advantages of each company are listed together with other background information in Table 5.

Especially in the larger companies, the capital invested in vehicles was mentioned to be a notable asset in balance sheet. When looking at the cost structure of the companies, fuel costs acted 1–20 % of company revenue. In other words, when investing in vehicles with better fuel economy and less expensive fuel, companies are trying to affect costs representing 1–20% percent of their revenue. Decrease in fuel cost affects directly company key figures through increase in gross margin, as fuel costs are usually marked as a variable cost in income statement. The interviewed taxi entrepreneur B was not aware of the cost structure of the taxi company, as bookkeeping was outsourced and the entrepreneur was only following the bottom-line. All the taxi entrepreneurs mentioned staff cost as a more noteworthy expense item than fuel cost.

Four out of seven interviewed companies had changed their entire or almost whole vehicle fleets to NGVs as the switch had occurred. The two largest customer companies and the driving school had adopted NGVs as a pilot project first. The pioneer status of NGVs game up also in the other four companies having switched their entire fleets. The taxi entrepreneurs saw the lifetime of one car so short that it allowed them to have a quick try on the technology and if needed, switch back after a short period of time. Based on three interviews with taxi entrepreneurs and one taxi agency, a common milestone for shifting to new car was after driving for 2 years or 200 000 km.

Table 5 *Interviewee background*

Company	**Waste management**	**Delivery state owned**	**Delivery private**	**Church welfare foundation**	**Driving school**	**Taxi A**	**Taxi B**
Employees	large	24 600	25	240	6	1,5	1,5
Business	Waste management, property maintenance and services for industrial services	Delivery	Food delivery, fast delivery	Home care services	Driving education, driving licences	Taxi services	Taxi and some product delivery
Competitive advantage	Cost competitive trustworthy partner to support recycling	Quality, reliability and availability	Combination of competitive price and quality in service: the professional appearance and environmental values	Local service provider using locally produced and environmentally friendly fuel, quality of service	Customer service, professional teachers	Good car for customers	Good relations with customers, offering many extra services to get more hits through taxi agency
Fleet	confidential, large	3000 delivery vehicles, over half own and the rest are leasing, 1000 vans, 40 NGV and **10 heavy duty NG trucks for 2 years**	**20 NGVs** 3 EVs	**7 NGVs (2 months)** 1 gasoline van	12 vehicles: 5 cars 5 motorcycles 1 truck **1 NGV (10 years' experience)**	**NGV for two years** and now switched back to diesel	**NGV for two years** and now switched back to diesel
% Fuel costs / Revenue approx.	15–20 % of total costs	2 %	10 %	2 %	-	7-10 %	no clue

As can be seen from Table 6, all the companies had made their action in investing in NGVs rather visible through using slogan stickers in marketing. Two largest companies had received funding from Tekes, the Finnish Funding Agency for Innovation, for in-

vesting in heavy duty NGVs. The involvement of the innovation funding agency implies that the adoption of NGVs is rather in early adapter or pioneering phase of technology adaption curve rather than being a mature technology.

Table 6 *The significance of NGVs for the companies' operations*

	Waste manage-ment	Delivery state owned	Delivery private	Church welfare founda-tion	Driving school	Taxi A	Taxi B
Fuel used in NGVs	Natural Gas (?)	Biogas	Biogas	Biogas	Natural Gas	Biogas	Natural Gas
Competitive advantage from NGVs, environment		x	x	x	x		
Competitive advantage from NGVs, domestic			x	x			
Pilot projects for NGVs	x		x			x	
Funding from Tekes	x	x					
Uses the NGVs in market-ing	x	x	x	x	x	x	x
Slogan in vehicles	x	x	x	x		x	x

From the marketing point of view, the domestic origin of biogas and the lower CO_2 emissions were seen as two positive marketing arguments for customer companies' own use. The domestic origin was said to be a positive attribute, but tricky in public tender invitations where domestic origin is not allowed to be favored. Therefore, even though domestic origin was a positive feature in fuels, it was not easy use this feature in own argumentation. Instead, using the environmental friendliness in marketing argumentation did not include contradictions. According to the waste management company, neither environmental nor domestic aspect could be seen as source for competitive advantage as long as using NGVs was a more expensive solution for them in heavy duty. According to the head of fleet the customers of waste management are not ready to pay extra for the environment or domestic features. Both of the taxi entrepreneurs saw that the slogan stickers communicating that the cars were "*driving on domestic biogas*" did stimulate interest but did not lure any additional customer flow at the taxi stand.

5.2.2 Facts and feelings

It turned out that vehicle investment can represent various aspects depending on the nature of company's business. The discussed decision making processed were never only fact based rational and straightforward process where only financial facts mattered. There was a large scale of aspects involved. The conversation on vehicles' importance included both fact and feeling based argumentation, feeling side being emphasized (see Figure 8).

Coding the quotations as being only fact or feeling based was impossible, since facts and feelings were brought up hand in hand in the discussion. The researcher gave up on dividing the quotations as representing only facts or feelings, as it was not making justice for interviewees' sayings.

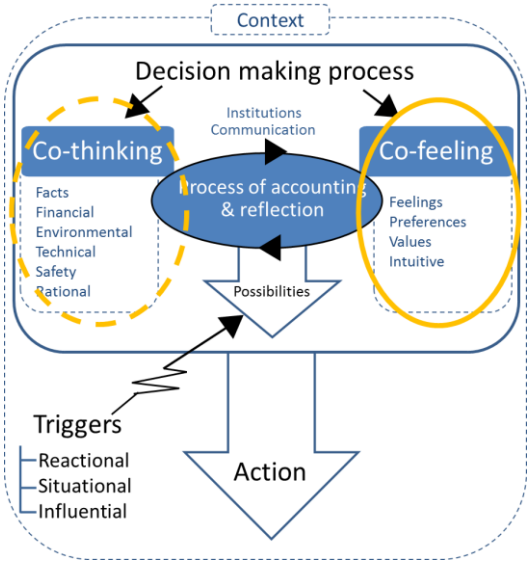


Figure 8 *Facts and feelings in decision making*

In the large waste management company garbage trucks were an asset binding large amount of capital. In this business, vehicles were seen as machine investments and the process as rational and fact driven. In order to improve the profitability of the machine, utilization rates and capital costs were followed closely.

In the other extend, for taxi entrepreneurs' vehicle represented investing in working space and customer premises, in some cases even in status symbol. Taxi car was the place for serving customers, which set special requirements for back seat: it should feel luxurious, spacious and comfortable. In case of taxi companies, same person worked in both in the roles of an investment decision maker and a driver. Taxi entrepreneurs were demanding especially on driving experience, and expressed feelings attached to different car models and brands during interviews. Taxi entrepreneur A pictured the decision the following way: "*If you spend all your working time in that driver's seat, the car should definitely be to your liking!"* Based on the researcher's interpretations from the interviews, *Table 9* summarizes how the vehicle investment was viewed in each company.

Table 7 *Vehicle as an investment*

	Waste management	**Delivery state owned**	**Delivery private**	**Church welfare foundation**	**Driving school**	**Taxi A**	**Taxi B**
Fuel used in NGVs	Natural Gas (?)	Biogas	Biogas	Biogas	Natural Gas	Biogas	Natural Gas
Vehicle as an investment	Machine, maximize the utilization rate and minimize capital cost	A part of a large flexible fleet with high requirements for technical performance and ergonomics	Environmental choice, provides means for differentiation	Enables operations, safety risk for users, needs to be effortless and easy to use	Teaching tool, first contact for youngster to learn safe driving and experience also NGV	Customer premises and working space	Working tool

It turned out from the discussions with the interviewees that there was not only one fact or value driven reason that would justify a vehicle investment. There were several reasons for each company's decision and the decision making criteria of each participant came clearer as the interview continued. The criteria seemed to also form hierarchies, as some criteria were more important than others for the decision maker. The hierarchical criteria levels included both fact and feeling aspects, which were constantly mixed up in interviewees' speeches.

The criteria hierarchies can be seen as hierarchies for the real possibilities in the research framework (see Figure 9). The hierarchies determinate the order in which the real possibilities become utilized in action. For example, when facts such as available models and feelings such as preferences for certain brands meet, a real possibility for action is born. Also other real possibilities can rise, such as choosing the environmentally friendly fuel. The hierarchy of the real possibilities, in other words the order for decision criteria, tells which subset is chosen first. For instance, a company can choose the least expensive fuel option out of environmentally friendly vehicles that were first chosen from suitable vehicle models (see case driving school). The criteria hierarchies are presented in Table 8 based on researcher's own construction from interviews.

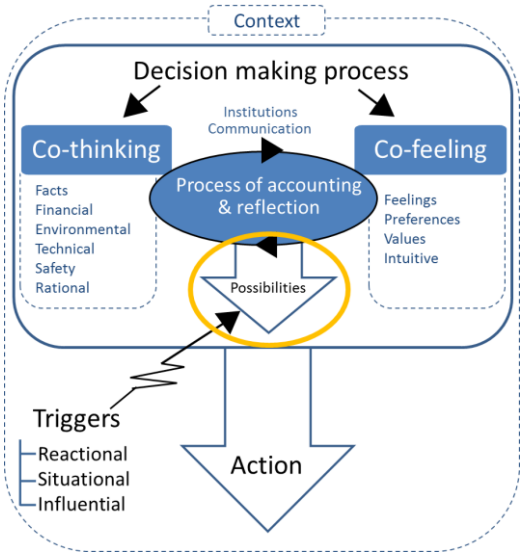


Figure 9 *Possibilities that rose from facts and feelings mentioned in discussions*

One criterion that came clearly out from the interviews was that the companies' operations set many specific requirements for the car model and features. For many, the using purpose was the starting point for decision making. Certain model features are essential for the vehicle be able to serve the user's needs sufficiently. For example, automatic gears are fundamental for saving taxi drivers from back pains, the front windows must be installed at ergonomically low height and with right-hand drive for a post delivery driver and food delivery sets requirements for the shape of boot space and equipment attached. Moreover, also personal preferences, e.g. favoring brands from German automobile manufacturers, limit the decision maker's options. With this mentioned, it comes visible that finding a suitable car model with appropriate brand, usability features and purchase price can already be a challenge before even considering fuel type or fuel cost.

In three cases, including the waste management company, state owned delivery company and the church welfare foundation, safety was emphasized as a core value. Vehicles constituted safety risk for companies' employees through unsuitable ergonomics, accidents in traffic and negligence when parking or during use of device attached to the vehicle. When realized, the risks caused among material and maintenance cost also losses in workforce and health care expenses. In all cases, natural gas was seen as an equally safe option for other fuels by the decision makers.

From the created table we see that there were cases where fuel cost did not appear in the criteria discussion (private and state owned delivery companies) at all or came after other factors (e.g. driving school). In the state owned delivery companies the effortless and flexible use of the fleet mattered most. Thus parameters having direct impact on usability, such as performance, technical features, warranty issues and infrastructure availability formed the top criteria for the decision.

To summarize the table, the decision making criteria varied in companies. Most of the time similar themes came up, but in different orders: The most mentioned criteria in the top three were model features and usability, fuel / life cycle cost, environment, personal interest / values and infrastructure / range issues.

One explanation for different decision making criteria in the companies can possibly be drawn from the ownership structures. Entrepreneurs have the possibility to bring their own personal values into the decision making process pretty effortlessly. Respectively, state owned companies can get strict value driven requirements for their CSR policies from government. Alternatively, the exchange-listed waste management company expressed their principles the following way: "*The reality is that the decision needs to be economically reasonable. And if some other good additional value is achieved on the side, it is all extra.*"

Table 8 *Criteria for vehicle choice*

	Waste management	**Delivery state owned**	**Delivery private**	**Church welfare foundation**	**Driving school**	**Taxi A**	**Taxi B**
Fuel used in NGVs	Natural Gas (?)	Biogas	Biogas	Biogas	Natural Gas	Biogas	Natural Gas
1. Criteria	Safety	Model features and technical performance serving flexible fleet, warranty agreements	Environment, for differentiation and personal reasons	Model features, usability and safety	Model features	Model availability and features	Fuel cost
2. Criteria	Life cycle cost	Infrastructure density: maintenance and refill	Domestic origin	Life cycle cost savings	Environment / Fine particles	Personal interest in new technologies	Model availability / loyalty to brand
3. Criteria	Technical performance / range / usability	Personal values / environmental pilots	Range (out of electric / gas vehicles)	Infrastructure	Fuel cost	Fuel cost	Environment
4. Criteria	Infrastructure			Marketing value/ environmental benefits			
5. Criteria	Environment						

The leading attributes, in other words the primary reasons for investing in NGVs, seemed to also be different in each interviewed company. Based on researcher's interpretation, the leading attributes in the natural gas vehicle choice are summarized in Table 10.

In the conversation with the waste management company, the most emphasized attributes were fact driven. Facts as capital cost or technical facts predicting vehicle's technical performance determined whether the investment option was recommendable. In line with the criteria, the reason for investing in NGVs was therefore the aim at reaching savings in life cycle costs with no trade off with technical performance, safety or usability. Similarly, the taxi entrepreneurs and the church welfare foundation emphasized the significance of expected fuel cost savings during the switch decision.

On the contrary, there were also companies where values played a clear role in directing the decision. The driving school viewed NGV investment as one way to effect on company's environmental footprint through reductions on fine particles or CO_2 emissions produced. The decision of fixing one out of the 12 vehicles as being a NGV was based on the combination of facts related to emission factors of each fuel type and the value of being a responsible company: *"I don't think it is advisable to drive with diesel car in the city center area because of the fine particle emissions. You can't influence much on what is happening in the world – you are a tiny ant, but you can do your small bit for this environmental cause."*

One private delivery company even saw the environmental values and domestic origin as so meaningful attributes that the whole business strategy was built on using only them in transportation. The motive powers having domestic and environmentally friendly origin were bio gas and wind power. Due to issues with range and technical performance, the company mainly used NGVs instead of EVs. Driving only on domestic biogas was seen as the key way to differentiate oneself from competitors.

Table 9 *Leading attributes in natural gas vehicle choice*

	Waste management	**Delivery state owned**	**Delivery private**	**Church welfare foundation**	**Driving school**	**Taxi A**	**Taxi B**
Fuel used in NGVs	Natural Gas	Biogas	Biogas	Biogas	Natural Gas	Biogas	Natural Gas
Leading attributes in NGV choice	Life cycle cost and technical performance	Personal values and interest among employees to try the NGVs Required model features from operations → no suitable NGV models available → own modifications on conventional vehicle models	Differentiation by being the only delivery company in Finland running only by domestic and environmentally friendly fuel	Fuel cost savings, but to be able to invest in NGVs good user experience and available model features also required	Fixed in fleet: keep one NGV as an environmental act	Life cycle cost savings, personal interest in pilots	Fuel cost savings

Personal interest in pioneer projects seemed to also have effect on the decision making regardless of how large the company was. Ranging from the large state owned delivery company to a taxi entrepreneur, decision makers' own interest in trying new technologies and piloting alternative fuels furthered the NGV choice. As in the case of state owned delivery company there were no suitable NGV models available, some engineer-minded curiousness was needed too: The company modified on its own 40 conventional vehicles to NGVs.

5.2.3 Nature and content of MA information

From the management accounting (MA) point of view, the earlier presented findings rise up two interesting points:

1) Even in business-to-business context investment decisions engage both facts and feelings, although B2B context is traditionally founded on the assumption of rational decision making.

2) The vehicle investment decision involving both facts and feelings also included MA argumentation. Parts of the discussed criteria, such as fuel cost, life cycle cost or emissions, are countable.

This chapter suggests findings on the nature and content of MA information being used in the investments in road transportation. In the decision making process framework

these findings are linked to the process of accounting & reflection, which is presented in Figure 10.

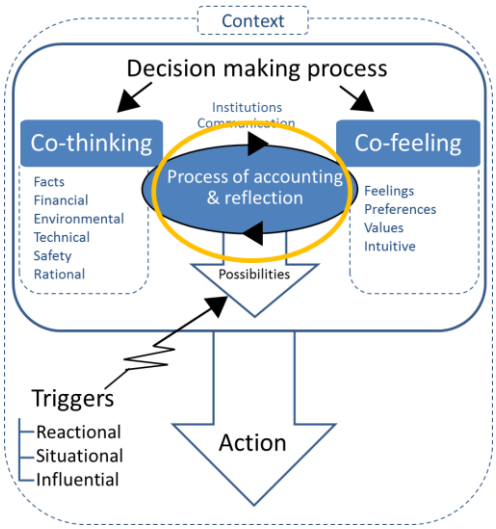


Figure 10 *Management accounting information supporting decision making*

The MA information that was used in decision making consisted of Total Cost of Ownership (TCO), Life Cycle Cost (LCC), Return on Investment (ROI) and CO_2 emission calculations. Also the calculation tool found from supplier's website was utilized. The online tool included parameters for fuel consumption, fuel price and motive power tax. The content of MA information utilized during investment decision making is presented in Table 10.

The simplest way of evaluating the cost differences between conventional and NGVs was to compare the purchase price and annual fuel costs of each fuel type. This was seen to already include the life cycle perspective, and was described to be a TCO or a LCC evaluation. For example, when the church welfare foundation was asked about the appropriate price difference between gas and conventional fuels, the answer was following: "*We haven't calculated it that precisely. But it must be cheaper than diesel and gasoline, as the purchase price for the vehicle is higher."*

From the table we see that there were several companies that did not need fuel cost information during the decision making. In four out of seven cases calculations did not have impact on the outcome of fuel choice. In the three cases where investment calculations gave answers for the fuel choice, other criteria such as safety and model features were the starting point for the decision.

Table 10 *Management accounting in vehicle investment decision making*

	Waste management	**Delivery state owned**	**Delivery private**	**Church welfare foundation**	**Driving school**	**Taxi A**	**Taxi B**
Fuel used in NGVs	Natural Gas (?)	Biogas	Biogas	Biogas	Natural Gas	Biogas	Natural Gas
Comparison calculations for vehicle investment	TCO, ROI and utilization rate comparisons on models, fuels, lifetimes	TCO calculations (no fuel cost / emission allowances included) are used in recommendations for purchasing team	No, gut-feeling on lower fuel costs	Ensuring supplier's marketing argumentation with own LCC calculation comparison (fuel cost and purchase price comparison)	Gut-feeling on fuel cost savings compared to NGV's higher purchase price	Life cycle cost calculations on purchase price, taxation and fuel cost, decrease in value not included	Used supplier's online calculation tool for evaluating fuel cost
Own LCC or TCO calculation in decision making	yes both before decision and actual	partly: but no fuel cost included	no	yes	no	yes	no
Actual fuel cost calculations	Actual fuel costs followed and compared with different fuels	Follows actual fuel costs, see driver performance indicators and route optimizing as primary ways to affect fuel costs	Follows actual fuel costs	Follows actual fuel costs	Follows actual fuel costs	Actual costs followed and compared with different fuels	After check done for the interview, follows only bottom-line. Profits of business are told by the outsourced bookkeeper
Actual CO2 saving calculations	-	partly for reporting, not linked to vehicle choice	yes	yes	no	no	no
Calculations affected the fuel choice	yes	no	no	yes	no	yes	no

When initial findings from this table were presented in IFKAD conference (see conference paper Laine et al. 2015), the researcher was asked: how it was possible that the fuel costs did not have any natural place in the investment decision process? In order to un-

derstand this more thoroughly, one customer company is shown as an example case. The investment decision process of the state owned delivery company is taken as an example due to two reasons: i) The conducted group interview ensures that the answers represented shared view, an institution, in the company instead of one individual's impression on the company practices. ii)) The company possessed a large vehicle fleet predicting that it most probably held established investment practices. The regular investment decision making process of the state owned delivery company is described in Figure 11.

As can be seen from the figure, the investment decision can go through the organization levels, be compared, evaluated and finally accepted with logical reasoning even though fuel cost information is not included. There might not be any good timing for the supplier to communicate the less expensive fuel cost, because the institutionalized internal process does not require such information.

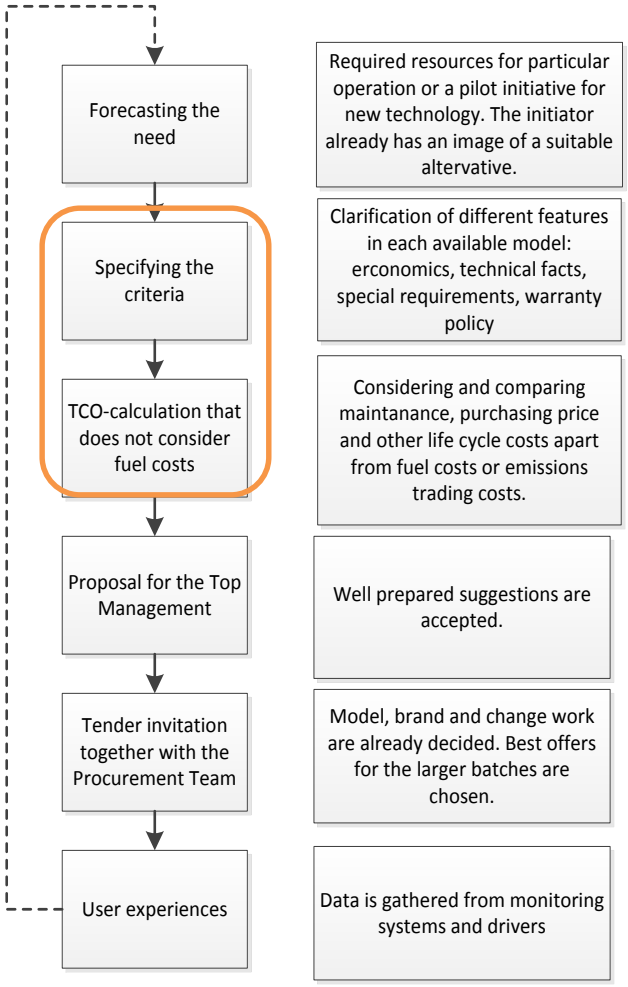


Figure 11 *Example of one customer's investment decision making process*

In the state owned delivery company driver performance indicators, route optimizing and using bicycles in delivery were seen as the primary means to reduce company's fuel

costs. The investment decision itself was not way to affect fuel costs; the cost savings got usually attention later as the vehicle was already in use. The TCO calculation not including fuel cost was explained by referring to impossibility to find correct fuel consumption figures. Consumption changed according to route, stops, traffic and drivers, so it was challenging to find any precise number to be used in calculations.

The companies were asked how MA could help them better in the future and which questions it should be providing answers for. The state owned delivery company was hoping MA to link the investments to company strategy. This could mean in the future that also emission trading costs and environmental targets would be linked to investment calculations. One of the asset managers stated the problem of linking the environmental targets to investment decisions: "*After all, we are talking about investments. If we (the asset management) decided to invest in a more environmentally friendly technology, we would need more money. No matter how we have calculated it using TCO, and even if we took into account the emission trading and other factors, it is still more expensive than the current less clean technology. The price tag must be decided beforehand, agreed on and we (the asset management) have to handle that. We can't just suggest here at the production that: "Could we possibly put 5 million euros more in this?"*"

Additionally, the importance of communication across organizational levels was emphasized by the state owned delivery company. Alternatively, in small companies one person was be responsible for the calculations, investment decision and purchase. In these cases much information sharing was not needed, but ready-made and user friendly calculation tools were welcomed. This kind of MA tools could in the future help in calculating the CO_2 savings gained from investment decisions, and these results could be used in marketing and in creating green supply chains.

The private delivery company had used MA for calculating the financial cost of the CEO's value driven decision for using bio gas instead of natural gas. The CEO knew exactly the cost of his choice for being more environmentally friendly, domestic and honest in marketing: "*I don't want to think about it too much [laughter], but I pay ten thousand euros extra yearly for that choice. There, now I said it. And this year the amount will be even more. We would be a different company if we talked only about natural gas. I can tell you that the customer can't understand the difference between bio and natural gas. I probably would get as many customers with the normal gas. If I had similar concept, it would be enough*."

MA was also used in the communication about how meaningful the fuel cost savings actually were for the company's profitability and what impact the savings actually had. In the church welfare foundation the impact of cost savings was viewed significant: "*As a foundation we are not aiming at making profit. --- The unit the vehicles are serving has a surplus of 0, so even small cost savings turn the unit profitable. This money can then be used elsewhere in church welfare operations.*"

In the waste company, heavy duty garbage trucks constituted approximately 80 % of company's fuel costs and CO_2 emissions. Hence the decision makers' attention was primarily on gaining savings in the heavy duty side instead of saving fuel costs in the passenger vehicle side. In this case MA was used for providing guidelines for prioritizing.

5.2.4 Triggers

After first actively searching for information or being passively used to the current situation, a fuel switch had occurred in the customer companies. When describing the switching situation, i.e. investing in NGVs, the interviewees also named reasons for taking action. These triggers explained why the customer company decided to switch to or from NGVs. The purpose this chapter is to summarize the reasons that triggered the customer to move from decision making discussions into action. This is illustrated in Figure 12.

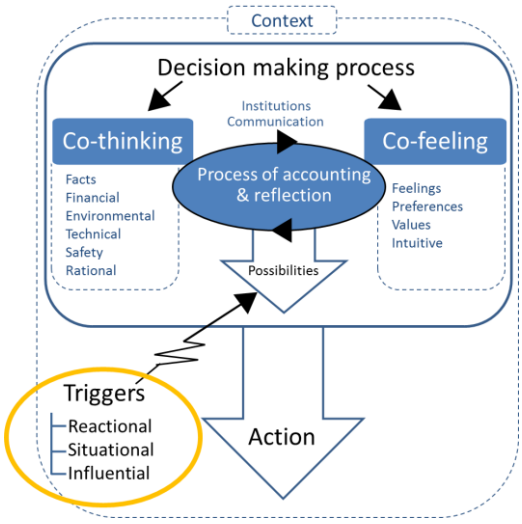


Figure 12 *Triggers turning the real possibilities into action*

Four out of seven customers named their own interest in new technologies and piloting as reasons for switching to NGVs. These active customers were affected by influential trigger. Situational triggers were related to Tekes initiatives, vehicle models, technology and infrastructure becoming available and competitive positions in the market. Also personal relationships mattered, as one situational trigger was the retirement of a personal contact in the former vehicle retailer. As the salesperson retired, it became possible to reconsider the used car brand and models.

Table 11 *SPAT analysis: Triggers to switch to invest in NGVs or switch from NGVs*

	Waste management	**Delivery state owned**	**Delivery private**	**Church welfare foundation**	**Driving school**	**Taxi A**	**Taxi B**
Fuel used in NGVs	Natural Gas (?)	Biogas	Biogas	Biogas	Natural Gas	Biogas	Natural Gas
TO NGVs Reason for the switch	Piloting	Tekes initiatives and employees' interest in environmentally friendly pilot projects, last chance to try gas in EUR 5 type of vehicles	Company/personal values, differentiation in business, infra and technology available	Available locally produced biogas and retirement of the personal contact from former vehicle retailer, cost and CO2 savings, required: availability of models and infra	One NGV fixed due to environment and cost savings, others: model features and purchase price first	Lower taxation, fuel cost, pilot, available model	Fuel cost
Trigger	influential	influential, partly situational	influential, situational	influential, situational	influential	influential	influential
FROM NGVs Reason for the switch						No available models and investment needed to be done before the estimated unfavourable change in taxation, reacted to the rumours on rising taxation	Back problems from manual gears, no model availability for the preferred VW Passat with automatic gears, changing taxation set deadline, higher purchase price in NGVs, higher fuel consumption of earlier NGV and higher costs than expected
Trigger						situational & reactional	situational & reactional

Influential triggers were emphasized in all of the discussions. In the customer side, the active role was related to interest in being aware of the newest solutions and technologies and activity in participating in pilot projects. In the cases where the supplier had been active, the importance of personal contacts during sales work came up. The interviewees remembered the supplier' sales representative by name, and described in detail the steps of the cooperation. The active role of supplier had influence on customer in the role of an information provider, who told about the available models, costs and introduced the NGV as an option. The passive/passive roles in each switch to NGVs are summarized in Table 12.

Table 12 *Passive and active roles of supplier and customer during switch to NGVs*

	Waste management	**Delivery state owned**	**Delivery private**	**Church welfare foundation**	**Driving school**	**Taxi A**	**Taxi B**
Fuel used in NGVs	Natural Gas (?)	Biogas	Biogas	Biogas	Natural Gas	Biogas	Natural Gas
Customer active/passive	active	active	active	passive	passive	active	active
Supplier active/passive during switch	active	not mentioned	active	active	active	passive	active

As we look at the switching cases from using NGVs, both taxi entrepreneurs share similar story. The quick response to the uncertainties in future taxation combined with the situation of limited vehicle model availability triggered the taxi companies to switch back to conventional vehicles.

5.2.5 Action

Following the research framework, we move to look at the final outcome of the decision making process, action. This chapter summarizes how the interviewees reflected on their investment actions. Action, the actual switch to another fuel type, is the result of all the earlier presented decision making elements as seen in Figure 13.

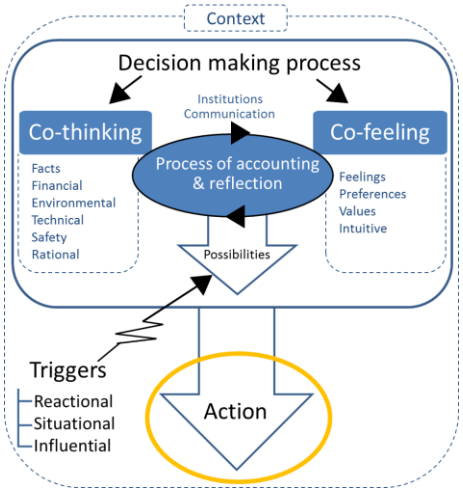


Figure 13 *Action as the final outcome of the investment decision making process*

The last table demonstrates the cases requiring the supplier company's reaction. The customers expressed clearly their satisfaction and dissatisfaction on the NGV investment. Negative experience on natural or bio gas as fuels can be implication of several elements: in the case of waste management, the maintenance network was not sufficient to serve the company's needs and the technology in heavy duty garbage trucks was not reliable. This decreased the utilization rate and ROI, especially when the NGV option had been considerably more expensive than the conventional one. Although the whole conversation with the interviewee had been picturing the decision making as rational and financial fact driven, the bad experience on the pilot influenced the future investments. The interviewee told that he was not interested in NGVs in passenger car side due to bad history with gas in heavy duty side. As the NGV technology is in different phases of development in passenger cars than heavy duty side, this argumentation can be seen as feeling driven.

The other customer not being satisfied with the investment decision was the taxi entrepreneur B. The entrepreneur was disappointed on the fuel and maintenance costs of the NGV, as its maintenance interval was tighter and the promised fuel cost savings did not actualize. It is possible that the fuel cost savings caused disappointment due to car manufacturer's too low consumption promises compared to actual consumption levels. Or alternatively, the promised savings did exist, but they were too small in relation to the unfavorable difference with conventional solutions in maintenance costs and purchase price.

Table 13 *Customers requiring supplier's action*

	Waste manage-ment	Delivery state owned	Delivery private	Church welfare founda-tion	Driving school	Taxi A	Taxi B
Fuel used in NGVs	Natural Gas (?)	Biogas	Biogas	Biogas	Natural Gas	Biogas	Natural Gas
Satisfied with decision?	no	yes	yes	yes	yes	yes	no
Network key issue at the moment?	some impact	yes	no	no	some impact	no	no

Contrary to supplier company's hypothesis, the infrastructure density seemed to be key issue only to some of the customer companies. Three other barriers were mentioned to be equally important or even more significant in hindering NGV's adoption:

1) Lack of general knowledge and awareness on NGVs and their benefits hinders the adoption by the general public.

2) The too narrow availability of vehicle models and model features attached is a barrier especially in B2B context. Vehicles are bought to serve specific needs in companies' operations, and it is not advisable to make trade-offs between practicality for small cost savings. Problems with usability quickly overcome the benefits received from savings.

3) The price difference with diesel was seen to be too small, as the life cycle costs were viewed to be the same or even lower for diesel. The cost savings compared to diesel are not large enough to compensate the inconvenience caused by limited model range and refueling station and maintenance network availability.

5.3 Synthesis

Reflecting on the case company's initial understanding on the customer decision making process, new information was gathered during the interviews. According to the case company, the new information broke their earlier assumption on customers' rational decision making process. Fuel costs are not always taken into account in investment decisions, or other criteria has become more important for the company. Investment calculations can serve the decision maker and provide answers for justifying the investment, even though fuel costs are not included. During steering group meetings the reactions were surprised and spontaneous: "*I would have never thought of that someone wouldn't include fuel costs in TCO at all nor even in criteria!*"

The chicken-egg dilemma was emphasized to be currently more in the automobile manufacturer side instead of being a problem in the supply network side. NGVs are left out from the proposed options already in the earlier phases of decision making and therefore the station network does not become a problem. The availability of suitable models and

features as well as the availability of maintenance network is important for both large and small companies. As one manager from the state owned delivery company summarized the situation, a whole network of partners is needed to support a successful adoption: "*The wider adoption of NGVs is not a result of one or two parties co-operating. Many partners are needed: it is the importer, the vehicle retailer, the maintenance and the fuel supplier that are required for the whole planned vehicle's lifetime. Otherwise we can't take the risk of investing in them."*

Additionally, it came out that investing in NGVs was associated with being a pioneer in industry. The pilot status had a positive vibe in conversations. However, it can turn into a stigma or burden when the supplier company is aiming for boosting the wider adoption of NGVs. As long as NGVs are seen as pilot projects, they might not have place in the institutionalized investment procedures and become a natural part of vehicle fleet.

The new information provided to the case company representatives also started the internal reflection on company's own pricing principles and marketing messages. The assumption that natural gas was by any comparison the most inexpensive fuel was questioned during the process based on the taxi entrepreneur B's bad experience on cost savings, the consumption data provided by interviewees and researcher's life cycle cost calculations. For further reflection in the company, it would be advisable for the pricing team to make sensitivity analysis not only with different prices but also with other consumption levels than the ones provided by the car manufacturer. Usually the price of diesel is used as a reference point for natural gas, and also changes in diesel's price affect the attractiveness of NGV in terms of cost savings.

Moreover, some earlier stereotypes on taxi entrepreneurs as a customer group got questioned. The case company had viewed taxi entrepreneurs as a fuel cost oriented customer group, which would potentially be interested in the message of lower fuel costs. Contrary to current understanding in the case company, taxi entrepreneurs saw themselves as feeling driven decision makers. According to taxi entrepreneur A,"*Brands affect the car choices in taxi business among several other aspects. I have said many times as a joke that in our business entrepreneurs have usually religion ten and mathematics four in school report. It should be the other way round, math ten and leave all the feelings out from decision making. The financial outcome would be better.*" The case company's earlier perception was that taxi entrepreneurs are well aware of their cost structure and fuel cost figures. In reality, two out of three interviewed taxi entrepreneurs had outsourced their bookkeeping to accountancy firm and these entrepreneurs knew well only the bottom-line figures.

Lastly, the results from the created vehicle's life cycle cost calculation tool showed that the fuel comsumed during refuelling round is minor or negligible compared to other costs. Even with long distances to station, such as an extra round of 20 kilometres, caused only infinite changes in the total costs. However, it is a too narrow view to only

look at this analysis as basis for conclusions. The message from the interviews was that the more significant costs during refuelling came actually from losses in personnel's working time and decrease in vehicle's utilization rate as it was not creating any revenue during the refill.

6. DISCUSSION AND CONCLUSION

6.1 Answers to the research questions

To be able to look at the decision making process in the chosen road transportation context, the facts and feelings behind vehicle investment decisions needed to be identified and clarified first. Hence, the first question was brought up: ***What are the facts and feelings affecting companies' investment decisions?*** Practical contribution of this thesis was achieved through gathering new information about the factors behind vehicle investment decisions. These findings were relevant especially for businesses operating in automobile and/or vehicle fuel industries.

The facts and feelings appeared in the research material were closely linked together in decision making. This finding is in line with the conclusions of Sadler-Smith & Shefy (2004), Nørreklit et al. (2010) and Laine et al (2015) suggesting that the decision making results from the sub processes of co-thinking and co-feeling. The facts that emerged from the vehicle investment discussions were related to technical, safety, financial, environmental, model availability, model features and network availability information. It turned out from the interviews and meetings that currently the industry does not agree on all the facts concerning the environmental and financial savings received from each fuel. For instance, the discussions questioned several times the cost savings received from NGVs. In was considered as a fact in the case company that gas was by no exception the most inexpensive fuel at the market. The findings strengthen the perception of Nørreklit et al. (2010) stating that facts are social constructs that need to be agreed on with other actors in the industry to become recognized and proved.

The feelings related to the investment decision could be grouped to value of being a pioneer, environmental values, value coming from domestic origin, value from vehicle brand, brand loyalty, fuel supply reliability, maintenance reliability, driving experience, value for safety, assumptions on own customers' values and what they appreciate, beliefs on the coming vehicle and fuel trends, value for personal contacts with vehicle supplier and feelings towards the provided saving information in sales meeting. The total list of topics covered in the discussions is presented in appendices. An interesting notion is that some of the characteristics in consumer context seem to also have influence on B2B decision making. Topics such as brand loyalty and personal preferences were mentioned to affect decision making in the interviewed companies excluding the two largest ones. It is possible that the nature of the investment decisions in small companies approaches the nature of decisions in consumer context (Choo & Mokhtarian 2004; Prieto & Caemmerer 2013). This could be investigated more in the future studies.

The nature of vehicle investment in customer company's business determinates the investment criteria. The criteria differs based on whether the company feels like investing in a machine with ROI and utilization rate targets, a necessary working tool or a part of flexible and long lasting fleet. For instance, when choosing customer premises and a work place for a taxi entrepreneur, the first criterion is linked to user experience and model features. The working place needs to be comfortable, have a spacious backseat for customers and provide ergonomic features such as automatic gear.

Barriers that were mentioned for the wider adaption were primarily related to the availability of vehicle models and secondary to the availability of maintenance and fuel supply network. Also the higher first cost for NGVs was recognized as a factor possibly hindering the adoption, because the price difference with diesel was seen to be too small. Majority of these barriers have already been recognized by Romm (2006). New barriers to his list were the availability of vehicle models and features and the availability of maintenance network. Contrary to the findings of Romm (2006), limited range was not considered as an issue by the interviewees. Instead, the technology allowing the use of both gasoline and natural gas was seen as a factor increasing the flexibility of the vehicle. Neither did the safety concerns emerge during discussions; the interviewees had more been convincing other operators, customers, neighbors and own employees on the safety of NGVs than been worried about it.

The purpose of the second research question was to create new information for the academic discussion on management accounting. The intention was to clarify, ***what role does management accounting (MA) information play when making investment decisions?*** In line with the conclusions of Hall (2010), the managers being responsible for the investment decision making create their own MA tools to support their work. The research material suggests that the MA tools are used for justifying decisions and making topics under discussion more visible and concrete. This came up in situations where case company's sales manager calculated the potential fuel cost savings for potential customers in sales meeting. The case company used MA in customer service by providing calculations on the actual CO_2 savings to customer.

In customer side, MA was used in after checking the supplier's marketing arguments and communicating recommendations for top management. Currently the role of MA seems to pattern after the characteristics of short term translation (Mouritsen et al. 2009), as MA was mainly used for controlling and following fuel costs instead of facilitating discussions. However, MA was hoped to possess a more strategic role in the future. For example, MA could be used for sharing information on the gained CO_2 emission savings with the whole supply chain to create customer value. Internally the more strategic role could mean connecting the environmental targets named in company strategy to investment calculations and decision making in the operative side.

The findings also show that calculations do not always determinate the outcome of the decision. It seems that sometimes the role of MA is small or almost does not exists in the decision making process. As Hall (2010) has stated, accounting information is just one part of the wider information set that managers use to perform their work. When these other factors in the information set are considered as more relevant, the MA ellipse can shrink to a minor role in communication.

Theoretical contribution of this thesis was to improve the understanding on decision making and on the role of MA in this process. The thesis completed the framework of Nørreklit et al. (2010) concerning actor based reality, where facts and values create possibilities leading to actions. Combining the SPAT theory on triggers (Roos 1999) as starters of action, the created thesis framework gives insight on why and when some possibilities culminate to actual action and some do not. Communication on the possibilities requires the influence of a trigger in order to proceed into action. The thesis applies the SPAT framework in new context, B2B investments, and gives new approach for analyzing the decision making determinants (criteria) by dividing them into facts and feelings. Recognizing the influence of institutions (Tolbert & Zucker 1999) and context on the decision makers explains why some facts and feelings are taken for granted in organizations. Reflection and questioning the institutions can be supported by institutional work (Perkmann & Spicer 2007). In business the suggested role of MA is to support the decision making process by clarifying the facts and identifying the feelings related to the topic under discussion. It also serves reflection in organizations by enabling the break the institutionalized facts and affect feelings through the new information it creates. (Laine et al. 2015) The thesis suggests that the size and position of the MA ellipse in the decision making framework of this thesis can vary between organizations.

Lastly, the third research question was formed to understand the actual content and nature of the MA ellipse in the thesis framework: ***What is the content and nature of MA information that is being used?*** Net Present Value was used in the infrastructure investment planning in the case company, which gets support from the academic literature as being theoretically correct way to evaluate investments (Bennouna et al. 2010). Total Cost of Ownership (TCO) and Life Cycle Cost (LCC) calculations were mentioned in vehicle investment cases, but usually the described calculation tools did not have all costs included. For example, the calculations may have taken into account purchase price but not decrease in value during the life cycle or have considered maintenance cost but not fuel costs as a part of TCO or LCC. Most commonly the customer companies' calculations were simple comparisons between purchase price and fuel costs or follow-up of bottom-line. MA was also used for setting guidelines or norms for controlling, for example for utilization rate in route optimizing.

There seemed to be unclear facts and vagueness in the calculations due to disagreements on the achievable cost savings and certain relevant expenses being excluded from

TCO and LCC calculations. However, these shortcomings did not prevent the companies making investment decisions. The discussions pointed out a need for more information on the achieved CO_2 savings when investing in NGVs. This information could be used in customer company's marketing. Moreover, realistic fuel consumption figures were wished for fuel cost comparisons as the car manufacturer's figures were viewed too optimistic. Other than this, there were no requests for making MA more detailed or accurate. This finding supports the view of Mouritsen et al. (2009) suggesting that MA calculations rarely become meaningful and powerful by appeal to their definitional correctness. Because fuel cost was not always the primary criteria for customer companies, making the calculation even more detailed does not support the decision maker (Selos & Laine unpublished).

6.2 Managerial implications

The created framework provides means for understanding investment decision making processes in companies in a structured way. The managerial implications of this thesis are closely related to marketing and sales functions, as the framework helps in finding ideas for boosting customer's investment decisions or keeping the current customers. Meanwhile, it also shows the challenges in bringing change into organization. To be able to affect the process, it is essential to be familiar with the concept of institutional work and its three dimensions: technical, cultural and political.

At its simplest, the supplier company can try to serve its current customers so well that no negative reactional triggers occur. Protecting the customers from influential and situational triggers might be more challenging, as the customers are constantly prone to changes in external environment and contacts from competitors. The supplier can communicate actively with the customer and provide the customer with latest information about the benefits of current solution. In order to keep the situational triggers favorable, the supplier must both work in political field and cooperate with partners in the technology network.

In order to change the institutionalized investment procedures in customer companies, the supplier can do technical work by creating suitable MA tools for customers. This kind of tool could help the customers to link their environmental targets and strategy to the vehicle investment decisions. This would work by adding the effect of fuel prices, CO_2 trading and value of reaching strategical targets into the investment calculation. Also other valued features, such as value for fuel's domestic origin and marketing potential, could be included in the tool. So far the MA tools presented by the interviewees did not include such inspection. Another way to apply technical work is to accept the used MA tools and procedures in customer companies, and only provide up-to-date facts on emissions and vehicle life cycle costs to these processes.

Cultural work is needed to change the current feelings related to NGVs: NGVs could work as a natural part of fleet instead of being only pilot projects. According to the framework it comes clear that marketing material has more impact in companies, were the initial values already support the solution. The new facts communicated to potential customer bring in information that creates real possibilities. If values are not in line with the provided facts, the technical work of the supplier has no impact. Based on the values mentioned by interviewees, companies and entrepreneurs with high environmental targets, interest in pilot projects or personnel with personal interest in environment could be fertile ground for NGVs.

6.3 Limitations

For many interviewees some time had already passed from the latest switch to/from using NGVs. When asked about the switching event, some of the more detailed questions were challenging to answer as the interviewee needed time to memorize the event. In these cases it is possible that the interviewer might have missed some of relevant information concerning the actual triggers and paths that led to the switch. In one case even relying on the interviewee's memory did not provide answers for certain questions, since the representative was not holding the current position by the time the investment decision was made. However, the interviewee was employed by the same company and he remembered some parts of the discussions the company had about the switch when it occurred.

The questions related to the content and nature of management accounting used in decision making seemed to be challenging for some of the interviewees. Some of the answers were vague and needed to be confirmed during the interview. The researcher recommends reviewing the interview questions related to management accounting and editing them into a clearer form in future studies.

The qualitative analysis applied in this thesis relies much on researcher's own interpretations from the research material. Even though systematic coding has been used to provide the finding tables, the analysis is following the researcher's subjective view on the interesting results and conclusions. However, the follow-up discussions with other members of the research group proved that other researchers would have come to somewhat similar conclusions from the material.

6.4 Future research

The created research framework could be tested in the consumer context as well in the future. As brought up by Yeh (2007) and Greene et al. (2005), the use of economic information in consumer vehicle purchase decisions requires more studying. This thesis contains the supposition that company's employees are driven by both intrinsic and extrinsic motivators for keeping their selves updated on the latest available information

(Ryan & Deci 2000). Decision maker tries to apply the available facts into decision making and is utilizing management accounting as language for reflection and business. On the contrary, it can be that in consumer context the consumer knows the existence of factual information, but prefers trusting only on intuition. In this case the ellipse of reflection and accounting would be passed, leading the process straight from feeling to possibilities and action. This is only hypothesis, and it might be that other dynamics are at play.

Another interesting option would be to apply the created research framework in other B2B contexts to investigate the decision making models there. Rather natural way of preceding the work would be to apply the framework in maritime industry, which based on discussions with companies is seen as rather traditional, financial fact driven and engineering mindset context. The investments in this context are irreversible (Kärri 2007), and one investment decision has broad impact. It would be interesting to see, if there are any feelings attached to decisions and if there are, how they affect the decision making process. Finally it would be possible to compare the differences between road and maritime transportation.

The impact of stakeholder networks in the adoption of new technology came up during the thesis project. This creates an interesting starting point for studies looking at the profitability of the whole NGV technology network. The motives and positions of each operator could be first mapped and the critical nodal points recognized. Management accounting could be used for recognizing the pull and push motives from the network through investigating the profitability and incentives of each business.

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APPENDIX 1: INTERVIEW QUESTIONS

0 Background information

0.1 Interviewee

- Can you tell me your name and title?
- Tell me about your experience in the company?
- What role do you have in investment decision making and fuel choice decisions in the organization?

0.2 Organization

- What products and/or services your organization offers?
- Who are your customers?
- How large is the organization?

0.3 Business environment

- Can you describe the business environment?
- How competitive is the environment?
- Who are the biggest competitors?
- How do you differentiate yourselves from the competitors?
- How does regulation affect your business?

0.4 Technology

- What meaning do electric / natural gas / or conventional vehicles have on your business?
- How easy it is to find the right models from the market?

0.5 Strategy

- What are your competitive advantages?
- Have electric / natural gas vehicles contributed to creating the competitive advantage? If yes, how?
- What does the company do by itself and what work has been outsourced?
- Has there been any recent changes is this share-out?

0.5 Operations

- Can you describe the operations that the vehicles are serving?

1 Background information on the switching situation

- Can you describe the switching situation to using natural gas vehicles (/ electric vehicles)?
- What was the decision making process like?

- What things affect the decision? (E.g. how well the fuel options are known, who is the decision maker, which parties are involved, what are the prerequisites for the investment to realize?)

2 Switching decision: Actual switch

- Can you describe how the situation eventually culminated in switching to natural gas vehicles (/ electric vehicles)?
- What was the switch like? (E.g. outcome of long consideration / quick choice)
- Do you recognize some specific factors or events after which you started to consider the switch?
- Did fuel suppliers or car manufacturers attempt to affect the decision making in some way?
- What kind of criteria is used to compare the different fuels?
- Was there any uncertainties related to the switch?

3 Used information during the switching situation

3.0 Activity or passivity in information search

- Did you end up switching to natural gas vehicles based on your supplier's initiative, or were you the active party?
- What convinced you about this option?
- Did you independently search information to support the choice?

3.1 The roles of management accounting information

- What kind of information was used? From which sources?
- Were the cost or the environmental benefits visible and comparable somewhere?
- Whose information was used?
- To what extend the information was management accounting information (information that has been produced using calculations or measuring)?
- To which questions the management accounting information provided answers?
- How was this information utilized?
- Can you describe management accounting information that would well support the switching decisions? What kind of information are you longing for?
- Have you calculated afterwards the actual savings gained from the switch?

3.2 Feelings, intuition and values

- How do you see feelings or intuition affecting the decision making in the organization?
- Can you think of any investment situation where facts were not available?
- How did you proceed then?

4 Refilling station network

4.0 Driving

- How large is the driving range?
- Does it circulate around some specific area?

4.1 Refilling

- How does your organization organize the refilling?
- Do you plan it in some way? How?
- Which factors determinate the refueling station choice? (Price, distance, supplier, some other factor?)
- Has the natural / bio gas station network been extensive enough?
- Has the density / location of the natural / bio gas station network affected the decision on the used fuels?

4.2 Barriers

- Which factors do you see as largest barriers for the adoption of natural gas vehicles?
- If some other organization considered investing in NGVs, which factors should it take into account?
- Why do you think some other organization would not invest in NGVs?
- How should the refilling station network serve the customer?
- What should be changed in the network so that it would serve the customer sufficiently?

APPENDIX 2 ATLAS.TI CODE LIST

Company
- Com_Supplier
- Com_Delivery Private
- Com_Church Welfare Foundation
- Com_Driving School
- Com_Waste Management
- Com_Delivery State Owned
- Com_Taxi Hybrid
- Com_Taxi A
- Com_Taxi B

Criteria
- Criteria_1
- Criteria_2
- Criteria_3
- Criteria_not

Facts
- IFa_Negative
- IFa_Neutral
- IFa_Positive

Feelings
- IFeel_Negative
- IFeel_Neutral
- IFeel_Positive

Institution
- Institution

Institutional Work
- IW_Cultural
- IW_Political
- IW_Technical

Investments, Topic

Conventional fuels
- ITop_Convent_green wash
- ITop_Convent_Regulation
- ITop_Convent_user experience
- ITop_Convent_prices

Customers' customer
- ITop_Customer's Customer_ Decision Maker
- ITop_Customer's Customer_ Easiness
- ITop_Customer's Customer_ green supply chain
- ITop_Customer's Customer_ marketing
- ITop_Customer's Customer_ Savings
- ITop_Customer's Customer_ Service price
- ITop_Customer's Customer_more demand with NGVs?

Electric Vehicles
- ITop_Electric_Electricity Origin
- ITop_Electric_Environment
- ITop_Electric_Incentives
- ITop_Electric_Model Availability
- ITop_Electric_Network
- ITop_Electric_Purchasing Price
- ITop_Electric_Range

ITop_Electric_Supplier
ITop_Electric_technical performance

Environment
ITop_Env_CO2
ITop_Env_Differentation
ITop_Env_Fine Particle
ITop_Env_Impact
ITop_Env_smell / clean
ITop_Env_Value

Financial factors
ITop_fin_depreciation
ITop_Fin_Fuel Consumption
ITop_Fin_Fuel Cost
ITop_Fin_Fuel Cost difference BG NG
ITop_Fin_leasing cost
ITop_Fin_Life Cycle Cost
ITop_Fin_Lifetime
ITop_Fin_Lost revenue during maintenance
ITop_Fin_Maintanance Cost
ITop_Fin_Marketing agreement with Supplier
ITop_Fin_Purchasing Price
ITop_Fin_Regulation/Incentives
ITop_Fin_Resale
ITop_Fin_Stable Fuel Price
ITop_Fin_Taxation
ITop_Fin_revenue_loss_during_refill
ITop_Fin_warranty

Fuel supply network
ITop_Netw_Biogas Availability
ITop_Netw_Biogas Availability
ITop_Netw_Density
ITop_Netw_Distance
ITop_Netw_Location
ITop_Netw_Maintanance Service Stations
ITop_Netw_Refill
ITop_Netw_Refill_Machine
ITop_Netw_Refill_stations service

Fuel origin
ITop_Origin_Domestic
ITop_Origin_Waste
ITop_Origin_Verifiability

Investment Process
ITop_Process_communication
ITop_process_criteria
ITop_Process_education
ITop_Process_procurement

Trends
ITop_Trends_Clean Cities
ITop_Trends_Common Awareness / knowledge
ITop_Trends_Customer Value
ITop_Trends_Environment
ITop_Trends_Vechicles

Values
ITop_Personal_Values
ITop_Pilot_Pioneer
ITop_value_environment
ITop_Value_reliability

ITop_Supplier_Vehicle_Personal Contact
ITop_Tradeoff_fin and practical
ITop_references_creating_realiability
ITop_shareholder targets

Natural Gas Vehicles
ITop_Vehic_Driving Experience
ITop_Vehic_Fleet
ITop_Vehic_Model Availability
ITop_Vehic_model_features
ITop_Vehic_Origin
ITop_Vehic_Range
ITop_Vehic_Safety
ITop_Vehic_Technical Performance
ITop_Vehic_Used_Car
ITop_Vehic_Volumes

The Content and Role of Management Accounting

Management Accounting Content
MAC_tech and cost experience from pilots
MAC_actual cost
MAC_bottomline
MAC_capital
MAC_certificates
MAC_CO2 emission trading
MAC_CO2 Savings
MAC_driver_performance_meters
MAC_fuel cost
MAC_fuel cost difference with diff. fuels
MAC_goal
MAC_guideline/norm
MAC_material stream optimizing
MAC_optimal lifetime
MAC_payback
MAC_price_quality_ratio
MAC_route optimizing
MAC_service pricing
MAC_supplier comparison
MAC_TCO
MAC_technical features
MAC_utilisation rate
MAC_vehicle model comparison
MAC_vehicle_ROI

Management Accounting Role
MAR_affect
MAR_after check
MAR_break assumption
MAR_clarify
MAR_comparing_CO2
MAR_comparing_fuel cost
MAR_comparing_vehicle_models_required_turnover
MAR_controll
MAR_customer relations
MAR_customer service from supplier company
MAR_customer service from supplier company's customer
MAR_ensurance
MAR_gutfeeling
MAR_justifies decisions
MAR_links actions to strategy
MAR_Long translation
MAR_makes visible and concrete
MAR_marketing

MAR_motivator
MAR_neutral/reliable information provider
MAR_not needed
MAR_outsourced
MAR_planning
MAR_raporting
MAR_recommendation for decisionmakers
MAR_scenarios
MAR_Short translation
MAR_updated facts

Switching Path Analysis

Passivity and Activity

SPATIF_Customer_Active
SPATIF_Customer_Passive
SPATIF_Supplier_Active
SPATIF_Supplier_Passive

Triggers

Trig_Influential
Trig_Reactional
Trig_Situational