THE ROLE OF INFORMATION TECHNOLOGY IN PROCESS CHANGE AND THE IMPACT ON CUSTOMER SATISFACTION: A STUDY OF SLOVENIAN TRANSPORT FIRMS

By

Andreja Habjan

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Cardiff University

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DECLARATION

This work has not previously been accepted in substance for any degree and is not concurrently submitted in candidature for any degree.

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ABSTRACT

Although the impact of IT-enabled information on firm performance has been well documented in the business value of IT literature, our understanding of how adopting GPS can transform operational decision-making and foster differential firm performance is limited. Moreover, price and service quality have been highlighted as key determinants of industrial customer satisfaction, yet there is little understanding of how IT-enabled information utilisation influences these relationships. In response, I employ two-phase research. In the first phase, I conduct an exploratory comparative case study of three transport firms that have implemented GPS in their operations. The results show that increased use of GPS-enabled information enhances information quality and makes operational decision-making more fact-based and collaborative. I also find that such transformations in operational decision-making can have differential performance impacts. However, I warn scholars and practitioners that a firm's information management capability and organisational factors can facilitate the effective use of GPS-enabled information in operational decision-making and, thus, moderate the differential performance benefits of adopting GPS. In the second phase, I carry out a quantitative study with transport firms' customers. The findings make two contributions. First, I find that the more an industrial firm utilises IT-enabled information in the service process, the less emphasis its customers place on prices when it comes to determining their satisfaction. Drawing on equity theory, I theorise that information utilisation in the service process may mobilise perceptions of fairness and transparency, thereby suppressing the relative impact of price on the formation of industrial customer satisfaction. Second, I find that industrial customers view the utilisation of IT-enabled information in the service process as a value-adding capability that boosts their service quality perceptions. Interestingly, although I had expected that the utilisation of IT-enabled information would also increase the importance of service quality in forming customer satisfaction, the results suggested that this was not the case.

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1. INTRODUCTION

As today's society becomes increasingly information-driven, the information management capability of the firm to manage the quality of its information is exceptionally important (Davis and Golicic, 2010, Mithas et al., 2011). Information technology (IT) enables the utilisation of quality information (Popovič et al., 2009) which, in turn, enables internal and external performance impacts (Mithas et al., 2008, Clercq et al., 2009). Internally, IT-enabled information facilitates changes in decision-making (Davis and Golicic, 2010), while, on the other hand, the utilisation of IT-enabled information enables the firm to manage its customers' satisfaction (Mithas et al., 2008). While both views are equally important, in this study I address both the internal and external value of IT-enabled information along with its firm performance impacts in the transport industry.

1.1 THE INTERNAL VALUE OF IT-ENABLED INFORMATION

The potential of information systems (IS) to transform decision-making and foster organisational performance has been emphasised in the business value of IT literature for quite some time (Dedrick et al., 2003, Mithas et al., 2011). In supply chain studies, IS have been found to support timely decisions, provide information that enhances comparative advantage in supply chain relationships, help manage risk in exporting and offer a means to cope with the uncertainty inherent in the business environment (White et al., 2003, Eng, 2004, Souchon et al., 2004, Li and Lin, 2006, Davis and Golicic, 2010). High quality information, i.e. information that is reliable, accurate and timely (Low and Mohr, 2001, Davis and Golicic, 2010), facilitates improvements in decision quality and can, in turn, foster improvements in firm performance (Raghunathan, 1999, Parssian, 2006, Clercq et al., 2009). To leverage the benefits of high quality information, firms are therefore increasingly investing in Information and Communication Technology (ICT) and Information Technology (IT). IT enables the storing, organising and structuring of information consistent with user needs and allows instantaneous information availability through easy sharing (Carbonara, 2005).

In transport firms, the application of IT is particularly critical for supporting operational decision-making and enhancing firm performance. Unexpected delays, a lack of coordination, delivery constraints and variable demand are common obstacles to

providing superior customer value in this industry (Sanchez-Rodrigues et al., 2008). Practical evidence shows that transport firms with little access to high quality information find it hard to manage transport service amidst such uncertainty. For example, they have difficulty monitoring employees' daily productivity, struggle to exercise control over speeding (e.g. driving 5 mph above the posted speed limit can cost about 20 cents more per gallon of gas) and often fail to identify the location of every vehicle, sending the closest vehicle to a job site, and so on. Such uncertainty amplifies the exposure to risk in the supply chain and increases total costs (Sanchez-Rodrigues et al., 2008). The need to inform operational decision-making with high quality information is therefore extremely important in the transport industry (Sanchez-Rodrigues et al., 2008, Sanchez-Rodrigues et al., 2010a, Aharoni et al., 2011).

In response, investments in automatic vehicle location technologies such as the Global Positioning System (GPS) have been widespread in the transport industry. GPS carries the promise of improving driver, vehicle and overall firm performance by enhancing communication, planning and agility in the transport process (Loebbecke and Powell, 1998, Van Der Vorst et al., 1998, D'Este et al., 1999, Giannopoulos, 2004, Andersson and Lindgren, 2005, Theiss et al., 2005, Marchet et al., 2009). GPS technology has some important and interesting characteristics. It allows transport firms to determine a vehicle's geographical position on a map in real time, calculates the distance to a transport destination, enables communication between dispatchers and drivers at all times and collects transport data that can be used for further analysis (Li and Qin Zhu, 2003, Mintsis et al., 2004, Theiss et al., 2005, Dauwalter et al., 2006, Taylor et al., 2006). GPS-enabled information can therefore potentially aid transport firms in minimising costs and improving control in the transport process, calculating wages, reducing manual work and the use of mobile phones, automating and improving information sharing and, ultimately, optimising real-time decision-making, fleet management and customer service (Loebbecke and Powell, 1998, D'Este et al., 1999, Giannopoulos, 2004, Mintsis et al., 2004, Andersson and Lindgren, 2005, Theiss et al., 2005, Marchet et al., 2009).

However, scholars increasingly argue that leveraging such performance benefits depends less on having the technology and more on being able to make the best use of information in decision-making (Moorman et al., 1992, Dedrick et al., 2003). Studies on the relationship between investments in IT and firm performance have produced equivocal

findings (Davis and Golicic, 2010). IT investments have been linked to improvements in processes and operations (Boynton et al., 1994, Ryssel et al., 2004, Davis and Golicic, 2010, Mithas et al., 2011), productivity (Brynjolfsson, 1993, Dedrick et al., 2003), financial performance (Devaraj and Kohli, 2000), efficiency and relationship development (Wu et al., 2003), competitiveness (Liu and Arnett, 2000, Mithas et al., 2011) and customer satisfaction (Tracey et al., 1999, Ata and Toker, 2012). Yet, critics of studies linking IT investments to firm performance note that firms only enjoy differential performance when IT is combined with resources and capabilities that drive comparative advantage (Clemons and Row, 1991, Mithas et al., 2011). Scholars, for instance, have highlighted the role of systems integration (Kim et al., 2006, Rai et al., 2006), alignment with core competencies (Ravichandran and Lertwongsatien, 2005) and the firm's information management capability (Mithas et al., 2011) as critical for leveraging differentials in firm performance. It seems that some firms use IT more productively than others (Dedrick et al., 2003). Accordingly, emphasis is increasingly placed on the underlying mechanisms that link investments in IT to financial performance (Bharadwaj, 2000).

Despite growing recognition of the value GPS investments can bring to transport firms and their widespread adoption in the transport industry, our understanding of how GPS-enabled information is transforming operational decision-making in this context and how it can positively impact firm performance remains low (Mukhopadhyay et al., 1997, Bharadwaj, 2000, Dedrick et al., 2003, Lu and Ramamurthy, 2011). To address this gap, I conducted a comparative case study of three transport firms that adopted the same GPS during the same year. I explored: *(RQ1) How does the adoption of GPS transform operational decision-making in the transport process? (RQ2) What are the underlying mechanisms that facilitate better use of GPS-enabled information in operational decision-making and link investments in GPS to firm performance?*

My contribution to the business value of IT literature is threefold. First, my results demonstrate that GPS-enabled information can enable a shift towards fact-based and collaborative decision-making in the supply chain (among the transport firm, client, maintenance firm etc.). Second, I find that the more prominent these changes in operational decision-making are, the more they can underlie differential performance impacts of GPS adoption. Yet, third, I identify that the firm's information management capability

(availability of quality information in decision-making, software tools for connectivity and access to information, IT systems integration post-GPS adoption and adaptability of the infrastructure to emerging business needs) and organisational factors (such as top management support, project management of GPS implementation, financial support, end-user involvement, rewarding, training and low employee resistance) facilitate more effective use of GPS-enabled information in operational decision-making and, therefore, moderate the relationship between GPS-enabled information and firm performance.

1.2 THE EXTERNAL VALUE OF IT-ENABLED INFORMATION

Understanding customer satisfaction is important for industrial marketers because satisfaction has an impact on future behaviours (Tanner Jr, 1996). Satisfaction is a key determinant of repeat purchases (Kuksov and Ying, 2010), positive word-of-mouth, loyalty (Austen et al., 2012) and corporate reputation (Walsh et al., 2009). As such, it plays a significant role in creating, developing and maintaining successful, long-term relationships with customers in industrial markets (Homburg and Rudolph, 2001). Not surprisingly, customer satisfaction has also been emphasized as an important driver of firm performance (Patterson et al., 1997). High levels of satisfaction can lead to increased revenues and higher market share (Szymanski and Henard, 2001, Homburg et al., 2013). On the contrary, low levels of satisfaction may encourage industrial customers to explore alternative product/service providers, and even possibly withdraw from a partnership (Homburg et al., 2013).

Business-to-business literature increasingly seeks to unpack factors that shape industrial customer satisfaction (e. g. Homburg et al., 2013, Flint et al., 2011, Sarstedt et al., 2009). Amongst the various financial and non-financial determinants highlighted in recent studies (Ghosh et al., 2004, del Bosque Rodríguez et al., 2006), pricing and perceived service quality have emerged as key drivers of industrial customer satisfaction (Anderson et al., 1994, Williams et al., 2011, Høst and Knie-Andersen, 2004, Kelley and Davis, 1994, Balasubramanian et al., 2003). Scholars have drawn on equity theory (Huppertz et al., 1978) and expectation-confirmation theory (Oliver, 1980) to conceptualise these influences. According to equity theory, customers look for *"a fair product for a fair price"* (Huppertz et al., 1978). Business-to-business studies have, hence, highlighted that industrial customer satisfaction is very much contingent on how fair or

competitive customers perceive the price they pay (Homburg et al., 2005, Homburg et al., 2013). When customers perceive a high price compared to the quality offered, this can have a negative effect on their satisfaction (Balasubramanian et al., 2003). On the contrary, when providers lower their prices while keeping product/service quality constant, this tends to increase customers' satisfaction (Anderson et al., 1994). Interestingly, studies have shown that customers may be willing to accept a high price as long as they perceive pricing formation to be transparent (Carter and Curry, 2010) and fair (Homburg et al., 2005, Høst and Knie-Andersen, 2004). Moreover, drawing on expectation-confirmation theory, satisfaction has also been conceptualised as a function of an initial standard and the perceived discrepancy from this initial reference point (Oliver, 1980). Service quality, viewed as the gap between expectations and perception of service performance levels has hence been highlighted as a key component of industrial customer satisfaction (Homburg and Rudolph, 2001, Chenet et al., 2010, Gil-Saura et al., 2010, Lewin et al., 2010).

The potential of IT as a catalyst for improving firm performance in general (Galliers, 1995, Macher and Mowery, 2009) and customer satisfaction in particular has been recognised in industrial marketing, supply chain and service quality studies for quite some time (Matthyssens and Vandenbempt, 1998, Ata and Toker, 2012, Bienstock et al., 2008). Firms are increasingly investing in IT in order to service their need to utilise high quality information in their operations (Xu et al., 2003). Utilizing quality information has been found to foster information sharing; this, in turn, can enhance industrial relationships, help to manage operational risk and mitigate uncertainty (Davis and Golicic, 2010, Li and Lin, 2006, Souchon et al., 2004). Information utilisation via such IT investments (Mutch, 1999) has been linked to the provision of superior customer value (Sanchez-Rodrigues et al., 2008). Empirical evidence shows that industrial firms with little access to high quality information find it hard to meet customers' demands (Sanchez-Rodrigues et al., 2008, Sanchez-Rodrigues et al., 2010a). In addition, IT-enabled information utilisation can provide supply chain members with needed information on pricing (Gal-Or et al., 2008). The lack of pricing information within the supply chain can lead to a poor customer experience and, ultimately, to dissatisfaction with the provider (Estelami and Bergstein, 2006).

Despite the recognised benefits of IT, our understanding of how IT-enabled information utilisation shapes industrial customer satisfaction remains scarce. To address

this gap, I conducted a quantitative study with transport firms' customers. My overarching research question was: *How does the utilisation of IT-enabled information by the service provider influence industrial customer satisfaction?* My findings provide two key contributions to the industrial marketing literature regarding the role of IT utilisation in shaping industrial customer satisfaction. First, although studies repeatedly highlight price perceptions as a key determinant of industrial customer satisfaction (e.g. Williams et al., 2011), we know little about how IT-enabled information utilisation influences this relationship. I find that the more a firm utilises IT-enabled information in the service process, the less emphasis customers place on prices when it comes to determining their satisfaction. Drawing on equity theory, I theorise that information utilisation in the service process may mobilize perceptions of fairness and transparency, therefore, suppressing the relative impact of price on industrial customer satisfaction formation (Carter and Curry, 2010, Homburg et al., 2005). Second, although extant literature acknowledges service quality as a key determinant of customer satisfaction, surprisingly little research has investigated how IT-enabled information utilisation influences the service quality-customer satisfaction relationship in industrial markets (Vaidyanathan and Devaraj, 2008). I find that industrial customers view the utilisation of IT-enabled information in the service process as a value-adding capability that boosts their service quality perceptions. Interestingly, although I expected that utilisation of IT-enabled information would also increase the importance of service quality in forming customer satisfaction, my results suggested that this was not the case. Drawing on service quality literature, I offer possible explanations.

In the following paragraphs I set out the research questions, research propositions, main hypotheses and structure of the thesis.

1.3 RESEARCH QUESTIONS, PROPOSITIONS AND THE HYPOTHESES

The research questions addressed within the initial qualitative phase are:

- (1) How does the adoption of GPS transform operational decision-making in the transport process? (2) Which are the underlying mechanisms that facilitate better use of GPS-enabled information in operational decision-making and link investments in GPS to firm performance?

The second quantitative phase examines the following research question:

- (3) How does the utilisation of IT-enabled information by the service provider influence industrial customer satisfaction?

The main hypotheses of this work are the following:

- *H1: As the utilisation of IT-enabled information in the service process increases, the importance of price offered in the formation of industrial customer satisfaction decreases.*
- *H2: Utilisation of IT-enabled information has a positive effect on service quality.*
- *H3: As the utilisation of IT-enabled information in the service process increases, the importance of service quality in forming customer satisfaction increases.*

1.4 STRUCTURE OF THE THESIS

The structure of this thesis is as follows. Chapter 1 introduces the field of business process change and the importance of IT use in changing existing business processes. It provides an insight into positive and negative effects of IT utilisation on business processes and consequently on firm performance. The chapter continues by explaining the external value of IT-enabled information utilisation, focusing on its impact on customer satisfaction in a business-to-business (B2B) context. It then identifies the gaps in the extant literature, which serve us as the focus of this study. The chapter concludes with an overview of the structure of this thesis.

Chapter 2 illustrates the theoretical background of the internal and external value of IT-enabled information utilisation. The internal view of IT-enabled information starts by describing the uncertainty in transport operations and the role of information, the use of IT-enabled information in operational decision-making, the importance of IT for achieving high quality information, and concludes with an explanation of the importance of information management capability and organisational factors for achieving firm performance. The external view of IT-enabled information includes a description of customer satisfaction focusing on business-to-business markets and the determinants of

customer satisfaction, an explanation of how IT-enabled information influences customer satisfaction, and finishes with the development of the main research hypotheses.

Chapter 3 explains the methodology used, outlining the research paradigm, research design, first initial qualitative phase and second quantitative phase.

Chapter 4 illustratively presents the research findings from the initial qualitative and second quantitative phase. I first explain the main changes in the transport process after implementing GPS, further elaborating the main changes in operational decision-making due to the use of IT-enabled information. I conclude this chapter with a quantitative presentation of the impact of information utilisation on customer satisfaction and the moderating role of the price offered on this relationship.

I conclude this thesis by summarising and discussing the main findings, explicating the contributions of the dissertation, elaborating on the implications and reflecting on both limitations and possible extensions of this study.

2. THEORETICAL BACKGROUND

In this chapter the theoretical background of the internal and external value of IT-enabled information for the firm is presented.

2.1 THE INTERNAL VALUE OF IT-ENABLED INFORMATION

The following sections address the internal value of IT-enabled information. The description includes an explanation of the uncertainty in transport operations and the role of information, the use of quality information in operational decision-making, the use of IT as an enabler of high quality information, the impact of IT on business processes and firm performance and the importance of information management capability and organisational factors for achieving firm performance.

2.1.1 UNCERTAINTY IN TRANSPORT OPERATIONS AND THE ROLE OF INFORMATION

The inherent uncertainty in the transport process is a key challenge for operational decision-making in transport supply chains (Lorentz, 2008). Uncertainty is seen to increase risk within supply chains and is an obstacle to the effective management and control of supply chain operations (Sanchez-Rodrigues et al., 2010a). Generally, *"uncertainty occurs when decision makers cannot estimate the outcome of an event or the probability of its occurrence"* (Sanchez-Rodrigues et al., 2010b). With limited information at hand, decision-makers find it hard to determine how they should proceed and which decision is best to accept (Jack and Beulens, 2002). Uncertainty comes in different forms in the transport industry. To better understand the different forms of uncertainty, I first highlight various forms of transportation and logistics.

First, carriers or one party logistics (1PL) are transport firms that perform transport service (Krakovics et al., 2008). They are responsible for transporting goods between the manufacturer and customer (Bienstock and Mentzer, 1999). The performance of the transport carrier may influence the effectiveness of the logistics function of a company; therefore, the selection of the appropriate carrier is very important for logistic sustainability (Meixell and Norbis, 2008). Traditionally, carriers only submit quotes for lanes (Lim and Palvia, 2001). Carriers can operate at lower costs in those cities where they

have hubs. On the other hand, in cities that are new to their work they may have high start-up costs (Lim and Palvia, 2001).

Further, second (2PL) and third party logistics (3PL) involve the use of external companies (for example transportation carriers, warehousers, bankers, brokers, and suppliers to these functions, such as stevedores) perform logistics functions which have traditionally been performed within an organisation (Sahay and Ranjan, 2008, Mukhopadhyay and Setaputra, 2006, Leuschner et al., 2014). Thus, 3PL operate on behalf of the manufacturer (Whipple and Roh, 2010, Marasco, 2008). These logistics functions usually include transportation, warehousing, distribution, and financial services (Büyüközkan et al., 2009). Marasco (2008) suggested that 3PL "*includes any form of outsourcing of logistics activities previously performed in-house*". Compared to traditional transport or freight services, contract logistics services are more interaction oriented and better fulfil individual customer requirements (Prockl et al., 2012). 3PL services can be classified as front-end and back-end processes (Schmenner, 2004). Services where the customer is not directly involved are more back-office processes, while services that require intense customer interaction are more front-office processes (Prockl et al., 2012). Notwithstanding the important success and growth of 3PL in the late 1990s (Sahay and Mohan, 2006, Krakovics et al., 2008), in recent years users of 3PL service providers have expressed the view that 3PL service firms do not provide the expected level of service and performance benefits (Büyüközkan et al., 2009). Users have also indicated that providers are not sufficiently proactive, although on the other side service providers claim that they are seldom given the opportunity to develop new ideas (Büyüközkan et al., 2009). This led to development of the idea of using an additional firm to oversee and take the responsibility for all outsourced services, which later became known as fourth party logistics (4PL).

Lastly, fourth party logistics (4PL) is the "*single connection between a customer and the logistics operators, being responsible for hiring other 3PL and 2PL, and managing the logistics process end-to-end*" (Krakovics et al., 2008). 4PLs are focused more on management atttributions and manage a network of logistics operators in order to increase the efficiency of their clients (Huiskonen). Unlike 3PL, 4PL combines process, technology and the process to manage and is a business process outsourcing provider (Mukhopadhyay and Setaputra, 2006). Mukhopadhyay and Setaputra (2006) state that 4PLs provide

visibility and integration across multiple firms so the users of a 4PL can focus on core competencies to better manage and utilise company assets and resources, such as inventory and personnel. Customers use 4PLs to form close relationships amongst the participants along the supply chain, support cost-cutting initiatives, and develop the flexibility to deal with supply and demand uncertainties (Win, 2008). In a supply chain, a 4PL is treated as a strategic partner, a chain integrator that synthesises and manages its own resources, capabilities and technology with those of other service providers (Mukhopadhyay and Setaputra, 2006).

In the transport industry, request uncertainty, for instance, refers to spontaneous changes of the portfolio of requests (Fleischmann et al., 2004). Handling uncertainty refers to issues pertaining to loading or unloading times; these may exceed or be shorter than the planned handling time. Transhipment uncertainty relates to possible delays caused by the non-availability of ramps, gates or special loading or unloading equipment, such as a forklift (Schönberger, 2010). Next, loading uncertainty refers to situations when different types of goods cannot be loaded as planned or are not allowed to be loaded by the same resource (Gendreau et al., 2004). Last but not least, outcome uncertainty represents the external conditions the 3PL has to operate under (e.g., theft, corruption) (Whipple and Roh, 2010).

Amidst these different types of uncertainty, the availability of information has been highlighted in the literature as a catalyst that can improve decision-making and positively influence firm performance (Atuahene-Gima and Haiyang, 2004, Brynjolfsson et al., 2011, Forslund and Jonsson, 2007, Li et al., 2009a, Lorentz, 2008, Souchon et al., 2004, Vandenbosch and Huff, 1997). Brynjolfsson et al. (2011), for instance, find that firms engaging in data-driven decision-making enjoy a higher output and productivity return and also see benefits in asset utilisation, return on equity and market value. They therefore argue that IT investments that support the collection and distribution of valuable information should lower costs and improve firm performance. For example, utilisation of technology can help shorten lead times and simplify orders (Van Der Vorst et al., 1998). Companies which use quality information have a better understanding of their internal operations (Berente et al., 2009) and achieve work of a better quality (Petter et al., 2008). However, to generate improvements in organisational performance information must be of good quality and support decision-making (Popovič et al., 2012) in processes that add

value to the firm (Davenport and Beers, 1995, Diamantopoulos and Souchon, 1999). Researchers from different domains have deliberated about what can be classified as 'good information' for quite some time (Eppler et al., 2004). A review of the management, communication and IT literature on what determines information quality reveals numerous criteria that influence information quality in different contexts (Burn and Knight, 2005, Eppler, 2006). It is therefore fair to say that information quality is a vaguely defined concept (Lillrank, 2003) and no single definition has been established for it (Ruževičius and Gedminaitė, 2007). See Table 1 for an overview of definitions.

Wang (1998) understands information quality as the characteristic of information of being of high value to its users. English (1999) views information quality as consistently meeting users' expectations and enabling them to perform their job effectively. According to Huang et al. (1999), information quality can be defined as *"information that is fit for use by information consumers"*. Eppler (1999) views the quality of information as *"the characteristic of information to meet the functional, technical, cognitive, and aesthetic requirements of information producers, administrators, consumers, and experts"*. Kahn et al. (2002) identify information quality as *"the characteristic of information to meet or exceed customer expectations"* and as *"information that meets specifications or requirements"*. Hu & Feng (2005) understand information quality as *"the degree to which the information is represented and to which the information can be perceived and accessed"*. In a recent publication, English (2007) updated his information quality definition to *"meeting knowledge worker and end-customer expectations through information and information services"*. Last but not least, Popovič et al. (2012) see information quality as information characteristics and dimensions to meet or exceed the expectations, requirements or needs of the knowledge worker.

Table 1: List of Selected Information Quality Definitions

Author	**Selected definitions of information quality**
Wang (1998)	Information quality is seen as the characteristic of information of being of high value to its users
English (1999)	Information quality is seen as consistently meeting users' expectations and enabling them to perform their job effectively.
Huang et al. (1999)	Information quality is defined as *"information that is fit for use by information consumers"*.
Eppler (1999)	Information quality is viewed as *"the characteristic of information to meet the functional, technical, cognitive, and aesthetic requirements of*

Author	Selected definitions of information quality
	information producers, administrators, consumers, and experts".
Low & Mohr (2001)	Information quality is a function of its reliability, accuracy and timeliness.
Kahn et al. (2002)	Information quality is defined as *"the characteristic of information to meet or exceed customer expectations"* and as *"information that meets specifications or requirements"*.
Hu & Feng (2005)	Information quality is seen as *"the degree to which the information is represented and to which the information can be perceived and accessed"*.
English (2007)	Information quality is viewed as *"meeting knowledge worker and end-customer expectations through information and information services"*.
Hilligoss & Rieh (2008)	Information quality is regarded as individuals' *"subjective judgment of goodness and usefulness of information"* (p. 1469).
Zhou, Li, & Liu (2010)	Information quality reflects the accuracy, comprehensiveness and timeliness of information supplied by the provider.
Arazy & Kopak (2011)	Information quality is seen as fitness for use (on a judgment of value) which encompasses both of these objective and subjective aspects.
Popovič et al. (2012)	Information quality refers to information characteristics and dimensions to meet or exceed the expectations, requirements or needs of the knowledge worker.
Kim & Hwang (2012)	Information quality refers to how useful and valuable the content that the mobile Internet service provider's portal site provides to its customers.

For the purpose of this work, I adopt the definition of information quality offered by Ruževičius and Gedminaitė (2007). I argue that information quality is a function of its reliability, accuracy and timeliness (Low and Mohr, 2001) and focus on information that serves the needs of dispatchers who are planning and controlling operations in dispatching centres within transport firms (Mintsis et al., 2004).

2.1.2 USE OF QUALITY INFORMATION IN OPERATIONAL DECISION-MAKING

Quality information can in particular facilitate operational decision-making in the transport industry. Operational decision-making includes areas such as the fine-tuning of production, sales and distribution and the management of day-to-day operating processes and systems (McDonald et al., 2008). In the transport industry, operational decision-making refers to "decision making performed by local management, yard masters and dispatchers, for example, in a highly dynamic environment, where the time factor plays an important role and detailed representations of vehicles, facilities and activities are essential. It includes: *the implementation and adjustment of schedules for services, crews, and maintenance activities; the routing and dispatching of vehicles and crews; the allocation of scarce resources"* (Crainic, 2000). Information enters the decision-making

process when the decision-makers identify a problem, develop criteria and formulate a range of possible solutions to the problem (Korhonen-Sande, 2010). In decision-making, the use of information can be either instrumental (direct) where a decision is made through the direct application of the information, or conceptual (indirect) where information is used in the form of concepts, assumptions, models, theories and heuristics (rules of thumb) (Korhonen-Sande, 2010). Generally, information is gathered because it benefits the making of a choice (Korhonen-Sande, 2010). Actively seeking information from several sources increases the assortment of information and the potential to find the right information that can be used in decision-making (Katila and Ahuja, 2002). On the other hand, the overall diversity of the information, known as an '*information overload',* increases the time required to make a decision and confusion regarding the decision, resulting in reduced decision quality (Souchon et al., 2004, Speier et al., 1999). Decision-makers overloaded with information will more likely need to use highly formal established procedures to deal with the amount of information and make sense of it (Souchon et al., 2004).

Under conditions of high uncertainty (Citroen, 2011, Frishammar, 2003, Menon and Varadarajan, 1992), high complexity and high time pressure (Low and Mohr, 2001, Rahman and de Feis, 2009), information has been found to act as a catalyst that supports decision-making. Quality information from electronic and real-time data, for instance, has been found to enhance real-time analysis in decision-making (Mintsis et al., 2004), enable quick responses to market needs (Davis and Golicic, 2010) and, overall, improve the efficiency of supply chain logistics (Paulraj and Chen, 2007).

2.1.3 IT AS AN ENABLER OF HIGH QUALITY INFORMATION

To acquire high quality information and mobilise its benefits, transport firms are increasingly investing in IT. There is no consensus in the literature on a definition of IT. Table 2 provides an overview of all definitions.

Table 2: List of Selected Information Technology Definitions

Author	Selected definition of information technology
Kraemer and Dedrick (1994)	IT is seen as a set of generic technologies, such as semiconductors, computer systems and software, which are pervasive in their impacts on industrial and economic development.
Lai and Mahapatra (1997)	IT is defined as "technologies dedicated to information storage, processing, and communications".

Author	Selected definition of information technology
Bharadwaj (2000)	IT is seen as "computer and communication technologies including the shareable technical platforms and databases which is a shared information delivery base".
Attaran (2004)	IT is as "capabilities offered to firms by computers, software applications, and telecommunications to deliver data, information, and knowledge to individuals and processes".
Aral and Weill (2007)	IT represents "combinations of investment allocations and a mutually reinforcing system of competencies and practices that together represent organisational IT capabilities".
Lin (2009)	IT is state-of-the-art hardware equipment to purchase and develop application systems for business reengineering, to install networks for communication between manufacturers, suppliers, and customers, and to support the education of the IS staff and employees to be capable of using IT.
Davis and Golicic (2010)	IT is to be classified as an organisational resource with physical and human elements. The physical elements consist of tangible artefacts such as computers, peripherals, network cabling and data files. The human elements develop, implement and monitor working routines include employees' technical skills and managerial skills.

Kraemer and Dedrick (1994) see IT as a set of generic technologies, such as semiconductors, computer systems and software, which are pervasive in their impacts on industrial and economic development. Another view was put forward by Lai and Mahapatra (1997) in one of their studies where they defined IT as *"technologies dedicated to information storage, processing, and communications".* Along with this definition, Attaran (2004) defined IT as "*capabilities offered to firms by computers, software applications, and telecommunications to deliver data, information, and knowledge to individuals and processes",* whereas Bharadwaj (2000) regarded IT as *"computer and communication technologies including the shareable technical platforms and databases which is a shared information delivery base".* Recently, Byrd et al. (2008) defined IT as a composition of assets (communications quality, hardware/operating systems (OS) quality, data quality) and capabilities (IT skills, business application integration) that are integrated to work closely together and serve as a sound foundation for organisational software applications that support business functions and activities. Melville et al. (2004) developed five conceptualisations of IT. First, IT is viewed a tool, namely the *"tool view",* that it does what its designers intended; second, in the *"proxy view",* IT is conceptualised by its crucial characteristics, which are defined by individual perceptions of its usefulness or value; third the *"assemble view"* focuses on the interaction of people and technology in the development and use of IT; the emphasis of the fourth *"computational view"* is on

algorithm and system development and testing as well as data modelling and simulation; last but not least, fifth the *"nominal view"* invokes technology in name but not in facts.

For the purpose of this study, I define IT as technologies for communication and information exchange between organisations and individuals (Morgan et al., 2006), such as automatic vehicle location technologies using either GPS or digital mobile communications (Giannopoulos, 2004). Specifically, GPS is an information and communication tool which facilitates *"vehicle fleet management and monitoring; data collection and mapping of the transport infrastructure; incident management and monitoring; and vehicle navigation systems"* (Mintsis et al., 2004). IT technologies are distinguished as coordination technologies, which help in the integration and coordination of processes supporting the information transfer (e.g. LAN, WAN, EDI etc.); process technologies which add to the transformation of the inputs into outputs (e.g. CNC, FMS etc.); and knowledge management technologies which support the process of problem-solving and organisational learning (e.g. Lotus Notes etc.) (Carbonara, 2005).

Various forms of IT are used in the transport industry. Generally, literature on the transport industry classifies IT into either *intrafirm* or *interfirm* information systems (Saatçioglu et al., 2009). Firms use intrafirm systems to facilitate collaboration among different functions within a firm. For example, a transportation management system can assist in fleet visibility and dispatcher productivity by decreasing the paper work (Pokharel, 2005). In addition, a warehouse management system tracks products during the production process and is closely related to manufacturing system management (Ruiz et al., 2011). Next, radio frequency technology (RFID) is used to remotely identify, retrieve and store the data of physical objects (Zhang, 2013, Nemoto et al., 2012). RFID technology allows firms to track inventory accurately in real time, resulting in reduced processing time and labour (Kwang So et al., 2010). Moreover, intranet is widely used in the port industry especially for human resource activities, storing corporate information and as an alternative tool for in-house communication (Norzaidi et al., 2007). Lastly, the use of enterprise resource planning (ERP) has been booming in the past years due to its ability to process transaction information faster, track product orders and inventory, automate orders and payments, lower setup costs, reduce order cycle time and avoid data duplication (Hwang and Min, 2013).

On the other hand, interfirm information systems are employed to assist with operation and communication among different parties outside a firm, including state authorities (Saatçioglu et al., 2009). Electronic data interchange (EDI) and collaboration via electronic logistics marketplaces (ELMs) are the two most widely used communication systems in supply chains (Perego et al., 2011). First, EDI can be defined as "*the direct computer-to-computer builds knowledge of the innovation, examines its communication between an organization and its trading relevance and appropriateness to the organization, and partners of business documents and information in a makes a decision whether to adopt the innovation*" (Premkumar et al., 1997). EDI authorises the transfer of data from one point of the supply chain to another with use of EDI messages which are carried through XML platforms. These messages cover multiple parameters such as the current location, where the quantities and dispatching times are swapped between the customs broker and the transporter and are later used for the analysis with use of a freight management system (Coronado Mondragon et al., 2009). Second, ELMs are defined "*as an electronic hub using web-based systems that link shippers and carriers together for the purpose of collaboration or trading*" (Wang et al., 2007). Normally, ELM consists of three parties: the shipper, the carrier and the technology provider with the primary objective of reliable delivery (Wang et al., 2011). Usually, this system allows the participating buyers and sellers to exchange information about price and product offerings (Wang et al., 2007). All parties benefit from the use of ELMs, especially from the lower search costs, reduced transaction costs, wider accessibility of a large base of buyers or suppliers, improved flexibility, business processes automation, improvement in service quality and reduction of inventory cost (Howard et al., 2006).

Finally, the use of GPS, telematics and intelligent transportation technologies has been recognised as most prevalent in the transport industry (Mintsis et al., 2004, Theiss et al., 2005, Mishra and Hegde, 2012, Kim et al., 2011). First, GPS (for a detailed description also see 4.1.1) that was initially developed for military uses in the 1970s is nowadays mainly used in the transport industry for vehicle fleet management and monitoring, data collection and mapping of the transport infrastructure, incident management and monitoring, and vehicle navigation systems (Mintsis et al., 2004). Firms that use GPS can cut costs through increased efficiency and creating a better customer service (Theiss et al., 2005). Second, telematics presents "*the integrated use of telecommunication and*

informatics, for application in vehicles and with control of vehicles on the move" *(Mishra and Hegde, 2012)*. A telemetics system provides various types of information such as temperature, moisture, illumination and the existence of any objects on the road, accident risk information, and a neighbouring vehicle's status information (Daesub et al., 2008). This technology and multimedia applications are at the forefront with vehicle tracking, remote diagnostics and collision avoidance (Mishra and Hegde, 2012) to enable transport firms to manage transport operations. Third, an intelligent transportation system (ITS) brings together the fields of transportation planning, telecommunications, computing, vehicle and electronics manufacturing, and infrastructure construction. Stakeholders, such as government agencies at the national, regional and municipal levels, highway operators, carriers, equipment manufacturers, system vendors, and service operators are involved in the development of the ITS (Crainic et al., 2009). These systems usually aim to improve passenger safety, reduce transportation time and fuel consumption (El Faouzi et al., 2011).

IT is used to generate internal transport information such as the collection location and time, delivery point and time, vehicle number, position of the vehicle, mileage covered, travel speed etc. (Ghiani et al., 2003, Schmid and Doerner, 2010, Wang et al., 2011). It enables solving real-time vehicle rerouting problems (Li et al., 2009b), the generation of vehicle routing plans (Repoussis et al., 2009) and assures efficient real-time logistics (Novoa and Storer, 2009). Second, IT generates external transport information, like online transactions, order status, product schedules, sales records etc. (Coronado Mondragon et al., 2009, Eng, 2006). It facilitates the integration of major supply chain processes, plan production, logistics and marketing promotions and is replacing traditional methods involving paper, phone and fax which allows greater control to be achieved (Coronado Mondragon et al., 2009, Giannopoulos, 2004). Especially greater control has been put forward as a facilitator of greater operational performance (Ahmad and Schroeder, 2003). The control issues can be explained by drawing on agency theory which explains the relationship between the principal and principal representative or employee (Fayezi et al., 2012). The relationship depends on the outcome or behaviour (salary) of the employee (Eisenhardt, 1989b). The underlying assumption is that the "*expected behavior will lead to the expected outcomes, and, as such, if the principal can ensure that the employee has met behavioral expectations, the principal can assume that the expected performance outcomes will result*" (Whipple and Roh, 2010). In this relationship, the

principal's goal is to lower the agency costs, for example by rewarding, monitoring and policing. On the other hand, an employee seeks to maximise their rewards and reduce the principal's control (Fleisher, 1991). In order to reduce/eliminate the employee's ability to cheat, the principal utilises behaviour-based mechanisms to try to ensure that the employee behaves according to the principal's best interests (Whipple and Roh, 2010). For example, principal control or monitoring provides the principal with information about the agent's actions (Mahaney and Lederer, 2003). Thus, the principal invests in IT (e.g. a radio frequency identification and global positioning system tracking) to provide the principal with information which reveals the employee's behaviour (Eisenhardt, 1989b, Whipple and Roh, 2010).

Last but not least, IT is used to disseminate transport information vertically and horizontally across the firm (Davis and Golicic, 2010). Effective dissemination improves the quality of transport information delivering it in an actual value and timely manner to members of the firm (Davis and Golicic, 2010).

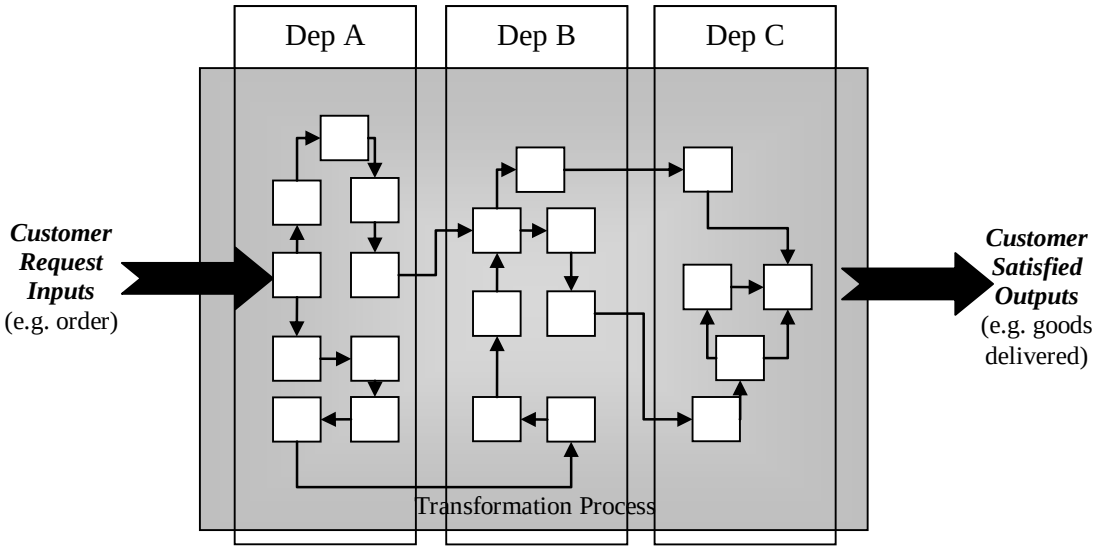
Reported benefits of IT use include improved real-time tracking information, better information visibility and reliability and enhanced up-to-date information sharing (Coronado Mondragon et al., 2009, Eng, 2006, Ferneley and Ben, 2006, Morgan et al., 2006). The increased use of easily accessible, highly accurate and on-time information therefore enhances a firm's information management capability and facilitates improvements in its operational decision-making (White et al., 2003). For example, for firms with substantial export operations, increasing the use of information helps them avoid making suboptimal export decisions (Souchon et al., 2003). In addition, firms can use information to understand and manage the performance of their marketing strategies (Moorman, 1995). Moreover, increased use of information has been found to improve confidence in the decision-making process since it equips managers with the ability to deal with ambiguous situations more effectively (White et al., 2003).

2.1.4 Impact of IT on Business Processes and Firm Performance

The impact of IT on business processes and firm performance has dominated debate on the business value of IT literature (Hitt and Brynjolfsson, 1996, Kohli and Devaraj, 2003, Wang et al., 2011, Melville et al., 2004, Mithas et al., 2011, Mukhopadhyay et al., 1995). Generally, Hammer and Champy (1993) describe a business process as a collection

of activities that takes one or more kinds of input and creates an output that is of value to a customer. A business process has a goal and is affected by events occurring in the external world or in other processes. Moreover, Davenport (1993) along with Eriksson and Penker (2000) say that a business process is a specific ordering of work activities across time and space with a beginning, an end and clearly identified inputs and outputs: a structure for action. Finally, Melão and Pidd (2000) understand business processes as a natural way for work to be done in firms in order to create value for internal or external customers (see Figure 1).

Figure 1: Business Processes as Deterministic Machines



Source: Melão and Pidd (2000).

Business processes are also categorised in academic literature dissimilarly. Usually, processes are divided into two groups where *"operational processes"* represent the execution of the operational tasks and *"management processes"* refer to the activities of controlling, administering and allocating the resources (Mooney et al., 1996). Alternatively, Earl and Khan (1994) imply a distinction between different types of processes based on value chain concepts, such as: *core processes* (which have external customers and include the primary activities of the value chain); *support processes* (which have internal customers and concern secondary activities in the value chain); and *management processes* (which manage core and support processes). Moreover, Gulla and Lindland (1994) distinguish between production processes and coordination processes,

with traditional approaches to modelling, input – process – output. Lastly, Yu and Mylopoulos (1995) separate office processes from processes executed by machines. These are simply a progression of tasks whereas office workflows are about actors in social systems collaborating to achieve a goal.

Several studies have taken a process orientation to illustrate the positive performance impact of IT (Mukhopadhyay et al., 1997). In these studies, IT is seen as an '*enabler'* of the process change before the process is designed; as a '*facilitator'* of the change while the process is being designed; and as an '*implementer'* of the change after the design is complete (Attaran, 2004). As we seek to understand how IT creates value in terms of firm performance, we primarily draw on the insights of the two key theories: the resource-based view (RBV) and transaction cost economics (TCE). A combination of these two theories could serve as a better theoretical framework for explaining the formation of inter and intra organisational relationships (Chu and Wang, 2012). First, the RBV attributes an improvement in firm performance to valuable resources or resource bundles (Dong et al., 2009, Barney, 1991). The RBV has used a variety of different terms to talk about a firm's resources, for example competencies, skills, strategic assets and stocks (Wade and Hulland, 2004). In the IT literature authors have also identified numerous IT-related resources. Key IT-based resources, classified as IT infrastructure, human IT resources (e.g. technical and managerial IT skills) and intangible IT resources (e.g. knowledge assets, customer orientation and synergy) are firm-specific and hence likely to serve as sources for competitive advantage (Bharadwaj, 2000). The contribution of the RBV is the notion that firms should focus on the development of their internal assets and processes (Kearns and Lederer, 2003). Accordingly, firms should foster processes that are unique and leverage core resources. Strategic IT alignment is such a process as it combines business and IT knowledge in order to support business objectives (Kearns and Lederer, 2003). Along with this notion, those sceptical of IT's direct effect on firm performance argue that firms can only benefit from IT when they have introduced IT in a way that produces valuable, sustainable resource complementarity (Bharadwaj, 2000). Therefore, I pay particular attention to the relationship of IT-enabled information in the decision making on a firm's process operational performance.

In addition, TCE argues that performance improvements in the supply chain can be achieved by efficient coordination (Dong et al., 2009). Initially, TCE emphasises the role

of governance in overcoming the limitations of limited rationality and in securing economic efficiency through a reduction of transaction costs (Chu and Wang, 2012). For that reason, when the transaction costs between the actors are likely to be high, organisations tend to substitute coordination by hierarchy, thus creating vertically integrated chains (Christiaanse and Kumar, 2000). However, vertical integration may mean that not all activities in the chain benefit from economies of scale and specialisation, thus increasing the production costs associated with the entire chain (Christiaanse and Kumar, 2000). The use of ICT can influence both production costs and coordination costs and, in supply chain contexts, digitally enabled integration capability can substantially improve transactional efficiencies (Dong et al., 2009, Christiaanse and Kumar, 2000). For example, increased real-time information sharing and communications capabilities can acquire and exploit an appropriate asset base, resulting in an improved supply chain performance (Lau et al., 2007, Zhu and Kraemer, 2005). In addition, IT can substantially add to the supply chain distribution by reducing the upstream and downstream coordination costs (Dong et al., 2009). Last but not least, performance improvements can also be achieved from the use of IT to effectively manage the profitability levels of a transaction based on flexible pricing (Christiaanse and Kumar, 2000).

Nonetheless, to these theoretical perspectives, Mukhopadhyay et al. (1997), for instance, argue that IT can improve the efficiency and effectiveness of processes in terms of cost and quality, making IT investments economically valuable. IT enables retailers and manufacturers to track inventory levels and the availability of raw materials (Davis and Golicic, 2010). IT can also improve communication and aid dynamic pricing in supply chains (Li and Lin, 2006, Li et al., 2009a). Finally, the use of IT enables changes in performing customer processes involving less paper work, and fewer data input errors (Barua et al., 2004).

Scholars thus support the notion that IT investments can improve process efficiency and effectiveness (Karimi et al., 2007, Pavlou and El Sawy, 2006), productivity (Brynjolfsson, 1993, Dedrick et al., 2003) relationship development (Sawhney and Zabin, 2001, Wu et al., 2003), customer satisfaction (Ata and Toker, 2012, Karimi et al., 2001, Sambamurthy et al., 2003, Tracey et al., 1999), competitiveness (Bhatt et al., 2010, Liu and Arnett, 2000, Mithas et al., 2011, Sambamurthy et al., 2003) and, ultimately, financial

performance (Devaraj and Kohli, 2000). For a detailed review of the positive performance impact of IT, see Table 3.

Table 3: Review of the Positive Performance Impact of IT

Performance impact	Author	Description
Efficiency and Effectiveness	Karimi et al. (2007)	IT implementation reduces operational costs and decreases the input/output conversion ratio, which results in process efficiency. Implementing IT also provides better functionality, enhanced quality of users' work in terms of better access to corporate data, higher level of enterprise-wide data integration, better sales forecasts, and improved quality of operations resulting in process effectiveness.
	Pavlou and El Sawy (2006)	IT leveraging competence indirectly supports effectiveness in undertaking two primary business processes (effectively executing operational processes and effectively reconfiguring existing functional competencies).
Productivity	Brynjolfsson (1993)	The author linked the IT benefits and productivity paradox in the research which reflects the results of a computerised literature search of 30 leading journals in both information systems and economics.
	Dedrick et al. (2003)	The author argues that greater investment in IT is associated with increased productivity growth. The performance of IT investments among firms can be explained by complementary investments in organisational capital such as decentralised decision-making systems, job training, and business process redesign which is reflected in productivity gains.
Relationship development	Wu et al. (2003)	IT helps build and manage relationships with customers, suppliers, employees and partners, which can potentially transform a firm into a networked entity with seamless supply chains and value creation processes.
	Sawhney and Zabin (2001)	IT enables enterprise applications targeted at building and managing relationships with key partners including customers, suppliers, employees, and partners.
Customer satisfaction and customer orientation	Liu and Arnett (2000)	Website success in the context of electronic commerce aims at serving customers better through all phases of marketing activities.
	Sambamurthy et al. (2003)	IT-enabled knowledge reach refers to the comprehensiveness and accessibility of codified knowledge in a firm's knowledge base. It therefore enables firms to better manage customer knowledge.
	Ata and Toker (2012)	IT applications are likely to have an effect on customer satisfaction because IT applications enable firms to customise and improve the reliability of their offerings, and help firms manage customer relationships more effectively through different stages of the relationship.
	Karimi et al. (2001)	Firms with better IT planning and integration are more effective at managing IT to improve customer service.
Competitiveness	Mithas et al. (2011)	IT-enabled information management capability enables business excellence and creates and sustains a competitive advantage.
	Bhatt et al. (2010)	By generating relevant and timely IT-enabled information, firms are more likely able to sense customers' expressed and latent needs. In doing so, firms are better equipped to exploit an existing

Performance impact	Author	Description
		competitive advantage.
	Sambamurthy et al. (2003)	IT competence importantly affects the level of competitive actions by firms throughout the information value chain and the functionalities of advanced information technologies.
Financial performance	Devaraj and Kohli (2000)	The use of technology significantly affects Revenue per admission and Revenue per day.
	Bharadway (2000)	Use of IT enables more efficient product placements, which leads to higher revenues.

Yet, critics of studies linking IT investments to firm performance differentials argue that some firms use IT more productively than others (Dedrick et al., 2003) and, thus, IT infrastructure per se will not necessarily improve a firm's performance relative to its competitors (Mithas et al., 2011). For instance, Kettinger et al. (1997) show a negative relationship between IT adoption and market share and profits, Hitt and Brynjolfsson (1996) offer mixed results in analyses of correlations between IT spending and various measures of business profitability, while Ryssel et al. (2004) report that IT has no effect on relationship value. Mithas et al. (2008) also propose an insignificant or negative relationship between IT investments and customer satisfaction.

2.1.5 IMPORTANCE OF INFORMATION MANAGEMENT CAPABILITY AND ORGANISATIONAL FACTORS FOR ACHIEVING FIRM PERFORMANCE

Weighing against the above stated equivocal findings, there is therefore growing evidence that, although IT infrastructure provides a necessary foundation for decision-making, it is the use and management of information that are critical for ensuring technology-enabled information can be appropriately deployed to generate differentials in firm performance (Davenport, 2000, Mithas et al., 2011, Mukhopadhyay et al., 1997). Scholars, for instance, argue that *"the ability to provide data and information to users with the appropriate levels of accuracy, timeliness, reliability, security, confidentiality, connectivity, and access and the ability to tailor these in response to changing business needs and directions"* (Mithas et al., 2011), i.e. a firm's information management capability, may enable process management that can trigger differences in firm performance (Kohli and Grover, 2008). This not only includes the availability of quality information for decision-making, but also software tools that allow connectivity and access to such information, IT systems integration and the ability to adapt the IT infrastructure to

emerging business needs (Mithas et al., 2011). A number of scholars studying supply chains also highlight the role information sharing plays in mobilising positive process outcomes and firm performance (Mukhopadhyay et al., 1997, Mukhopadhyay and Kekre, 2002). Information sharing enables processes that connect the firm with its supply chain business partners (Davenport, 1993, Li and Lin, 2006). As such, it enhances internal business process integration and improves a firm's ability to rapidly cope with market or demand changes (Lu and Ramamurthy, 2011). Mukhopadhyay and Kekre (2002), for instance, show that electronic integration in B2B procurement processes offers suppliers operational gains in transaction processing which over time translate into strategic benefits like increased sales. Improved inventory turnover, plant productivity, product quality, accuracy and sales along with reduced costs are often highlighted as the key productivity impacts of information sharing (Dedrick et al., 2003). Accordingly, information sharing will bring firms a competitive advantage in the long run (Li and Lin, 2006).

In addition, contributions focusing on IT-organisation fit highlight various critical organisation factors for the successful adoption of IT (McLaren et al., 2011, Oh and Pinsonneault, 2007) (for a detailed review of organisational factors in recent studies, see Table 4). Nah et al. (2001), for instance, emphasise top management support, a business plan and clear vision, along with effective communication as important organisational factors. Leung (2001) also argues that organisational structure and design, organisational culture and human resource management, as well as communication, employee satisfaction and motivation can influence successful IT adoption. Moreover, Hong and Kim (2002) claim that IT implementation success depends largely on the level of IT and process adaptation, as well as on the extent of organisational resistance. Similarly, Dezdar and Sulaiman (2011) show a positive relationship between organisational factors such as top management support, enterprise-wide communication and IT training and education, and IT implementation success. Top management should have an active role in the IT adoption process (Dezdar and Sulaiman, 2011, Nah et al., 2001). Moreover, IT needs to be integrated into the firm's strategic planning process (Tippins and Sohi, 2003). In addition, formal training should be provided to help end-users accept the organisational change (Nah et al., 2001); it should address all aspects of the system and be offered on a continuous basis (Dezdar and Sulaiman, 2011). Enterprise-wide communication is important since expectations for IT adoption should be clearly communicated across levels (Dezdar and

Sulaiman, 2011, Nah et al., 2001). Last but not least, Bruque-Cámara et al. (2004) showed that firm size can be related to human and financial resources, and that large firms will more likely have better equipped technical departments. They also conclude that experience in the use of basic technologies may significantly add to the extent to which firms adopt IT. These firms tend to adopt subsequent innovations more intensely and perhaps more quickly (Bruque-Cámara et al., 2004).

Table 4: Review of Organisational Factors for Successful adoptionof IT in Recent Studies

Factor	**Author**	**Context**
Teamwork and composition	Nah et al. (2001)	ERP adoption
	Leung (2001)	Software development
	Sabherwal and Kirs (1994)	Academic IT
	Bruque-Cámara et al. (2004)	IT adoption in the pharmaceutical distribution sector
Change management programme and culture	Nah et al. (2001)	ERP adoption
	Leung (2001)	Software development
	Dezdar and Sulaiman (2011)	ERP adoption
	Chang-su et al. (2012)	Ubiquitous computing technology adoption
	Bruque-Cámara et al. (2004)	IT adoption in the pharmaceutical distribution sector
	Del Aguila-Obra and Padilla-Meléndez (2006)	Internet technology adoption
Top management support	Nah et al. (2001)	ERP adoption
	Dezdar and Sulaiman (2011)	ERP adoption
	Chang-su et al. (2012)	Ubiquitous computing technology adoption
	Bruque-Cámara et al. (2004)	IT adoption in the pharmaceutical distribution sector
	Del Aguila-Obra and Padilla-Meléndez (2006)	Internet technology adoption
	Rouibah et al. (2009)	IS/IT use in public organisations
Business plan and vision	Nah et al. (2001)	ERP adoption
	Chang-su et al. (2012)	Ubiquitous computing technology adoption
BPR and minimum customisation	Nah et al. (2001)	ERP adoption
	Chang-su et al. (2012)	Ubiquitous computing technology adoption
Effective communication	Nah et al. (2001)	ERP adoption
	Leung (2001)	Software development
	Dezdar and Sulaiman (2011)	ERP adoption
	Bruque-Cámara et al. (2004)	IT adoption in the pharmaceutical

Factor	Author	Context
		distribution sector
Project management	Nah et al. (2001)	ERP adoption
Monitoring and evaluation of performance	Nah et al. (2001)	ERP adoption
Project champion	Nah et al. (2001)	ERP adoption
Appropriate business and IT legacy systems	Nah et al. (2001)	ERP adoption
	Del Aguila-Obra and Padilla-Meléndez (2006)	Internet technology adoption
Organisational structure and design	Leung (2001)	Software development
	Sabherwal and Kirs (1994)	Academic IT
	Bruque-Cámara, S. et al. (2004)	IT adoption in the pharmaceutical distribution sector
	Del Aguila-Obra and Padilla-Meléndez (2006)	Internet technology adoption
Job satisfaction and motivation	Leung (2001)	Software development
	Dezdar and Sulaiman (2011)	ERP adoption
	Rouibah et al.(2009)	IS/IT use in public organisations
Organisational resistance	Hong and Kim (2002)	ERP adoption
User training and education	Dezdar and Sulaiman (2011)	ERP adoption
	Rouibah et al. (2009)	IS/IT use in public organisations

While building on this theoretical background, our understanding of how GPS-enabled information transforms operational decision-making in the transport industry to support decisions amidst high uncertainty remains limited. Moreover, against the equivocal findings on the relationship between investments in IT and financial performance (Davis and Golicic, 2010), our knowledge of the underlying mechanisms that link GPS-enabled information to improvements in firm performance is also scarce (Bharadwaj, 2000, Dedrick et al., 2003). These gaps motivated my research questions: (RQ1) How does the adoption of GPS transform operational decision-making in the transport process? (RQ2) Which are the underlying mechanisms that facilitate better use of GPS-enabled information in operational decision-making and link investments in GPS to firm performance? The first qualitative phase of my research explores these questions through a comparative case study of three transport firms that introduced the same GPS during the same year.

2.2 THE EXTERNAL VALUE OF IT-ENABLED INFORMATION

In the following paragraphs the external value of perceived IT-enabled information is addressed. They present a description of customer satisfaction, specifically focusing on

industrial markets and explaining the determinants of customer satisfaction in industrial markets. This section concludes with the development of the research model with the hypotheses.

2.2.1 UNDERSTANDING CUSTOMER SATISFACTION

The definition of customer satisfaction has been divergent in the industrial and consumer markets ever since Cardozo (1965) introduced this concept to the marketing field. Howard and Sheth (1969) first implied customer satisfaction as a related psychological state to appraise the reasonableness of what a customer actually receives and gives. From a transaction-specific perspective, customer satisfaction is viewed as a post-choice evaluative judgment of a specific purchase occasion (Hunt, 1977). Fornell (1992) and Anderson et al. (1994) view later customer satisfaction as an overall evaluation based on the total purchase and current, past or future consumption experience with a good or service over time, while Zeithaml and Bitner (1996) see satisfaction as a customer's evaluation of a product or service in terms of whether that product or service has met their needs and expectations. Failure to meet needs and expectations is assumed to result in dissatisfaction with the product or service. Recently, Peter and Olson (2002) asserted that customer satisfaction represents the degree to which a consumer's pre-purchase expectations are fulfilled or surpassed by a product. Lastly, Liao (2012) determined customer satisfaction as *"a person's approval or disappointment when comparing their opinion of services received with their original expectations"*. An overview of customer satisfaction definitions is presented in Table 5.

Table 5: Selected Definitions of Customer Satisfaction Throughout Time

Author	Definition of customer satisfaction
Levitt (1960)	Customer satisfaction is the ultimate goal of every business.
Howard and Sheth (1969)	Customer satisfaction is related psychological state to appraise the reasonableness of what a customer actually receives and gives.
Hunt (1977)	Customer satisfaction is a post-choice evaluative judgment of a specific purchase occasion.
Oliver (1981)	Customer satisfaction is a total psychological state when there is an existing discrepancy between the emerging emotion and expectation.
Fornell (1992)	Customer satisfaction is an overall evaluation based on the total purchase and consumption experience with a good or service over time.
Anderson et al. (1994)	Customer satisfaction is based not only on current experience but also on all past experiences, as well as future or anticipated experiences.
Zeithaml and Bitner (1996)	Customer satisfaction is a customer's evaluation of a product or service in

Author	Definition of customer satisfaction
	terms of whether that product or service has met their needs and expectations.
Kotler (1997)	Customer satisfaction presents a consequence of the customer's experiences during various purchasing stages.
Kristensen et al. (1999)	Customer satisfaction is an evaluative response of the product purchase and consumption experience.
Peter and Olson (2002)	Customer satisfaction is the degree to which a consumer's pre-purchase expectations are fulfilled or surpassed by a product.
Olsen (2002)	Customer satisfaction is a global evaluation or feeling state.
Nagar and Rajan (2005)	Customer satisfaction is one dimension of a firm's customer relationships.
Liao (2012)	Customer satisfaction is a person's approval or disappointment when comparing their opinion on services received with their original service expectations.

Although in earlier literature customer satisfaction was well researched in the area of consumer goods and services (Bolton and Drew, 1991, Churchill, 1999, Oliver, 1997), there has been a lack of attention to industrial markets (Ata and Toker, 2012, Rossomme, 2003, Sheth and Sharma, 2006). Due to this reason and the fact that my study considers customer satisfaction in industrial markets, I am now distinguishing the definition of customer satisfaction with regard to consumer and industrial markets (Dotan, 2002, Håkansson and Snehota, 1995).

2.2.2 UNDERSTANDING CUSTOMER SATISFACTION IN INDUSTRIAL MARKETS

In industrial markets, customer satisfaction has been emphasised as an important driver of firm performance (Patterson et al., 1997). High levels of customer satisfaction can lead to increased revenues, bigger market share and lower costs incurred through repeat purchases and fewer customer complaints (Szymanski and Henard, 2001, Homburg et al., 2013). On the contrary, low levels of satisfaction may encourage customers to explore alternative product/service providers, and even possibly withdraw from the partnership (Homburg et al., 2013).

Since there is a clear difference between customer-buyer relationships in consumer and industrial markets, in the early 1980s authors also began distinguishing customer satisfaction in consumer and industrial markets. By definition, firms in the consumer market pursue individual consumers and families/households who buy for personal consumption; in contrast, industrial market firms pursue organisations that acquire goods

(and/or services) for use in production or the offering of other products (services) (Kahn and Mentzer, 1995). In general, the differences between these two types of firms include the following:

- industrial market firms have fewer buyers than consumer market firms;
- industrial market firms reflect a closer customer-seller relationship;
- industrial market firms typically have inelastic demand in the short run (Kahn and Mentzer, 1995); and
- in industrial markets, cost advantages, customer switching costs and government policy are perceived to be more important than in the consumer market (Karakaya and Stahl, 1989).

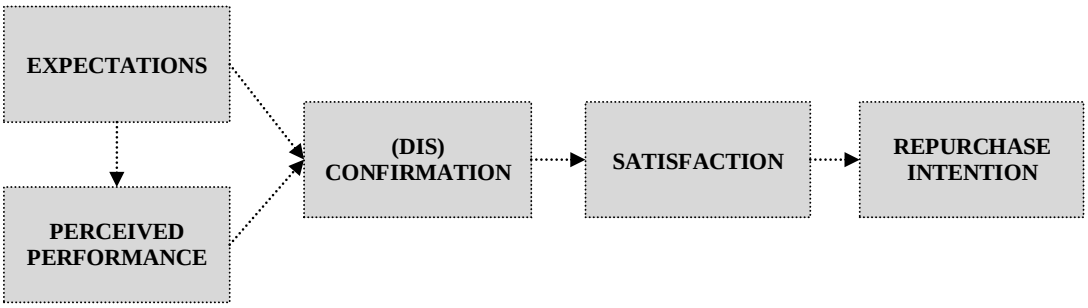
Since the industrial market is sharply distinguished from the consumer market, new definitions and views of customer satisfaction were established especially for understanding and use in industrial areas. For example, Håkansson (1982) states that *"in industrial marketing settings, customer satisfaction presents the relationship between buyer and seller which is frequently long term, close and involving a complex pattern of interaction between and within each firm"*. Firms' long-term relationships and their strategic well-being are crucial to firm success. Therefore, firms should regularly monitor customer satisfaction and dissatisfaction levels and understand their customers' expectations and perceptions (Patterson et al., 1997). The relationships between buyers and sellers are often bilateral and products need to be customised to the buyers' needs. For that reason, the customer is no longer a passive buyer but an active partner and their satisfaction may play an important role in establishing, developing as well as maintaining successful customer relationships (Homburg and Rudolph, 2001). Customer satisfaction is usually related to the key elements and outcomes of the inter-organisational exchange process (Halinen, 1996, Halinen, 1997, Möller and Wilson, 1995). Tikkanen and Alajoutsijärvi (2002) further suggest that firms should take account of the inner context of a customer-supplier relationship; the connected network of the customer-supplier relationship and the outer context of the connected network. Consequently, the level of customer satisfaction, at least in the long run, is essentially affected by how the firms in the customer's own focal network have responded by way of adapting to the functioning of the

focal customer-supplier relationship (Tikkanen and Alajoutsijärvi, 2002). In this study, as a relationship-specific phenomenon industrial customer satisfaction reflects a supplier's ability to meet a customer's expectations about a product or service (e.g. features, product/service-related information, services) and accompanying activities (e.g. order handling, complaint handling, interaction with salespeople and interaction with internal staff) (Homburg and Rudolph, 2001).

The Expectation-Confirmation Theory (ECT) has been used extensively to study customer satisfaction in the marketing literature (Dabholkar et al., 2000, Oliver, 1980, Oliver, 1981, Patterson and Spreng, 1997). The ECT framework, originally employed in marketing, demonstrates that customers form a repurchase intention in the following manner (Oliver, 1980) (also see Figure 2). First, customers form an initial expectation about a specific product or service prior to purchase; mainly based on prior experience and existing knowledge (Parasuraman et al., 1991), as well as through interactions with different information sources (e.g. prior customers, advice from opinion leaders, existing customers) (Rogers, 2010). For the same product, the expectations therefore may vary across customers (Tse and Wilton, 1988) depending on the quality and reliability of the information source. Unrealistic expectations can be generated because of wrong and misleading information and by a lack of product knowledge. For example, based on product information, a customer may expect a certain performance level from the product (Oliver, 1980, Boulding et al., 1994), but if the information itself is misleading or overstated the expectations will be unrealistic, which would affect the whole satisfaction-intention process (Spreng et al., 1996). Second, if they perceive the product as useful, they accept, purchase and use it. Following a period of initial consumption, they form perceptions about its performance. Third, they assess the perceived performance of the product/service based on their initial expectation and determine the extent to which their expectation is confirmed (confirmation, also called disconfirmation). If the product performs better than expected (i.e. the perceived performance is greater than the expectation), a positive disconfirmation is expected to occur. Alternatively, if the customers' evaluation about the product falls below the expectation (i.e., perceived performance is less than the expectation), a negative disconfirmation occurs. And, of course, if the product performance just matches the expectation a *"simple confirmation"* is expected to occur. Fourth, customers form a level of satisfaction based on the confirmation

of their expectation. A positive disconfirmation, even a simple confirmation strengthens a customer's attitude to the product and forms a sense of satisfaction (Oliver and DeSarbo, 1988, Erevelles and Leavitt, 1992). However, a negative disconfirmation weakens the positive attitude to the product and forms a sense of dissatisfaction. Finally, some satisfied customers might form a repurchase intention while dissatisfied customers might discontinue its subsequent use and/or search for a substitute product.

Figure 2: Expectation-Confirmation Theory (ECT) Framework



Source: Oliver (1980).

While there is a dominance of studies concerning the application of ECT to consumer markets, the existing literature about the utilisation of ECT in industrial markets is quite limited. Yet, scholars applying ECT to business-to-business relationships (Cronin and Morris, 1989, Patterson et al., 1997, Wagner et al., 2010, Lemke et al., 2011) collectively suggest this area needs more attention from academia.

2.2.3 DETERMINANTS OF CUSTOMER SATISFACTION IN INDUSTRIAL MARKETS

Satisfaction in industrial markets may not have been examined to the same depth as satisfaction in consumer markets, yet scholars have begun to identify several determinants that shape industrial customer satisfaction. Table 6 below presents an overview of the key empirical studies and the industrial customer satisfaction determinants they identified.

Table 6: Customer Satisfaction Determinants in Industrial Markets

Author	Industrial customer satisfaction determinants
Giovanis et al. (2013)	Logistics service quality
O'Cass and Ngo (2011)	Performance value, pricing value, relationship building value, co-creation value

Author	Industrial customer satisfaction determinants
Williams et al. (2011)	Service performance, price perceptions
Cahill et al. (2010)	Prices offered and the costs imposed by the logistic service provider, service satisfaction, relational satisfaction
Carter and Curry (2010)	Price transparency and fairness
Chenet et al. (2010)	Service quality, commitment
Gil-Saura et al. (2010)	Logistics service quality, sacrifices associated with logistics service delivery in terms of costs, and benefits derived from intensifying the customer-supplier relationship
Mysen and Svensson (2010)	Commitment, competitive intensity, continuity, cooperation, coordination, dependence, formalisation, market turbulence, opportunism, specific assets, and trust
Lewin et al. (2010)	Performance quality, perceived value, pre-purchase expectations
Lewin (2009)	Perceived product/service quality, customer expectations, perceived value
Cater and Cater (2009)	Direct product costs, product quality, delivery performance, supplier know-how, time-to-market, service support, personal interaction
Davis-Sramek et al. (2009)	Technical service quality, relational service quality
Molinari et al. (2008)	Service quality, word-of-mouth, positive disconfirmation
Vaidyanathan and Devaraj (2008)	Logistics fulfilment process quality (fulfilled order accuracy, fulfilled order timeliness)
Caceres and Paparoidamis (2007)	Service quality (technical quality, functional quality)
Chakraborty et al. (2007)	Reliability, product-related information, commercial aspects
Whittaker et al. (2007)	Value, service quality
del Bosque Rodríguez et al. (2006)	Communication, trust, commitment, quality of performed service, margins/discounts
Witlox and Vandaele (2005)	Economic attributes of transport service (price & cost), satisfaction with transport service provider in terms of frequency, reliability, flexibility and duration of the service
Abdul-Muhmin (2005)	Satisfaction with product, satisfaction with pricing, satisfaction with distribution, satisfaction with marketing communication, benevolence, credibility, opportunism
Ghosh et al. (2004)	Financial expectations (cost), differentiation expectations
Høst and Knie-Andersen (2004)	Price, service performance (tangibles, reliability, responsiveness, assurance, empathy)
Matzler et al. (2004)	Quality of products, functionality of design, customer care, complaint handling, project management, innovativeness
Balasubramanian et al. (2003)	Price, perceived trustworthiness, perceived operational competence
Janda et al. (2002)	Quality, acquisition costs, possession costs
Homburg and Rudolph (2001)	Satisfaction with products, satisfaction with salespeople, satisfaction with product-related information, satisfaction with order handling, satisfaction with technical services, satisfaction with interaction with internal staff, satisfaction with complaint handling
Evers and Johnson (2000)	Perceptions of communication, quality of customer service, consistent delivery, transit times, and competitive rates
Lapierre et al. (1999)	Perceived quality, perceived value
Tracey et al. (1999)	Competitive price offered, quality of products, product line breadth, order

Author	Industrial customer satisfaction determinants
	fill rate, order cycle time, order/shipment information, frequency of delivery
Murphy and Daley (1997)	Expertise, size, product specialisation, convenient to use, geographical specialisation, company reputation, reasonable prices, personal attention, financial condition, number of services offered, ability to provide relevant information, reliability of service
Anderson et al. (1994)	Price, quality of goods/services, expectations
Kelley and Davis (1994)	Service quality
Levy (1994)	Guaranteed pricing
McGinnis (1989)	Price rates and costs

Amongst the various determinants of industrial customer satisfaction, price (Tracey et al., 1999, Homburg et al., 2013, O'Cass and Ngo, 2011) and service quality (Giovanis et al., 2013, Molinari et al., 2008, Caceres and Paparoidamis, 2007) have been consistently highlighted as the most influential. Scholars argue that a key antecedent to customer satisfaction is the 'sacrifice' – the price – that one has to pay to receive the service (Rutner and Langley, 2000, Stank et al., 2003). Customer satisfaction with the price is comprised of several dimensions such as price transparency, the price-quality ratio, relative price, price confidence, price reliability and price fairness (Matzler et al., 2006). The author defined "*price transparency as to a clear, comprehensive, current and effortless overview of quoted prices, relative price is compared to that of competitors, price confidence refers to consumer belief that a price is favourable, and price reliability is related to absence of hidden costs and unexpected price changes*" (Matzler et al., 2006). McGinnis (1989) and Cahill et al. (2010) also suggest that price rates are a vital factor when it comes to customers' satisfaction with transport firms. At the same time, marketing and logistics studies note that service quality shapes satisfaction and long-term relationship commitment in supply chains (e.g. Chenet et al., 2010, Gil-Saura et al., 2010, Giovanis et al., 2013). For logistics customers, providing distinctive value-added services, meeting both current and potential future needs, accommodating unique and/or unplanned requirements and adapting to unexpected operational situations represent a proxy for service value (Bowersox et al., 1999) and influence customer satisfaction (Gil-Saura et al., 2010). Pre-purchase expectations and post-purchase performance are therefore often highlighted as determinants of industrial customer satisfaction (Lewin, 2009). Witlox and Vandaele (2005) similarly argue that, beyond the importance of the pure economic attributes of a

transport service, the frequency, reliability, flexibility and duration of the service are critical when it comes to industrial customer satisfaction.

2.2.4 THE INFLUENCE OF IT-ENABLED INFORMATION ON CUSTOMER SATISFACTION

While there is a general agreement about the contribution of IT to firm performance (Melville et al., 2004, Mithas et al., 2011, Kohli and Devaraj, 2003), there are mixed reports about the ways through which IT is linked to firm performance. Earlier research proposed that IT was directly linked to firm performance and sustainable competitive advantage (e.g. McFarlan, 1984). For example, it enables large retailers and manufacturers in the retailing process to permit important suppliers to see inventory levels and track the availability of key raw materials (Davis and Golicic, 2010). It also improves the communication process in supply chain management with information sharing and enhanced information access quality (Li and Lin, 2006). Finally, the dynamic pricing process can be achieved due to the increased availability of demand data provided by the IT (Li et al., 2009b). However, later studies found no direct technology-performance connection (e.g. Zahra and Covin, 1993, Clemons and Row, 1991). For example, Ryssel et al. (2004) found that IT had no effect on relationship value, Kettinger et al. (1994) report a negative relationship between IT adoption and market share and profits; and Brynjolfsson and Hitt (1996) show mixed results in analyses of correlations between IT spending and various measures of business profitability. In addition, Dedrick et al. (2003) show that some firms use IT more productively than others and therefore IT infrastructure per se will not necessarily improve a firm's performance relative to its competitors (Mithas et al., 2011). Yet, there seems to be a widespread consensus that IT enables the utilisation of quality information (Popovič et al., 2009), which, in turn, may enhance decision-making in key supply chain processes such as managing customer orders, product/service maintenance, human resource acquisition, material acquisition, cash acquisition and product/service development that impact firm performance (Popovič et al., 2012).

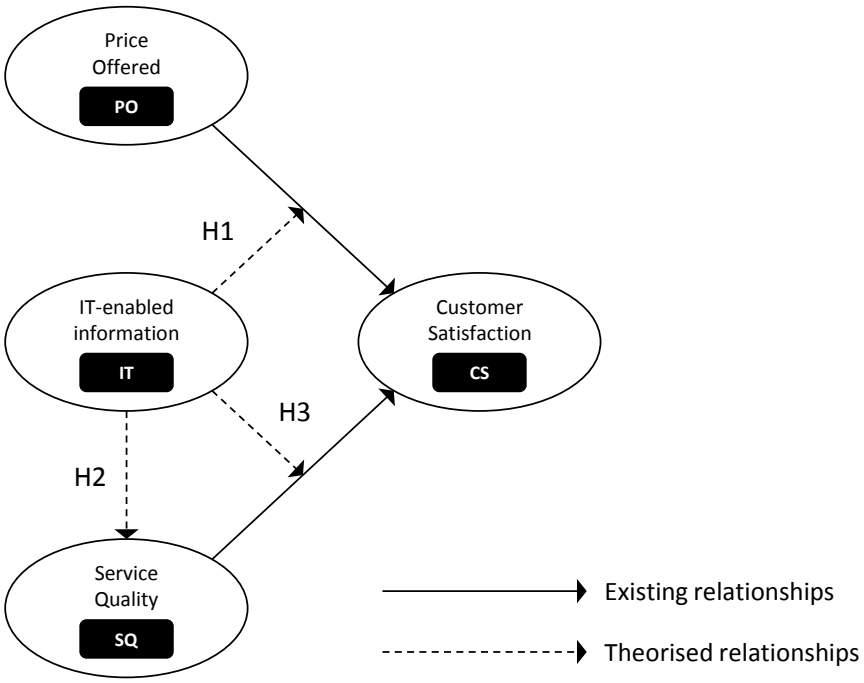
Industrial marketing studies have long emphasised the positive impact of utilising IT-enabled information on customer-provider relationships (Kim et al., 2010, Stump and Sriram, 1997). Information-focused capabilities such as information sharing and information usability appear to shape long-term supply chain relationships (Zhao et al., 2001). Many scholars have demonstrated the importance of IT-enabled information in the

coordination of planning and control activities for effective logistics services between supply chain partners (Fiala, 2005, Subramani, 2004, Sanders, 2005). For example, utilising Electronic Data Interchange (EDI) information in logistics has been found to bring about improved efficiency, service quality and lower costs (Zhao et al., 2001). More recently, Sambamurthy et al. (2003) argue that the deployment of the right IT systems may enable agile processes in the customer interface with firms, and thereby help in proactively managing customer information. In addition, Karimi et al. (2001) report that firms with better IT planning and integration are more effective at managing IT to improve customer service and thus at managing customer relationships. IT-enabled information offered by logistics providers also has the potential to influence customer perceptions of logistics service quality (Bienstock et al., 2008). In addition, the service quality literature has linked process and outcome quality to customer satisfaction (Jiang et al., 2000, Bienstock et al., 1997). The utilisation of IT-enabled information can therefore potentially enhance customers' satisfaction with a logistics service provider.

2.2.5 THE RESEARCH MODEL AND HYPOTHESES

Drawing on industrial customer satisfaction and information utilisation literature, I argue that perceived utilisation of IT-enabled information can play an important role in industrial customer satisfaction formation. Figure 3 summarises my research model, which is discussed in detail in the following sections.

Figure 3: The Influence of Perceived IT-Enabled Information Utilisation on Customer Satisfaction



2.2.5.1 Impact of IT-enabled information utilisation on the price offered-customer satisfaction relationship

Previous research has repeatedly identified price perceptions as a key determinant of industrial customer satisfaction (e.g. Tracey et al., 1999, Anderson et al., 1994, Williams et al., 2011). Scholars suggest that service providers' ability to offer competitive prices (Tracey et al., 1999) and to guarantee prices (Levy, 1994) can lead to greater customer satisfaction. Customers who seek long-term relationships will carefully consider the future path of prices when making purchasing decisions (Elmaghraby and Keskinocak, 2003).

According to equity theory, an increase in price generally leads to a decrease in customer satisfaction, except in cases of exceptionally satisfied customers and/or transparent, reliable and fair pricing (Homburg et al., 2005, Carter and Curry, 2010, Høst and Knie-Andersen, 2004, Matzler et al., 2006). Customers have been found to be more price-sensitive when there is a lack of information sharing about prices (Gal-Or et al., 2008, Lancioni, 2005) and costs (Formentini et al., 2011). Providers can leverage their information management capability (Mithas et al., 2011) to aid customers' price

perceptions when forming purchasing decisions. This is particularly important for industrial firms. As industrial services can have a wide range of outcomes, they are often difficult to price. It, therefore, pays to utilise relevant information in establishing prices (Docters et al., 2004). IT can perform an important and supportive role in addressing this challenge by providing quality information about the transport process to transport operations' supply chain members (Habjan et al., 2014). In supply chain environments, quality information and the sharing of such information are repeatedly highlighted as important aspects that affect the customer-provider partnership (Monczka et al., 1998). When customers obtain quality information that can aid understanding of how prices are formed (resulting in price transparency and price fairness), they are more willing – *ceteris paribus* – to accept a higher price charged (Gal-Or et al., 2008, Homburg et al., 2005, Carter and Curry, 2010, Høst and Knie-Andersen, 2004). The above theorising collectively leads to the development of the following hypothesis:

> *H1: As the utilisation of IT-enabled information in the service process increases, the importance of price offered in the formation of industrial customer satisfaction decreases.*

2.2.5.2 Impact of IT-enabled information utilisation on service quality and customer satisfaction

Extant literature has long confirmed that perceived service quality is a key contributor to customer satisfaction with a service provider (e.g. Vaidyanathan and Devaraj, 2008, Lapierre et al., 1999, Whittaker et al., 2007, Chenet et al., 2010, Molinari et al., 2008, Rauyruen and Miller, 2007, Kelley and Davis, 1994). Yet, Abell (1994) and Kirk (1999) suggest that service quality and customer satisfaction rest on information, its use and distribution. Spreng et al. (Spreng et al., 1996) believe that when customers assess their satisfaction they value both information regarding the product/service as well as its performance. In a supply chain setting, all value chain partners are believed to be better off when integrating credible information regarding their products/services and making it available to other partners (Schau et al., 2005). Further, Siguaw et al. (1998) report that information sharing and utilisation are associated with stronger commitment by the customer and service provider to their relationship. More specifically, customers expect suppliers to acquire and maintain the market information needed to meet or exceed agreed

service levels (Davis and Golicic, 2010). For example, a consumer electronics retailer expects key computer suppliers to have access to necessary information, such as point-of-sale data and inventory levels, in order to adjust production to support unexpected surges or declines in sales. Following a similar reasoning, McIvor et al. (2003) suggest that acquired, analysed, shared and utilised information improves future post-purchase customer experience. Drawing from these works I hypothesise that the more customers perceive that a service provider utilises IT-enabled information, the more their perceptions about the quality of the services performed will be enhanced, and that this will amplify the influence of service quality on customer satisfaction. I, therefore, propose the following hypotheses:

H2: Utilisation of IT-enabled information has a positive effect on service quality.

H3: As the utilisation of IT-enabled information in the service process increases, the importance of service quality in forming customer satisfaction increases.

3. RESEARCH METHODOLOGY

3.1 INTRODUCTION

This chapter introduces the methodology used to conduct the research for this study. The first section presents the research paradigm and research design, followed by a description of the initial qualitative phase and second quantitative phase. Both sections include an outline of the justification of the approach, the selection of the respondents, the data collection, data analysis and a discussion of the research's trustworthiness. The chapter concludes by setting out the limitations of the study.

3.2 RESEARCH PARADIGM

Since a research paradigm is a world view spanning ontology, epistemology and methodology, the quality of scientific research done within a paradigm should be judged by the paradigm's own terms. In his book, The Structure of Scientific Revolutions Kuhn (1962) defines a scientific paradigm as: what is to be observed and scrutinised; the kind of questions that are supposed to be asked and probed for answers in relation to this subject; how these questions are to be structured and how the results of scientific investigations should be interpreted. Therefore, philosophical traditions in management should lead the researchers to identify the (Guba, 1990):

- Ontological aspect: What is the nature of the 'knowable'? Or what is the nature of 'reality'? Or what is the 'reality' that researchers investigate?

- Epistemological aspect: What is the nature of the relationship between the knower (enquirer) and the known (or knowable)? Or what is the relationship between that reality and the researcher?

- Methodological aspect: How should the enquirer go about finding out knowledge? Or what is the technique used by the researcher to investigate the reality?

Ontology by nature makes implicit knowledge explicit, it describes relevant parts of the world and makes it understandable and processable (Haase et al., 2005). In business and social sciences, subjectivist ontology assumes that what we take as reality is an output of the human cognitive process. On the other hand, the objectivist view of ontology

assumes that social and natural reality have an independent existence prior to human cognition (Johnson and Duberley, 2000). This approach provides not merely a means of collecting data but ultimately aims to develop social theory by drawing on that individual-level data (Rustin, 2000). For these reasons, researchers who study physical objects usually find that objectivist ontology suits what they want to research and how they want to research it. Conversely, subjectivist ontology may therefore be more appropriate for studying business and management phenomena like human behaviour etc.

Epistemological assumptions which consider the researchers' view on how he or she knows the reality have been summarised in three *"worlds"*: positivism, constructivism and realism (Popper and Popper, 1979). First, the most widely used paradigm for business school research (Orlikowski and Baroudi, 1991) – positivist epistemology – adheres to the notion of objectivity and the possibility of finding universal truths. Hence, its central position is that *"experience is the foundation of knowledge"* (Bernard, 2006). In positivism, the social world exists externally and usually implies objective measurement methods rather than seeing the world subjectively with the use of sensation, reflection and intuition (Easterby-Smith et al., 2002). Those holding positivistic views see reality as existing autonomously from any observer, and inquirers can be objective and non-participant observers of the events they see. In other words, the data and its analysis are value-free and data do not change because they are being observed. That is, researchers view the world through a *"one-way mirror"* (Guba and Lincoln, 1994). Early positivism was denoted by August Comte's belief that the scientific research method is the surest way to produce knowledge about the natural world, which should be based on observed facts (Bernard, 2006). Alternatively, members of the Vienna Circle founded the later positivism known as *"Logical Positivism"* or *"Logical Empiricism"* whose fundamental principles present experience as the basis for knowledge. In addition, they agreed that there are no synthetic a priori propositions and that metaphysical explanations of phenomena are incompatible with science (Bernard, 2006). The researchers influenced by positivist epistemology assume the role of an objectivist analyst, making isolated interpretations about data collected in a value-free manner (Saunders et al., 2003). Moreover, they see the reality as existing autonomously of any observer; they do not affect nor are affected by the subject of the research (Remenyi, 1998); and they use highly structured methodology (Gill

and Johnson, 1997) mostly including quantitative methods that lend themselves to statistical analysis.

Nevertheless, while positivism was a widely used and generally accepted doctrine, philosophers whose independent and creative thinking moved beyond the boundaries of existing ideas started a new *"scientific revolution"* which resulted in the evolution of a new paradigm named *"social constructionism"* (Easterby-Smith et al., 2002). Essentially, it argues that people's creations are driving the topics investigated in social science research. It is important what people think and feel, focusing on forms of their interaction and communication (Easterby-Smith et al., 2002). Constructivism has four epistemological axioms (Iles et al., 2004): *"knowledge is the result of cognitive processes, cognition is an adaptive process that enhances the viability of behavior for a given environment, experience becomes meaningful through cognitive processes, and knowing is created through biological/neurological as well as social, cultural, and language-based interactions"*. This research philosophy may be useful for studies of significant social issues including family and political ideologies (Sobh and Perry, 2006). Further, it requires the researcher to be a *"passionate participant"* during his/her field work (Guba and Lincoln, 1994) especially focusing on establishing close interaction between the interviewer and respondent. Lastly, the research process aims to gather rich data, usually by employing qualitative methods, from small number of cases chosen for specific reasons (Easterby-Smith et al., 2002).

As a mixture of the first (positivism) and second (social constructionism) philosophical approaches, the third epistemological doctrine, so-called '*realism'* sees knowledge as external and objective nature; nonetheless, it also states that people themselves are not objects to be studied (Saunders et al., 2003). In addition, it argues that the *"world consists of independent creations of minds or living creatures, that is, it is the world of ideas, art, science, language, ethics, institutions, etc."* (Healy and Perry, 2000). Realism is recognised in several varieties. Realists traditionally recognise the external world where science is directly related to the observable facts through observations. Internal realism, alternatively, supports the notion that revealed scientific laws are *"absolute and independent of further observations"* (Easterby-Smith et al., 2002). Further, relativist realists believe that scientific laws before their acceptance and closure may be strongly predisposed to by political, commercial and economic beliefs. Finally, an anti-

positivist movement known as *"critical realism"* supports the belief that the world out there is observable and independent. However, this world is socially constructed where feelings and thoughts are core characters of society (Denzin and Lincoln, 2005). In management research, realism is a *"growing movement transforming the intellectual scene"* (Sobh and Perry, 2006) and social scientists are therefore becoming gradually interested in its use. Realism research focuses on establishing an understanding of the general reality of an economic system in which people work subordinated to each other. As the opposite of constructionism where the data collection starts with no prior inputs from another audience, the research design in realism typically advises that a groundwork conceptual framework should be taken from the literature (Miles and Huberman, 1994). Moreover, realism believes in multiple insights into a single reality (Healy and Perry, 2000), hence researchers typically employ a two-phase research approach, starting with an exploratory and concluding with a confirmatory investigation (Sobh and Perry, 2006). Finally, methodological triangulation enables the researcher to interpret the research issues by applying qualitative (e.g. case studies, interviewing) and quantitative (e.g. structural equation modelling) research techniques (Healy and Perry, 2000).

The methodological aspect is the research perspective which sets out the research vision and the strategy for how the research should be conducted (Potter, 1996). Currently, researchers in the social sciences can be more or less classified in three groups (Tashakkori and Teddlie, 2003):

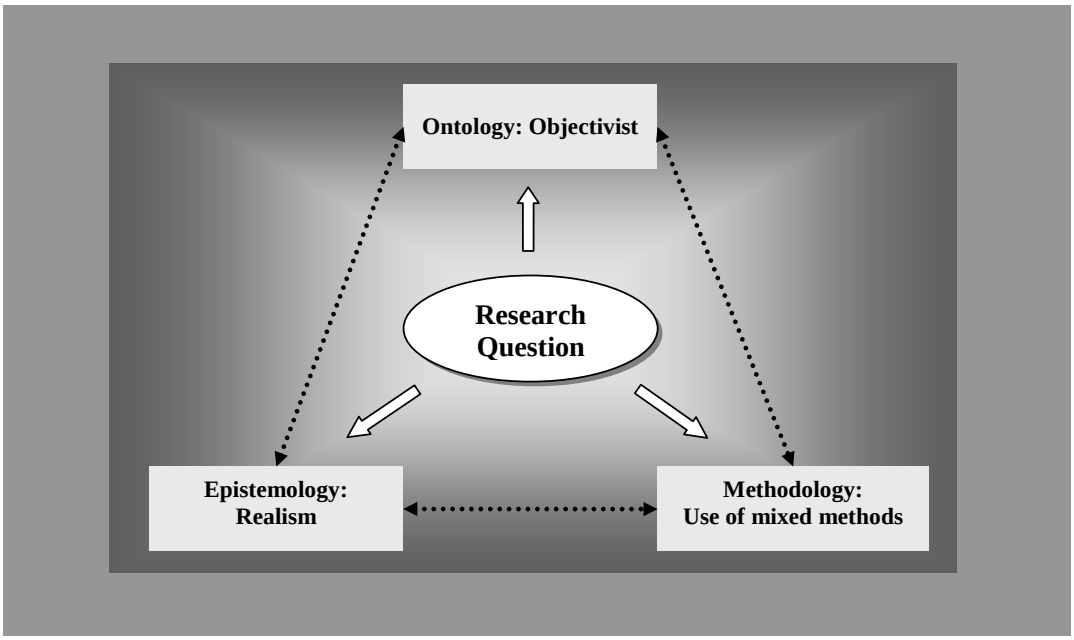
- *"quantitatively oriented researchers working within postpositivist tradition and primarily interested in numerical analysis,*
- *qualitatively oriented researchers working within the constructivist tradition and primarily interested in analysis of narrative data and*
- *mixed methodologists working within other paradigms (e.g. pragmatism, realism) and interested in both types of data".*

First, quantitative methodology sees the relationship between the researcher and theory as deductive by having an objectivist view of reality (Bryman and Bell, 2007). Moreover, researchers usually employ a linear and logical structure of the research, where a hypothesis reflects the relationship between recognised concepts identified in the

hypothesis (Eldabi et al., 2002). On the other hand, qualitative research methodology assumes that knowledge is subjective where the researcher learns from the participants in an ordered society with a particular position of objectivity (Marshall and Rossman, 1999). The foremost techniques used within qualitative research are interviews, observation and diary methods (Easterby-Smith et al., 2002). Finally, mixed methodology which was employed throughout the 20th century and into the 21st century combines both the quantitative and qualitative points of view (Tashakkori and Teddlie, 2003). It enables the researcher to use the qualitative and quantitative data collection and analysis techniques in either parallel or sequential phases. Consequently, this provides more viewpoints on the observable fact being examined (Easterby-Smith et al., 2002).

This research posits in objectivist ontology and realist epistemology. A mixed methods research approach is used as a research technique (also see Figure 4).

Figure 4: Research Paradigm

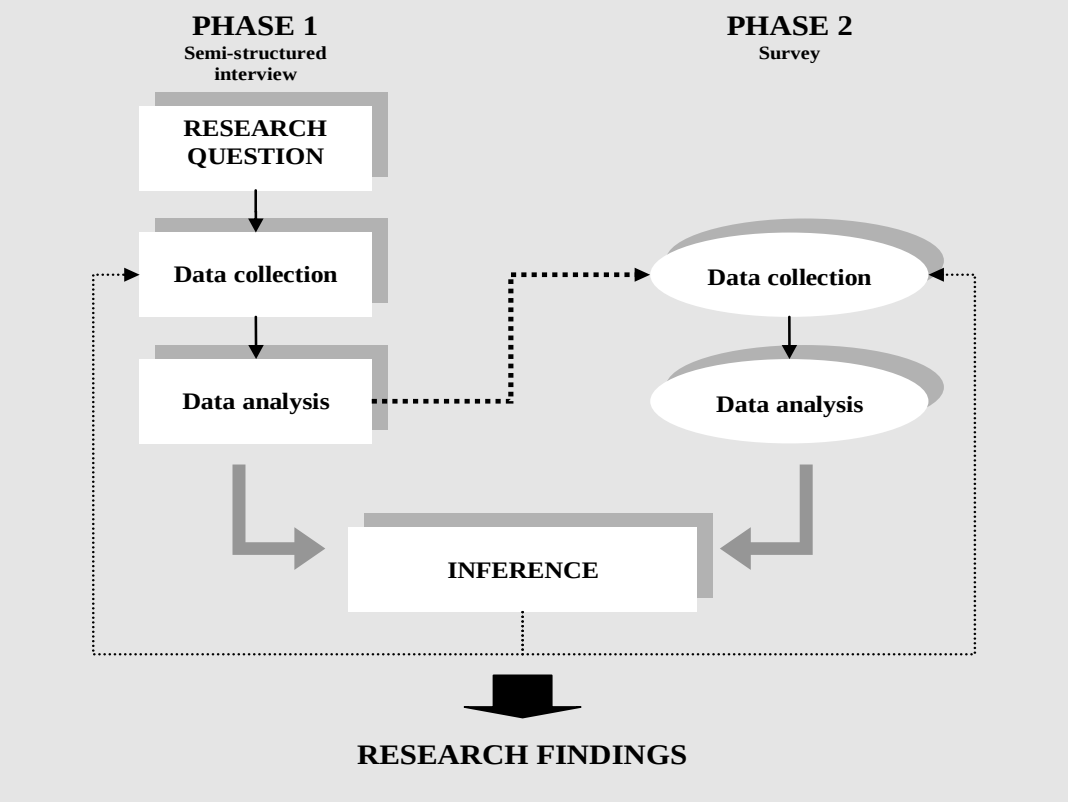


3.3 RESEARCH DESIGN

In this research, a two-phase research design was adopted using a multiple case study (first phase) and a survey (second phase). Following the development of the research questions and hypotheses of this research (highlighted in Section 1.3), the Sequential Mixed Method (Tashakkori and Teddlie, 2003) was chosen as the most appropriate for

conducting this study. The distinguishing attribute of a sequential mixed design is that the second phase of the study emerges as a result of, or in response to, the findings of the first phase. This design involves one type of question (exploratory or confirmatory), two types of data (qualitative and quantitative) that are collected in sequence (with one being dependent on the other) and analysed accordingly and one type of inference at the end (see Figure 5). The second phase of the study emerges as a response to or during the data analysis of the first phase. In the first phase, semi-structured interviews within three Slovenian transport firms were conducted. The interviewees highlighted the two key changes in operational decision-making and information quality – service quality and price offered – as the key process change outcomes due to GPS use. In order to explore the moderating effect of GPS-enabled information use on the relationship between process change outcomes and customer satisfaction, the second quantitative phase was introduced.

Figure 5: Sequential Mixed Methods Design



Source: Tashakkori and Teddlie (2003).

The various combinations of qualitative and quantitative research methods used in this research encourages methodological triangulation (Creswell, 2003). Literally, triangulation is used *"to reduce the risk that your conclusions will reflect only the*

systematic biases or limitations of a specific source or method, and allows you to gain a broader and more secure understanding of the issues you are investigating" (Maxwell, 2005). The next two sections discuss in detail the two phases of the research.

3.4 FIRST PHASE: INITIAL QUALITATIVE PHASE

Due to the early stages of research on how information stemming from the adoption of GPS may transform operational decision-making and improve firm performance, I selected an exploratory case study method (Benbasat et al., 1984). Case studies provide a source of well-grounded, rich descriptions and explanations of processes (Miles and Huberman, 1994) that are relatively poorly understood (Glaser and Strauss, 1967). In this study, I employed a multi-case design that supports a replication logic whereby a set of cases are treated as a series of experiments, each serving to confirm or disconfirm a set of observations (Yin, 1994). The next section illustrates the justification for the qualitative approach, followed by the selection of the respondents, data collection and data analysis. Lastly, it presents other data sources used in the initial qualitative phase of the research.

3.4.1 JUSTIFICATION OF THE QUALITATIVE APPROACH

Due to the dearth of general perspectives on the research topic, this initial qualitative phase was designed to explore the characteristics of the transport process and changes in operational decision-making after the adoption of GPS. Therefore, this phase required flexible ways of data collection and analysis based on primary data with the study, use and collection of a variety of empirical materials. Since qualitative methods can be used to provide important contextual information, explore specific issues inside a topic (Collis and Hussey, 2003) and investigate in more depth within a few cases (Tashakkori and Teddlie, 2003), their use was considered as the most suitable. Qualitative research is strong with regard to its mode of data collection, with emerging themes and idiographic descriptions (Cassell and Symon, 1994). Nevertheless, the collection and analysis of qualitative data are time-consuming.

In the initial qualitative phase interviews were chosen as the most appropriate research tool. When using a structured interview, the interviewee is considered as a '*subject'* like completing a questionnaire where the interviewer tries to minimise the impact of the inter-personal process on the course of the interview (Cassell and Symon,

1994). On the other hand, an unstructured interview is regarded as appropriate when exploring general topics to help reveal an interviewee's viewpoints (Potter, 1996). A semi-structured interview is considered as the most appropriate when (Easterby-Smith et al., 2002):

- the interviewer needs to understand the constructs the interviewee uses;
- the interview aims to develop the understanding of the interviewee's view so that the researcher might influence it; and
- the subject matter is highly confidential.

Since the initial phase was exploratory, the interviewee's flexibility and ability to speak and describe the answers freely as well as follow the problem and focus on the answer to the research question was required, semi-structured interviews are adopted I developed a list of themes and questions to be covered in the semi-structured interviews (Saunders et al., 2003). A detailed description of the questions included in the semi-structured interview is given in section 3.4.2.1.

3.4.2 SELECTION OF THE RESPONDENTS AND DATA COLLECTION

3.4.2.1 Semi-structured Interviews

I conducted this research in transport firms as the transport context has proven well-suited to study the benefits of information on decision-making (Mintsis et al., 2004). Uncertainty in costs, routes and dealing with distributors are challenging decision-making in transportation (Ghodsypour and O'brien, 2001). I theoretically sampled firms to fit the research focus (Eisenhardt, 1989a). The three Slovenian medium-sized transport firms all implemented the same GPS during the same year. Since adopting it they have grown in size, annual revenues and fleet size. The transport industry in Slovenia represents almost 10 percent of the country's gross domestic product and is the only industry in the country to have significantly grown in the past two years (by over 10 percent). In the EU, this sector has also grown significantly in newer EU member states and in 2012 road transport made up over one-half of freight transport in all EU member states. This industry directly employs more than 10 million people, accounting for 4.5% of total employment, and represents 4.6% of gross domestic product (GDP) (EC, 2014). Finally, within this setting I

sought firms with similarities that would aid comparisons and replication, yet with sufficient heterogeneity to help assess potential generalisability.

Although all of the firms are headquartered in Slovenia, they all conduct road transport abroad. They are differently sized and aged with annual revenues of between €6 million and €16 million. Detailed information about the firms participating in this initial qualitative phase is shown in Table 7.

Table 7: Overview of the Case Firms

Firm	Year founded	Services and specialisation	Number of employees	Annual revenue	Number of vehicles
Firm A	1978	Land transport in the EU using road trains and mega trailers, maintenance	61	€ 5,718,735	45
Firm B	1986	Land transport of frozen food	54	€ 2,745,945	39
Firm C	1990	Land transport in the EU using road trains and mega trailers, maintenance	117	€ 15,960,277	69

Source: Agency of the Republic of Slovenia for Public Legal Records and Related Services.

I first contacted five transport firms to obtain the right contact details of each firm's General Manager. Due to the increasing importance of establishing personal interaction (Marshall and Rossman, 1999), I then called the potential interviewees to explain the research topic and ask them about the possibilities of their participation. Out of five transport firms I telephoned, two firms declined participation due to the daily overburdening of the dispatchers and other employees working in the transport office.

Interviews. I conducted a total of 28 interviews with employees who were directly (e.g. dispatchers) and indirectly (administrators) involved in the transport process. I also sought information from clients. I conducted 18 interviews with clients who had used the transport services of the case firms. The interviews were conducted from December 2009 to January 2010, and in May 2011. Their length varied from 1 hour to 1.5 hours (the average length was 70 minutes). For a detailed description of the respondents' characteristics, see Table 8.

Table 8: Description of the Respondents

	For how many years have you been working in this industry?				
	5 or less	between 6 and 10	between 11 and 15	between 16 and 20	more than 20
Firm A	1	5	3	2	1
Firm B	4	2	1	1	1
Firm C	3	1	1	2	0
	For how many years have you been working for the firm?				
	5 or less	between 6 and 10	between 11 and 15	between 16 and 20	more than 20
Firm A	7	1	1	2	1
Firm B	6	2	0	0	1
Firm C	4	1	1	1	0

The interview questions focused on understanding the changes in the transport process and their impact on customer satisfaction in the customer's perspective. Using theoretical sampling, new informants were chosen so as to either confirm or challenge the emerging patterns of data. Finally, I stopped collecting data when it reached a state of theoretical saturation with respect to a particular issue. Following the Silverman (2004) guidelines for conducting the interview, I thanked the participant for their cooperation, presented the purpose of the research and stressed that confidentiality and anonymity were assured. To avoid a *"non-directive"* interview (Easterby-Smith et al., 2002), I prepared a checklist which was used as a movable structure of questions (also see the Appendix).

Before the actual interview with each of the firms and to gather all relevant information about it, I used secondary sources such as websites, annual reports and the profit evaluation of the firm prepared by the Slovenian Agency for Public Legal Records and Related Services. For a successful setting of the interview, the appropriateness of the researcher's appearance at the interview was deemed extremely important. This included selection of the right dress code, language skills and the initial impression which should all be considered by the researcher. According to the Robsons' (2002) advice that researchers should choose a similar type of dress to those about to be interviewed, in this study I selected '*casual'* dress code. Moreover, I chose a neutral tone of voice and focused mostly on open questions, which helped to avoid bias (Easterby-Smith et al., 2002). During the interviewing I focused on establishing a good relationship and a high level of trust with the

respondent. I therefore allowed the interviewees to talk freely, I put questions in a straightforward, clear and non-threatening way, I eliminated cues that could lead to a particular way of answering and gave a positive impression throughout the whole interview. Lastly, comments or non-verbal behaviour such as gestures were avoided. Careful consideration was also given to the setting in which the interviews were to take place. The interviews were mostly finished within 1.5 hours. The interviews were conducted in the respondents' work environments.

Finally, all semi-structured interviews were audio recorded and later transcribed for further analysis. The use of audio recording aids the listening process and enables the researcher to obtain meanings in the participant's own words (Powell, 1997). Before the start of each interview, I asked for permission to audio-record the interview (Robson, 2002) and stressed that the respondents had the opportunity to stop the recording at any time they felt uncomfortable with the recording (Easterby-Smith et al., 2002). The semi-structured interviews were also translated into English by the author, as it was previously emphasized as a frequently used practise (Brislin, 1976).

In this phase, so as to strengthen the research results, I also used other data sources (also see Table 9). The firms' archival materials as well as office and field observations were two additional sources of data collection.

Table 9: Data Sources

Firm	Source 1 – Semi-structured interviews	Source 2 – The firms' archival data	Source 3 – Office and field observations
Firm A	General manager (3) Quality assurance manager (1) Logistics manager (2) Dispatcher (5) Administrator (1) Client (5) Total (17)	Annual financial reports Customer satisfaction surveys Annual management review reports GPS booklets Transport reports Total: approx. 250 pages	Office and vehicle observations Total: approx. 1.5 months
Firm B	General manager (3) Logistics manager (2)	Quality manual GPS instructions and booklets	Office and vehicle observations

	Dispatcher (4) Client (7)	Process instructions Periodical financial reports Transport reports	
	Total (16)	Total: approx. 200 pages	Total: approx. 3 weeks
Firm C	General manager (3) Transport manager (1) Dispatcher (3) Client (6)	Annual financial reports Annual management review reports Quality manual Process instructions GPS booklets Transport reports	Office and vehicle observations
	Total (13)	Total: approx. 400 pages	Total: approx. 1 month

3.4.2.2 Archival Material

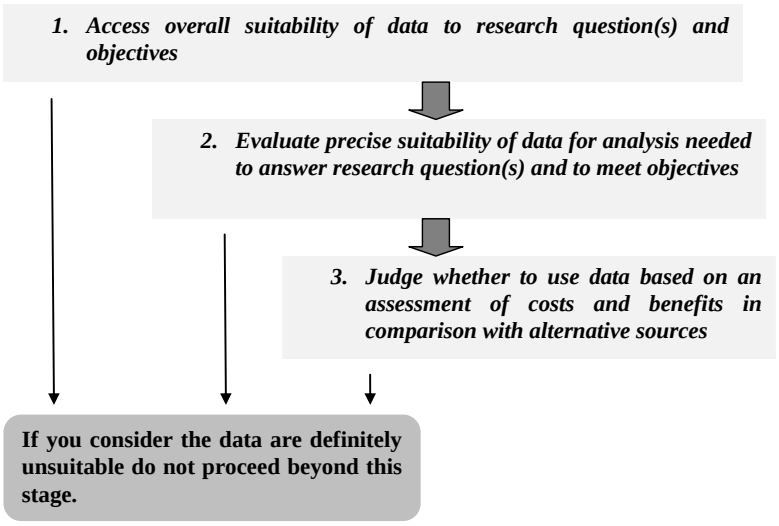
I established a very good idea about the transport process before and after the use of GPS by collecting archival material for the following reasons (Patzer, 1995, Silverman, 2004):

- it may have fewer resource requirements especially in terms of time and money;
- it enhances the efficiency of gathering, analysing and reporting the primary data;
- due to time constraints it provides the only possibility to perform a longitudinal study; and
- it allows the findings from the data collected by the researcher to be triangulated.

For all these reasons, annual financial reports, GPS booklets, transport reports, quality manuals and process instructions were examined. All three firms also implemented the ISO 9001 quality standard and therefore the quality manual and process flows were available to examine. I focused on the documentation used when carrying out the transport process before and after employing GPS. Handbooks that included instructions on the operation and handling of GPS were also collected. Before the collection, the researcher

followed Saunders' (2003) process of evaluating potential secondary data sources (also see Figure 6).

Figure 6: Evaluating Potential Data Sources



Source: Saunders et al. (2003).

3.4.2.3 Office and Field Observations

In this phase, I also employed '*focused observation'* where *"the researcher looks only at material that is pertinent to the issue at hand, often concentrating on well-defined categories of group activity"* (Denzin and Lincoln, 2005). Before the actual start of the interview, I told each of the participants that the observation would be one part of the research process (Ackroyd and Hughes, 1992).

Over a period of two months I recorded the following activities and organisational processes:

- transport office observations which included observations of how the transport service was being organised with use of GPS;
- separate observations of how the office GPS software application was performing;
- participation in actual organisation of the transport service; and
- observations of the operation of the GPS system in the vehicle.

3.4.3 DATA ANALYSIS

My data analysis was iterative. Following Glaser and Strauss (1967) and Miles and Huberman (1994), systematic, iterative comparisons of data, emerging categories and existing literature aided the development of an integrative theoretical framework.

Stage 1: Isolating broad categories within each case. From the data, I first compiled separate case studies of each firm. I identified patterns and variances in descriptions of how information stemming from the adoption of GPS had transformed operational decision-making and examined the underlying mechanisms that linked the GPS-enabled information to improvements in firm performance. To assess the reliability of the generated open codes, I then involved a second coder who has considerable qualitative research experience. Disagreements were resolved through discussion between the first author and the second coder.

Stage 2: Linking related concepts within each case. During this stage, I examined all conclusions derived from the initial coding and established links between and among previously stated categories, a process known as selective coding. I allowed concepts and patterns to emerge based on the collected primary data, while new categories were added and others were regrouped when further interviews were analysed (Cassell and Symon, 1994).

Stage 3: Cross-case comparisons. To enhance the generalisability (Firestone and Herriott, 1983) as well as to deepen the understanding and explanation (Glaser and Strauss, 1967), I compared each category and its properties across the cases. My main intent was to compare and contrast changes in the operational decision-making amongst the three case firms. To assess the reliability of each dimension, I firstly involved the second coder. All disagreements were resolved through discussion. Secondly, I shared the results of the initial analysis with key informants at the three case firms and an independent professional in the field to assess whether the conclusions reached were plausible.

Stage 4: Connecting emergent themes and ideas with the theoretical concepts from the literature. My data analysis moved back and forth between the emerging themes and existing literature to explore broadly possible explanations of my findings and enable a

focus on the explanation that best fits the data, which Yin (2003) called explanation building.

The collected archival material went through a rigorous process of verifying the overall and precise suitability of the available data. I addressed the issue of measurement validity, by selecting the data that provide the information which answers the research question or meets the research objectives (Kervin, 1999). Moreover, the coverage criterion, which requires that the population about which I needed the data was covered, was satisfied by the collection of materials from the leading transport firms in Slovenia. I first ensured that unwanted data were excluded and then that sufficient data were further used for the analysis (Hakim, 2000).

Taking into consideration the information that every firm included in this study is a well-known, medium-sized and fast-growing Slovenian transporter, it was evident that the archival material collected is likely to be reliable and trustworthy (Dochartaigh, 2002). Moreover, a clear explanation of the methodology used (including sampling techniques, response rates and method of analysis) and the validity and reliability of the collection methods for the survey data were thereby secured (Miles and Huberman, 1994).

3.4.4 RESEARCH TRUSTWORTHINESS OF THE QUALITATIVE PHASE

A number of data quality issues were identified in this research. I followed the quality or trustworthiness criteria for quality research within the realism paradigm, which are briefly described in the following table (see Table 10).

Table 10: Trustworthiness Criteria of the Initial Phase of the Research

Trustworthiness criteria	**Description of criteria**	**Criteria for qualitative research**	**Method of addressing in this study**
Ontological appropriateness	Selection of the research problem	/	• The research problem deals with complex social science phenomena • Participants see the outside world as independent of their beliefs
Contingent validity	Theoretical and literal replication	Internal validity/ Credibility	• The triangulation of the methods produced generally harmonious conclusions • The findings are internally consistent and systematically interconnected
Multiple perceptions of the	The research includes multiple	Objectivity	• The methods and procedures used in this research are described in detail

Trustworthiness criteria	Description of criteria	Criteria for qualitative research	Method of addressing in this study
participants	interviews, supporting the evidence		• The researcher avoided potential personal assumptions • The research data were also analysed by other researchers • Conclusions were established based on displayed data
Methodological trustworthiness	Trustworthy – the research can be audited	Reliability	• Interview bias was minimised by avoiding unnecessary comments, tones or non-verbal behaviour • Non-directive probing questions were used • A second coder was involved in the analysis part • Analytic constructs were clearly described and specified by the researcher
Analytical generalisation	Defining the research issues before the data collection and development of the interview protocol	External validity	• The interview protocol was developed before the interviews were conducted • Characteristics or the original sample of participants, settings and processes were transparently described • The researcher established responsive interaction between the interviewer and respondent • Topics were covered from a variety of angles
Construct validity	Use of prior theory, triangulation	/	• Data gathered from semi-structured interviews, archival material and observations

Source: Developed based on Healy and Perry (2000).

To begin with the ontological appropriateness, an objective view of the reality is considered as suitable for this research problem. First, the research problem deals with complex social science phenomena and, second, the participants see the outside world as independent of their beliefs. A more detailed explanation of the ontological consideration is given in section 3.2.

The second criterion also refers to ontology and seeks the *"control that the experimenter has over the experiment, including the extraneous variables"* (Powell, 1997). In other words, internal validity perceives the independent variable as a facilitator of the effect on the dependent variable. It asks us whether a research design has been developed that can eradicate the bias and effect of irrelevant variables (Easterby-Smith et al., 2002). Among other possibilities, this criterion can be verified through the richness and meaningfulness of the research descriptions, the conclusions drawn upon the triangulation

of the methods, the linkage of the categories with prior or emerging theory and the consistency of the research findings (Miles and Huberman, 1994). In order to satisfy this criterion, I examined the research findings with the triangulation of the research methods to assure internal steadiness and a systematic connection of the findings.

Multiple perceptions of a single reality in qualitative realism research include the selection of multiple data resources to provide the objectivity of the research (Healy and Perry, 2000) by achieving reasonable freedom from complicated researcher biases and other predictable biases that subsist (Miles and Huberman, 1994). Especially in qualitative research, rather than managing the variables, objectivity is the readiness and openness to listen to and observe the respondents (Strauss and Corbin, 1998). Notwithstanding that a state of absolute objectivity is impossible and that in all qualitative or quantitative research the sound of subjectivity exists, in this research I assured the objectivity through the detailed and complete preparation for the interview procedures, avoiding potential personal assumptions, establishing conclusions based on the displayed data which were also examined by an external examiner.

The reliability issues, which concern whether alternative researchers would reveal similar information (Easterby-Smith et al., 2002), were related to interviewer bias and interviewee or response bias. I minimised the interviewer bias by avoiding unnecessary comments, tones or non-verbal behaviour which might have an impact on the interviewees' responses. Moreover, I also steered clear of my own beliefs and ideas through the question asked. In addition, when exploring and seeking explanations of certain sensitive themes I did not seek concrete answers (Saunders et al., 2003). Conversely, I used '*non-directive'* probing questions that allowed the respondents to answer freely and without constraints. Finally, the time-consuming requirements of the interview process which can lead to sample bias were carefully considered (Robson, 2002) and a second coder was involved in the analysis part.

I also needed to know whether the conclusions and findings of the study hold any greater significance, if they are usable in other contexts and to what extent they can be generalised (Miles and Huberman, 1994). External validity which answers these questions refers to the *"generalizability of a research finding, for example, to other populations, settings, treatment arrangements, and measurement arrangements"* (Powell, 1997).

Generalisability can be made at three levels: from the sample to a population, analytic and case-to-case transfer (Miles and Huberman, 1994). To achieve the external validity criterion, I developed the interview protocol as well as transparently described the participants, settings and processes of the interviews (Miles and Huberman, 1994). Last but not least, during the interviews I focused on establishing an atmosphere for a flexible and responsive interaction between the interviewer and respondent to allow meanings to be probed and topics to be covered from a variety of angles (Healey and Rawlinson, 1994).

Finally, there is the issue of construct validity which deals with whether the chosen research methods are truthful measures of reality (Easterby-Smith et al., 2002). The research instrument should be capable of measuring a construct in the proper way, including logical judgment and external criteria (Powell, 1997). Therefore, a key proposition for achieving construct validity is to use various data sources (Easterby-Smith et al., 2002). In order to meet these requirements, I employed three data sources: semi-structured interview, archival material and observations. The purpose of the qualitative phase was exploratory and thus the mathematical or statistical conclusions were not drawn up to the conclusions.

3.5 THE SECOND PHASE – QUANTITATIVE PHASE

During the qualitative phase, informants from all three transport firms described how the adoption and later use of GPS has brought many changes to the transport process, which are particularly seen through the change in controlling of the transport service and both sending and receiving information from the driver. Moreover, the respondents also highlighted that the information used in operational decision-making facilitates a shift towards more collaborative decision-making in the supply chain (among the transport firm, client, maintenance firm etc.) and a shift from intuitive towards fact-based decision-making. Following the initial phase, in the second quantitative phase our aim was to elaborate how the process change outcomes after the adoption of GPS directly and indirectly affect customer satisfaction. The following sections present the justification of the quantitative approach, the measurement items, instrument development, data collection, development of the structural and measurement model, the method of analysis and limitations of the methodology.

3.5.1 JUSTIFICATION OF THE QUANTITATIVE APPROACH

In line with the Sequential Mixed Methods design, the quantitative phase followed after the execution of the qualitative phase (Tashakkori and Teddlie, 2003). The purpose of this design is to use quantitative data to assist the interpretation of the qualitative findings to allow a better exploration of the phenomena.

For quantitative data collection self-administered survey research was chosen which has often been used to capture data from business organizations. Survey research is prominent as a methodology that has been used to study unstructured organizational problems (Malhotra and Grover, 1998).

3.5.2 MEASUREMENT ITEMS

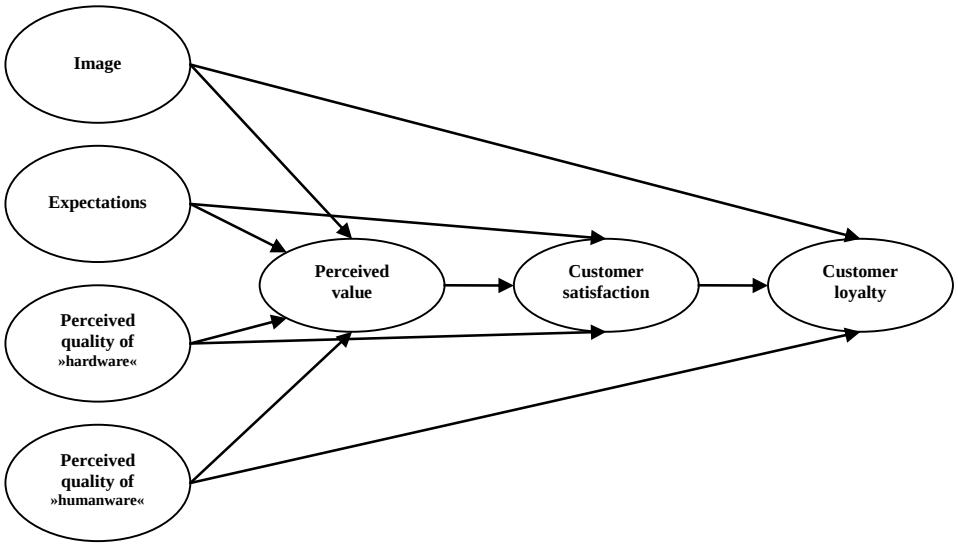
All constructs of our measurement model were measured in a reflective way. In fact, prior studies provide good support for reflectively measuring our latent constructs. For example (Johnson, 1995, Johnson et al., 2001, Flint et al., 2011) argue that customer satisfaction should be operationalised as a latent variable using a variety of proxies that evaluate performance relative to the different standards that customers use in the course of their purchase and consumption experience. In the B2B service context, Lam et al. (2004) advise that the customer satisfaction construct should be measured in a reflective way. Similarly, various studies from the B2B customer satisfaction research field employ reflective measures for price quality (Tracey et al., 1999, Homburg et al., 2014, Papassapa et al., 2009), and service quality (Lam et al., 2004, Spiros, 2005) latent variables.

3.5.2.1 Customer Satisfaction

The measurement of customer satisfaction has seen dramatic growth in the past 15 years. Although the customer satisfaction construct has been researched in many studies (see Fornell, 1992, Hackl and Westlund, 2000, Krishnan et al., 1999, Kristensen et al., 1999, Mai and Ness, 2006, McKinney et al., 2002, Szymanski and Henard, 2001, Yoon and Suh, 2004, Mithas et al., 2008), there is no consensus on how to measure it. The basic model for estimating customer satisfaction is the structural equation model developed by Fornell (1992) which links customer satisfaction to its determinants, namely perceived quality, customer expectations and perceived value. According to Fornell (Fornell, 1992), the Swedish Customer Satisfaction Barometer (SCSB) introduced in 1989 was the first

national cross-company and cross-industry measurement instrument of customer satisfaction (Fornell, 1992). The successful experiences of the Swedish and later US customer satisfaction indices have inspired recent moves to create a European Customer Satisfaction Index (ECSI) (Kristensen et al., 2000). The model links customer satisfaction to its determinants and, in turn, to its consequence, namely customer loyalty (also see Figure 7).

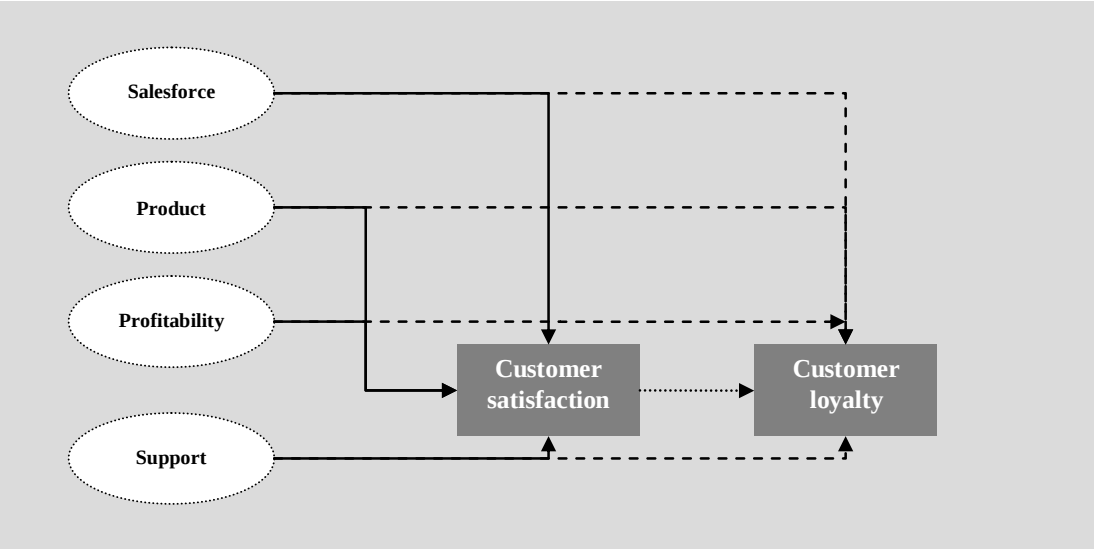
Figure 7: The Basic ECSI Model



Source: Kristensen et al. (2000).

However, customer satisfaction has been measured differently in various industries. For example, in the health care industry customer satisfaction is measured through perceived quality which includes a willingness to recommend the hospital to others, satisfaction with the doctors and nurses, and treatment with dignity, respect and compassion (Devaraj and Kohli, 2000). In financial services, customer satisfaction is measured by branch service satisfaction, automated telephone service satisfaction, product line satisfaction and financial report satisfaction (Krishnan et al., 1999) while, in contrast, in the retail industry (see Figure 8) customers identify how salesforce, product, profitability and support affect the long-term perspective between the supplier and retailer (Biong, 1993).

Figure 8: Conceptual Model for Testing Satisfaction and Loyalty



Source: Biong (1993).

Finally, in the food industry two customer satisfaction measurement models exist. The first one includes measures such as: enquiry service, product selection, product quality, price, catalogue presentation, delivery service, ordering process and payment terms (Mai and Ness, 2006), while the second one recognises food quality, service quality and price/value as core measures of fast food restaurants (Hong Qin, 2008).

The construct of customer satisfaction is also of importance both theoretically and managerially in industrial markets. Therefore, several attempts to measure it have been made in the past (see Dwyer et al., 1987, Tracey et al., 1999). While research in the consumer goods area typically relates satisfaction to a single distinct transaction (Cardozo, 1965, Churchill and Surprenant, 1982), research in industrial marketing has emphasised the importance of customer-supplier relationships (Håkansson, 1982). First, a complete attempt to measure customer satisfaction or more precisely the customer-supplier relationship was made by Homburg and Rudolph (2001) who clarified that *"customer satisfaction in industrial marketing should be understood as a relationship-specific rather than a transaction-specific construct"*. Based on theoretical grounds they developed seven satisfaction dimensions: satisfaction with products, satisfaction with salespeople, satisfaction with product-related information, satisfaction with order handling, satisfaction with technical services, satisfaction with interaction with internal staff, and satisfaction with complaint handling (see Figure 9).

Figure 9: Causal Model Relating the INDSAT Factors to Overall Customer Satisfaction

Source: Homburg and Rudolph (2001).

Homburg and Rudolph (2001) employed a 29-item scale and suggested that in situations where customer satisfaction is one of several other constructs under investigation, the use of a complete scale is not a viable alternative. In such situations, summarising each of the seven dimensions may be a reasonable compromise between the use of the full scale and the use of more primitive single-item measures (Homburg and Rudolph, 2001). They also suggest that if researchers are not interested in analysing the full range of industrial customer satisfaction but only a limited part of it, the scales developed for the different dimensions of customer satisfaction may be used. In line with this research I am using the six dimensions of customer satisfaction presented in Table 11.

For the purpose of this study, I do not use the fifth variable *"satisfaction with technical services"*, which refers to satisfaction with the speed of availability of the service staff, the technical quality of the service provided, and the price/value ratio of the supplier's service. Since the transport firms' customers do not directly interact with GPS, they are unable to evaluate the technical attributes of this application. In this research, an industry-specific language and question structure is used (Wilson, 2002).

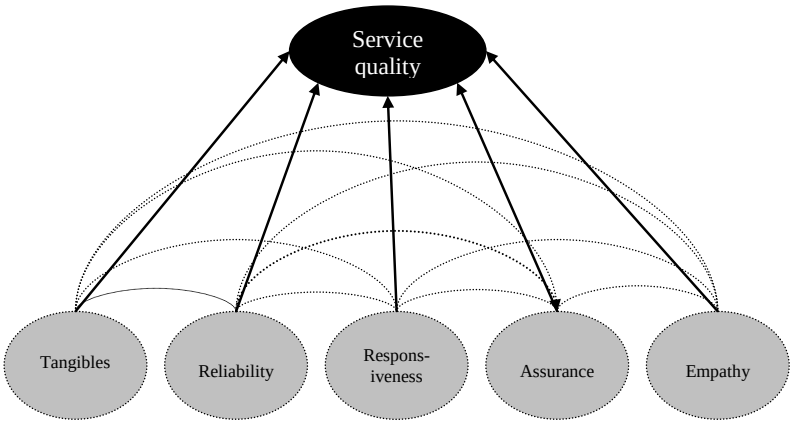
Table 11: Customer Satisfaction Measurements

Construct	Variable	Indicator
Customer Satisfaction (CS)	CS1	Satisfaction with the transport service
	CS2	Satisfaction with the salespeople
	CS3	Satisfaction with transport services-related information
	CS4	Satisfaction with order handling
	CS5	Satisfaction with interaction with the internal staff
	CS6	Satisfaction with complaint handling

3.5.2.2 Perceived Service Quality

The most widely used service quality measurement framework is SERVQUAL developed by Parasuraman et al. (1988). SERVQUAL was designed to measure service quality across a range of businesses and industries. Parasuraman et al. (1988) conceptualised a customer's evaluation of overall service quality as the gap between expectations and perceptions of service performance levels. Further, they proposed a five-dimensional construct: (1) tangibles; (2) reliability; (3) responsiveness; (4) assurance; and (5) empathy as measures of overall service quality performance (also see Figure 10). The SERVQUAL instrument suggests that a negative gap between perceptions and expectations will result in customer dissatisfaction, and a positive gap will result in satisfaction. However, SERVQUAL has not avoided criticism, theoretically as well as operationally (Buttle, 1996). Asubonteng et al. (1996) criticise (following a critical review of 18 service quality empirical studies) the underlying SERVQUAL dimensions which are likely to be industry-specific.

Figure 10: SERVQUAL – Service Quality



Source: Cronin and Taylor (1994).

Yet, subsequent research efforts cast doubt on the utility and appropriateness of the disconfirmation paradigm advocated by Parasuraman et al. (1985). Hence, theoreticians incorporated the original five dimensions and 22 items, although the gap scales were replaced with a perception that measures service quality (Cronin Jr and Taylor, 1994). In accordance, they developed an instrument of service performance (SERVPERF) that seems to produce better results than SERVQUAL (Asubonteng et al., 1996). My research accepts these conclusions and adopts the performance based SERVPERF paradigm (see Table 12).

Table 12: Service Quality Measurements

Level	Variable	Description
Tangibles	SQ1	The company has up-to-date equipment.
	SQ2	The company's physical facilities are visually appealing.
	SQ3	The company's employees are well dressed and appear neat.
	SQ4	The appearance of physical facilities of the company is in keeping with the type of services provided.
Reliability	SQ5	When the company promises to do something by a certain time, it does so.
	SQ6	When you have problems, the company is sympathetic and reassuring.
	SQ7	The company is dependable.
	SQ8	The company provides its services at the time it promises.
	SQ9	The company keeps its records accurately.
Responsiveness	SQ10	The company does not tell customers exactly when services will be performed.
	SQ11	You do not receive prompt service from the company's employees.
	SQ12	Employees of the company are not always willing to help customers.
	SQ13	Employees of the company are too busy to respond to customer requests promptly.
Assurance	SQ14	You can trust the employees of the company.
	SQ15	You feel safe in your transactions with the company's employees.
	SQ16	Employees of the company are polite.
	SQ17	Employees get adequate support from the company to do their jobs well.
Empathy	SQ18	The company does not give you individual attention.
	SQ19	Employees of the company do not give you personal attention.
	SQ20	Employees of the company do not know what your needs are.
	SQ21	The company does not have your best interest at heart.
	SQ22	The company does not have operating hours convenient to all their customers.

Source: Cronin and Taylor (1994).

For the purpose of this study and building on the preliminary phase, the semi-structured interviews with respondents in the transport firms and the transport firms' customers, selected questions were included in the final questionnaire. While customers evaluated perceived service quality, those questions that cannot be evaluated by customers were left out. The final perceived service quality measurement framework is presented in Table 13.

Table 13: Perceived Service Quality Measurements

Construct	Variable	Indicator
Perceived Service Quality (SQ)	SQ1	When the company promises to do something by a certain time, it does so.
	SQ2	When you have problems, the company is sympathetic and reassuring.
	SQ3	The company is dependable.
	SQ4	The company provides its services at the time it promises.
	SQ5	The company keeps its records accurately.
	SQ6	You can trust the employees of the company.
	SQ7	You feel safe in your transactions with the company's employees.
	SQ8	Employees of the company are polite.
	SQ9	Employees get adequate support from the company to do their jobs well.

3.5.2.3 Perceived Price Offered

To date, few attempts have been made to measure perceptions of price offered. Put briefly, Hahn et al. (2002) measured price in a study of unobserved customer heterogeneity using overall value, the competitiveness of prices, and frequency of sales. Moreover, focusing on a variety of industries, Soriano (2002) in his research into the Spanish restaurant sector used food and wine price competitiveness to measure the cost/value of a meal. In addition, in fast food restaurants customers perceive price as a value of the service/product (Gilbert et al., 2004), price competitiveness, price-value worthy and special discounts (Hong Qin, 2008).

In the manufacturing and service sector, Tracey et al. (1999) measured price offered with the use of price competitiveness and price warranty. To measure perceptions of the price offered, I adopted the previously researched and validated indicators provided by Tracey et al. (1999). The content of the measures is therefore presented in Table 14.

Table 14: Perceived Price Offered Measurements

Construct	Variable	Indicator
Competitiveness	PO1	The firm offers competitive prices for its services.
	PO2	The firm is able to offer prices as low as its competitors.
Warranty	PO3	The firm guarantees its prices.

Source: Tracey et al. (1999).

3.5.2.4 Perceived GPS-enabled Information Utilisation

The measurement scale of perceived GPS-enabled information utilisation was compiled by drawing on similar earlier studies by Boyer et al. (1997), Sánchez-Rodríguez et al. (2006), Swamidass and Kotha (1998), and Marett et al. (2013) and adapted to the industry under study (see the initial qualitative phase results in section 4.1). Face validity of the GPS measure was obtained through expert judgment; other forms of validity (convergent, discriminant and nomological) are assessed in the results section.

The content of the measures is presented in Table 15 below.

Table 15: Perceived GPS-enabled Information Utilisation Measurements

Construct	Variable	Indicator
Perceived GPS-enabled Information Utilisation	GPS1	To encourage your employee involvement to improve work processes
	GPS2	To improve communications between the transport firm and your
	GPS3	To improve ordering process
	GPS4	To enable staff to share task-related information with your employees
	GPS5	To collect data about work/production processes needed by you
	GPS6	To provide reports and diagrams based on GPS enabled information for you
	GPS7	To provide timely information to you for decision-making
	GPS8	To provide relevant information to you that meets your needs

3.5.2.5 Structural controls

In addition to the constructs discussed above, two control variables that represent structural characteristics of firms are included in this research model: the size of the firm (customer) and the industry to which it belongs. Prior industrial marketing management literature has suggested that firm size may have a significant impact on industrial relationships (Droge and Germain, 2000). For example, larger transport service customers

may have different requirements and hold different expectations regarding the transport service than smaller customers. Thus, it is important to control for the impact of firm size on industrial customer satisfaction. Further, customers' expectations of transport firms' services may differ across industries and this may influence their satisfaction with the transport service provider (Giannopoulos, 2004). I therefore also control for the impact of industry on the customer satisfaction with a transport service provider.

3.5.3 INSTRUMENT DEVELOPMENT

I started developing the questionnaire by building on the previous theoretical basis in order to ensure content validity. The development process went through four rounds of modification to determine the questions and format to be used prior to pre-testing the instrument. In the first round, the initial set of questions from the reviewed literature was included. Then, in the second round, the content of the questionnaire was reviewed by researchers from the field who provided suggestions regarding individual parts of the questionnaire, specifically service quality, price offered, customer satisfaction and GPS-enabled information utilisation. In this round, questions regarding a theoretically unrelated construct, namely job satisfaction, were also included. I included the *Job satisfaction* construct for the purpose of testing the common method bias; with its inclusion it is possible to adjust the correlations among the principal constructs later in the analysis (Lindell and Whitney, 2001). In the third round, I reviewed suggestions made by the customers interviewed in the qualitative phase of the research to further modify the questionnaire, especially the parts concerning GPS and customer satisfaction. In the fourth round, the instrument was reviewed once again by two independent academic researchers to make sure all aspects had been satisfactorily covered and to reorder some questions previously exposed as not being clear enough by the customers. Finally, in the fifth round the questionnaire was reviewed to fulfil ethics requirements and later approved by the university.

The survey items were based on existing items from validated instruments found in the research literature and on and on items not previously used together within a measurement instrument. Many survey items from validated instruments had been widely confirmed in a variety of populations and organisational settings, while others had been validated in more limited contexts.

When drafting the closed questions I adopted the following Easterby-Smith et al. (2002) general rules for structuring the questions or statements:

- *make sure that the question is clear;*
- *avoid any jargon or specialist language;*
- *avoid negatives;*
- *avoid personal questions;*
- *avoid asking two questions in one item; and*
- *avoid leading questions which indirectly suggest what the right answer might be.*

I also assured that the words of the questions were consistent with the respondents' level of understanding (Forza, 2002). Cooper & Schindler (2003) recommend that answers to four types of questions may be collected when utilising surveys to conduct research: administrative questions, filtering questions, target questions, and classification questions. First, administrative questions, which provide basic identifying information regarding the participants, are rarely asked of a participant but are necessary to study patterns within the data and identify possible sources of error (Cooper and Schindler, 2003). However, for this study, answering administrative questions was not compulsory for the participants since I wanted to assure the confidentiality of those participating in the research. Second, filtering questions may be used to screen respondents with respect to their qualifications for participating in a study (Cooper and Schindler, 2003). Nonetheless, the introductory letter explained who the potential participants in the study are, while the questionnaire included questions to profile the participants in terms of education, years at present employer, years in the industry, and working field. Moreover, target questions which *"address the investigative questions of a specific study"* (Cooper and Schindler, 2003) are presented in section 3.5.2. I used a structured questionnaire with 7-point Likert scales for all the constructs. A 7-point Likert scale was used since a scale above 5 points generally shows higher convergent and discriminant validity than a 5-point scale, and greater explanatory power for the main variables, thus confirming higher nomological validity (Coelho and Esteves, 2007). Cooper & Schindler (2003) further suggest that target questions be

arranged and grouped logically with clear transitions between groups. The first group of target questions measured service quality. Therefore, the participants were instructed to consider the level of service quality of the transport service provider with whom their firm had the strongest relationship. The second group of questions measured different aspects of price offered and hence the participants were asked to think about various aspects of price competitiveness and warranty by the transport firm. In the third and final set of target questions the participants were first asked to rate their satisfaction with the transport firm and then to assess the level the importance of GPS-enabled information utilisation in the business operations of that specific transport firm, namely for improved communications, ordering process, for sharing task-related information, quality of such information, and to provide reports. Last but not least, classification questions which allow responses to be grouped for analysis according to demographic criteria or other categories (Cooper and Schindler, 2003) were included in this questionnaire to collect information about the firm (economic activity, headquarters, number of employees etc.) and the participant (gender, age, education etc.).

3.5.4 SELECTION OF THE RESPONDENTS

The target population for this study was all Slovenian export firms that utilise transport services. This is a particularly good setting to study how IT-enabled information influences the formation of industrial customer satisfaction. Slovenia has a long tradition in the road transport sector (Transport industry in Slovenia: Business Report 2014). The transport industry in Slovenia represents almost 10% of the country's gross domestic product and is the only industry in the country to have grown significantly in recent years. From an IT perspective, Slovenia exhibits wide utilisation of IT systems for transport and logistics management, such as applications for fleet control, GPS, and transport communications (ICT and e-Business Impact in the Transport and Logistics Industry, 2008). To obtain a comprehensive list of export firms that show transport activities in their profit and loss account we merged records from two sources. First, the target population for this study was all Slovenian export firms included in the Official Slovenian Exporters directory maintained by the Chamber of Commerce and Industry of Slovenia in cooperation with the Public Agency of the Republic of Slovenia for Entrepreneurship and Foreign Investments (JAPTI). The database was obtained on 24 June 2010 and included 4,463 potential respondents. The volume of transport costs spent in 2009 was a second

criterion for selecting the respondents. I therefore contacted the Agency of the Republic of Slovenia for Public Legal Records and Related Services (AJPES) which provided the database of all Slovenian firms that use transport services and actually have transport costs shown in their profit and loss account. The second database was obtained on 28 June 2010. According to all the information I received, I then merged the first and second databases and filtered out only firms that fit both criteria (export products and services to other countries and use transport services). At the time of gathering data for this study, out of the total 4,463 potential respondents 1,377 were finally eligible for inclusion in the target population.

The informants were contacted: 1) directly via email, when their email address was publicly available; 2) if their email address was not publicly available, then they were contacted through the general departmental email address listed as the contact for transport services in their export firm; and 3) if neither 1 or 2 were available, they were contacted through the general contact email of the target export firm. In a cover letter accompanying the email, respondents were informed about the objectives of the study, their voluntary participation, anonymity, and the confidentiality of their responses. Respondents were asked to focus on (a) the transport service provider with whom their firm had the strongest relationship and (b) the utilization of information in the transport process enabled by GPS technology.

3.5.5 PRETESTING AND PILOT TESTING

Prior to administering the questionnaire to participants from the target population pre-testing was conducted using a focus group involving one academic interested in the field and three employees in the firms (Forza, 2002) that order transport services who did not complete the questionnaire later (Van der Velde et al., 2004). The pre-testing was also used to assure face validity (Forza, 2002). An important outcome of the pre-testing was the exclusion of certain measures from the questionnaire (e.g. items included in the GPS-enabled information utilisation measurement framework) since they were believed to be sufficiently represented by other measures. Moreover, the pre-testing also considerably helped the researcher understand the meaning of the questions for the respondents (Robson, 2002), and the content of the terminology used (Hensley, 1999). The final version of the questionnaire is presented in the Appendix.

Apart from the pre-testing, a pilot study was conducted for the purpose of identifying potential problems and anomalies which would consequently require corrective actions (Smither and London, 2009). Pilot tests are recommended for all fixed design research studies as a way to estimate the appropriateness of the overall study design and instrument design (Cooper and Schindler, 2003, Robson, 2002). In particular, Moore and Benbasat (1991) recommend that participants in a pilot study are asked to comment on the length, wording and instructions for using the instrument. For this research, a pilot study was conducted by administering the questionnaire to a small subset of the study's population and by then asking those participants to comment on those aspects of the instrument suggested by Moore and Benbasat (1991). The pilot study sampling frame included personal contacts who use transport services for their business. Qualitative data collected in response to the request for feedback were assessed to determine whether adjustments to the instrument design or its administration were warranted prior to proceeding with the full study. A full explanation of the data collection in the quantitative phase is given in the next section.

3.5.6 DATA COLLECTION

In summer 2010, empirical data for this research were collected by means of a web-based survey. I first sent the questionnaire by e-mail for the following reasons (Bryman and Bell, 2003, Forza, 2002, Schonlau et al., 2002): (1) web surveys are conducted faster than mail or phone surveys; (2) they do not include unnecessary costs for data entering and coding since the data are obtained electronically; (3) they can provide a better response rate; (4) they remove the need to return the questionnaire by post; (5) they can offer a much nicer appearance; (6) they can reduce interviewer bias; and (7) some groups of respondents may feel more comfortable completing the questionnaire online. Questionnaires were addressed to clients' employees (1 employee per client firm) responsible for organising transport services. These employees usually work in the export/import department, purchasing or customer services. All selected participants received the web questionnaire, with an introductory letter explaining the purpose and goals of the research with a link to the web questionnaire (Schonlau et al., 2002). In the introductory letter, I also noted that the related ethical issues had been carefully considered (A. Bryman & Bell, 2003) through the assurance of complete confidentiality and

anonymity of the answers sent. The web survey was hosted on a server operated by my home institution.

To increase the response rate, Robson (2002) recommends up to three follow-up reminders. Consequently, follow-up surveys were sent out five weeks after the initial call and resulted in an additional 31 responses. I followed the approach of Prajogo and McDermott (2005) and discounted the number of "return to sender" mails so the final response rate was 14.09%. The profile of respondents by industry type, average number of employees and sales in 2010 are presented in Table 16, Figure 11 and Figure 12. Given that non-profit organisations were excluded from the study, the sample is an adequate representation of the population of Slovenian export firms.

Table 16: Profile of Respondents by Industry Type

Economic activity	**%**
Wholesaling/retailing	31.63
Miscellaneous manufacturing	25.00
Transportation/equipment services	13.78
Chemicals/rubber/mining	6.63
Food and drug processing	3.06
Electronics/telecommunications	2.04
Marketing services	1.02
Financial	0.51
Healthcare	0.51
Other, please specify	15.82

Figure 11: Average Number of Employees in 2010 in respondents' firms

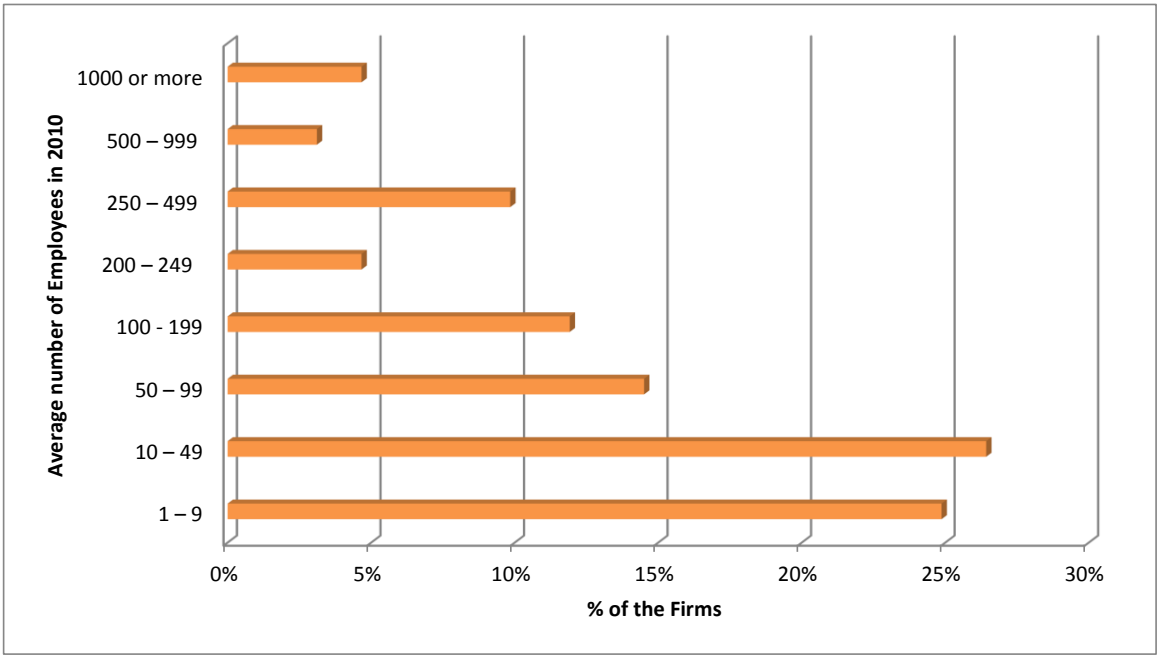
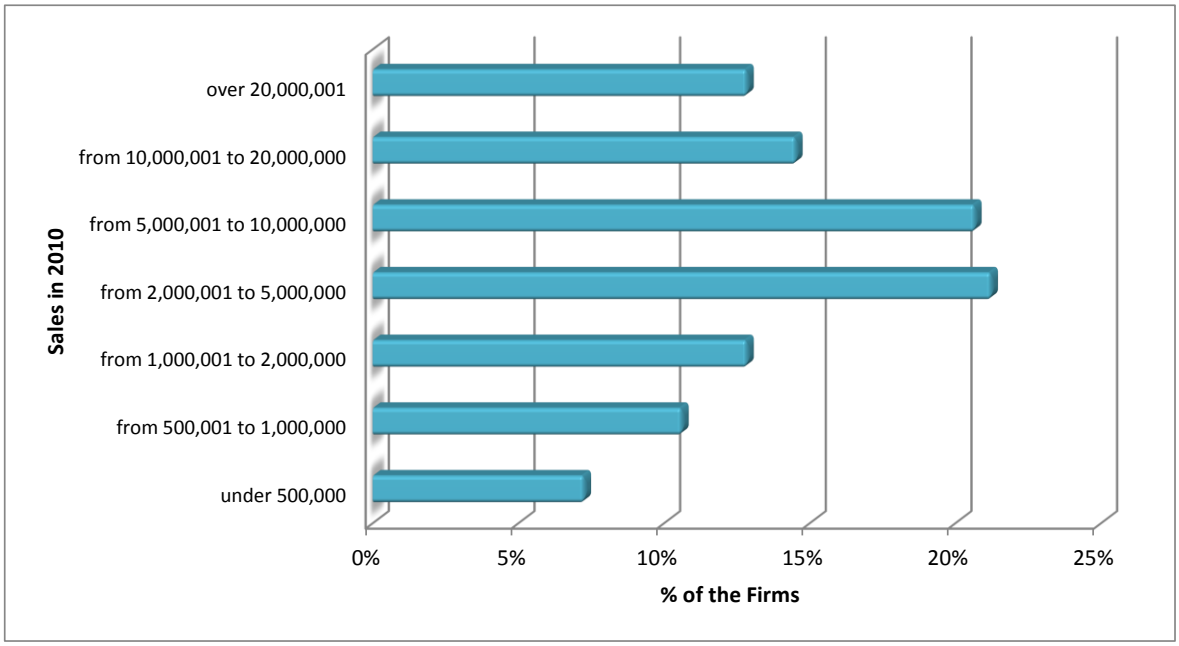


Figure 12: Sales in 2010 in euros



Upon the conclusion of the survey, the data were retrieved by the researcher from the server in the form of an Excel spreadsheet, which was then used as a data source for further analysis. The chosen method of analysis is presented in the following section.

3.5.7 DEVELOPMENT OF THE STRUCTURAL AND MEASUREMENT MODEL

A structural (inner) model relates the constructs to each other. It can be described as a set of one or more dependence relationships linking the model constructs (Gefen et al., 2000). A measurement (outer) model consists of the relationships between the indicators and the construct which they measure (Stan and Saporta, 2005). In a measurement model the researcher specifies which indicators define each construct (Hair et al., 1998). The pattern of loadings of the measurement items on the constructs were specified explicitly in the model. Then, the fit of the pre-specified model was assessed to determine its construct validity.

The proposed model included 26 measures (manifest variables) loading on to 4 latent constructs: (1) Service Quality; (2) Price Offered; (3) Customer Satisfaction; and (4) GPS-enabled information utilisation (Stan and Saporta, 2005).

3.5.8 METHOD OF ANALYSIS

The data were analysed using structural equation modelling ("SEM"). SEM techniques provide researchers with a comprehensive means for assessing and modifying theoretical models and have become increasingly popular in information systems research because they offer great potential for furthering theory development (Gefen et al., 2000). Two different methodologies exist for the estimation of such models: SEM-ML (Maximum Likelihood Approach to Structural Equation Models), also known as LISREL (Linear Structural RELations) (Jöreskog, 1970), and SEM-PLS (Structural Equation Models by Partial Least Squares) (Tenenhaus et al., 2005), also known as PLS Path Modelling ("PLS"). Comparisons between the two methods can be found in Fornell and Bookstein (1982), Dijkstra (1983), Chin (1998), and Vilares et al. (2008) (also see Table 17). PLS is a widely used tool in the information systems/information technology field (Wasko and Faraj, 2005) and was chosen to conduct the data analysis in this study. Unlike SEM-ML, which is based on the covariance structure of the latent variables, SEM-PLS is a component-based approach. Thus, PLS is suitable for predictive applications and theory-building because it aims to examine the significance of the relationships between research constructs and the predictive power of the dependent variable (Chin, 1998). PLS also has the advantage of modelling single-item scales and summated scales (Chin et al., 2003). In addition, PLS does not place any requirements for a normal distribution on the source data

and thus works better than LISREL in conditions of non-normality (Chin, 1998, Gefen and Straub, 2005). PLS also has the ability to handle a relatively small sample size (Barclay et al., 1995, Chin, 1998) and copes well with common research issues such as missing values and the presence of multicollinearity (Chin, 1998, Gefen et al., 2000). The PLS method is designed to maximise prediction rather than fit. The pattern of loadings of the measurement items on the latent construct is specified explicitly in the model. The fit of the pre-specified model is examined to determine its convergent and discriminant validities. PLS is considered well suited to explain complex relationships (Fornell and Larcker, 1981).

Table 17: Comparative Analysis Between Techniques

Issue	**LISREL**	**PLS**
Objective of Overall Analysis	To show that the null hypothesis of the entire proposed model is plausible, while rejecting path-specific null hypotheses of no effect	To reject a set of path-specific null hypotheses of no effect
Objective of Variance Analysis	Overall model fit, such as an insignificant $\chi 2$ or a high AGFI	Variance explanation (high R-squared)
Theory Base Required	Requires a sound theory base Supports confirmatory research	Does not necessarily require a sound theory base. Supports both exploratory and confirmatory research.
Assumed Distribution	Multivariate normal, if estimation is through ML. Deviations from a multivariate normal are supported with other estimation techniques.	Relatively robust to deviations from a multivariate distribution
Required Minimal Sample Size	At least 100–150 cases	At least 10 times the number of items in the most complex construct

Source: Gefen et al. (2000).

PLS was chosen for two reasons. First, I have a relatively small sample size for my research. Chin (1997) recommended, as a rule of thumb, that the sample size should equal the larger of either: (1) ten times the largest number of formative (i.e., causal) indicators loading on one scale; or (2) ten times the largest number of paths directed at a particular construct in the model. This study used reflective indicators and hence rule 2 was deemed more appropriate (Aubert and Kelsey, 2003, Chin, 1998, Gefen et al., 2000). The minimum acceptable sample size was 30 because the largest number of structural paths directed at the construct (Customer Satisfaction) is 3. Second, PLS is more appropriate when the

research model is in an early stage of development and has not been tested extensively (Teo et al., 2003). Further, my data have an unknown non-normal frequency distribution which also favours the use of PLS. A review of the literature suggests that empirical tests of business intelligence systems, business intelligence systems maturity, information asymmetry, and issues affecting the use of information are still sparse. Hence, PLS was deemed as the appropriate technique for my research purposes. The estimation and data manipulation was accomplished using SmartPLS 2.0 M3 (Ringle et al., 2005) and SPSS 19 for Windows.

3.5.9 RESEARCH TRUSTWORTHINESS OF THE QUANTITATIVE PHASE

There is no established goodness of fit criterion (yet) for evaluating PLS results (Hair et al., 2012). Elements of the model structure are separately evaluated regarding certain quality criteria for the measurement model and the structural model (see section 4.2.2).

Assessment of the measurement model involves examining individual indicator reliabilities, the reliabilities for each construct's composite of measures (i.e., internal consistency reliability), as well as the measures' convergent and discriminant validities. When evaluating how well constructs are measured by their indicator variables, individually or jointly, researchers need to distinguish between reflective and formative measurement perspectives (e.g. Diamantopoulos et al., 2008). Reflective measurement models should be assessed with regard to their reliability and validity. Usually, the first criterion which is checked is internal consistency reliability. The traditional criterion for internal consistency is Cronbach's alpha, which provides an estimate for the reliability based on the indicator intercorrelations (Henseler et al., 2009). While Cronbach's alpha assumes that all indicators are equally reliable, PLS ranks indicators according to their reliability, resulting in a more reliable composite. As Cronbach's alpha tends to provide a serious underestimation of the internal consistency reliability of latent variables in PLS path models, it is more appropriate to apply a different measure, composite reliability (Werts et al., 1974). Composite reliability takes the fact that indicators have different loadings into account, and can be interpreted in the same way as Cronbach's alpha. No matter which particular reliability coefficient is used, an internal consistency reliability value above 0.7 in early stages of research and values above 0.8 or 0.9 in more advanced

stages of research are regarded as satisfactory (Nunnally, 2010), whereas a value below 0.6 indicates a lack of reliability.

As the reliability of indicators varies, the reliability of each indicator should be assessed. Researchers postulate that the absolute correlations between a construct and each of its manifest variables (i.e. the absolute standardised outer loadings) should be higher than 0.7. Moreover, some psychometrists (e.g. Churchill Jr, 1979) recommend eliminating reflective indicators from measurement models if their outer standardised loadings are smaller than 0.4. Taking into account the PLS' characteristic of consistency at large, one should be careful when eliminating indicators. Only if an indicator's reliability is low and eliminating this indicator goes along with a substantial increase in composite reliability, does it make sense to discard this indicator (Henseler et al., 2009).

When assessing validity, two validity subtypes are usually examined: convergent validity and discriminant validity. Convergent validity signifies that a set of indicators represents one and the same underlying construct, which can be demonstrated through their unidimensionality. Fornell and Larcker (1981) suggest using the average variance extracted (AVE) as a criterion of convergent validity. An AVE value of at least 0.5 indicates sufficient convergent validity, meaning that a latent variable is able to explain more than half of the variance of its indicators on average. Discriminant validity is a rather complementary concept: Two conceptually different concepts should exhibit a sufficient difference (i.e. the joint set of indicators is expected not to be unidimensional). In PLS path modelling, two measures of discriminant validity have been put forward: The Fornell and Larcker criterion and the cross-loadings (Fornell and Larcker, 1981). The Fornell and Larcker criterion (1981) postulates that a latent variable shares more variance with its assigned indicators than with any other latent variable. In statistical terms, the AVE of each latent variable should be greater than the latent variable's highest squared correlation with any other latent variable. The second criterion of discriminant validity is usually a little more liberal: The loading of each indicator is expected to be greater than all of its cross-loadings (Chin, 1998, Götz et al., 2010). Although the Fornell and Larcker (1981) criterion assesses discriminant validity on the construct level, the cross-loadings allow this kind of evaluation on the indicator level (Henseler et al., 2009).

Reliable and valid measurement model estimations permit an evaluation of the structural (inner) path model estimates. The essential criterion for this assessment is the coefficient of determination (R^2) of the endogenous latent variables. Chin (1998) describes R^2 values of 0.67, 0.33, and 0.19 in PLS path models as substantial, moderate and weak, respectively. If certain inner path model structures explain an endogenous latent variable with only a few (e.g., one or two) exogenous latent variables, a 'moderate' R^2 may be acceptable. However, if the endogenous latent variable relies on several exogenous latent variables, the R^2 value should exhibit at least a substantial level. Lower results, on the contrary, cast doubts regarding the theoretical underpinnings and demonstrate that the model is incapable of explaining the endogenous latent variable(s) (Henseler et al., 2009).

The individual path coefficients of the PLS structural model can be interpreted as standardised beta coefficients of ordinary least squares regressions. Structural paths provide a partial empirical validation of the theoretically assumed relationships between latent variables. Paths that possess an algebraic sign contrary to expectations do not support the a priori formed hypotheses. In order to determine the confidence intervals of the path coefficients and statistical inference, resampling techniques such as bootstrapping should be used (Tenenhaus et al., 2005). Another important evaluation of direct and indirect relationships of the predecessor of a certain endogenous latent variable involves the analysis of mediating and moderating effects (Hair et al., 2012). Researchers and practitioners using PLS path modelling should first assess their hypothesised path model of direct effects and then conduct additional analyses involving mediating and moderating effects to learn, for instance, more about possible spurious effects or suppressor effects.

3.6 LIMITATIONS OF THE METHODOLOGY

Two broad categories of limitations of the methodology used in this study have been identified: limitations of multiple case study and survey research and limitations associated with generalising the results to a broader population. Survey research is limited by the extent to which the responses accurately reflect the perspectives of the participants, and the degree to which those perspectives reflect the real-world situation under investigation. These limitations can be eased through careful attention to the design of the survey instrument and the extent of the limitation can be assessed by analysing the construct validity of the instrument (Cooper and Schindler, 2003, Robson, 2002). The

instrument used for this study was developed based on accepted practices and items used for measuring Service Quality, Price Offered and Customer Satisfaction had been validated previously. Further tests were conducted to assess the validity of those items that were previously not validated.

The population for this study was limited to three transport firms in the qualitative phase and employees of Slovenian export firms that actually deal with ordering transport services in the quantitative phase. These people are assumed to have enough knowledge about the transport firm's operation. The ability to generalise the results is limited to that population, and is further limited by the characteristics of those who actually participated. This limitation was accepted as such, hence limiting the interpretation of the study's findings.

4. RESEARCH FINDINGS

In this chapter I present the results of this study that tried to 1) provide a better understanding of the ways the adoption of GPS transforms operational decision-making in the transport process, along with the understanding about the underlying mechanisms that facilitate better use of GPS-enabled information in operational decision-making, and 2) offer an answer to how does the utilisation of IT-enabled information by the service provider influence industrial customer satisfaction. I first analyse within the qualitative phase how the transport process changes in the transport firm after GPS was adopted. I then look closely for an understanding of how GPS adoption can transform operational decision-making. Lastly, I analyse the proposed model to provide results for the direct and indirect impacts of the GPS-enabled information utilisation and process change outcomes on customer satisfaction.

4.1 QUALITATIVE PHASE – INTERNAL VALUE OF IT-ENABLED INFORMATION

4.1.1 THE ROLE OF GPS IN THE TRANSPORT PROCESS

I started the investigation by building an understanding of how the three case firms used GPS in their transport process. Detailed descriptions of GPS uses, differences in GPS adoption among the three case firms and the role of GPS in transforming the transport process are presented in the following sections.

4.1.1.1 A description of GPS

A typical fleet-tracking GPS in the transport industry has three parts: the GPS tracking device, GPS tracking server and user interface (GPS software). The GPS device is installed in the vehicle and captures GPS location information and additional vehicle information (distance travelled on a particular trip, vehicle mileage, speed, driving activity, including the address of each destination, names of streets travelled, how long the vehicle remained at each location, fuel amount, engine temperature, altitude, reverse geocoding etc.) at periodical intervals in a central server. The GPS tracking server receives the data from the GPS tracking unit, stores the data and provides this information on demand to the

user. Information is disseminated through various media including Traffic Information Centres.

The GPS software enables the dispatcher to examine and analyse the generated data to inform various operational decisions in the transport process. First, the integration of GPS-generated information into vehicle fleet routing and scheduling enables efficient vehicle routing plans (Repoussis et al., 2009). At the same time, GPS enhances internal communication between the driver and dispatcher to further enhance efficiency in the transport process. Second, interactions with trading partners and clients via GPS enable supply chain partners to perform online transactions, share and exchange up-to-date information, provide customer service on request, manage logistics, transportation and inventory levels, and routinely communicate shipment-tracking information to clients (Davis and Golicic, 2010, Eng, 2006). Third, the integration of GPS-enabled information with a transport firm's transactional or ERP systems (spanning operational planning, statistics and personnel management) enables more accurate and timely operational decisions.

4.1.1.2 Differences in the case firms' adoption processes

In the following paragraphs a description of the case firms as well as differences in the firms' adoption of GPS are explained. GPS was adopted in all three case firms around the same time.

FIRM A

A transport firm located in the north-west of Slovenia that is one of the largest transport firms which operates mainly in Austria, Germany, Switzerland, France and Belgium. With a little more than 60 employees, annually the firm earns approximately EUR 5.5 million from transporting lightweight and dangerous goods. The firm has a very close relationship with four customers that order around 70% of the annual transport services. The firm's linear organisational structure is spread over four departments which are located in the same building and on the same floor. For this reason, employees from all departments interact and communicate directly effortlessly.

With its core focus on European markets, the firm was exposed to strong pressures from international customers to prove the quality and improve its internal operational procedures. Hence, in September 2001 the firm implemented the ISO quality assurance standard. Reasons such as proactive participation in the market, enabling IT support in process operation and upgrading the existing quality assurance system further led the firm to adopt the GPS system in 2006. GPS includes the following features: First, GPS software which is run by the server is installed on the computers in the transport office. The software enables the dispatcher to monitor the position and route of the vehicle; to send and receive messages to and from the driver; to calculate the vehicle's fuel consumption, toll costs and any other costs (e.g. parking, maintenance); and to analyse for all vehicles the historical data of previously completed transport services. Second, the device installed inside the vehicle is important for the driver to communicate with the transport office. The driver can also use the map installed on the device for basic route planning.

The adoption of GPS was undertaken in two phases. First, the installing phase included the installation of the software and devices into the vehicles. The installation was completed successfully with a few errors arising from the programming work. On the other hand, in the second, preparatory phase the firm experienced various problems with use of the system.

FIRM B

Transport firm B has a yearly turnover over EUR 2.7 million from the transport of liquids, commercial and perishable but not solid goods. The firm operates in the Slovenian, Hungarian, Italian and German markets with very few transports made to other EU countries such as Austria, Spain, the UK and Belgium; 55% of the transports are conducted internationally for contracted customers. The workers in the transport department are grouped according to their market focus. Nevertheless, they are located in a single office which enables them to have face-to-face communication.

To improve competition in the Hungarian market and to enter the Italian market, in 2006 the firm implemented the ISO 9001 quality assurance standard. Soon after it entered the new market the firm faced strong competition. To maintain its proactive participation in both markets, at the end of 2006 the firm decided to invest in implementation of the GPS

system. The GPS system was simultaneously used to upgrade the existing quality assurance system, and provide convenient communication and continuous shipping information. The implementation began in 2006 and was finished in 2007. First, the firm installed the devices into the vehicles since it wanted to educate the drivers on how to use the device. This device enables them to communicate with the transport office and to plan the route to the required destination. At the same time, the firm separately installed the GPS application on the computers located in the transport office. The application enables the user to monitor routing information such as: the position of the vehicle, speed, mileage covered etc.; to communicate with the driver and to review the data of the transports already conducted.

FIRM C

Besides standard EU countries, Firm C conducts transports in Eastern European countries (Romania, Bulgaria etc.). The firm offers transport and logistics, vehicle servicing as well as sales of spare parts in the transport and agriculture industries.

The implementation of GPS was the firm's main project in 2006. It involved a complete transport office including a maintenance centre and planning. The firm's idea was to connect planning in the transport office with the maintenance centre to ensure the increased performance of vehicle routing. The firm's leaders adopted GPS prior to receiving the quality assurance standard ISO 9001. The chief reason was first to informatise all processes and later upgrade them by implementing the quality standard. To manage the GPS adoption project, a project group was established whose responsibilities were to make contact with the GPS supplier/provider, ensure education and training of all employees, planning project activities and to manage all tasks regarding the project. Results of the project were regularly reported to the leaders. Another central focus of the GPS implementation was to establish the transfer of data and information obtained by GPS into the existing transactional system and to replace the mobile phones that had been used for communication purposes. The GPS adoption process was completed in 10 months and was very positively evaluated by the leaders.

4.1.1.3 The role of GPS in transforming the transport process

Across these firms, informants noted that GPS was used across all stages of the transport process. Table 18 provides a detailed description. The transport process usually began with the receipt of a request from a client to provide a quote and finished with the issuing of invoices when the transport service had been was completed.

Table 18: The Role of GPS in the Transport Process

Stage	Activity	Input	Description	Output	Responsible
Selling of transport services					
1	Request for a quote	Request received for a quote	The request for a quote is usually sent to the transport office by e-mail or announced in the electronic logistics marketplace (ELM). The dispatcher revises the request and decides whether the transport firm is able to do the transport.	Revised request for a quote	Dispatcher Client
2	Preparation of the offer	Revised request for a quote	The dispatcher prepares the official offer and sends it to the client by e-mail. Calculations for the quote are made in the GPS. For transports to new destinations or those requiring specific handling, the transport manager is also involved.	Send offer to the client	Dispatcher Client
3	Receiving an order	Accepted offer	If the client accepts the quote, s/he sends the written order to the transport firm by e-mail or fax. The dispatcher immediately enters the order into the GPS.	Order received and entered in the GPS	Dispatcher Client
Performing transport services					
4	Allocation of the transport	Order received and entered in the GPS	Before the start of the drive (most likely on the Friday of the current week for the following week), the dispatcher assigns the orders to a specific vehicle and driver. Before this, s/he controls the position of the vehicle and plans the arrival day and hour for the closest vehicle to the loading/unloading place. The dispatcher also sends the message via GPS and verifies with the driver the number of available working and driving hours.	Orders assigned to a specific vehicle and driver	Dispatcher Driver
5	Booking of the loading/ unloading time	Orders assigned to the specific vehicle and driver	In collaboration with the driver, the arrival time is determined. When needed, the dispatcher also makes a booking of the arrival time in the client's information system or ELMs. Informing the customer and making the booking need to be completed at least one day in advance, or for urgent transports at least 4 hours in	Booking of the arrival date and time	Dispatcher Driver Client

Stage	Activity	Input	Description	Output	Responsible
			advance. When the dispatcher cannot do this, s/he needs to inform the client about the situation.		
6	Sending information to the driver	Booking of the arrival date and time	When the booking is completed and the client is informed about all the details regarding the arrival time, the dispatcher sends the core information (information about loading/unloading time and address, information about goods, customs clearance etc.) about the transport via GPS to the GPS device installed in the vehicle. All questions and clarifications are resolved with communication via GPS.	Information sent to the driver	Dispatcher Driver
7	Driving to the loading destination	Information sent to the driver	The driver heads to the loading/unloading place according to the dispatcher's instructions. When driving, the driver follows the road laws and regulations in the specific country and regulation ES no. 561/2006 that sets out the maximum length of the driver's working and driving hours. At all times during the journey the driver is monitored via GPS. If there are any inconvenient situations on the road the driver immediately notifies the dispatcher via GPS.	Arriving at the loading/ unloading destination	Driver
8	Loading/unloading the goods	Arriving at the loading/ unloading destination	At the loading/unloading place the driver loads/unloads the goods. The driver is required to participate when the loading/unloading is performed. If the driver is unable to participate and control the loaded/unloaded goods, s/he is required to enter a comment on the transport document. The driver also controls the quantity of the goods packed on the pallet, bags or any other kind of packing material. When needed, the goods are also fixed and secured in the vehicle with risers and boards. Before leaving the loading/unloading place, the driver obtains signed documents (invoice for the goods, delivery note, MRN-import/export declaration etc.).	Loaded/unloaded goods	Driver Warehouse Manager
9	Informing the transport	Loaded/unloaded goods	After the loading/unloading is completed, the driver	Transport service	Driver

Stage	Activity	Input	Description	Output	Responsible
	office		confirms the status on the GPS tracking device and sends this information via GPS to the transport office. The status of the transport service is automatically updated into “ready for drive” or “completed”. After receiving this information, the dispatcher informs the client about the status of the transport service.	completed	Dispatcher
10	Delivery of the documents	Transport service completed	When the driver arrives at the head office, s/he is required to hand the transport documents in. The administrator and dispatcher revise the documents and complete them with the transport order.	Revised transport documents	Driver Dispatcher Administrator
11	Issuing out the invoice	Revised transport documents	The administrator enters the information about the transport into the information system for finance and accounting from where the invoice is issued. The invoice is automatically sent to the client by e-mail and a hard copy is also sent by post.	Issued invoice	Administrator

Source: Interview transcripts.

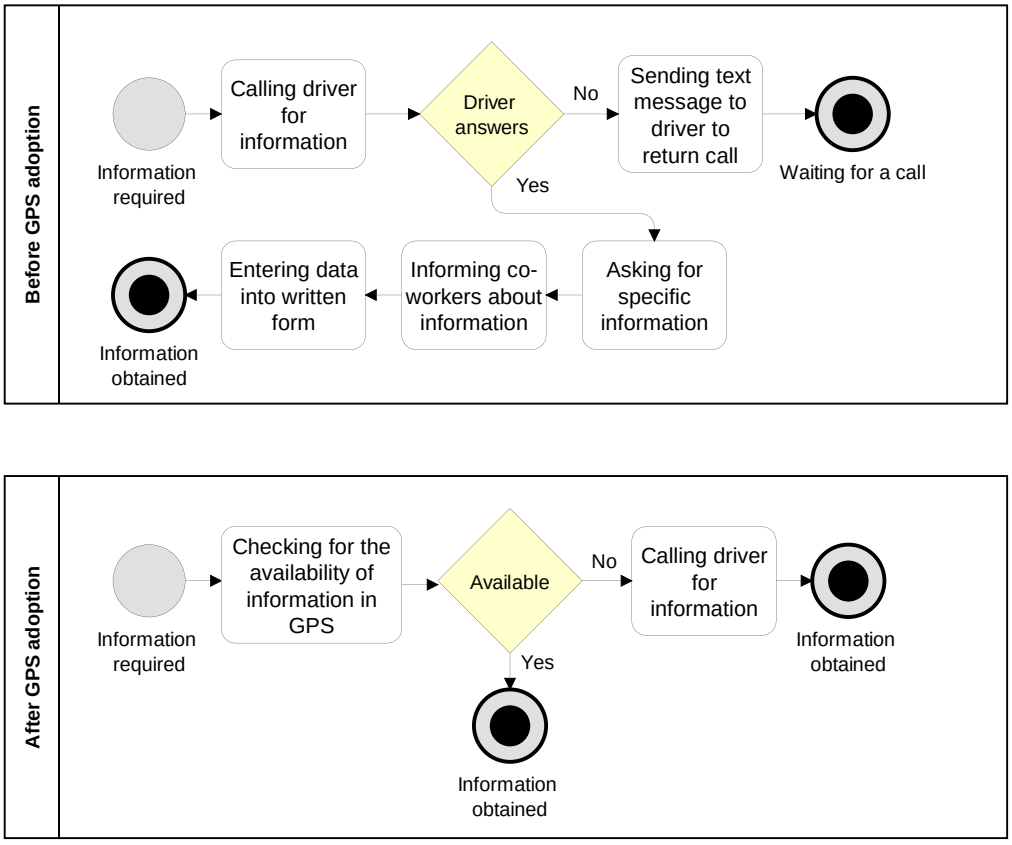
The typical process flow is presented in Figure 13 below.

Figure 13: Transport Process Flow Chart

Source: Interview transcripts.

The informants explained that GPS had significantly altered their transport process in at least three ways. First, the integration of the GPS-generated information into the vehicle fleet routing and scheduling enabled efficient vehicle routing plans (Repoussis et al., 2009). It therefore allowed better control of the process. The General Manager of Firm A explained: *"In the past, we had to monitor all vehicles periodically ... obtaining the required information was, due to poor access, extremely complicated and lengthy. GPS enables us to control the vehicle all the time".* Figure 14 below shows changes in the control of the transport service after GPS was adopted.

Figure 14: Change in the Control of the Transport Service

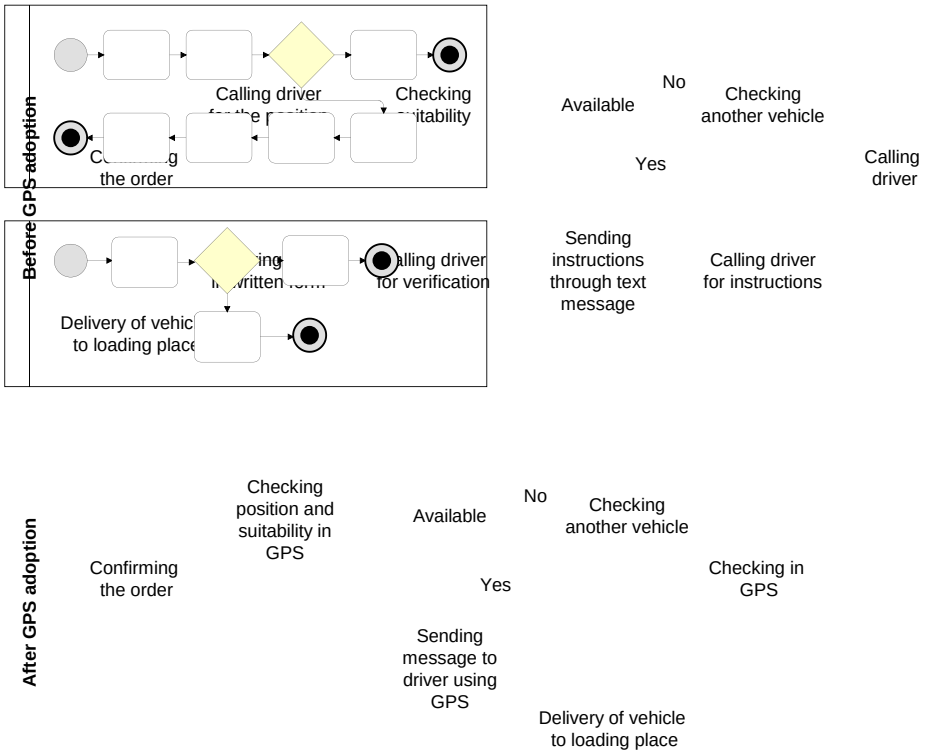


Source: Interview transcripts.

The GPS adoption enhanced internal communication between the drivers and the dispatchers and this further improved the efficiency of the transport process (see Figure 15 and Figure 16). GPS enabled the sending, receiving, monitoring and archiving of both sent and received text messages. Obtaining information from the driver prior to the adoption of GPS was highly problematic. A Logistics Manager from Firm A argued: *"We had to call the driver to find out the position of the vehicle. Many times either the driver did not*

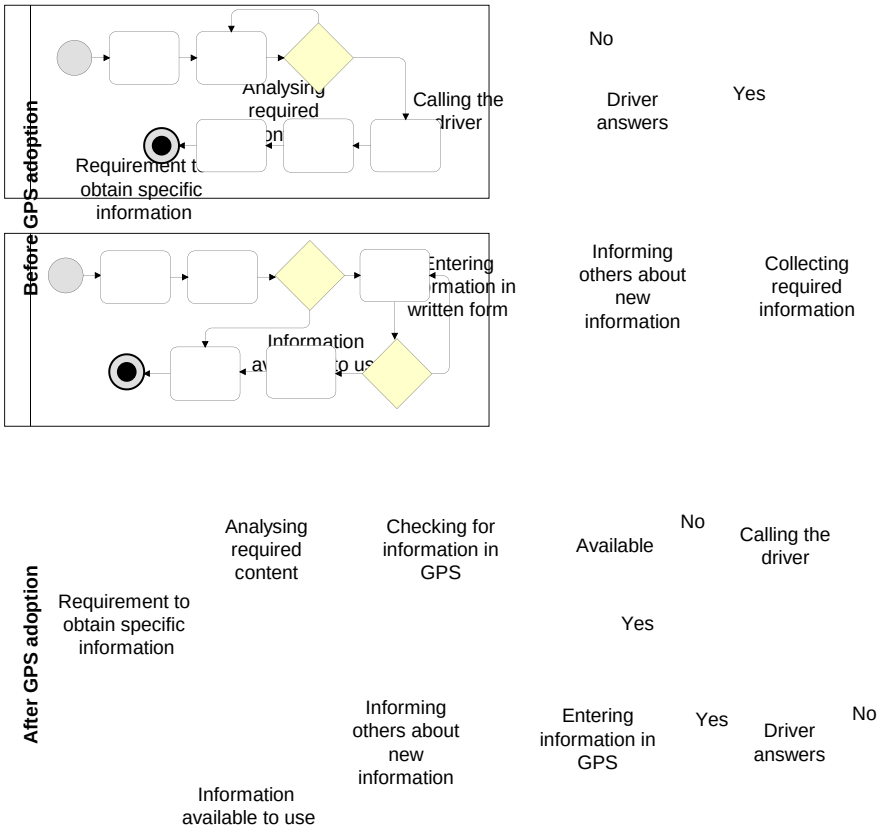
answer the phone or we could not get through. This was very inconvenient due to the short reaction time required by the customer. After the conversation with the driver we put down the information into a form, discussed it with other co-workers and decided which driver is going to go in each direction. Then we called the driver again. If he or she did not answer we sent a text message or called him or her again". After GPS was adopted, dispatchers and other workers used GPS to obtain the information required. Only in extreme situations (e.g. when a vehicle lost power, when a dispatcher needed a detailed explanation of a certain problem) do they now have to actually call a driver.

Figure 15: Changes in Sending Information to the Driver



Source: Interview transcripts.

Figure 16: Changes in Obtaining Information from the Driver



Source: Interview transcripts.

Second, interactions with trading partners and clients via GPS-enabled supply chain partners to perform online transactions, share and exchange up-to-date information, provide customer services on request, manage logistics, transportation and inventory levels and routinely communicate shipment-tracking information to clients (Eng, 2006). Instead of relying on mobile phones and sometimes fax machines, GPS was now used as the main medium for communication. A Logistics Manager from Firm C highlighted the benefits: *"Sending information through GPS is fast, easy and simple. We save time and money while expensive international calls are no longer needed".* Third, the integration of the GPS-enabled information with the transport firms' transactional or ERP systems (spanning operational planning, statistics and personnel management) aided more accurate and timely operational decisions.

4.1.2 CHANGES IN OPERATIONAL DECISION-MAKING AFTER GPS ADOPTION

In response to my first research question, I then examined how information stemming from the adoption of GPS had transformed operational decision-making in the three case firms. I found that the use of GPS mobilised improvements in information quality across the case firms. Moreover, operational decision-making was now more fact-based (less intuition-based) and collaborative. Below I discuss these findings in more detail.

4.1.2.1 Improvements in Information Quality and the scope of GPS implementation in operational decision-making

The three case firms used GPS for a wide range of operational decisions in relation to their vehicles (e.g. position, characteristics, mileage), drivers, routes (e.g. duration, fuel, fuelling), loads (e.g. loading/unloading specifications), clients and dealing with possible errors or taking advantage of additional clients in the area of transport (see Table 19 for a detailed description). Informants across the cases argued that the use of GPS enhanced information quality and, therefore, improved their decisions in these areas. Specifically, the informants highlighted seven key improvements in information quality. First, they argued that the use of GPS had improved the timeliness of the information. Data used in the transport process were no longer time-phased (Closs et al., 1997, English, 1999, Forslund, 2007). Second, they noted that the information accuracy had also improved as a result of using GPS (Gorla et al., 2010). Third, the informants discussed the benefit of the integrated information for making operational decisions (Jhingran et al., 2002), which aided the control of costs and route planning. Fourth, they noted the enhanced information availability (Smith and Simon, 2009). Obtaining information relevant to different decisions had become an easier task. Fifth, the use of GPS improved the generation of information (Davis and Golicic, 2010). This helped the informants collect market information, which was critical for several decisions (e.g. fuelling, understanding specific client requirements etc.). Sixth, using the GPS had enhanced the dissemination of internal information. Dispatchers in the case firms were then able to disseminate timely information to members of the supply chain (Davis and Golicic, 2010). Lastly, the use of GPS fostered information visualisation; gaining an insight into data through visual representation (Ellis and Dix, 2007).

However, my findings also revealed that the scope of GPS use in different areas of operational decision-making was wider in Firm C than in Firms A and B (see Table 19). Firms A and B primarily used the GPS information for making operational decisions about the performance of a transport service (e.g. position of the vehicle, vehicle characteristics, costs of the driver). Firm B's General Manager, for instance, explained: *"We get daily information about fuel consumption as the system is connected to the engine computer that calculates the current vehicle consumption".* Yet, Firm C had expanded its use of GPS information to operational decisions supporting transport services (such as maintenance, fuel supply etc.), but also to identifying and catering to client-specific requests. As such, Firm C had further leveraged cost savings in terms of fuel consumption and was able to improve sales through a more customer-oriented transport process. A Transport Manager in Firm C noted: *"We can plan following fuelling periods as the system gives us information about the quantity of litres left in the tank".*

Table 19: Scope of GPS Implementation in Different Operational Decisions and Improvements in Information Quality

Use of GPS information in different operational decisions	Explanation of operational decisions	Key benefits for information quality	Potential performance benefits	Firm A	Firm B	Firm C
Position of the vehicle	Current position of the vehicle (e.g. 5 miles west of the city of Ljubljana, Side Road No. 10)	Information timeliness and accuracy	Average mileage, Average sales/km, Customer satisfaction	√	√	√
Vehicle characteristics (length, width, height)	Characteristics of the vehicle such as registration plate, length, width and height (e.g. Road Train KR 56-88D (18.75 m, 2.55 m, 4 m))	Information integration and visualisation	Customer satisfaction	√	√	√
Mileage, duration of the specific transport	Mileage and duration of a transport between the loading and unloading place (e.g. Transport Ljubljana–Villach, Salzburg – Munich = 429 kilometres, 4 driving hours, stop in Villach 15 minutes)	Information generation and availability	Customer satisfaction, Average sales/month/vehicle, Average mileage (km)/month	√	√	√
Driver costs	Estimating costs of the driver based on: number of kilometres*0.12 EUR + number of loadings/unloadings*11 EUR + transport during the weekend (75 EUR) + transport in a non-EU country (10 EUR)	Information integration and visualisation, Dissemination of internal information	Earnings/employee, EBT	√	√	√
Loading and unloading specifications	Detailed information about loading and unloading places, such as: loading/unloading address, shipment number, contact person, booking times, Number of the ramp etc.	Information integration and visualisation	Customer satisfaction	√	√	√
Costs of fuel, tolls, etc.	Information about the current price of the fuel and toll, bridge, tunnel.	Information integration and visualisation	EBT, ROA	√	√	√

Use of GPS information in different operational decisions	Explanation of operational decisions	Key benefits for information quality	Potential performance benefits	Firm A	Firm B	Firm C
Determining maintenance work	GPS enables monitoring the planning of maintenance work for each vehicle. Maintenance information is marked per vehicle with the following colours: Green (maintenance within 2 months), Yellow (maintenance within 1 month), Red (maintenance within two weeks).	Internal information dissemination	Average sales/month/vehicle, Average mileage (km)/month	√	√	√
Time spent on maintenance	GPS monitors average time spent for maintenance (e.g. average small service 2 hours 20 minutes, medium service 3 hours 10 minutes and large service 5 hours 30 minutes). The information is used when planning transports.	Information generation and availability	Average sales/month/vehicle, Average mileage (km)/month	√		√
Possible errors	GPS has a warning function recognising an error made during the drive from loading to unloading (e.g. exceeding the driving hours allowance, not having enough minutes of a short break, driving over the speed limit etc.).	Information generation and availability	Customer satisfaction, Average mileage		√	√
Additional clients in the area of the transports	The clients are entered in the GPS and when a vehicle is sent to a certain destination the system offers the dispatcher possible clients that have loads close to the unloading place (e.g. the vehicle is sent to deliver goods to Hamburg. GPS shows those clients that have expressed an interest	Information generation and availability	Average sales/month/vehicle, EBT			√

Use of GPS information in different operational decisions	Explanation of operational decisions	Key benefits for information quality	Potential performance benefits	Firm A	Firm B	Firm C
	in loads from Hamburg or places around (within 150 kilometres) towards Austria or Slovenia).					
Average weight	GPS enables the weight of the loads of all vehicles towards different destinations to be monitored. This helps the dispatcher plan the transport in certain countries where there are special limitations on the weight of a vehicle (e.g. in Europe the total weight of a vehicle including goods must not exceed 40 tonnes).	Information generation and availability	EBT, ROA			√
Litres of fuel in the tanks and vehicle refuelling periods **Time spent for fuelling**	The current fuel level in the tank, average consumption of the vehicle and average fuelling time at a gas station (e.g. vehicle KR 56-88D (345 litres; weekly consumption 32.7 litres/100 kilometres; average 20 minutes fuelling period)).	Information generation and availability, Information timeliness and accuracy, Internal information dissemination	EBT, ROA, Average sales/month/vehicle, Average sales/kilometre			√
Client-specific information	GPS enables specific information to be entered about the client, such as: working time, type of goods, contact person, change of pallets and other material etc.	Information generation and availability, Information timeliness and accuracy	Customer satisfaction, Average sales/kilometre, Average sales/month/vehicle			√

Source: Interview transcripts.

4.1.2.2 Fact-based and Collaborative decision-making

The increased use of GPS information facilitates fact-based operational decision-making. Rationality in decision-making reflects the degree to which a decision-maker relies on a consideration of relevant facts when making decisions (Low and Mohr, 2001). Decision-makers who are less rational tend not to see the need to use much information; they rely on their own intuition (Low and Mohr, 2001, Citroen, 2011). The case data revealed that decision-making before GPS was adopted was less rational and more intuitive. As one informant explained: *"With no current information about the position of the vehicle from the GPS, we did not know for sure where the vehicle was when the client called us. We estimated the unloading time, according to previous experience but not according to any actual information we had"* (Dispatcher Firm A). Another elaborated: *"For sure the price was calculated based on our feeling of what the client would accept. We knew the competition and therefore we estimated how low the price for a specific destination could go. The real calculation was hardly ever made"* (General Manager, Firm C). This had implications in terms of the uncertainty of costs and quotes, and often negatively influenced efficiency in the transport process. Yet all of the firms proposed that the availability of new, accurate, reliable and on-time information arising from the adoption of GPS had helped them introduce decisions based on facts, rather than purely on assumptions and intuition (Hvolby and Steger-Jensen, 2010, McGuire and Dilts, 2008, Shapiro, 2004, Watson et al., 2004). This was most evident in Firm C (see the summarised evidence in Table 20). The use of GPS information about transport, variable costs, fuel consumption etc. made Firm C's decision-making more fact-based. However, some intuitive assumptions still informed their decisions. As a General Manager in Firm C explained: *"We sometimes change the decision about the price when we have a feeling that the market price offered by competition would be lower"*. And a Dispatcher added: *"If we believe that the client is important for expanding our business we could lower the price for the transport to a specific destination"*. In contrast, in Firms A and B the increasing use of facts in their decision-making after adopting GPS was not as pervasive as in Firm C. Informants in both firms argued that on average around 30% of operational decisions were still influenced by assumptions because of a lack of information about fuel costs on specific routes, the availability of transports and clients at specific destinations, and so forth.

Table 20: Facts vs. Intuition Driving Decision-Making Before and After GPS Adoption

	Firm A Moderate performer		**Firm B Moderate performer**		**Firm C Strong performer**	
	Before GPS adoption	After GPS adoption	Before GPS adoption	After GPS adoption	Before GPS adoption	After GPS adoption
% of fact-based decisions[1]	30% – 40%	70% – 80%	45% – 55%	75% – 80%	35% – 45%	90% – 95%
% of intuition-based decisions[1]	60% – 70%	20% – 30%	45% – 55%	20% – 25%	65% – 75%	5% – 10%
Decisions						
Knowing the situation in the market (The flow of goods; The estimate of imports and exports to and from Slovenia; The situation in the transport industry)	Intuition	Intuition	Intuition	Intuition	Intuition	Intuition
Importance of the client for the firm (The relationship with the client: years of cooperation, number of transports in one month, destination of the transports, quality of cooperation, payment terms)	Intuition	Intuition	Intuition	Intuition	Intuition	Intuition
Client order (Information about: loading/unloading time and address, goods, customs clearance, price of the transport etc.)	Intuition	Intuition	Intuition	Intuition	Intuition	Intuition
The duration of the transport in hours (Planned time for the specific transport to be made, or the time between the loading and unloading place)	Intuition	Fact	Intuition	Fact	Intuition	Fact
Toll costs	Intuition	Fact	Intuition	Fact	Intuition	Fact
Fuel costs	Intuition	Intuition	Intuition	Intuition	Intuition	Fact
Driver costs	Intuition	Fact	Intuition	Fact	Intuition	Fact
Vehicle closest to the loading place (Information about position of the closest vehicle to the loading place of the planned transport)	Intuition	Intuition	Intuition	Fact	Intuition	Fact
Clients close to the unloading place (The clients are entered in the GPS and when a vehicle is sent to a certain	Intuition	Fact	Intuition	Fact	Intuition	Fact

	Firm A **Moderate performer**		**Firm B** **Moderate performer**		**Firm C** **Strong performer**	
	Before GPS adoption	After GPS adoption	Before GPS adoption	After GPS adoption	Before GPS adoption	After GPS adoption
destination, the system offers the dispatcher possible clients that have loads close to the unloading place)						
Quality of the road (The roads in different countries are marked and grouped in motorways, highways, side roads etc. The dispatcher can obtain through GPS a digital camera view (through Google Maps) which shows the quality of the road)	Fact	Fact	Intuition	Fact	Intuition	Fact
Illustrative Quotes	*"The dispatchers, who work with clients on a daily basis, knew what the market and our competition could offer. If the transport was important for us we lowered the price by 20 or 50 euros, although we never did a precise calculation of what the price means for us"* (General Manager).	*"The company has a formula for calculating prices which includes the following information from the GPS: mileage, duration, price of tolls and fuel and costs of the driver. The price averagely deviates from the accepted market price for short distances between 15% and 25% and for long distances between 5% and 7%"* (Notes).	*"We had some rough estimation; however, how the competitor firms behave was crucial for us"* (Dispatcher).	*"We have a strategic client for which we propose yearly prices for all destinations. The starting point is the price from the last year, which is recalculated and then negotiated. How low we can go with the price depends on the quantity of the transports and on the situation in the market"* (General Manager).	*"We estimated the variable costs and we knew that the price must cover this number"* (Dispatcher).	*"We now calculate our internal cost price. We add the margin and correct it according to the importance of the client. The price is finally intuitively adjusted. In most cases this is the final price. It is very precise and reason we do not have an alternative solution in case the price is not accepted"* (Logistics Manager).

[1]Estimates provided by the case informants during the interviews

Source: Interview transcripts.

Moreover, the wide use of GPS-enabled information has supported more collaborative decision-making. Collaborative relationships refer to communication, trust and interdependence among firms in the supply chain; these have been found to reduce uncertainty and risk in the decision-making process (Wu and Chuang, 2010). My findings suggested that the more widely the case firms used GPS information, the more they established collaborative decision-making among supply chain partners (e.g. transport firm, maintenance firm, fuel supplier, client), resulting in added benefits for all partners involved. Across the cases, informants stressed that key GPS information such as the position of the vehicle, vehicle characteristics (length, width, height), mileage, duration of the specific transport and loading and unloading specifications was pivotal in resolving questions among supply chain partners about the duration of the transport, monthly capacity needed, possible loading/unloading days, type of goods delivered etc.

Before the adoption of GPS, in all three firms collaboration in decision-making with supply chain partners was limited. On the contrary, collaborative decision-making flourished after GPS was adopted. Detailed descriptions are available in Table 21.

Table 21: Collaboration in Decision-Making Before and After GPS Adoption

	Firm A		**Firm B**		**Firm C**	
	Before GPS adoption	After GPS adoption	Before GPS adoption	After GPS adoption	Before GPS adoption	After GPS adoption
Involvement of external partner in collaborative decision-making						
Client (firm or individual who places the order with the transport service)	√	√	√	√	√	√
Maintenance firm (responsible for the main maintenance work on the vehicles)		√				√
Supplier of the fuel (supplies the transport firm with fuel)				√		√
Areas of collaborative decision-making						
Transport characteristics (e.g. information about loading/unloading time and address, information about goods and other specific information such as customs clearance etc.)	√	√	√	√	√	√
Duration of the transport (planned time for the specific transport to be made, or the time between the loading and unloading place. For example, it is 820 kilometres from Ljubljana to Frankfurt, the driver therefore needs 10 hours and 30 minutes of driving time. Following EU regulations, if the driver starts at 8 am, s/he should arrive in Frankfurt around 10 am the next day (10 hours and 30 minutes of drive, two pauses for 45 minutes and one 9 hr pause.))	√	√	√	√	√	√
Type of goods (e.g. construction material, glass wool, automobile spare parts, granulate etc.)	√	√		√	√	√
Monthly capacity (e.g. number of loads per destination that can be made by the transport firm on a weekly and monthly basis)		√		√		√
Loading/unloading days (The preferred loading/unloading day. For example, for short transports like between Ljubljana and Vienna, the preferred loading day is Thursday so that the driver is back to Slovenia by Saturday and has a weekend pause made by Monday. However, for long transports, like from Ljubljana to London, the preferred loading day is Friday so that the driver can already go on the road on Sunday night at 9 pm when the Sunday road closure ends.)		√		√		√
Type of driver required (some drivers from foreign countries have limitations on doing transports to certain						√

	Firm A		**Firm B**		**Firm C**	
	Before GPS adoption	After GPS adoption	Before GPS adoption	After GPS adoption	Before GPS adoption	After GPS adoption
countries)						
Packing characteristics (whether the goods are packed on the pallet (euro pallet or English pallet), in bags etc.)		√				√
Customs clearance (if the transport is made to Switzerland, Croatia, Ukraine or any other non-EU country the information for customs clearance (the name of the agent, border etc.))						√
Periods of fuel deliveries (information about previous and planned fuel deliveries)				√		√
Maintenance planning (information about previous and planned maintenance work)						√

	Firm A		**Firm B**		**Firm C**	
	Before GPS adoption	After GPS adoption	Before GPS adoption	After GPS adoption	Before GPS adoption	After GPS adoption
Illustrative Quotes	*"We communicated with the client when we received an order about details of loading and unloading times and peculiarities that we should consider; and at the end, when we informed the client that the transport was completed" (Dispatcher).*	*"Before we sign the contract we set the standards for the delivery days. If the duration of the transport is more than 5 days and delivery is not in the same week, we leave the option to the transport firm to set the unloading day itself. However, this information must be passed on to us before the loading day so we can arrange the unloading with the receiver of the goods" (Client).*	*"We did not know exactly where the vehicles were at a certain time. We passed this information on to the client only when the driver called us" (Dispatcher).*	*"Each year the transport firm gives us information about when it is best for them to come to our warehouse for loading. Usually this is based on their experience with past transports. We then fix the day and arrange our production regarding this agreement" (Client).*	*"The planning of further maintenance was really hard. We did not know the position of thevehicle, hence we could not inform the maintenance firm when the vehicle would be in the workshop" (General Manager).*	*"When we decide to cooperate with a transport firm on a long run, we require from them information about the length, width and height of the vehicles. Then we decide together which packaging and loading method would be best according to the available options" (Client).*

Source: Interview transcripts.

Informants from Firms A and B mainly discussed how decision-making was transformed in relation to collaborating with their clients and operational efficiency. A Dispatcher from Firm A explained the situation before GPS was adopted: *"After we received an order, it was our decision how to plan and perform the transport, as long as we were on time at the loading/unloading place"*. The firm could not change the loading or unloading days since the client was not supported with sufficient information regarding why this was the case. Transport information from the GPS enabled these transport firms to promptly inform their clients about the position of vehicles and any changes that happened or were about to happen during the transport service. A Logistics Manager from Firm B noted: *"If anything unplanned happens on the road, we immediately inform the client"*. A Dispatcher from Firm A reinforced this point: *"We then together decide what is best to do, to change the route or the loading/unloading times"*. It was evident that the clients had also positively received this change towards a more collaborative decision-making approach. For instance, a client of Firm B elaborated: *"Before, we just asked the transport firm about the price and the feasibility of a specific transport. However, we never elaborated how it will be performed"*. Pre-GPS adoption, the partners were distant and only the transport firm drove the decision on performance of the transport. A client of Firm A stated: *"We used to set the loading day on Friday, not knowing that in this case the driver needs to drive over the weekend"*. On the contrary, post-GPS adoption the transport firm was able to provide clients with information (such as mileage, duration of the transport), collaborate on planning monthly capacity, possible loading and unloading days, and estimate the duration of the transport. *"We now together set the best loading day and frequency of transports so that the transport firm does not have unnecessary costs and that it is suitable for our production plan"* (Client, Firm A). Informants across the cases noted that this resulted in substantial cost savings for all partners, improved customer satisfaction and increased sales for the transport firms.

However, Firm C had adopted a more balanced orientation. It had expanded the use of information for operational decision-making also to the planning of maintenance works and managing of fuel deliveries. It used information such as: (1) average weight; (2) vehicle fuelling periods; (3) time spent fuelling; and (4) time spent on maintenance, on collaboratively organising maintenance works with the maintenance firm and fuel

deliveries with the fuel supplier. Before GPS was adopted, the lack of information about the position of the vehicles and the time spent on maintenance made the transport firm's maintenance planning harder. The General Manager of Firm C explained: *"Before the GPS implementation we did not know the estimated time for the vehicle to arrive at the maintenance shop. The workers in the maintenance shop had other vehicles to check. Therefore, each time our drivers waited for at least two hours"*. The Dispatcher could then constantly monitor the vehicle and was able to plan the maintenance works in advance. A Dispatcher from Firm C elaborated: *"On the day of sending the vehicle to the maintenance shop we inform them when exactly the vehicle will be there, we decide together whether the proposed time should be changed… As a result, we can plan further transports for the driver and the maintenance shop knows exactly when to expect the vehicle. It is much easier for both partners"*. Table 22 provides a summary of the benefits for the three transport firms, their clients, their fuel suppliers and maintenance firms arising from the shift towards more collaborative decision-making following the adoption of GPS.

Table 22: Benefits of Collaborative Decision-making After GPS Adoption

Benefits	**Firm A** ***Client Orientation***	**Firm B** ***Operational Efficiency Orientation***	**Firm C** ***Balanced Orientation***
Transport firm			
Loading day on a weekday	√	√	√
Mutual acceptance of the packing and loading procedures			√
Fuel delivery is planned 3-4 days in advance		√	√
Fuel supply is always above the required level		√	√
Maintenance is planned one week in advance			√
The client can set up the unloading day	√		√
Client			
Better planning	√	√	√
Planning of the loadings on a weekday	√	√	√
Mutual acceptance of the packing and loading procedures	√		√
More goods packaged and loaded on one vehicle	√		√
Simplified procedure of customs clearance			√
Fuel supplier			
Pre-arranged fuel deliveries		√	√
Maintenance firm			
Pre-arranged maintenance works			√

	Firm A – Client Orientation	**Firm B – Operational Efficiency Orientation**	**Firm C – Balanced Orientation**
Illustrative Quotes	*"We agreed with one of our largest clients that they will arrange the delivery in a way that our drivers do not need to drive over the weekend. This saved us a lot in costs" (General Manager).*	*"Our transport firm gives us the time of a vehicle's arrival two days in advance so we can arrange the production according to that information" (Client).*	*"This year we established the monthly required capacity of the transports the transport firm needs to deliver. The information the transport firm passed on to us was very helpful" (Client).*

Source: Interview transcripts.

Overall, the findings in relation to RQ1 illustrated that increased use of GPS information in more areas of decision-making, enhanced information quality and supported fact-based and collaborative decision-making among supply chain partners (e.g. the transport firm, maintenance firm, supplier of the fuel, client) had led to added benefits for all supply chain partners. Therefore, I argue that:

Proposition 1: Increased use of GPS-enabled information endorses fact-based and collaborative decision-making.

4.1.3 EXPLORING THE UNDERLYING MECHANISMS THAT LINK GPS-ENABLED INFORMATION TO IMPROVEMENTS IN FIRM PERFORMANCE

Turning attention to my second research question, I then investigated the link between GPS-enabled information in operational decision-making and firm performance. I first assessed firm performance before and after GPS adoption for the three case firms. Initially, I compared the Earnings/employee, Return on Assets (ROA), Total Profit (EBT) and customer satisfaction figures (where available) 12 months before and after GPS was adopted by the three firms. A comparison with the industry average was also obtained (see Table 23 and Table 24 below for a summary of these data). As indicated by those two tables, there were differences in performance amongst the three case firms after they had adopted GPS. The changes in Earnings/employee, ROA and EBT were significantly higher in Firm C compared to the other two case firms. Based on this evidence, I classified Firm C as a strong performer in my sample. Firm A performed relatively better than Firm B so I classified Firm A as a moderate performer and Firm B as a weak performer within the sample (note, however, that Firms A and B both exhibited a better performance across various indicators than the industry average).

Table 23: Differences in Earnings/Employee, Return on Assets (ROA) and Earnings Before Taxes (EBT) After GPS Adoption

		12 months before GPS adoption	***12 months after GPS adoption***	***Change in the performance measure***	***Industry Average****
Firm A	Earnings/employee	€128,699	€137,404	+ 6.76%	€40,292
	ROA	5.53%	6.08%	+9.4%	0.04%
	EBT	€37,406	€51,525	+37.7%	€48,134
Firm B	Earnings/employee	€54,782	€55,621	+ 1.53%	€40,292
	ROA	4.56%	4.72%	+1.4%	0.04%
	EBT	€53,494	€61,363	+14.7%	€48,134
Firm C	Earnings/employee	€138,339	€159,404	+ 15.22%	€40,292
	ROA	7.52%	9.39%	+24.9%	0.04%
	EBT	€583,738	€870,925	+49.19%	€48,134

* Industry averages for medium-sized transport firms (classified as H49.4 by the Agency of the Republic of Slovenia for Public Legal Records and Related Services) could only be obtained for 2011

Source: The firms' financial reports.

Table 24: Differences in Customer Satisfaction After GPS Adoption

	12 months before GPS adoption	**12 months after GPS adoption**	**Trend**
Firm A	Customer Satisfaction Index Satisfaction: 82.73% (Internal Annual report)	Customer Satisfaction Index Satisfaction: 88.89% (Internal Annual Report)	Positive (+7.4% change)
Firm B	N/A	"We are now able to share up-to-date information with the client as soon as they require it. They are happy about this" (General Manager).	N/A
Firm C	"The firm was not able to send us a report on the road driven. We then had a lot of troubles with our clients to prove to them that the vehicle was not late to the loading place" (Client).	"Yes, especially in case of urgent loads and complaint handling, the firm helps us a lot" (Client).	Positive

Source: Interview transcripts.

Informants in the three case firms associated these increases in ROA, EBT and Earnings/employee to increased sales and cost reductions. They argued that the adoption of GPS had contributed to these performance indicators by mobilising:

(a) more control over drivers' actions and improved planning between the unloading of the transport and loading of the next transport. One of the major benefits of

GPS was that the transport firms could better monitor each driver's actions, something impossible before GPS had been installed in all the vehicles. The General Manager of Firm A explained the problems that occurred before GPS was adopted: *"If the driver inadequately plans the route, s/he waits more and usually needs more time to come to the unloading place, and consequently does fewer kilometres within the working hours allowed"*. Drawing on agency theory, the dispatcher's better monitoring capability via the GPS-enabled close monitoring of both the driver and the vehicle by therefore led to cost savings and efficiency gains, such as minimising the time from the loading to the unloading place (Kraemer and Dutton, 1979). The annual management review report of Firm A noted: *"The productivity of the vehicles increased by 6.6%, this is particularly due to the use of GPS in transport planning and vehicle routing. The vehicles also on average did more kilometres and the average sales per month also increased"*. Table 25 below provides indicators of vehicle performance for the three firms that can be linked to improvements in sales and, therefore, contribute to the increased performance measures.

Table 25: Additional Indicators of Vehicle Performance

	Indicator	***12 months before GPS adoption***	***12 months after GPS adoption***	***Change in the performance measure***
Firm A	Average mileage (km)/month	10,741	11,466	+ 6.6%
	Average sales/month/vehicle	€9,871	€10,985	+ 11.3%
	Average sales/kilometre	€0.919	€0.958	+ 4.2%
Firm B	Average mileage (km)/month	10,985	11,263	+ 2.5%
	Average sales/month/vehicle	€9,971	€10,392	+ 4.3%
	Average sales/kilometre	€0.908	€0.923	+ 1.6%
Firm C*	Average mileage (km)/month	Around 11,000	Around 12,000	+ 9%
	Average sales/month/vehicle	€10,450	€12,000	+ 14.8%
	Average sales/kilometre	Around €0.95	Around €1	+ 7.7%

* Estimates provided by informants from Firm C

Source: The firms' internal data.

(b) real-time routing of the vehicles. On a daily basis, dispatchers were able to manage the real-time dispatching, routing and re-routing of vehicles in response to changes in clients' requests or urgent orders, travel time and drivers' capabilities. Without real-time information, the transport firms were unable to give up-to-date information about the availability of vehicles to perform a transport. A Dispatcher from Firm B noted: *"The GPS*

really changed our routing habits. Now, we easily reroute the vehicle on time if our client has an urgent load in the relation. Sometimes this is a matter of minutes". GPS information also helped dispatchers select the right vehicle if there were more vehicles close to the loading destination. The General Manager of Firm A explained: *"we have a special indicator called average sales/km to verify how good our routing system is. If the transport firm only transports complete loads, the average sale per km is around €0.89. This is how the market works. Anything more than this means that the transport firm transports an extra pallet or two from other clients, which add to the sales volume at the same destination. This is impossible to do without the current information about the position of the vehicle, working and driving hours etc. obtained via GPS"*.

(c) toll, fuel and other cost savings. After GPS was adopted, the dispatcher was able to closely monitor and plan the route the driver would take to optimise the toll costs and fuel consumption. A Dispatcher in Firm B explained: *"Before the start of the transport we give details about the route to the driver. Nevertheless, with constant monitoring we might change the route if we see that the costs are too high, or the required delivery time cannot be achieved"*. To emphasise the savings in fuel consumption, the General Manager of Firm A added: *"The average consumption of all vehicles has also fallen from 34.5 litres/100 km to 32.7 litres/100 km after we implemented the GPS, meaning huge savings"*. Other costs such as phone and maintenance costs also decreased after GPS adoption. Dispatchers did not need to spend that much time on the phone with drivers, as was explained by a Dispatcher from Firm C: *"In many cases, we do not use the phone to contact the driver. In around 95% of cases the communication goes via GPS"*. Moreover, better control of maintenance via GPS resulted in lower maintenance costs and fewer breakdowns.

I then explored the differences amongst the three case firms, particularly in terms of their use of GPS-enabled information in their operational decision-making which may have contributed to the variation in firm performances post-GPS adoption in my sample. At first glance, my data suggested that Firm C, the firm that had exhibited wider use of GPS information in its operational decision-making (see Table 19), was associated with a better firm performance. The wider use of GPS information improved the information quality and enabled more fact-based (see Table 20) and collaborative (see Table 21) decision-making in Firm C compared to Firms A and B. Managers as well as Dispatchers in Firm C argued

that the move towards more fact-based and collaborative decision-making in the transport process was an important contributor to the firm's growth. The General Manager in Firm C explained: *"Now we can reroute more vehicles in one week"*. A Dispatcher added: *"We can save time on loading and unloading, while the bookings are already agreed together with the client"*. A Transport Manager concluded: *"Generally we can earn more with one vehicle due to better routing and direct savings during execution of the transport"*. Moreover, Firm C's clients not only benefited from the availability of up-to-date information about the transport service. They also saw a dramatic improvement in the managing of urgent loads and coping with non-predictable changes. A Firm C client elaborated: *"We can plan the production as we have up-to-date information on when the vehicle will be at our place"*. Another two clients of Firm C added: *"Workers in the warehouse can plan the work and we have cut overtime hours by 20%"; "Compared to what we used to do, our cooperation is now much simpler, with fewer phone contacts. We are very happy about that"*. Firms A and B were not leveraging these benefits to the same degree. According to a Dispatcher in Firm A, *"we can do more at the same time; however, we sometimes still need to contact the driver by mobile phone, which also requires some time from us"*. A Logistics Manager in Firm B also claimed: *"In some cases, we were too expensive and hence had to lower the price. The first transports were given to the competition"*. And a Dispatcher from Firm B added: *"At first, we were overloaded with all this new information and this was confusing for us"*. The more fact-based and collaborative decision-making in Firm C therefore appeared to positively affect the firm's performance. Fact-based operational decision-making in terms of planning the transport, estimating the costs, managing the client, and even understanding the market enabled Firm C to achieve greater cost reductions, boost sales further and improve relationships with its supply partners. At the same time, the GPS equipped the trading partners with up-to-date and reliable information about the transports. This allowed them to efficiently and effectively coordinate and plan for current and future transports. Operational decision-making was thus transformed into a collaborative act with the trading partners in an effort to achieve common goals (Wu and Chuang, 2010). Such collaborative decision-making resulted in benefits for all trading partners, including reduced supply chain costs, better planning and better communication, coordination and integration in the supply chain. Overall, informants from Firm C associated their improved performance to the wide scope

of the implementation and use of GPS in their operational decision-making. I therefore propose that:

> *Proposition 2: A wider scope of the implementation and use of GPS in operational decision-making facilitates firm performance.*

However, a closer look at the data (see Table 19, Table 20, Table 21) highlighted that the breadth of the implementation and use of GPS in operational decision-making in Firms A and B was quite similar. Yet Firm A exhibited a better performance than Firm B post-GPS adoption. Drawing on critics who claim that firms only enjoy a differential performance when IT is combined with capabilities that drive a comparative advantage (Clemons and Row, 1991, Mithas et al., 2011) and is supported by other organisational factors (McLaren et al., 2011, Oh and Pinsonneault, 2007), I delved deeper into the case firms to gain richer explanations of factors that may have influenced the varying performances in my sample arising from the adoption of GPS. My investigation surfaced some interesting insights. The three case firms differed in their information management capability, but also in organisational factors such as top management support, project management, financial support for the project, end-user involvement, rewarding, training and employee resistance (see Table 26 and Table 27 for for a detailed description).

Table 26: Firm Differences in Information Management Capability

	Firm A – Moderate Performer	**Firm B – Weak Performer**	**Firm C – Strong Performer**
Availability of quality information for decision-making	GPS provides appropriate levels of accurate, timely, reliable, secure and confidential information	GPS provides appropriate levels of accurate, timely, reliable, secure and confidential information	GPS provides appropriate levels of accurate, timely, reliable, secure and confidential information. Information is more visual and comprehensive
Software tools for connectivity and access to information	Adequate software tools for connectivity and access to information are available. Information about the transport service is directly emailed to the customer via GPS at certain times.	Adequate software tools for connectivity and access to information are available. The firm has two types of customers. 'Strategic' customers receive information about the transport service via direct access to GPS. Other, 'less strategic' customers receive information about the transport service by phone.	Adequate software tools for connectivity and access to information are available. Customers receive information about the transport service through direct access to GPS.
IT systems integration after GPS adoption	The integration of IT systems was manually handled. End-users cooperated during the integration.	The integration of IT systems was manually handled.	Full integration of GPS and the transactional system
Adaptability of the infrastructure to emerging business needs	Standard features of the GPS	Standard features of the GPS	Available additional online features of the GPS: - Fuel monitoring sensor connected with GPS - Digital tachograph connected with GPS

Source: Interview transcripts.

Table 27: Firm Differences in Organisational Factors

	Firm A – Moderate Performer	**Firm B – Weak Performer**	**Firm C – Strong Performer**
Top management support	The project was partly supported by top management. *"We knew that we needed the system, that was why we implemented it, although I still believe that we could also function without it"* *(General Manager).*	The project was partly supported by top management. *"The current operation functioned well, we did not have complaints or reclamations. From this point of view this was not the reason for adopting GPS"* *(General Manager).*	The project was fully supported by top management. *"We increased sales each year. We believed that the GPS would also add to the future growth of sales"* *(General Manager).*
Project management (Planning and managing the project)	Planning of the project was included in the implementation phase. The quality assurance manager was informally the project manager who planned, controlled and managed the project. *"We saw the system within one of our partners. We then contacted their GPS supplier, and arranged a meeting, where the system was presented to us. Later the supplier arranged everything for the installation of the devices"* *(General Manager).*	There was no special planning and management of the project. The general manager was in charge of the whole project. The supplier of the GPS was the informal leader of the project *(Observation notes).*	Before the start of the project, the project group prepared the project description and investment plan in which the project time-plan was also presented. The project group was also responsible for managing and monitoring the project. It reported to the General Manager about the results and its performance. *"The plan and description of all project phases was also presented verbally and in written form to us in the transport department"* *(Dispatcher).*
Financial support for the project	A budget was not allocated and the firm had limited financial capabilities. "*We had a limited amount of money to spend on this. In the same year we bought the land for a new logistics centre, which was our investment priority"* *(General Manager).*	The budget allocated was limited, although it was included in the yearly planning. *"We included this investment in our yearly investment plan. However, we limited it to around €35,000; anything more than that we would not have been able to pay"* *(General Manager).*	The budget allocated was large enough and was included in the yearly planning. *"We planned the budget for adopting GPS, which was not exceeded by the end of the project"* *(Transport Manager).*
End-user involvement	End-users (dispatchers, drivers) were involved in the GPS adoption from the start of the project. They actively cooperated during the installation phase and asked about the adjustments that needed to	The general manager together with the GPS supplier firstly installed the system, but at the beginning it was inaccessible to other dispatchers. They then fine-tuned it and informed	The project group organised periodical meetings where end-users were informed about changes. End-users actively cooperated in optimising the operation and functionalities of the

	Firm A – Moderate Performer	**Firm B – Weak Performer**	**Firm C – Strong Performer**
	be done to optimise its operation. They accepted the system relatively quickly.	others on how to use it. End-users were educated and later constantly monitored by the general manager.	GPS.
Reward scheme	Data from the GPS were used to encourage the drivers to improve their performance. Data from the GPS were used for wage calculations and as part of the reward strategy. *"Measures of the current reward system: number of hours in the office, job position, responsibilities, sick leave"(Employment Relations Policy).*	Data from the GPS were used to encourage the drivers to improve their performance.	Data from the GPS were used to encourage the drivers to improve their performance. Data from the GPS were used for wage calculations and as part of the reward strategy. *"With the use of GPS we were finally able to tell the employees that their salaries depend on them" (Transport Manager).*
Training	End-users received general training and education on use of the GPS. *"The budget for training and education was very limited; I therefore tried to give an overview of the system. I explained what was needed to my colleagues" (Logistics Manager).*	End-users received general training and support on how to use the GPS. Training was seen as an unnecessary cost. *"Implementation of the GPS was very costly, hence we did not decide to have any special training. The handbooks were given to us by the supplier" (General Manager).*	End-users received advanced training and support on how to use the GPS following a special training plan. Training was seen as an advantage. A training contract was entered into with the supplier. *"We were asked to help the drivers while they were in the vehicle" (Dispatcher).*
Employee resistance to GPS use	The firm had minor problems with employee resistance to GPS use. "*We have one driver who simply refused to use the GPS. For communication he still uses just his mobile phone" (Dispatcher).*	The firm had major problems with employee resistance to GPS use. *"For some drivers we needed months so that they could learn how to send a message. They received messages on the GPS system and sent a reply from their mobile phone. We had real chaos and at some point we could not solve the problem" (General Manager).*	The firm had no problems with employee resistance to GPS use. *"Drivers did not believe at first that this would simplify their work, although we managed to show the positive contributions to them" (Transport Manager).*

Source: Interview transcripts.

To begin with, Firm C appeared to have the information management capability in place to ensure the best use of GPS-enabled information and enjoy the performance

benefits. In particular, compared to Firms A and B, Firm C worked on the full integration of its GPS and with its transactional system, including the positions of the vehicles, times of the transports, stops, border crossings, time spent in different countries, fuelling etc. The General Manager of Firm C noted: *"We managed to establish the transfer of all information from the GPS to our transactional information system from the start of the GPS' functioning. At first we had a few problems, which were resolved with our IT support immediately"*. Firm C also leveraged online features to enhance information quality in additional decision areas (for example, on fuel consumption). Firm A, however, appeared to make better use of the software tools for connectivity and access to information than Firm B.

Moreover, organisational factors seem to have facilitated the better use of GPS or inhibited its benefits amongst the case firms. In Firm C, for instance, the GPS adoption project was fully supported by top management and careful project planning and management was in place. The firm knew from the start what kind of information was needed, when and how this information should be visually presented and how this information should be shared among the stakeholders (departments, clients etc.). The GPS adoption project was skilfully led by a project group and was given appropriate financial and training support. The project group prepared a description of the GPS adoption and investment plan, which included a time plan with required changes and actions. A Dispatcher in Firm C recalled: *"The plan and description of all project phases was also presented verbally and in written form to us in the transport department"*. The adoption of GPS brought about many changes in communication for the dispatchers, drivers and administrators in the case firms. Leaders in Firm C, along with the project group and the supplier of the GPS, organised relevant training on how to communicate via GPS and utilise its benefits. The training took place on an ongoing basis. In addition, in Firm C the effective adoption of GPS was also linked to revised rewards to further motivate staff. The monthly sales by vehicle, monthly number of orders entered by the dispatchers and monthly earnings by vehicle were among the measures that were incorporated in performance reviews. A Transport Manager in Firm C argued: *"With the use of GPS we were finally able to show employees that their salaries depend on them".*

On the other hand, the adoption of GPS in Firms A and B was somewhat more of an ad-hoc decision, by way of a reaction to changes in the market. Yet, in Firm A, end-users were involved in the adoption process from the start of the GPS implementation project (compared to Firm B where end-users became involved only much later in the process). Users in Firm A quickly started to apply the GPS-enabled information and were not under too much stress and close supervision by the top management. The quality assurance manager helped end-users adjust their daily tasks and operations. The adjustment phase was, as a result, quite short. On the contrary, in Firm B the general manager was in charge of the entire project. She implemented the GPS initially along with the GPS supplier in isolation from the end-users (dispatchers, drivers). End-users were only informed about the changes when the GPS was already in operation. Firm B put some basic training in place, but still faced major problems with employees resisting use of the GPS. It seemed that post-GPS adoption the drivers suddenly became more 'visible'. The dispatchers were able to see in detail their times, roads taken, stops as well as all the mistakes the drivers made. The drivers therefore initially believed that GPS had only been adopted to control them and increase their workloads. Sticking to pre-GPS routines or even hampering the system were some of the forms of resistance exhibited in Firm B.

Overall, my findings indicate that information management capability (in terms of the availability of quality information for decision-making, software tools for connectivity and access to information, IT systems integration post-GPS adoption and adaptability of the infrastructure to emerging business needs) along with organisational factors (such as top management support, project management of the GPS implementation, financial support, end-user involvement, rewarding, training and employee resistance) facilitated better use of GPS-enabled information in operational decision-making and thus enhanced firm performance. I therefore argue that:

> *Proposition 3: Information management capability and organisational factors moderate the relationship between GPS-enabled information and firm performance.*

To conclude the qualitative phase, the findings suggest that the adoption of GPS fosters changes in the transport process. Information available in the GPS used in

operational decision-making enables a shift towards more collaborative (among the transform firm, client, maintenance firm etc.) decision-making in the supply chain and a shift from intuitive towards fact-based decision-making. In return, these changes enhance the firms' information management capability.

4.2 QUANTITATIVE PHASE – EXTERNAL VALUE OF IT-ENABLED INFORMATION

In this chapter I present the results of the second phase where the conceptual model (see Figure 3) was tested. The show how the utilisation of IT-enabled information by the service provider influences industrial customer satisfaction. The study was made among industrial clients of transport services in business-to-business markets and presents the customers' view. A detailed description of the results is given in the following subsections.

4.2.1 DESCRIPTIVE ANALYSIS

The means and standard deviations of the original variables can be found in Table 3. In the collected data set, the means varied between 4.34 for GPS2 (improve communications between the transport firm and your) and 5.97 for PO3 (firm guarantees its prices). The highest means were found in the perceived customer satisfaction (CS) indicators and the lowest in the perceived GPS-enabled information utilisation (GPS) construct. The means for most of the measures were around one scale point to the right of the centre of the scale, suggesting a slightly left (negative) skewed distribution. Standard deviations varied between .890 for CS4 (satisfaction with order handling) and 2.149 for GPS6 (provide reports and diagrams based on GPS enabled information). The GPS indicators showed the highest standard deviations, while the CS indicators had the smallest variability.

Table 28: Means, Standard Deviations and Standardised Loadings of Manifest Variables

Construct	Indicator	Mean	Std. deviation	Loading
Perceived Service Quality (SQ)	SQ1	5.80	1.336	0.790*
	SQ2	5.52	1.264	0.764*
	SQ3	5.91	1.085	0.831*
	SQ4	5.90	1.082	0.806*
	SQ6	5.67	1.180	0.775*

Construct	Indicator	Mean	Std. deviation	Loading
	SQ7	5.66	1.183	0.801*
	SQ8	5.73	1.153	0.765*
	SQ9	5.63	1.144	0.732*
Perceived Price Offered (PO)	PO1	5.66	1.231	0.836*
	PO2	5.46	1.581	0.794*
	PO3	5.97	1.220	0.786*
Perceived Customer Satisfaction (CS)	CS1	5.85	0.952	0.873*
	CS2	5.87	1.092	0.877*
	CS3	5.59	1.098	0.856*
	CS4	5.84	0.890	0.868*
	CS5	5.89	1.049	0.854*
	CS6	5.47	1.390	0.791*
Perceived GPS-enabled Information Utilisation (GPS)	GPS1	4.90	1.923	0.861*
	GPS2	4.34	2.066	0.852*
	GPS3	4.64	1.981	0.905*
	GPS4	5.02	1.940	0.898*
	GPS5	5.04	2.032	0.924*
	GPS6	4.89	2.149	0.895*
	GPS7	4.76	2.092	0.906*
	GPS8	4.79	2.076	0.911*

Note: *Significant at the 0.001 level (two-tailed test)

4.2.2 MEASUREMENT OF RELIABILITY AND VALIDITY

I first examined the reliability and validity measures for the model constructs (Table 30). All of the Cronbach alphas exceeded the 0.7 threshold (Nunnally, 1978). Without exception, the latent variable composite reliabilities (Fornell and Larcker, 1981) were higher than 0.80, and in general above 0.90, showing the high internal consistency of the indicators measuring each construct and thus confirming construct reliability. The average variance extracted (AVE) (Fornell and Larcker, 1981) was also consistently higher than 0.60, indicating that the variance captured by each latent variable was significantly larger than the variance due to measurement error, and thus demonstrating the unidimensionality and high convergent validity of the constructs. The reliability and convergent validity of the measurement model were also confirmed by computing standardised loadings for the indicators (Table 28) and Bootstrap t-statistics for their significance (Anderson and Gerbing, 1988). All standardised loadings – except for SQ5, which was removed in the

final run of the model – exceeded the 0.7 threshold and they were found, without exception, significant at the 1 percent significance level, thus confirming the high convergent validity of the measurement model.

Discriminant validity was assessed by determining whether each latent variable shared more variance with its own measurement variables or with other constructs (Fornell and Larcker, 1981, Fornell and Bookstein, 1982, Chin, 1998). The results presented in Table 29 show that the loadings (bolded) are larger than the other values in the same rows (cross loadings). Numbers shown in bold indicate manifest variable correlations with latent variables that are in an order of magnitude beyond other manifest variables. All the item loadings met the requirements of the first procedure in the assessment of discriminant validity.

Table 29: Comparison of Item Cross Loadings for the Baseline Model

		SQ	PC	CS	GPS
SQ	SQ1	**0.7901**	0.4439	0.5369	0.1098
	SQ2	**0.7643**	0.4333	0.5266	0.0895
	SQ3	**0.8314**	0.5411	0.6416	0.1435
	SQ4	**0.8062**	0.5362	0.5905	0.1422
	SQ5	**0.7753**	0.3688	0.4904	0.1407
	SQ6	**0.8006**	0.3740	0.5171	0.1277
	SQ7	**0.7654**	0.4012	0.6000	0.2443
	SQ8	**0.7319**	0.4087	0.5317	0.1739
PC	PO1	0.4649	**0.8364**	0.5006	0.1341
	PO2	0.3684	**0.7936**	0.3660	0.1004
	PO3	0.5136	**0.7864**	0.4588	0.1780
CS	CS1	0.6957	0.5729	**0.8734**	0.3333
	CS2	0.5987	0.4259	**0.8773**	0.2373
	CS3	0.6098	0.4760	**0.8558**	0.2850
	CS4	0.6288	0.4978	**0.8685**	0.2942
	CS5	0.5663	0.4234	**0.8539**	0.2300
	CS6	0.5250	0.4275	**0.7903**	0.2358
GPS	GPS1	0.1940	0.1622	0.2994	**0.8609**
	GPS2	0.1791	0.1228	0.2842	**0.8518**
	GPS3	0.1877	0.1819	0.2967	**0.9053**
	GPS4	0.1572	0.1789	0.2883	**0.8976**
	GPS5	0.1912	0.1594	0.3116	**0.9244**
	GPS6	0.1663	0.1199	0.2721	**0.8947**

	SQ	PC	CS	GPS
GPS7	0.1295	0.1578	0.2590	**0.9055**
GPS8	0.1359	0.1538	0.2573	**0.9114**

For the second procedure, I compared the square root of the AVE for each construct with the correlations for all other constructs in the model (Table 31). A correlation between constructs exceeding the square roots of their AVE indicated that they may not be sufficiently discriminable. I observed that the square roots of AVE (shown in boldface in the main diagonal of both matrices) were always higher than the absolute correlations between constructs. I concluded that all the constructs showed evidence of acceptable validity.

Table 30: Reliability and Validity Measures

Construct	Cronbach's Alpha	Composite reliability	Average variance extracted
Perceived Service Quality (SQ)	0.910	0.927	0.614
Perceived Price Offered (PO)	0.732	0.847	0.649
Perceived Customer Satisfaction (CS)	0.925	0.942	0.729
Perceived GPS-enabled Information Utilisation (GPS)	0.964	0.970	0.800

Table 31: Correlations Between Latent Variables and Square Roots of Average Variance Extracted

	Perceived Service Quality (SQ)	Perceived Price Offered (PO)	Perceived CustomerSatisfaction (CS)	Perceived GPS-enabled Information Utilisation (GPS)
Perceived Service Quality (SQ)	**0.784**	0.564	0.712	0.190
Perceived Price Offered (PO)		**0.806**	0.556	0.173
Perceived Customer Satisfaction (CS)			**0.854**	0.319
Perceived GPS-enabled Information Utilisation (GPS)				**0.894**

Note: Numbers shown in bold denote the square root of the average variance extracted

Because I used the key respondent approach for data collection, I attempted to reduce common method bias, and also estimated its impact on the results. First, as

suggested by Podsakoff et al. (2003), I allowed responses to be anonymous and assured respondents that there were no right or wrong answers. Second, through the pilot testing, I attempted to have simpler and more direct questions. These steps helped control common method bias. Further, I conducted Harman's one-factor test to estimate the extent of bias (Podsakoff and Organ, 1986). Principal components analysis resulted in four components which accounted for 64.9% of the total variance, where the first component accounted for 23.5% of the variance; hence, there was no single factor accounting for more than 50% of the variation. Last but not least, I used Lindell and Whitney's method (2001) which employs a theoretically unrelated construct (marker variable) to adjust the correlations among the principal constructs. Job satisfaction was used as the marker variable. Since the average correlation among job satisfaction and the principal constructs was r=0.11 (average t-value=1.55), this test showed no evidence of common method bias. I also added a first-order factor with all the measures as a control variable in the empirical model. Its addition did not change the variance explained significantly. Based on these tests, I concluded that common method bias was not a significant threat in this study.

4.2.3 MODEL ESTIMATION RESULTS

After validating the measurement model, the hypothesised relationships between the constructs were tested. A bootstrapping with 1,000 samples to confirm the significance of the relationships was conducted which showed that hypotheses H1 and H2 were supported, although the results for confirming hypotheses H3 were not significant (also see Table 32, Table 33 and Figure 17).

Table 32: The hypotheses and their Support

Hypothesis	Description	Supported?
H1	H1: As the utilization of IT-enabled information in the service process increases, the importance of price offered in the formation of industrial customer satisfaction decreases.	YES
H2	H2: Utilization of IT-enabled information has a positive effect on service quality.	YES
H3	H3: As the utilization of IT-enabled information in the service process increases, the importance of service quality in forming customer satisfaction increases.	NO/NOT SIG.

Table 33 also shows the explanatory power (through determination coefficient, R^2) of the equations explaining the endogenous construct. The proposed model revealed a high explanatory power for CS (0.6). Further, Table 33 presents the estimates of the path coefficients of the proposed model and respective significances. The effect sizes for evaluating the predictive importance of each determinant (original constructs and interaction terms) may also be found in Table 33 (origins of the effects in rows and destinations in columns). Mirroring the existing literature, PO and SQ showed significant positive impacts on CS, with the impact of SQ being considerably larger (0.538 vs. 0.186).

Table 33: Structural Model Results and Effect Sizes (f^2)

Criterion	Predictors	R^2	Path coefficient	f^2
Perceived Customer Satisfaction (CS)	Perceived Price Offered (PO)	0.601	0.186**	
	Perceived Service Quality (SQ)		0.538***	
	Perceived GPS-enabled Information Utilisation (GPS) x Perceived Price Offered (PO)		-0.138*	0.072
	Perceived GPS-enabled Information Utilisation (GPS) x Perceived Service Quality (SQ)		-0.048 (ns)	
	Firm size		0.063 (ns)	
	Industry		0.092 (ns)	
Perceived Service Quality (SQ)	Perceived GPS-enabled Information Utilisations (GPS)	0.036	0.190*	

Notes: (ns) non-significant; * significant at the 0.05 level (two-tailed test); ** significant at the 0.01 level (two-tailed test); *** significant at the 0.001 level (two-tailed test)

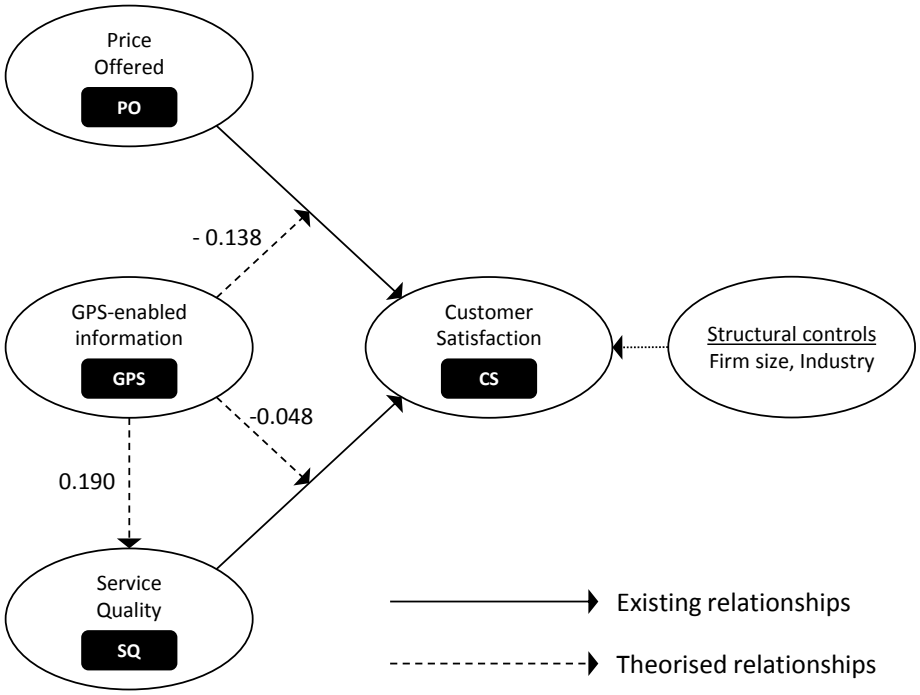
Within this study I also tested the potential moderating effect of GPS on the price offered-customer satisfaction relationship. The strength of the moderating effect can be assessed by comparing the proportion of variance explained (as expressed by the determination coefficient R^2) of the main effect model (i.e. the model without the moderating effect) with the R^2 of the full model (i.e. the model including the moderating effect). This idea also underlies the effect size. As suggested by Henseler and Fassott (2010), I employed the following formula to calculate the effect size:

$$f^2 = \frac{R^2_{model\ with\ moderator} - R^2_{model\ without\ moderator}}{1 - R^2_{model\ with\ moderator}}$$

Moderating effects with effect sizes f^2 of 0.02 may be regarded as weak, effect sizes from 0.15 as moderate, and effect sizes above 0.35 as strong (Henseler and Fassott, 2010). In this case, I have a relatively small effect size ($f^2 \approx 0.08$). Chin et al. (2003) state that a small effect size f^2 does not necessarily imply that the underlying moderator effect is negligible: *"Even a small interaction effect can be meaningful under extreme moderating conditions, if the resulting beta changes are meaningful, then it is important to take these conditions into account"* (Chin et al., 2003).

The GPS x PO-CS path was significant at 5 percent. It appeared that the more customers perceived that the transport service provider utilised IT-enabled information, the lower was the importance of prices offered in forming their satisfaction with the transport firm (H1 was, therefore, supported). Moreover, the effect of GPS on SQ was positive, thus suggesting that the more customers perceived that the transport service provider utilise IT-enabled information, the more this enhanced the perceived service quality (H2 was hence supported). The path GPS-SQ was significant at 5 percent. Interestingly, the GPS x SQ-CS path was non-significant (H3 was not supported). Utilising IT-enabled information thus did not appear to increase the perceived importance of SQ in forming CS with transport service providers. Lastly, the results indicated that the control variables, i.e. firm size and industry type, did not have any significant effect on CS.

Figure 17: Proposed Structural Model with a Moderating Effect



In the next chapter the theoretical and practical implications of the qualitative and quantitative results are discussed.

5. DISCUSSION

The fifth chapter has two sections. In the first section, I discuss the main findings from the qualitative and quantitative phases along with the theoretical and practical implications. In the second section, I expose the limitations of the qualitative and quantitative study and outline further research opportunities for this area of research.

5.1 THEORETICAL, PRACTICAL AND POLICY IMPLICATIONS

In the following paragraphs, the theoretical and practical implications are discussed. First, I present the internal value of IT-enabled information and, second, the external value of IT-enabled information utilisation.

5.1.1 THE INTERNAL VALUE OF IT-ENABLED INFORMATION

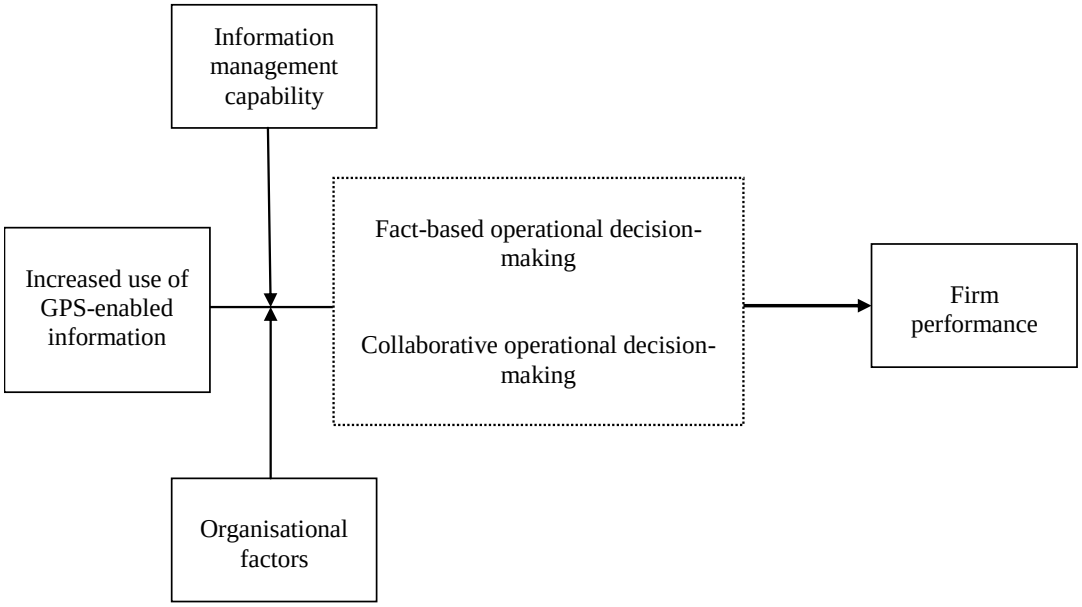
In the qualitative phase of this research my aim was to examine the internal value of IT-enabled information by answering the research questions: (1) How does the adoption of GPS transform operational decision-making in the transport process? and (2) What are the underlying mechanisms that facilitate better use of GPS-enabled information in operational decision-making and link investments in GPS to firm performance? I contribute to the business value of IT literature by unpacking how the use of GPS-enabled information changes operational decision-making and enables firms to earn above-normal returns (see Figure 18).

Consistent with my theoretical foundations in decision-making, resource-based perspectives and transaction cost economics, this study makes three theoretical contributions. First, I show that increased use of GPS-enabled information can enhance information quality and make operational decision-making more fact-based and collaborative. The shift towards fact-based decision-making enables decision-makers to use information in considering more alternatives when making operational decisions (Priem et al., 1995, Citroen, 2011). It involves tasks such as searching for information on potential alternatives, examining positive and negative consequences of different alternatives, defining the procedure for following up the decision etc. (Citroen, 2011). Echoing existing studies in decision-making literature, I find that when decision-makers

use more GPS-enabled information they accelerate the decision-making process, better forecast the decision-making time horizon (Citroen, 2011) and reduce the number of organisational levels involved in authorising the proposed decision (Huber, 1990). Increased use of GPS-enabled information also triggers a shift towards more collaborative decision-making within the supply chain (among the transport firm, client, maintenance firm etc.). As a result, supply chain partners realise operational process benefits in the form of cost reductions, better transport and maintenance planning, lower inventory levels, better organisation of the workforce and an absence of fuel shortages, while they leverage improvements in process integration and customer service (Cachon and Fisher, 2000, Barratt, 2004, Li and Lin, 2006, Smith et al., 2007). As such, GPS-enabled information not only empowers firms to automate and inform, but more importantly to transform information quality and operational decision-making in supply chain relationships (Zuboff, 1988). Second, drawing on resource-based logic (Barney, 1991, Ray et al., 2005), I argue that such transformations in operational decision-making, driven by increased use of GPS-enabled information, can foster differential performance impacts (Priem et al., 1995, Hvolby and Steger-Jensen, 2010). However, I warn scholars and practitioners that a firm's information management capability (in terms of the availability of quality information for decision-making, software tools for connectivity and access to information, IT systems integration post-GPS adoption and adaptability of the infrastructure to emerging business needs) and organisational factors (such as top management support, project management of GPS implementation, financial support, end-user involvement, rewarding, training and employee resistance) can facilitate (or inhibit) the effective use of GPS-enabled information in operational decision-making and thus moderate the differential performance benefits of GPS adoption. As such, I extend the business value of IT literature, which argues that seeking a strategic advantage solely by developing IT competency may not necessarily lead to an enhanced performance; information management capability is an important moderator (Tippins and Sohi, 2003, Davis and Golicic, 2010, Mithas et al., 2011). I also extend the literature that views organisational factors as being critical to effective IT adoption (Earl and Feeney, 2000, Leung, 2001, Nah et al., 2001, Hong and Kim, 2002, Dezdar and Sulaiman, 2011). The absence of information management capability and organisational factors may cause the adverse effects of GPS-enabled information use. For example, the driver might feel uncomfortable because of the close

monitoring of the position of their vehicle. The driver may disrespect the rules and resist using the system according to the agreement, which may turn into resistant behaviour (Junglas et al., 2008).

Figure 18: Proposed Conceptual Framework



These results should be interpreted with caution because it is not possible to completely rule out alternative explanations. One alternative explanation for the performance differences across the three case firms could be the differences in firm size. Although all three firms are classified as medium-sized, Firm C (the stronger performer) is the largest in my sample. One might suggest that it had a larger system scope for implementation and hence that size drove the enhanced use of GPS-enabled information. Yet, on the contrary, I could also argue that the larger system size could have made it more challenging to implement the GPS adoption and leverage the operational benefits of integrating the systems. In either case, firm size did not emerge as an alternative explanation through the qualitative findings. One could also claim that firm age, the industry sector and the location of the firms could have influenced the results. I therefore recommend that future studies control for firm size, age, industry sector and location to account for performance differences attributable to organisational resources, inter-industry or country variations (Capon et al., 1990, Hendricks and Singhal, 2001).

The qualitative results also hold important managerial implications. To begin with, I recommend the increased use of GPS-enabled information in operational decision-making since this can facilitate cost reductions, improve vehicle and dispatcher productivity, foster supply chain cooperation and enhance customer satisfaction. More specifically, cost reductions are seen in terms of lower fuel consumption, savings on shorter distances between unloading and loading places and effective transport planning. The Logistics Manager in Firm B explained: *"Before the start of the transport the dispatchers send the drivers all details about the transport route. During constant monitoring, the dispatcher might change the route if we see that the costs are too high, or the required delivery time cannot be achieved".* In addition, a Dispatcher from Firm A added: *"The drivers are also aware that we are monitoring them and, at the same time, we have exact information about fuel consumption. They are now more careful when driving; they are speeding less and do not constantly stop and go along the route".* Vehicle and dispatcher productivity has also been substantially improved. A Dispatcher from Firm B agreed: "*Our yearly productivity of the fleet including 39 vehicles rose by 4 percent after GPS was implemented*"; with the Dispatcher of Firm C adding: *"Real-time monitoring enables the dispatcher to reduce the number and time of phone conversations with the driver, so at the same time we can all do more".* Further, having a GPS device available in the vehicle also provides important GPS-enabled information (e.g. the best proposed route, best calculated time, mileage, closed roads etc.) to the driver. The driver is then able to better plan the driving hours, stops and rests according to the dispatcher's instructions. A dispatcher from Firm A (also a former driver) explained: "*When we receive the information about the loading and unloading times, we can now precisely plan the route with the use of GPS. If necessary, we can send the proposed route to the dispatcher via GPS to confirm it*". This enables the avoidance of unnecessary paper work, phone calls and disturbances of the driver, which in the long run leads to better satisfaction of the employees with the work environment. Finally, clients collectively agree that GPS-enabled information adds to supply chain communication channels and their overall satisfaction with the transport service. A client of Firm A elaborated: *"Now we know that the transport firm can give us information about the location of the vehicle at any minute. This provides us with important information which is promptly delivered to our customers to allow effective warehouse process coordination".* However, it is worth stressing that since GPS

is readily available and thus not rare or hard to imitate investing in this IT per se is unlikely to yield differential performance returns compared to competitors. Instead, the performance impact is conditional upon a firm's capability of utilising GPS-enabled data to improve information quality and engage in fact-based and collaborative operational decision-making. For illustration, the participation of the leaders before, during and after the adoption of the GPS and the planning of the GPS implementation project was very different in Firms A and B compared to Firm C. In first two firms, the leaders are also strongly involved in the day-to-day operating tasks and were thus not completely focused on the pre-implementation and implementation phases. On the other hand, the leaders of Firm C organised a project group which was given full financial and work resources to successfully implement the GPS. I therefore recommend that firms also pay attention to their information management capability and the organisational factors outlined in my findings as these will facilitate better use of GPS-enabled information in operational decisions and boost process benefits and performance returns. For instance, firms have to ensure that formal data and processes are embedded in the IT infrastructure, but also foster informal integration through active IT business collaboration within the supply chain. Leaders can also play a pivotal role by championing the adoption of GPS, offering ongoing training and support, and by revising the reward schemes to motivate and engage staff in this process. As the General Manager of Firm A concluded: *"A firm can invest in superior, technologically advanced GPS that can enable it obtain up-to-date information. But if the dispatchers and other employees do not know how to use the system and the information, it is all worthless. And here we failed in our exam by not providing staff support, unlimited training and, what is especially important, sufficient training time".*

5.1.2 THE EXTERNAL VALUE OF IT-ENABLED INFORMATION

In the quantitative phase of this research my aim was to examine the external value of IT-enabled information by answering the following research question: How does the utilisation of IT-enabled information by the service provider influence industrial customer satisfaction? Despite the recognised benefits of IT in the existing industrial marketing literature, our understanding of how IT utilisation shapes industrial customer satisfaction remains limited. While echoing the influence of price offered and perceived service quality

on industrial customer satisfaction, my research provides new insights into how utilisation of IT-enabled information affects the determinants of customer satisfaction.

The utilisation of IT-enabled information affects the customer satisfaction formation process as a noteworthy moderator (Gal-Or et al., 2008, Davis and Golicic, 2010). My study reveals two important contributions for industrial marketing theory in terms of the role that IT-enabled information utilisation plays on industrial customer satisfaction formation. First, the results suggest that the more customers perceive that service firms utilise IT-enabled information in their operations, the more this suppresses the relative impact of perceived price offered on the formation of overall customer satisfaction. Drawing on equity theory, I theorise that this happens because perceptions of information utilisation in the transport process trigger perceptions of fairness, reliability, confidence and transparency when it comes to prices (Homburg et al., 2005, Carter and Curry, 2010, Lymperopoulos et al., 2013). Increased utilisation of IT-enabled information thus not only enables industrial firms to determine prices with greater precision, segment customers more accurately through all available channels, and adjust prices promptly (Li et al., 2009b). For that reason, customers feel they have greater control and power to make decisions (Lymperopoulos et al., 2013), and place less emphasis on prices when it comes to forming levels of satisfaction.

Second, my results show that utilisation of IT-enabled information positively influences perceptions of service quality. IT-enabled information can enhance the quality of information, available during the service process (Smith and Mentzer, 2010). In the e-service context, Xu et al. (2013) have discussed this effect of information quality on service quality. Similarly, in the transportations and logistics context, delivering timely and comprehensive information to customers has been found to be critical (Kahn et al., 2002). IT utilisation enhances on-time delivery as well as flexibility in the transport process, enabling the transport firm to reroute a vehicle while en route if customers' requirements change (Mintsis et al., 2004, Rishel et al., 2003).

From the expectation-confirmation theory perspective (Oliver, 1980), I would expect that improved service quality, facilitated through perceptions of the utilisation of IT-enabled information, would increase the overall customer satisfaction with a service

provider. Yet, my results suggest that this is not the case. Surprisingly, my results suggest that quality improvements via perceived IT-enabled information utilisation do not translate into improved customer satisfaction. I can theorise three possible reasons for such an outcome. First, the literature suggests that positive enhancements of service quality might not be reflected in an immediate increase in customer satisfaction, but only in the long run (Anderson et al., 1994). Second, IT-enabled information utilisation may increase customers' expectations and thereby widen the gap vis-à-vis perceived service performance levels (Bebko, 2000, Chang and Chen, 2008). Third, an alternative possible explanation is that the weakened relative importance of price in the formation of customer satisfaction shifts the emphasis over to other customer satisfaction determinants such as order handling, delivery reliability or complaint handling (Homburg and Rudolph, 2001). For instance, delivery reliability, also a facet of the order handling process, and the introduction of electronic order handling through IT may reduce potential human error and paperwork that is then reflected in a cost-effective process (Giannopoulos, 2004, Inkinen et al., 2009, Rishel et al., 2003, Theiss et al., 2005). Next, up-to-date, transparent and current information about the service, that is also available in the post-purchase period and for complaint handling, can increase customer satisfaction (Sitko-Lutek et al., 2010, Barksdale et al., 1984).

My quantitative results also highlight several implications for industrial marketing practice. Utilisation of IT-enabled information makes price determination more transparent, reliable and hence possibly fairer in the eyes of customers by revealing common market and transport costs (e.g. road tolls, taxes, fuel costs). For that reason, industrial firms should re-examine how they provide information about prices to customers. They should concentrate their efforts on facilitating customers' information search through all available channels in order to make customers feel they have the control and power to make decisions. The customers may thus have greater self-service through financial comparison sites and financial planning tools. A customer of firm C explained: "*We always want that the transport firm fully describes the offered price, with all discounts and possible price add-ons. A later change in the price due to unexpected situations is always accepted as not good*". While IT-supported pricing determination may lead to less price variation between competitors, customers are likely to look for other factors in

forming their satisfaction with a transport service provider and pay less attention to the price offered. A customer of Firm B elaborated: *"If the transport firm provides us with the mileage spent on the road which is toll-payable, we have no problems paying this. This argument is accepted by us when we are presented with an explanation that no other non-payable road that would not extend the duration of the transport is nearby".* Industrial service providers utilising IT-enabled information for determining prices should therefore focus on developing other customer-oriented capabilities (e.g. order handling, complaint handling, flexibility, responsiveness, reliable delivery) in order to distinguish themselves from the competition. In this light, a customer of Firm A explained: *"At the yearly tender, we get quotations from at least 10 transport firms. When we eliminate the transport firms with the lowest and highest prices, we have final negotiations with around four transport firms. If we compare the final prices there is less than a 3% difference and we therefore also consider other elements such as quality, delivery times, types of vehicles, capacity etc.".* In essence, transport firms should be shifting their emphasis from being price-oriented service providers to customer-oriented service providers. While doing so, they can also emphasise such efforts as important parts of their sales strategy. Such incentives are very important for the overall optimisation of the logistics activities to meet customers' internal needs (e.g. customised bookings contributing to improved efficiency and process consistency, ensuring just-in-time delivery, promptly solving complaints) and can be a source allowing higher prices to be charged to transport service customers. The General Manager of Firm C noted: *"All of our vehicles are equipped with GPS, we hire highly qualified drivers and maintain our vehicles at high standards. Our customers know they will get a high quality service with the up-to-date information they need. We also assure full support for collaboration throughout the supply chain. For the service we of course charge a price with which we can cover all the costs. If we are too expensive, we look for other customers that are more demanding and require the service we can offer".* Relying on a fact-based price determination can bring several potential benefits to transport service customers. First, they can save valuable resources, especially time, when searching for competitive offers from prospective transport service providers. A customer of Firm C argued: *"Each year we issue a tender where we select transport firms for all the destinations we need. Within that year, we do not search for additional providers since it is too costly and time-consuming for us and we know that if the fuel price does not change*

the transport price will stay at the same level". Second, they can better focus on negotiating or tailoring other aspects of their customer-supplier agreement to meet their needs beyond direct economic interests. For instance, a transport provider might manage a customer's post-purchase activities through active complaint handling, document managing and reporting. All of this contributes to a positive customer-service provider experience, which is the key to repeat purchases (Kuksov and Ying, 2010).

5.1.3 POLICY IMPLICATIONS

Finally, from the wider policy perspective, these findings might also encourage government and other governmental institutions in the EU to propose some policy guidelines. For example, government should consider the use of GPS by road transportation firms as mandatory, especially to improve control over the driving hours of the driver and vehicle, the use of toll and non-toll roads and the fuelling habits of the transport firms. Driving hours of the driver and the vehicle are extremely important for preventing road accidents and injuries while performing a transport service. In addition, the use of toll instead of non-toll roads is important for preventing road congestion, particularly during the summer tourist season. Lastly, limiting fuelling in those countries where the fuel price is significantly lower than the average price in the EU might also help government to redistribute fuel consumption to within EU. Government should then establish a thorough and solid scheme for the collection of fuel tax. Further, while GPS-enabled information is readily available in electronic format, the government should establish the direct electronic reporting of transport firms to governmental institutions. Information (for example, weight of the load, mileage, driving road, driving hours, maintenance period etc.) is gathered by the GPS, the digital tachograph and the fleet management system installed in the vehicle. This information is periodically examined by the governmental inspection agencies that are in charge of preventing abuse. The online availability of transport information to these agencies would enable the government to widen the pool of controlled firms that do not respect the laws and regulations in this area. This would result in better control over the grey economy and missing traders that create instability and jeopardise safety in road transport.

5.2 LIMITATIONS OF THE STUDY AND FUTURE RESEARCH

First, the case study design in the qualitative phase limits my ability to generalise the results to a wider population of firms. Thus, I recommend that scholars replicate and extend this study to broader contexts. For instance, I should underline that the deep change often required for leveraging transformational benefits from the adoption of IS can entail a costly and risky process (Besson and Rowe, 2012). In this study, all three firms were profitable and exhibited better performance across various indicators than the industry average. Therefore, perhaps the context of the three firms was not that risky when it came to adopting GPS. Future research should study how GPS or another IS adoption influences operational decision-making in lower performing firms and also explore the associated costs and risks. Further, studying cases of failure will add valuable insights (Besson and Rowe, 2012). In addition, a longitudinal design would be desirable to further examine the causal dynamics of the relationships outlined in my conceptual framework. Moreover, future research should delve deeper into the mechanisms that foster IT capability building. Data-driven operational decision-making is only one piece of the puzzle for achieving differential performance returns. Future research should extend my work and examine how other elements such as firm structure, people and routines interact with IT to enable differential performance returns.

Second, despite its contributions to theory and practice the quantitative phase of this study has limitations that open up opportunities for future research. To begin with, my model was tested in the transport services environment in Slovenia, with GPS as the underlying technology providing quality information. Future research could examine the generalisability of the findings to other industrial settings, countries and systems, e.g., enterprise resource planning (ERP). Moreover, future studies could identify the antecedents of perceived IT-enabled information utilisation in these contexts, as well as possible additional boundary conditions (i.e., moderators). It would also be useful to test how other customer satisfaction determinants, for example order handling and complaint handling, impact customer satisfaction. This would facilitate an answer to whether IT as a moderator facilitates a redistribution of the impact of price competitiveness and warranty to other aspects of customer satisfaction. Last but not least, researchers might also

investigate the organisational conditions in which IT-enabled information facilitates or hinders customers' repurchase intentions.

6. CONCLUSION

Information is a vital resource for managers and customers amidst environments high in uncertainty. Moreover, customer satisfaction plays a major role in retaining long-term supply chain relationships and enhancing firm performance in industrial contexts. In this light, this study explored the internal and external value of IT-enabled information use by industrial providers.

First, the study showed how the use of IT-enabled information transforms operational decision-making and highlighted its link with firm performance. My findings revealed that IT-enabled information facilitates fact-based and collaborative operational decision-making. First, more fact-based decision-making enables decision-makers to use information to consider more alternatives when making operational decisions. The decision-making steps, such as identifying limiting factors, developing potential alternatives, analysing the alternatives and selecting the best alternatives, are significantly improved with use of fact-based information. When decision-makers use IT-enabled information they speed up the decision-making process, better forecast the decision-making time horizon and reduce the number of organisational levels and staff involved in authorising the proposed decision. Second, a shift towards more collaborative decision-making within the supply chain (among the transport firm, client, maintenance firm etc.) enables supply chain partners to reduce costs, implement better transport and maintenance planning, minimise inventory levels and avoid fuel shortages, and improve organisation of the workforce. Third, a firm's information management capability (for example, the availability of quality information for decision-making, software tools for connectivity and access to information, IT systems integration post-GPS adoption and adaptability of the infrastructure to suit emerging business needs) and organisational factors (for example, top management support, project management of GPS implementation, financial support, end-user involvement, rewarding, training and employee resistance) facilitate the effective use of GPS-enabled information in operational decision-making and thus moderate the differential performance benefits of GPS adoption. For that reason, IT competency by itself may not necessarily lead to an enhanced performance. Moreover, the absence of information management capability and organisational factors may cause the adverse effects of GPS-enabled information use, reflected in resistant behaviour.

Second, this study explored how utilisation of IT-enabled information by the service provider influences industrial customer satisfaction. By bringing together the customer satisfaction and information utilisation literature I was able to develop research hypotheses that shed light on these relationships. My findings revealed that the utilisation of IT-enabled information suppresses the relative importance of the price offered in forming customer satisfaction in industrial contexts. This occurs because perceptions of information utilisation in the transport process trigger perceptions of fairness, reliability, confidence and transparency when it comes to prices. Increased utilisation of IT-enabled information thus not only enables industrial firms to determine prices with greater precision, but to segment customers more accurately through all available channels and adjust prices promptly. For that reason, customers feel they have greater control and power to make decisions, and they place less emphasis on prices when it comes to forming satisfaction. Moreover, perceptions of IT-enabled information utilisation positively affect customers' perceptions of a transport firm's service quality; although this does not impact on the relative importance of service quality in the formation of customer satisfaction. The reason for this situation may occur while the positive enhancements of service quality might not be reflected in an immediate increase in customer satisfaction, but only in the long run. Moreover, IT-enabled information utilisation may increase customers' expectations and thereby widen the gap vis-à-vis perceived service performance levels. Last but not least, the weakened relative importance of price in the formation of customer satisfaction shifts the emphasis over to other customer satisfaction determinants such as order handling, delivery reliability or complaint handling.

I hope that this study will trigger future research that sheds more light on the role IT-enabled information plays in operational decision-making and firm performance, and in determining industrial customer satisfaction formation.

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APPENDICES

APPENDIX 1

Topic guide, initial qualitative phase of the research – transport firms

PART 1

Gender of the interviewee: FEMALE MALE

Age: _____

What is your position in the transport firm?

For how many years have you been working in this industry?

For how many years have you been working in this transport firm?

Which activity/activities of the transport process do you cover with your main working tasks? Can you describe all the tasks you do within the activity/activities.

In which activity of the transport process do you usually have contact with the client?

Besides your contact with the client, how do clients also interact with other staff within the transport process (process point, other employees etc.)?

PART 2

We are exploring how the adoption of GPS in the transport firm affects customer satisfaction. The following questions relate to the implementation of GPS, and the following issues: (1) how does the transport process change after implementing GPS; and (2) how do transport process changes affect customer satisfaction.

When was GPS implemented in your transport firm?

Do you use GPS on a daily basis?

How do you use GPS on a daily basis?

What do you think are the key advantages of using GPS?

Can you specify the main changes in the transport process after implementing GPS?

How would you describe the transport process before and after GPS was implemented?

Before the implementation of GPS	After the implementation of GPS

Which process changes after GPS was implemented affect customer satisfaction? Would you add any other changes? Prompt from the list below.

Determinant	**Measure**	**YES**	**NO**
Price competitiveness and warranty	Competitiveness		
	Warranty		
Service quality	Tangibles		
	Reliability		
	Responsiveness		
	Assurance		
	Empathy		
Information quality	Convenience		
	Timeliness		
	Traceability		
	Interactivity		
	Consciences		
	Consistency		
	Correctness		
	Currency		
Customer service	Importance of customers		
	Fully operational services		
	Service based on customers		
	Monitoring of services		
	After-sales services		
Operational efficiency	Time order to complete		
	Control of the order		
	Electronic tracking		
	Service errors		
Delivery service	Order fill rate		
	Order cycle time		

Please score all of the identified process changes according to their importance for their effect on customer satisfaction? (where 1 is the most important)

APPENDIX 2

Topis guide, initial qualitative phase of the research – transport firms additional questions

Use of information in decision-making

Strategic decision-making: in which areas do you use information from the GPS:

- restructuring;
- implementing new services (for example, new types of transport etc.);
- organisational changes (for example, a new organisational structure, new departments etc.);
- implementing new IT in the transport process (for example, intranet, transport planning and monitoring solution etc.);
- marketing strategy (for example, implementing new forms of advertising etc.);
- geographical expansion (for example, performing transport services to Russia, Ukraine etc.);
- diversification (for example, implementing new services such as maintenance works, warehousing etc.);
- new strategic investments (for example, building a new logistics centre at a different location etc.);
- employment strategy (for example, employing foreign workers etc.); and
- quality (for example, assurance of a high quality transport service).

Operational decision-making: in which areas do you use information from the GPS:

- transport planning (for example, planning new and return transports etc.);
- transport control (for example, controlling the status of the transport service etc.);
- vehicle routing (for example, routing a vehicle to the closest load etc.);
- fuel consumption;
- maintenance works (for example, planning future maintenance works etc.);
- individual pricing (for example, setting an individual price for a specific transport etc.);
- controlling costs (for example, toll and fuel costs, costs of the driver etc.);
- rewarding staff (for example, a reward model for drivers and dispatchers etc.); and
- other.

How do you use the information from the GPS in strategic and operational decision-making? Do you have direct access to the GPS-enabled information; do you have access to the reports?

What are the main changes for strategic and operational decision-making from the use of GPS-enabled information? Possible changes:

- decisions are accepted faster;
- fewer/more individuals are involved in the decision-making process;
- the correctness of the accepted decision; and
- other.

Can you describe two strategic and operational decision-making processes before and after the use of information from the GPS?

APPENDIX 3

Topic guide, initial qualitative phase of the research – transport firms' clients

PART 1

Gender of the interviewee: FEMALE MALE

Age: _____

What is your position in the firm?

For how many years have you been working in this industry?

For how many years have you been working in this firm?

Which activity/activities of the transport process do you cover with your main working tasks? Can you describe all the tasks you do within the activity/activities?

In which activity of the transport process do you have contact with the staff of the transport firm?

PART 2

We are exploring how the adoption of GPS by the transport firm affects customer satisfaction. The following questions relate to the implementation of GPS, and the following issues: (1) how does the transport process change after implementing GPS; (2) how do transport process changes affect customer satisfaction.

Do you perhaps know when the GPS was implemented in this transport firm?

Do you receive GPS-based information from this transport firm on a daily basis?

In your opinion, what are the key advantages for this transport firm of using GPS?

How do you see changes in the transport process before and after GPS was implemented by this transport firm?

Before the implementation of GPS	After the implementation of GPS

Which process changes after the implementation of GPS affect your satisfaction with this transport firm? Would you add any other changes? Prompt from the list below.

Determinant	Measure	YES	NO
Price competitiveness and warranty	Competitiveness		
	Warranty		
Service quality	Tangibles		
	Reliability		
	Responsiveness		
	Assurance		
	Empathy		
Information quality	Convenience		
	Timeliness		
	Traceability		
	Interactivity		
	Consciences		
	Consistency		
	Correctness		
	Currency		
Customer service	Importance of customers		
	Fully operational services		
	Service based on customers		
	Monitoring of services		
	After-sales services		
Operational efficiency	Time order to complete		
	Control of the order		
	Electronic tracking		
	Service errors		
Delivery service	Order fill rate		
	Order cycle time		

Please score all of the identified process changes according to their importance for their effect on your satisfaction with this transport firm? (where 1 is the most important)

APPENDIX 4

Final questionnaire, second quantitative phase

A: Perceived Service quality

On a scale of 1-7 please state how strongly you agree or disagree with the following statements:	1 = Strongly Disagree, 7 = Strongly Agree						
SQ1: When the company promises to do something by a certain time, it does so.	1	2	3	4	5	6	7
SQ2: When you have problems, the company is sympathetic and reassuring.	1	2	3	4	5	6	7
SQ3: The company is dependable.	1	2	3	4	5	6	7
SQ4: The company provides its services at the time it promises.	1	2	3	4	5	6	7
SQ5: The company keeps its records accurately.	1	2	3	4	5	6	7
SQ6: You can trust the employees of the company.	1	2	3	4	5	6	7
SQ7: You feel safe in your transactions with the company's employees.	1	2	3	4	5	6	7
SQ8: Employees of the company are polite.	1	2	3	4	5	6	7
SQ9: Employees receive adequate support from the company to do their jobs well.	1	2	3	4	5	6	7

B: Perceived Price Offered

On a scale of 1-7 please state how strongly you agree or disagree with the following statements:	1 = Strongly Disagree, 7 = Strongly Agree						
PO1: The firm offers competitive prices for its services	1	2	3	4	5	6	7
PO2: The firm is able to offer prices as low as its competitors	1	2	3	4	5	6	7
PO3: The firm guarantees its prices	1	2	3	4	5	6	7

C: Customer Satisfaction

On a scale of 1-7 how would you rate your satisfaction towards the company's:	1 = Very Unsatisfied, 7 = Very Satisfied						
CS1: Satisfaction with the transport service	1	2	3	4	5	6	7
CS2: Satisfaction with the salespeople	1	2	3	4	5	6	7
CS3: Satisfaction with transport services-related information	1	2	3	4	5	6	7
CS4: Satisfaction with order handling	1	2	3	4	5	6	7
CS5: Satisfaction with the interaction with internal staff	1	2	3	4	5	6	7
CS6: Satisfaction with complaint handling	1	2	3	4	5	6	7

D: Perceived GPS-enabled Information Utilisation

On a scale of 1-7 please answer to what extent does your transport company use GPS enabled information for the following:	1 = Not at all, 7 = Intensively						
GPS1: To encourage your employee involvement to improve work processes	1	2	3	4	5	6	7
GPS2: To improve communications between the transport firm and your	1	2	3	4	5	6	7
GPS3: To improve ordering process	1	2	3	4	5	6	7
GPS4: To enable staff to share task-related information with your employees	1	2	3	4	5	6	7
GPS5: To collect data about work/production processes needed by you	1	2	3	4	5	6	7
GPS6: To provide reports and diagrams based on GPS enabled information for you	1	2	3	4	5	6	7
GPS7: To provide timely information to you for decision-making	1	2	3	4	5	6	7
GPS8: To provide relevant information to you that meets your needs	1	2	3	4	5	6	7

E: Demographic information of the firm

1. Economic activity. (tick only one)

a) Food and drug processing
b) Transportation / equipment services
c) Chemicals / rubber / mining
d) Miscellaneous manufacturing
e) Publishing
f) Marketing services
g) Wholesaling / retailing
h) Electronics / telecommunications
i) Financial
j) Institutions
k) Healthcare
l) Other

2. Where is your firm's headquarters? (tick only one)

   a) Pomurska region
   b) Podravska region
   c) Koroška region
   d) Savinjska region
   e) Zasavska region
   f) Spodnjeposavska region
   g) Jugovzhodna Slovenija
   h) Osrednjeslovenska region
   i) Gorenjska region
   j) Notranjsko - kraška region
   k) Goriška region
   l) Obalno - kraška region

3. Average number of employees in 2009. (tick only one)

   a) 1 – 9
   b) 10 – 49
   c) 50 – 99
   d) 100 – 199
   e) 200 – 249
   f) 250 – 499
   g) 500 – 999
   h) 1000 or more

4. Sales in 2009. (tick only one)

   a) under 500.000 €
   b) from 500.001 € to 1.000.000 €
   c) from 1.000.001 2.000.000 €
   d) from 2.000.001 to 5.000.000 €
   e) from 5.000.001 to 10.000.000 €
   f) from 10.000.001 to 20.000.000 €
   g) over 20.000.001 €

5. Year when your firm was established? (tick only one)

    a) Prior to 1960
    b) 1961-1970
    c) 1971-1980
    d) 1981-1990
    e) 1991-2000
    f) 2001-2010

F: Information of the person who fills in this questionnaire:

1. Gender.

    a) Male
    b) Female

2. Age. (tick only one)

    a) under 25
    b) between 25 and 35
    c) between 36 and 45
    d) between 46 and 55
    e) between 56 and 65
    f) 66 and over

3. Education. (tick only one)

    a) Postgraduate degree
    b) Some postgraduate school
    c) Four-year college graduate
    d) Two year college graduate
    e) High school diploma
    f) Some school
    g) Other

4. Years with present employer. (tick only one)

    a) 0 – 5
    b) 6 – 10
    c) 11 – 15
    d) 16 – 20
    e) 21 – 25
    f) 26 – 30
    g) over 30

5. Years in the industry. (tick only one)

    a) 0 – 5
    b) 6 – 10
    c) 11 – 15
    d) 16 – 20
    e) 21 – 25
    f) 26 – 30
    g) over 30

6. Which function of your firm do you work in? (tick only one)

    a) Finance/Investment
    b) Accounting/Audit
    c) Marketing
    d) Customer service
    e) Personnel
    f) General administration/Planning
    g) Purchasing
    h) Other

Thank you for your participation.