Thresholds in logistics collaboration decisions

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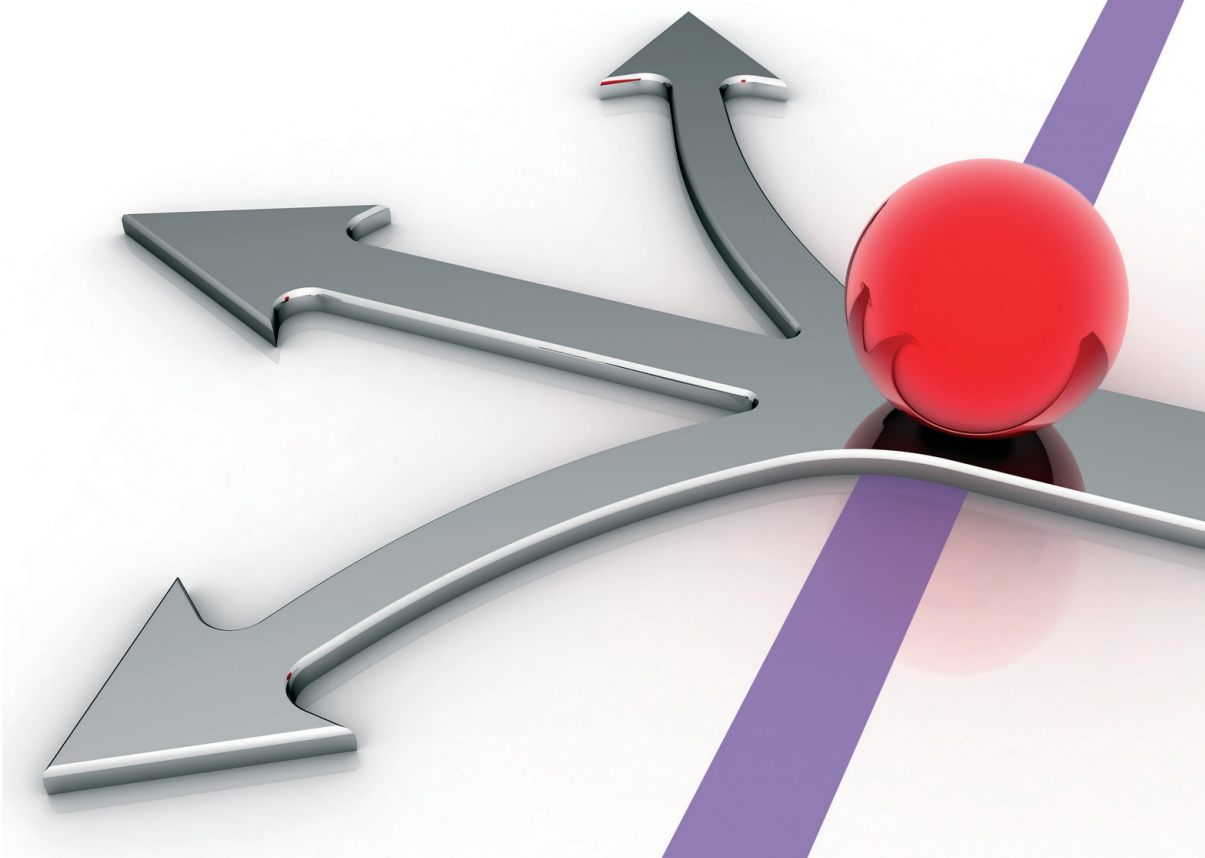
A Study in the Chemical Industry



Lenny Visser

Thresholds in Logistics Collaboration Decisions

A Study in the Chemical Industry

Thresholds in Logistics Collaboration Decisions

A Study in the Chemical Industry

PROEFSCHRIFT

ter verkrijging van de graad van doctor aan de Universiteit van Tilburg op gezag van de rector magnificus, prof. dr. Ph. Eijlander, in het openbaar te verdedigen ten overstaan van een door het college voor promoties aangewezen commissie in de aula van de Universiteit op vrijdag 18 juni 2010 om 14.15 uur door

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PROMOTOR:
Prof. Drs. Kees Ruijgrok

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Preface

This PhD thesis is the result of four years of research. Now the thesis is finished, it is the moment to look back and realize that this thesis would never have been completed without the help and support of many people. First of all, I would like to thank my promoter Kees Ruijgrok without whom I would never have finished this journey. During our discussions, I always had the feeling you were already two steps ahead of me. As a result, your valuable ideas, comments and feedback helped me to find the finish line. Furthermore, your positivism and enthusiasm always gave me the conviction that this project would succeed.

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Furthermore, I would like to thank Lorike Hagdorn, Walther Ploos van Amstel and Jos Vermunt for their valuable comments and suggestions on earlier versions of this manuscript. These were very helpful to further improve the quality of my work. I also thank the other committee members, Gerard de Jong and Bart Vos, for their time to read and comment on this thesis.

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Various other people have also helped me to finish this PhD project. I would like to thank my respondents of the different companies and branch organizations for their time and willingness to share information. This information was crucial to find an answer for the defined research questions. I am also grateful to my colleagues at Fontys. Especially the colleagues at the Financial Management department in Eindhoven as well as my former colleagues at the Engineering and Logistics department in Venlo, I would like to thank for their interest and support. Special thanks to Marianne, it was inspiring and motivat-

ing to have the possibility to share my research experiences with someone in my direct working environment. I also thank the other Fontys PhD candidates, especially Annemie, Marije and Yvonne, it was good to have people around you that are in the same position.
Finally, I would like to thank my family and friends for their respect for the choices I made, their interest in my work and their endless support. However, deepest gratitude goes out to Harm. You gave me the final encouragement that was needed to start this journey and you unconditionally supported me during the entire process. When there was any doubt from my side on how to continue the project, you were always there (where ever you were on the globe) to express your faith in my capabilities. Now I have finished this thesis and you have finished travelling and studying, there should be more time to spend together. I am looking forward to that!

Lenny Visser

Tilburg, December 2009

Glossary of terms and abbreviations:

Before getting started, the central terms used in this dissertation are defined below. Next to this, also the abbreviations and symbols used in the different chapters are explained.

Terms:

Arm's length. Gulati and Kletter (2005) have defined a relationship ladder to identify different levels of supply chain collaboration. These different levels are: arm's length, bundling, integration and strategic partnering. Arm's length is used to refer to a relationship in which a company purchases each product or service as an isolated transaction.

Attributes. In a stated preference experiment alternatives are presented to the respondents who are asked to choose the most preferred one. These alternatives are described as bundles of variables known as attributes.

Between mode experiment. Two types of a stated preference experiment are distinguished: between mode and within mode experiment. In a between mode experiment respondents are asked to make choices between alternative product descriptions that are based on different concepts (f.e. train and bus). In a within mode experiment respondents are asked to make choices between alternative product descriptions that are based on the same concepts (f.e. two train types). The alternatives differ in the values attached to the attributes that are included in the alternatives.

Bounded rationality. The term used to refer to the limited capacity of human beings to formulate and solve complex problems.

Bundling. Gulati and Kletter (2005) have defined a relationship ladder to identify different levels of supply chain collaboration. These different levels are: arm's length, bun-

dling, integration and strategic partnering. The level bundling is characterized by a relative low level of integration and trust.

Collaboration. Collaboration is in this research is defined as an effective, voluntary, mutually shared process where two or more actors work together, have a mutual understanding, a common vision, share resources, and achieve common goals.

Choice. A decision making process consists of different phases: problem recognition, generation of alternatives, alternatives evaluation, choice and implementation. Choice is the outcome of a decision making process.

Commitment. In this research commitment is defined as the belief that participating actors are loyal and tolerant and do not worry about being replaced.

Commodities. The chemical industry is roughly segmented in commodities and specialties to identify the diverse range of products supplied by the chemical industry. The term commodities is used to refer to raw materials and basic chemicals.

Confidentiality. In this research confidentiality is defined as the belief that a partner will not harm the interests of the counterpart.

Costs. In this research the term costs refer to the price a shipper pays to a LSP.

Driver. Force, inside of outside the organization, that supports logistics collaboration.

Economies of scale. Refers to the reduction in average costs per unit through higher efficiencies resulting from an increased scale of operation.

Economies of scope. Refer to the reduction of per-unit costs through the production of a wider variety of goods or services.

Full rationality. Decision makers have well-defined stable preferences, know and understand all existing alternatives and are only guided by financial incentives. This definition is based on the neo-classical and new-institutional economic tradition.

Homo economicus. A term used to refer to a person who in his choice is only guided by financial incentives and has full knowledge of all options and consequences upfront. This definition follows the neo-classical and new-institutional economic tradition.

Horizontal collaboration. Supply chain collaboration exists in different forms. Collaboration between parties that are at the same level between resources and final products is called horizontal collaboration.

Impediment. Force, inside of outside the organization, that impede logistics collaboration.

Inertia. Term used to refer to the resistance to change of individuals and organizations.

Integration. Gulati and Kletter (2005) have defined a relationship ladder to identify different levels of supply chain collaboration. These different levels are: arm's length, bundling, integration and strategic partnering.

Lateral collaboration. Supply chain collaboration exists in different forms. A combination of horizontal and vertical collaboration is called lateral collaboration.

Lead Logistics Provider. A lead logistics provider is responsible for the coordination of logistics activities (f.e. transport) that are outsources to different logistics service providers.

Logistics. Logistics is the design and operation of the physical, managerial, informational and financial systems needed to allow goods to overcome space and time.

Logistics collaboration. Collaborative relationship between a shipper and logistics service provider.

Logistics outsourcing. The provision of single or multiple logistics services by an external vendor on a contractual basis.

Logistics service provider. A company that provides logistics service on request and payment of an external firm.

Non-full rationality. Decision makers are guided by both material and immaterial incentives.

Operations research. Discipline that is focused on the application of mathematical techniques and methods to support decision making.

Package density. Term used to express the number of colli per unit of volume being handled in a particular process.

Procurement. The complete process of ordering products or services from an external supplier. This process includes supplier selection, ordering, receiving and evaluation.

Revealed preference analysis. Research method that analyzes actual behavior of decision makers.

Service. In this research service is defined as the number of shipments that are delivered on time by the LSP.

Specialties. The chemical industry is roughly segmented in commodities and specialties to identify the diverse range of products supplied by the chemical industry. The term specialties is used to refer to intermediates and end-products.

Strategic partnering. Gulati and Kletter (2005) have defined a relationship ladder to identify different levels of supply chain collaboration. These different levels are: arm's length, bundling, integration and strategic partnering. At the strategic partnering level a company turns its activity completely over to its supplier. The supplier takes ownership of all related decisions and actions. This collaboration has a long term horizon.

Supply chain management. The co-ordination and management of the flows of goods and information from supplier to the end-consumer.

Stated preference analysis. Research method that analyzes hypothetical choice behavior. Stated preference use interviews or questionnaires, in which respondents are asked to make choices between alternative product descriptions, to reveal how respondents value different attributes.

Switching costs. Term used to refer to the costs incurred when switching to a different logistics service provider. These costs include the costs for tendering, implementation and terminating the relationship with the old service provider.

Technical service. Some chemical companies support their customers to install production machinery in such a way that the product performance of the sourced product is most optimal. This type of service is called technical service.

Threshold. Term used to refer to aspects that prevent decision makers to choose a specific (collaboration) alternative.

Transparency. The term transparency refers to the openness between operating parties in terms of communication and measurability of service elements.

Trust. Trust is defined as the belief that a partner will not harm the interests of the counterpart.

Utility maximizing. Decision makers can use different decision rules to make their choice. In case utility maximizing is used, it is assumed that the decision maker compares a set of alternatives and choose the alternative that maximizes his utility.

Value density. Term used to express the value of products per m^3.

Vertical Collaboration. Supply chain collaboration exists in different forms. Collaboration between parties that succeed each other in a particular generation process and therefore have different activities is identified as vertical collaboration.

Within mode experiment. Two types of a stated preference experiment are distinguished: between mode and within mode experiment. In a within mode experiment respondents are asked to make choices between alternative product descriptions that are based on the same concepts (f.e. two train types). The alternatives differ in the values attached to the attributes that are included in the alternatives. In a between mode experiment respondents are asked to make choices between alternative product descriptions that are based on different concepts (f.e. train and bus).

Abbreviations:

BU:	Business unit
D.O.F.	Degree of freedoms
EDC:	European distribution centre
GDC:	Global distribution centre
KPI:	Key performance indicator
LL:	Log-likelihood
LLP:	Lead logistics provider
LSP:	Logistics service provider
MNL model	Multinomial logit model
N.A.:	Not Applicable
RDC:	Regional distribution centre
RFI:	Request for information
RFQ:	Request for quotation
SLA:	Service level agreement
SP:	Stated preference
RP:	Revealed preference
VAL:	Value added logistics

Symbols:

ß:	Represents the coefficients in an utility function
Δ LL:	Represents delta in the log-likelihood
e	Exponent
ε:	Represents the error component in an utility function
μ:	Represents mean
P:	Represents probability a specific alternative is chosen
σ:	Standard deviation
U:	Represents utility
X:	Represents the independent variable in utility function
X^2:	Represents chi-square

Table of contents

Preface 5

Glossary of terms and abbreviations: 7

Table of contents 13

1. Introduction 17
1.1 Research background 17
1.2 Relevance and contribution 19
1.3 Research scope and focus 20
1.4 Research objective 22
1.5 Research strategy 22
1.6 Outline of the thesis 25

PART I: LITERATURE REVIEW 27

2. Logistics outsourcing 29
2.1 Logistics strategy 29
2.2 Drivers and impediments of logistics outsourcing 34
2.2.1 Drivers of logistics outsourcing 34
2.2.2 Impediments of logistics outsourcing 36
2.3 Purchasing logistics services 36
2.3.1 Purchasing process 36
2.3.2 Positioning logistics services 37
2.4 Concluding remarks 42

3. Collaboration 45
3.1 Classifications of supply chain collaboration 45
3.1.1 Level of integration 45
3.1.2 Forms of collaboration 49
3.2 Variables influencing collaboration decisions 50
3.2.1 Organizational theory 50
3.2.2 Additional variables 57
3.2.3 Discussion 58
3.3 Drivers and impediments of collaboration 60
3.3.1 Drivers 60
3.3.2 Impediments 61
3.4 Concluding remarks 62

4. Decision making behavior 65
4.1 Decision making process 65
4.2 Economic literature 67
4.3 Behavioral decision making literature 70
4.3.1 From rational to intuitive based decision making 70
4.3.2 Inertia 72
4.4 Utility framework 73
4.5 Concluding remarks 75

5. Theoretical findings and hypotheses 79
5.1 Cross-section of the theoretical findings 79
5.2 Hypotheses 82
5.3 Introduction to empirical research phase 83

PART II: EMPIRICAL ANALYSIS 85

6. Focus industries 87
6.1 Chemical industry 87
6.1.1 Current situation 87
6.1.2 Subsectors in the chemical industry 90
6.2 Logistics service providers 90
6.2.1 Current situation 90
6.1.2 Different types of LSPs 92

7. Case studies . . . 95
7.1 Methodology . . . 95
7.1.1 Case study design . . . 95
7.1.2 Drawbacks of case study strategy . . . 96
7.1.3 Case study protocol . . . 96
7.2 Case characteristics . . . 102
7.2.1 Company characteristics . . . 103
7.2.2 Product characteristics . . . 105
7.2.3 Characteristics supply chain structure . . . 105
7.3 Findings: cross-case analysis . . . 107
7.3.1 Logistics outsourcing and collaboration . . . 107
7.3.2 Purchasing process . . . 111
7.4 Concluding remarks . . . 124

8. Stated preference experiment . . . 125
8.1 Method . . . 125
8.1.1 Stated Preference method . . . 125
8.1.2 Drawbacks stated preference research . . . 127
8.1.3 Design template . . . 127
8.2 Experimental design . . . 131
8.2.1 Attribute selection . . . 131
8.2.2 Context of the experiment . . . 132
8.2.3 Three different parts . . . 135
8.2.4 Attribute levels . . . 136
8.2.5 Outline of the questionnaire . . . 139
8.3 Analysis . . . 141
8.4 Findings . . . 147
8.4.1 Sample size . . . 147
8.4.2 Findings general questions . . . 151
8.4.3 Choice experiment: variables . . . 153
8.4.4 Choice experiment: inertia . . . 157
8.5 Concluding remarks . . . 159

PART III: CONCLUSIONS AND RECOMMENDATIONS 161

9. Conclusions and recommendations 163
9.1 Conclusions 163
9.2 Contributions 165
9.2.1 Scientific contributions 165
9.2.2 Managerial contributions 166
9.3 Limitations and further research 167

References 171

List of Figures 187

List of Tables 189

Appendix A: Overview explorative interviews 191
Appendix B: Questionnaires case studies 192
Appendix C: Coding scheme case studies 197
Appendix D: Market characteristics case studies 198
Appendix E: Single case study reports 200
Case A: Hub operation 200
Case B: European transport 206
Case C: Lead logistics provider 211
Case D: Global distribution centre 218
Case E: Warehousing and distribution activities for the Dutch market 224
Case F: European distribution center 229
Case G: Site and transport operations 235
Appendix F: Overview SP respondents 241
Appendix G: Questionnaire SP experiment 242

Summary 259

Samenvatting (summary in Dutch) 265

About the author 273

CentER Dissertation Series 275

1. Introduction

1.1 Research background

Logistics is the design and operation of the physical, managerial, informational and financial systems needed to allow goods to overcome space and time. Until the nineties, the logistics field was focused on the internal processes of a company in such a way that the profitability was maximized. Later on supply chain management builds upon these processes and seeks to achieve linkage and co-ordination between the processes of other entities in the pipeline and the organization itself. The focus of supply chain management is on the management of up- and downstream relationships with suppliers and customers to deliver superior customer value at less cost to the supply chain as a whole. This development of the logistics field is influenced by general business developments like increasing customer requirements, globalization, technological innovation and focus on sustainability (Christopher, 2005).

In a context of the mentioned developments, an increasing part of the value adding activities is placed outside the boundaries of a firm (Christopher, 2005; De Man, 2004; Skjott-Larsen, 2000; Vermunt and Binnekade, 2000). Companies concentrate on their core competencies and non-core activities are outsourced to specialized manufacturers and providers. Logistics is one of the activities increasingly identified as a non-core competence, and for that reason outsourced to specialized service providers: Logistics Service Providers -LSPs[1] (Canete, 2005; Jafaar and Rafiq, 2005; Razzaque and Sheng, 1998). This outsource decision is the starting point for a collaborative relationship between shipper and LSP.

The collaboration with LSPs becomes increasingly important for shippers for two reasons. First, shippers not only decide more often to outsource logistics activities to external providers, but simultaneously the complexity of the outsourced activities is increasing. Nowadays, logistics services are more often not bought in isolation, but as a package of logistics services and more varied activities like value adding services and IT services

1 LSP is a company that provides logistics services on request and payment of an external firm (Lambert et al. 1998)

are included in the package of services bought (Van Laarhoven et al., 2000; Berglund, 2000; Andersson and Norrman, 2002). Second, the last decades shippers have become more aware of the impact that logistics can have on the costs of doing business and on the degree the customer is serviced. This ongoing awareness has led to an ongoing rationalization in the supply chain. As a result the average total logistics costs as a percentage of sales have declined from 12.1% in 1987 to 6.1% in 2003 (A.T. Kearney, 2009). Figure 1 makes visible that since 2003 the average logistics costs are slightly increasing. One reason can be found in the fact that more value added services are included in the logistics scope. Nevertheless, there is still a constant need for companies to increase the economies of scale and scope in logistics networks to keep their competitive position in the market. One of the possibilities to reach such economies is collaboration with a LSP.

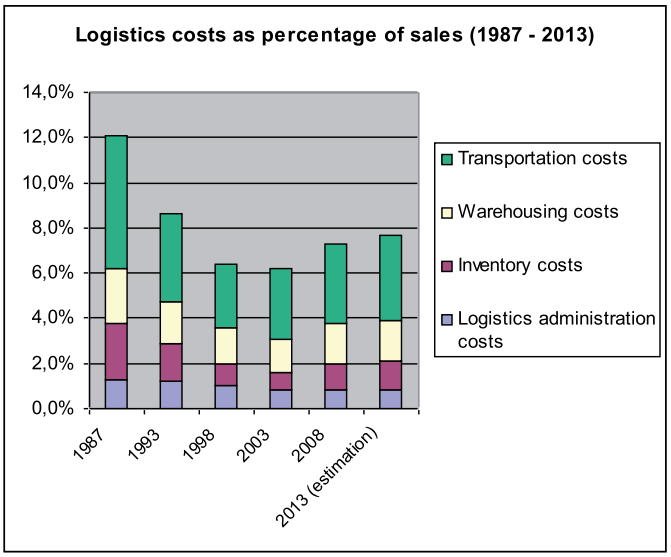

Figure 1: Logistics costs as percentage of sales (1987 – 2013) (A.T. Kearney, 2009)

Also from a LSP's perspective, collaboration between shipper and LSP becomes increasingly important, because LSPs are facing hard times. There are several causes for this fact: fierce competition in the global market, high fixed cost, fragmentation of transport flows, rising fuel and labor prices, increasing expectations of customers in terms of both service and price (Cruijssen et al, 2007; Groothedde et al, 2005). Since costs in terms of price is the most important criterion in selecting a LSP (Laarhoven et al, 2000; Lynch 2004), competition at price level increases and profit margins decrease. Therefore service

providers also focus on efficiency by achieving economies of scale and scope. As a result, during the last decade the providers' industry is characterized by mergers and acquisitions (Carbone and Stone, 2005; Lieb and Bentz, 2005). Beside mergers and acquisitions, also LSPs can reach economies of scale and scope by closer collaboration with the shippers (Groothedde, 2005).
The potential of collaboration between shippers and LSPs, in terms of cost and service advantages, has been been shown by several researchers (Cruijssen, 2006; Groothedde, 2005). Especially, there are opportunities when shippers and LSPs are willing to share responsibilities at a tactical or strategic level. Nevertheless, in practice, the majority of the collaborative relationships between shippers and LSP remain at an operational level and only focus on the operational execution of the outsourced activities (Selviaridis and Spring, 2007). Min et al. (2005) conclude that impediments and resistance to change do exist in practice, which prevents a certain proportion of logistics collaboration being initiated. As a result, it might be concluded that despite the potential of and even necessity for logistics collaboration between shipper and LSPs, thresholds prevent the potential benefits from being exploited fully in practice.

1.2 Relevance and contribution

Previous research in the logistics and supply chain management field has widely discussed the topic of logistics collaboration between shipper and logistics service provider. Nevertheless, there are some reasons to define an additional research project. Current publications about logistics collaboration emphasize that human factors like trust and commitment are important impediments for collaboration between shipper and LSP (e.g. Mentzer et al., 2000; Simatupang and Sridharan, 2002; Verduijn 2004). Nevertheless, these publications do not quantify the impact of these human factors or prove that they significantly impact a logistics collaboration decision. Quantifying the impact of human factors will help to understand why potential benefits of logistics collaboration are not exploited in practice. This understanding is a necessary condition to provide recommendations for removing or at least reducing the thresholds of logistics collaboration.
Next to this, operations research models, which are used to prove the potential of logistics collaboration, typically have relied on the assumptions of the neoclassical theory or the new institutional economic theory. As indicated by Carter et al. (2007) these models have significantly enriched the theoretical and grounded frameworks which have been developed in the field of supply chain management. The theories regard decision makers as a "homo economicus". In the neoclassical and institutional economic tradition this means that each decision maker maximizes his utility, is only guided by financial incen-

tives, and has full knowledge of all options and consequences (Folmer, 2007). Nevertheless, there is abundant evidence in the decision making behavior literature that decision makers often violate this rationalistic paradigm that is found in some economic streams, and that decisions lead to suboptimal results (Simon, 1957; Kahneman and Tversky, 1979; Bazerman, 1998). The impact of behavioral aspects has received little attention or is even ignored in the available models (Carter, 2007; Hopp, 2004; Mantel et al. 2006). As a result, Mantel et al. (2006) conclude that the integration of operations research and decision making behavior literature can contribute to closing the research gap in understanding collaboration decisions within the logistics field. Quantifying and proving the significant impact of human factors will be a first step to enhance the precision and rigor of the existing models and their outcomes.

1.3 Research scope and focus

Collaboration has been examined the last decades by practitioners and researchers across disciplines including sociology, psychology, marketing and supply chain management. This research focuses on collaboration in the field of supply chain management. In this context Simatupang and Sridharan (2002) distinguish three types of collaboration: vertical, horizontal and lateral cooperation. They define vertical collaboration as collaboration between parties that succeed each other in a particular generation process and therefore have different activities. Horizontal cooperation is used to refer to concerted practices to share private information, facilities or resources to reduce costs or improve service between companies (competing or unrelated) operating at the same level(s) in the market. Finally, Simatupang and Sridharan (2002) define a lateral cooperation as a combination of vertical and horizontal cooperation, e.g. to synchronize shippers and LSPs of multiple companies in an effective logistics network (see e.g. Tavasszy et al. 2003). In this project we only focus on a specific form of vertical collaboration: the dyadic relationship between shipper and LSP. In this relationship, the shipper is the outsourcing entity. As a result, in this research we mainly focus on the shipper's perspective. Logistics outsourcing is widely used and still increasing, but services most frequently outsourced are those with a more operational, transactional and repetitive character (Lieb and Bentz, 2005; Lieb and Randall, 1996; Selviaridis and Spring, 2007). As a result, the focus in the collaborative relationships between shippers and LSPs is also on the operational execution of the outsourced activities (Lieb and Bentz, 2005; Selviaridis and Spring, 2007). Shippers are still reserved to increase the level of collaboration by transferring more responsibilities to a service provider (Min et al. 2005). However, previous research has shown that there are opportunities, in terms of cost and service advantages

when shippers would be willing to share responsibilities at a tactical or strategic level (Cruijssen, 2006; Groothedde, 2005). Therefore, this study focuses on the shippers' decision to intensify the level of collaboration with their LSPs and not on the initial outsourcing decision.

Decisions made within organizations are about issues or problems of a varied nature, are derived from a variety of situations and need to be worked on by various groups or departments. A common way to cluster these different decisions is to position them in a hierarchical model. Traditionally, in such hierarchical model three levels of decision making are distinguished: strategic, tactical and operational decisions (Anthony, 1965). Also logistics decisions differ in terms of scope, frequency and time horizon. In his dissertation, Verduijn (2004) compares different classifications of logistics decisions and concludes that the exact position of each logistics decision at the hierarchy is arbitrary, because the different models do not categorize the same type of logistics decisions at the same hierarchical level[2]. At least, it may be concluded that logistics outsourcing and collaboration decisions are not taken at the operational level within an organization, because operational decisions relate to the execution of the day-to-day operation. Furthermore, at the end of each decision making process, one person has the final responsibility for the decision made. Nevertheless, decisions are mostly not taken in isolation. Depending on the type of decision and the organizational structure within a particular organization, different persons from different disciplines are involved (Marcus et al. 2007). These different persons use their own considerations and background to provide input for the person that has the final responsibility. The same is applicable for logistics outsourcing and collaboration decisions. The structure of, and persons involved in these decisions differ between organizations, but in most cases more than one person is involved (Laios and Moschuris, 1999). In this research, we focus on the different individuals that participate in logistics outsourcing and collaboration decisions. The possible interactions between these individuals or other aspects of a group decision process are out of scope for this research.

2 For a more detailed discussion about logistics decisions we refer to section 2.1.

1.4 Research objective

Given the observation that in practice some thresholds prevent the potential benefits of logistics collaboration from being exploited, it is the objective of this research project to measure these thresholds.

The following research questions are defined to reach our objective:

- *Which factors hamper a shipper to intensify collaboration with a logistics service provider?*
- *What is the relative importance of the identified factors in a shipper's collaboration decision?*

1.5 Research strategy

This research project incorporates both a theoretical and an empirical part. The theoretical part consists of a descriptive literature review. Three different streams of literature are reviewed in parallel: logistics outsourcing, collaboration and behavioral decision making. These three streams are chosen as a starting point, because they are the key words in our research questions. The review starts from a specific perspective with a discussion of the logistics outsourcing literature. The second stream includes supply chain collaboration literature. Subsequently, several organizational theories are reviewed, because these theories provide characteristics of designing and selecting inter-organizational relationships. Finally, the behavioral decision making literature is discussed. Historically, supply chain management and decision making behavior literature are studied by separate communities of scholars. In practice, the two fields are intimately tied to one another. Therefore, we adopt the approach of Mantel et al (2006), that an integration of decision making behavior literature within the field of supply chain management can contribute to closing the gap in understanding collaboration decisions, because the behavioral decision making literature provides an opportunity to understand the human aspects of the decision making process. This is in line with Van Aken (1994) who states that the use of theories from a different domain can help to put a research topic in another light. The results of the three different streams are combined into a conceptual model. This conceptual model is used to draft hypotheses for the empirical part of the research project.

For the empirical testing of the hypotheses a stated preference (SP) experiment is used. SP techniques are a family of market research tools that enable the analysis of the decision behavior of individual respondents, by proposing (hypothetical) alternatives (Ben-

Akiva et al., 1994; Faivre d'Arcier et al. 1998). SP uses carefully constructed interviews or questionnaires, in which respondents are asked to make choices between alternatives product descriptions, so to reveal how respondents value different attributes. SP results can be used to determine and quantify the relative importance of attributes that are of interest to the researcher. The SP method is selected as an appropriate research method for this project for several reasons. In stated preference (SP) analysis researchers ask respondents what they would do if they faced a specific situation; SP research analyzes hypothetical behaviour. Alternatively, observations of respondent behavior, revealed preference (RP) research, could be used to answer the research question. However, such a direct approach has some disadvantages. Validity issues arise in such a direct approach, because the researcher cannot be sure whether the respondent incorporates additional variables in his evaluation (Futures Group, 1994). Moreover, in general, RP research requires larger sample sizes in order to develop efficient statistical models as with SP. Each SP interview produces multiple observations per individual, because a respondent is asked to consider a number of situations[3]. Conversely, RP data most frequently only result in a single observation per individual. Additionally, SP enables a researcher to better control the choices offered to a respondent. Thus, the effects of variables of interest can be isolated from those of other factors, and SP techniques can ensure that data is of sufficient quality to construct adequate statistical models (Pearmain et al., 1991). Finally, when selecting an appropriate method for this analysis of shippers' choice behavior, it needs to be taken into consideration that logistics collaboration decisions and accompanying thresholds have a random aspect: not all individuals have the same preferences under comparable conditions. Therefore, for the empirical validation of our hypotheses we need an analytical approach that supports this random aspect of decision making. The stated preference method that uses a random utility framework meets this criterion. The random element of the utility function implies that the utility is related to the probability of an individual making a certain choice than directly to the decision itself. Pearmain et al. (1991) state that this is a more plausible approach to modeling choice behavior than the simple assumption of complete consistency in the way individuals express their preferences, as used in models without random utility.

The data for the SP experiment are only collected at the shippers' side, because the shipper is the purchasing and thus leading actor in a collaboration decision between shipper and LSP. All data are collected in the chemical industry. The chemical sector is selected for four reasons. First, to reach our final research objective it is important to select a sector that is not characterized by opportunistic choice behavior, but by well-considered

3 It is important to distinguish two types of variation in observations collected in a SP experiment: variation that occurs between individuals and variation within each interview. This issue is discussed in section 8.1.3.

decision behavior. The chemical sector with its stable and conservative character meets this criterion (Connekt, 2003). Besides, the chemical sector has a broad experience in logistics outsourcing and thus enough experienced respondents are available from a relatively homogenous sample. Third, although the chemical industry has broad experience in outsourcing logistics; the outsourced services often have an operational and transactional character. Stronger relationships need to be established with LSPs to find truly innovative and competitive supply chain solutions. Line organizations in the chemical industry have identified more intensive supply chain collaboration between shippers and logistics service providers as one of the critical drivers for long term competitiveness of the industry (McKinnon, 2004; Roller et al, 2004). Finally, the chemical sector is a key contributor to the European economy (Cefic, 2007).

Although widely used in transport and marketing, applying SP research to freight transport is still fraught with difficulties (Danielis et al., 2005). Also Bergkvist (2001) and Tsai et al. (2007) concur that defining and evaluating choice behavior is still in its infancy, compared to passenger transport. To overcome this difficulty, we follow the design rules defined by Sheldon (2007) and Pearmain et al. (1991) who recommend designing the experiment based on prior qualitative research like literature and case studies. As a result, prior to our stated preference experiment a sector study and some case studies are conducted. This sector study involves the chemical sector and logistics service providers industry. The sector study is based on literature review and four explorative interviews with sector representatives. Details about these four interviews can be found in appendix A. The sector study is followed by seven case studies. These case studies are used to validate some of our theoretical findings and as a result create in-depth understanding of logistics collaboration and outsourcing decisions based on practitioners' knowledge. The case study method is selected based on three conditions identified by Yin (1994). First, this empirical phase has an exploratory character. Second, the researcher has no control of the behavioral events as objects of research are in a real life environment. Finally, the research focuses on a contemporary event and situation. Also Eisenhardt (1989) selects the case study as the most preferred method for research with an exploratory character; a case study strategy provides the opportunity to gather a lot of data on a small number of study objects which in turn makes it possible to receive detailed descriptions of complex research subjects. Moreover, Dubois and Araujo (2004) argue that case studies are very suitable for studies in which interactions and relationships form the basic units of analysis. The case study approach enables the researcher to capture potentially crucial contextual information and facilitates a deeper understanding of relationships. Relationships are characterized by interaction between at least two parties. Therefore not only the shipper but also the service providers' perspective is incorporated

in the case studies. All data at the shippers' side are collected in the chemical industry to support the in-depth character of this study.

1.6 Outline of the thesis

The remainder of this thesis consists of three parts. Part I describes the results of the literature review. In three different chapters the logistics outsourcing, collaboration and behavioral decision making literature are reviewed. Chapter 5 concludes part I. In this chapter, a cross-section of the theoretical findings and the hypotheses resulting from the theoretical findings are presented.
Part II describes the empirical research part and consists of three chapters. Chapter 6 shortly introduces the two sectors that are involved in our study: the chemical sector and logistics service providers industry. Afterwards, chapter 7 describes the results of the case studies. As discussed in the previous section, these cases are used to validate some of the theoretical findings. The results of the case studies create the base to design a reliable stated preference experiment that is used to test the hypotheses. Chapter 8 explains the setup and the results of this stated preference experiment. In this chapter, the hypotheses as presented in chapter 5 are tested.
Finally, conclusions are formulated in part III. Chapter 9 describes the conclusions of this research project and concludes with recommendations for future research. Figure 2 depicts the outline of the thesis. The numbers in the figure correspond with the nine chapters of this thesis.

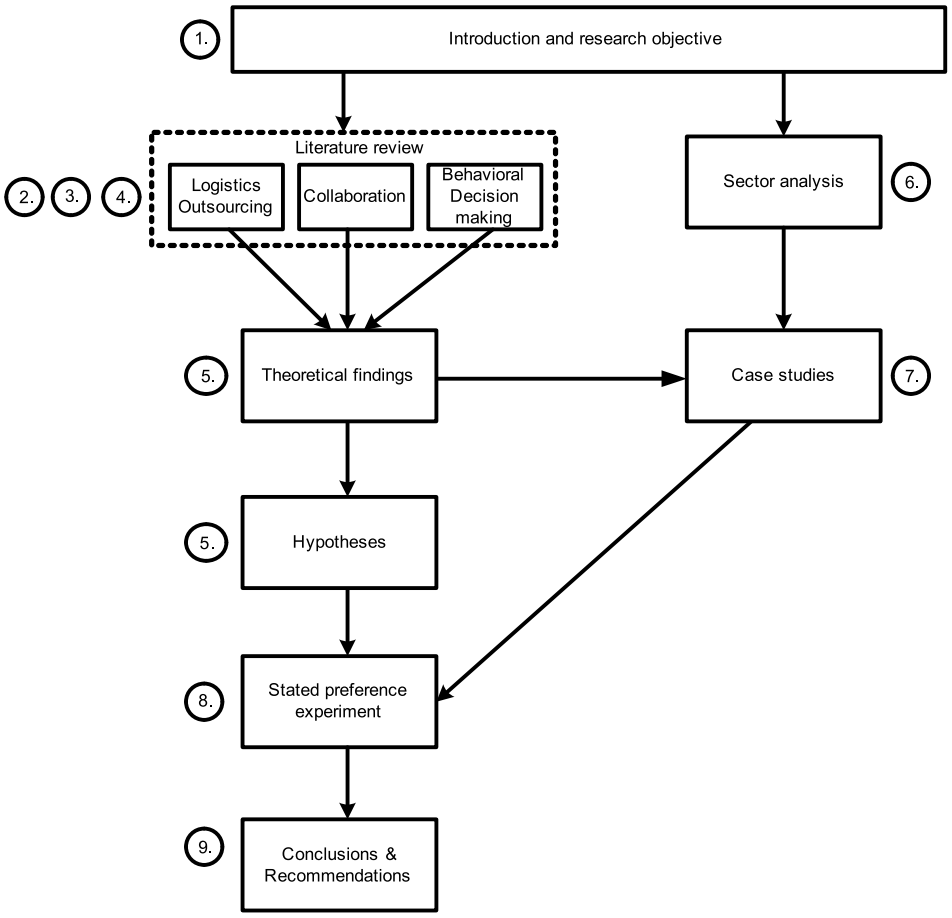

Figure 2: Outline thesis

PART I: LITERATURE REVIEW

2. Logistics outsourcing

This chapter describes the first of the three literature streams that are reviewed in this research. As a result, the phenomenon of logistics outsourcing is discussed. Traditionally, most firms are organized and viewed as independent and single entities that need to compete with others to survive. Nowadays, business processes become more specialized and an increasing part of the value adding activities is placed outside the physical boundaries of a firm. As explained in the first chapter, logistics is one of the activities that are increasingly outsourced to specialized providers. The first chapter starts with defining logistics outsourcing. Afterwards, the link between outsourcing decisions and the overall business strategy is explained. The second section describes drivers and impediments of logistics outsourcing. Subsequently, the sourcing process for logistics services is discussed. Finally, the chapter concludes with summarizing the main findings.

2.1 Logistics strategy

When a particular firm identifies a need for a specific product or service, the first process step is to decide whether to make the product or perform the service internally (make), or to purchase the requirement from an external source (buy). The classic make-versus-buy decision has been a historical debate centered on the economic trade-offs associated with each option (Bowersox and Closs, 1996; Ford et al, 1998). More recently, attention has expanded to the analysis of the strategic trade-offs. This expanded focus requires that outsourcing decisions examine not only which firm has the lowest total cost, but also which one can deliver a superior service. Both questions must be answered from a long-term perspective (Skjott-Larsen, 2000; Hakansson and Ford, 2002; Momme and Hvolby, 2002).

Logistics is one of the activities increasingly sourced from external providers (Canete, 2005; Jafaar and Rafiq, 2005; Razzaque and Sheng, 1998). In recent years, outsourcing logistics activities has received considerable attention in academic literature. Various terms have been introduced to describe this phenomenon; they generally mean the same thing (Van Laarhoven et al., 2000). Table 1 presents an overview of the different terminology used.

Terminology used	Source
Third-party logistics	Lieb, 1992; Virum, 1993; Lieb and Randall, 1996; Skjott-Larsen, 1995; Langley et al, 1997; Murphy and Poist, 1998; Beglund et al, 1999; Skjott-Larsen, 2000; Sohail and Sohal, 2003; Selviaridis and Spring, 2007.
Contract logistics	Kearney, 1995
Logistics alliances	Bowersox, 1990; Van Laarhoven and Sharman, 1994; Andersson 1995; Bagchi and Virum, 1996
Logistics partnerships	La Londe and Cooper, 1989; Andersson, 1997
Operational alliances in logistics	Van Laarhoven and Sharman, 1994
Contract distribution	Wilson and Fathers, 1989; Cooper and Johnstone, 1990
Outsourcing	Razzaque and Sheng, 1998; Rabinovich et al, 1999; Van Laarhoven et al, 2000; Stefansson, 2004; Wilding and Juriado, 2004; Groothedde, 2005; Canete, 2005: Isiklar et al, 2007; Hsiao, 2009

Table 1: Terminology used to describe logistics outsourcing phenomenon(adapted from Van Laarhoven et al., 2000)

We continue to use the term outsourcing, and follow Razzaque and Sheng (1998) to define logistics outsourcing as the provision of single or multiple logistics services by a vendor on a contractual basis.

From a business perspective, logistics outsourcing is never a goal to be reached; it is only a means to an end. The business strategy is at the top of the decision-hierarchy. This overall business strategy can be seen as a choice of products, markets and required service levels (Copacino and Rosenfield, 1987). These choices result in a corresponding logistics strategy and decisions (Groothedde, 2005). Outsourcing can be one of the possible decisions to achieve the company's overall objectives.

A common way to cluster the logistics decisions that need to be made to define the logistics strategy, is to position the choices within a hierarchical model, because the choice of a strategy leads to decisions of a more tactical and operational nature that flash out the strategic concepts and guide the activity of the firm on a month-to-month and day-to-day basis (Lalonde and Masters, 1994).

Copacino and Rosenfield (1987) present such a hierarchical model and divide the logistics decisions into four hierarchical levels:

- Long term distribution and production patterns: plant and warehouse choices, customer assignment and product assignment to facilities.
- Deployment of inventories within a network: locating and controlling the inventories.
- Aggregate planning for the intermediate term: manufacturing and distribution plans for a relatively short term horizon of 6 to 12 months

- Plant operations: specific manufacturing and distribution plans including workforce planning, scheduling of workers and routing for each operational period are defined.

Ruijgrok (2001) presents a similar hierarchy using slightly different wording and adds a time horizon to each of the hierarchical levels:

- The structure of the logistics network: decisions concern the number, size and locations of the fixed assets in a logistics network and the assignment of customers and production to these facilities. These decisions have a strategic character and a relatively long planning horizon of 2-5 years.
- Alignment of the logistics network: the alignment of the network prescribes material flow management policies including production levels at plant level, assembly policy and inventory sizes. These decisions have a mid-range horizon of 6 - 24 months.
- Scheduling the logistics network. Decisions are made on frequency of delivery, lead times, shipment sizes and transportation mode. Time horizon is 3 - 30 days.
- Resource management: decisions about the resources and the efficient and effective deployment of these resources are made. In fact, it concerns the operational decision to guide the daily operation like order handling and vehicle routing decisions. Time horizon differs from 2 to 48 hours.

An alternative hierarchical model is presented by Christopher (1998). Also this model consists of four levels, but the top level is linked to the customer service requirements. In his model these requirements set the standard for the other logistics decisions. The second level in the hierarchy concerns structural choices regarding channel design and network strategy. The third level concerns functional decisions about warehouse operations, transportation management and materials management. At the bottom there is the implementation level that contains choices such as policies and procedures and information management.

Moreover, several authors have presented hierarchical models of logistics decisions which are based on the classical three decision levels as defined by Anthony (1965): strategic, tactical and operational decisions. Muckstadt et al. (2001), Pel and Sirisoponsilp (1988) and Van Goor et al. (1996) have classified the different logistics decisions in the same way.

While the described logistics decisions models focus on the design of the physical logistics network, the hierarchy presented by Christiaanse and Kumar (2001) stretch the supply chain dimension of logistics decisions. According to these two authors the logistics decision hierarchy starts with the choice of actors. The process consists of selecting possible actors like suppliers, contract manufacturers and logistics service providers. At a second level the governance structure is defined. The governance structure plays a

key role in designing the logistics network, because it deals with decisions on core competences and the extent where in activities are outsourced. Afterwards, a sequence of manufacturing and logistics processes need to be defined to deliver a product to fulfill customer demand. This step includes selection of the type of processes and resources that are required to bring the product to the market. The lowest level in this model is supply chain coordination. This deals with the management of the activities of the different actors in a supply chain.

Verduijn (2004) compares the different classifications presented above and concludes that it remains disputable what level of decision making a particular decision should be allocated. As an example he shows that Van Goor et al. (1996) assign facility location to the tactical level, while Perl and Sirisoponsilp (1988) classify this as a strategic choice. Nevertheless, we conclude that each of the classifications is useful to show the wide range of decisions that need to be made by organizations concerning their logistics strategy and that these decisions differ in terms of scope, frequency and time horizon.

Figure 3 shows the link between the overall business strategy and the logistics strategy as well as the different aspects of a logistics strategy (Groothedde, 2005). As depicted in this figure, the process for developing a logistics strategy starts with an understanding of the corporate business strategy. As a next step this business strategy is translated into customer service requirements. Afterwards the logistics strategy is defined. This requires decisions on different aspects of logistics like network structure, inventory policies, material handling and order processing. Once a logistics strategy is defined and implemented, control activities over the flow of goods and information through a logistics network are required.

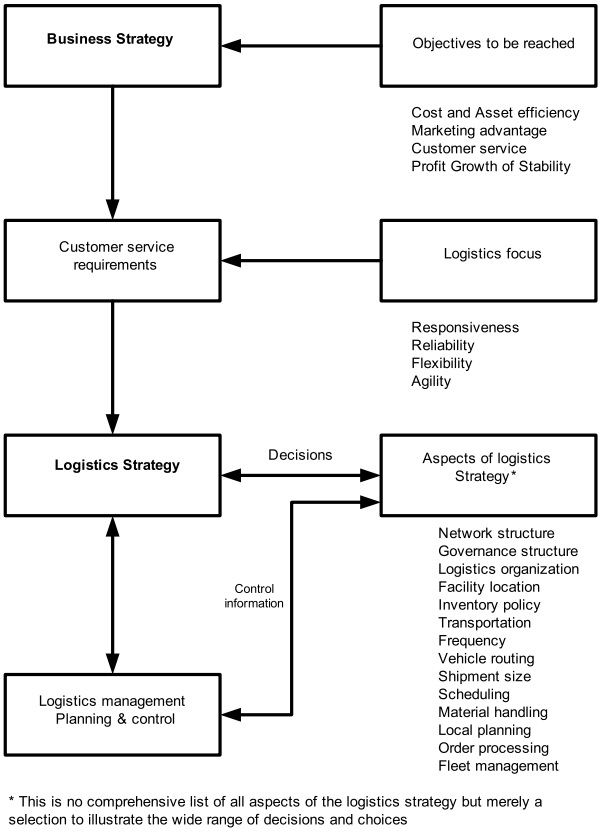

Figure 3: Business and Logistics Strategy (Groothedde, 2005)

Outsourced logistics services differ in complexity. Literature contains several classifications to distinguish between different types of logistics services. Table 2 provides an overview of these classifications. The classifications presented in this table differ in names and number of levels used to distinguish between different logistics services outsourced, but they have the same objective: to explain that not all logistics services outsourced have the same level of complexity. In this dissertation, we will follow Andersson and Norrman (2002) and distinguish two types of logistics services: basic and advanced. This classification is chosen, because Andersson and Norrmann (2002) not only mention that logistics services outsourced differ in complexity, but they also explain criteria that drive the degree of complexity. These criteria are factors such as the number of services bought at the same time (single or multiple), whether focus is on execution of the activities or also on management of these activities, and whether the outsourced service is pre-defined or development and re-engineering are parts of the scope.

Year	Author(s)	Levels	Description
1990	Bowersox	2	Distinguish between single transactions and integrated service contracts
1994	Van Laarhoven and Sharman	2	Classification in basic and integrated services
1995	Bagchi and Skjott-Larsen	2	Distinguish in early and advanced stage of maturity in logistics outsourcing
1998	Razzaque and Sheng	2	Distinguish between traditional logistics services and contract logistics
1999	Berglund, Van Laarhoven and Sharman	2	Categorization in logistics services and logistics solutions
2002	Andersson and Normann	2	Distinguish basic and advanced logistics services
2002	Delfmann, Albers and Gehring	2	Categorize logistics service in direct or indirect services related to the physical flow of products
2002	Gunasekaran	5	Classification based on service level characteristics (1PL till 5PL)
2003	Hertz and Alfredsson	3	Classification based on service level characteristics (1PL till 3PL)
2004	Halldorsson and Skjott-Larsen	3	Categorize logistics services based on competencies

Table 2: Classifications of logistics services, adapted from Zeegers (2007).

2.2 Drivers and impediments of logistics outsourcing

2.2.1 Drivers of logistics outsourcing

Drivers of logistics outsourcing are widely discussed in academic literature. Some examples are Bask, 2001; Power et al., 2006; Sink and Langley, 1997; Van Damme and Ploos van Amstel, 1996. In their contribution, Wilding and Juriado (2004) compare findings of five previous empirical studies. We extend their results by two additional cases (Lieb and Randhall, 1996; Wilding and Juriado, 2004). The results are shown in table 3. Since different studies use different wording to refer to generically same or similar reasons, the first column is indicating the type of reason in general terms. Columns two till seven indicate the ranking of each reason in the particular study. For each of the studies, ranking 1 before a reason means that the largest share of companies surveyed claimed a particular reason to be their primary motivator for outsourcing logistics activities. In the last right-hand column an overall ranking is calculated. This overall ranking shows in how many studies a specific reason for outsourcing is identified. The table shows that cost reduction is the reason most often mentioned for logistics outsourcing. This reason is often combined with service, flexibility and core competences related reasons. Wilding

Type of Reason	P-E International (1994): consumer goods industry	Lieb and Randhall (1996): several industries	Boyson et al (1999): several industries	Fernie (1999)*: retailers	Penske Logistics (1999): several industries	Van Laarhoven et al (2000): several industries	Wilding and Juriado (2004): consumer goods industry	Score
Cost or revenue related	3. Reduce costs	1. Cost reduction	1. Cost saving or revenue enhancement	5. Be more cost efficient	1. Reduce cost	1. Cost reduction	3. Cost reduction	7
Service related	2. Improve service levels	4. Improve customer service		4. Provide more "specialist services"	3. Improve service levels	2. Service improvement		5
Focus on core activities	5. Non-core activity	5. Focus on core activities	2. Outsourcing non-core business			4. Focus on core activities	4. Focus on core activities	5
Operational flexibility related	1. Flexibility			1. Provide more flexible system		3. Strategic flexibility	2. Operational flexibility	4
LSP expertise related		2. Improve expertise		3. Exploit management expertise of contractors			1. Competencies of LSP	3
Asset utilization or efficiency related		3. Improve operations		2. Allows financial resource to be concentrated on mainstream business	2. Increase efficiency			3
Change management related			4. Re-design or re-engineering the supply chain		5. Overall improvement of distribution	5. Change implementation		3
Investment related	4. Avoid investments						5. Avoid investments	2
Problem related			3. Outsourced area was a major problem for the company					1

Table 3: Reasons for outsourcing logistics, summary of previous surveys. (Adapted from Wilding and Juriado, 2004)

and Juriado only talk about cost reduction in general as a driver for logistics outsourcing. Andersson (1995) and Van Laarhoven et al. (2000) give a more detailed description of cost related motives for logistics outsourcing. They explain that these motives are not only related to absolute cost reductions, but also turning fixed logistics costs (partly) into variable and finance some logistics activities off-balance by avoiding investments in logistics assets.

2.2.2 Impediments of logistics outsourcing

Just like there are many reasons for logistics outsourcing, there are many others that discourage its use. Loss of control and increased dependency appear to be the most commonly cited concern that inhibits firms from outsourcing logistics activities (Lieb and Randhall, 1996; Razzaque and Sheng, 1998, Van Laarhoven et al, 2000, Canete, 2005; Selviaridis and Spring, 2007). Loss of control refers to losing control in production, inventory management, important information or customer service. Besides losing control and increased dependency of third parties, concerns about the true costs and uncertainty about service level offered by the service provider are often cited as concerns regarding outsourcing logistics (Lieb and Randhall, 1996; Canete, 2005). Other concerns that have been mentioned in literature are: evaluation and monitoring problems, lack of trust in business partner, lack of (top) management support, clashing firm cultures, switching costs and sunk costs (Ellram and Cooper, 1990; Aertsen, 1995). Sunk costs refer to earlier investments. Investments in for example a warehouse management system have large setup costs. These costs are normally spread over the whole operating life-time of the system. Outsourcing the warehouse operation before end-of-life to an external service provider makes the system useless. The remaining investments are marked as sunk costs. These costs can be a reason to keep certain logistics services in-house.

2.3 Purchasing logistics services

2.3.1 Purchasing process

A standard purchasing process consists of six steps (Van Weele, 2005). The first step in the process is determining specifications. Then the partner is selected and contracted. During the contract period, goods or services are ordered from the supplier, and subsequently these orders are monitored and controlled. The final step in the process is evaluation of the supplier and accompanying contract. Although the purchasing process is described sequentially, no linear path should be assumed. In some processes a phase may be omitted entirely, and interruptions and recycling throughout the stages

are common. The time and effort involved in each step may vary depending on both an organization's previous experience, and the kind of products purchased.
There is no difference between outsourcing logistical functions and any other purchasing process (Bradley, 1994). Bradley asserts that like a reliable supplier of materials and parts, contract logisticians should also provide a high level of customer satisfaction so that their clients can become a tougher competitor. Several authors have defined processes to purchase logistics services (Andersson and Norman, 2002; Bagchi & Virum, 1998; Lambert and Stock, 1993; Menon et al., 1998; Sink and Langley, 1997; Skjott-Larssen, 1995). Although these authors use different names to explain the different phases in a purchasing process for logistics services, the processes all distinguish the same basic phases as identified in the standard purchasing process explained at the beginning of this section.

2.3.2 Positioning logistics services

The Kraljic matrix has become the standard in the field of purchasing portfolio models to determine a comprehensive strategy for supply (Gelderman, 2003). Kraljic's approach includes the construction of a portfolio matrix that classifies products on the basis of two dimensions: profit impact and supply risk. Each variable has two possible values: ''low" or "high". The result is a 2x2 matrix and a classification in four categories: bottleneck, non-critical, leverage and strategic items. Each of the four categories requires a distinctive approach towards suppliers. This is illustrated in figure 4.

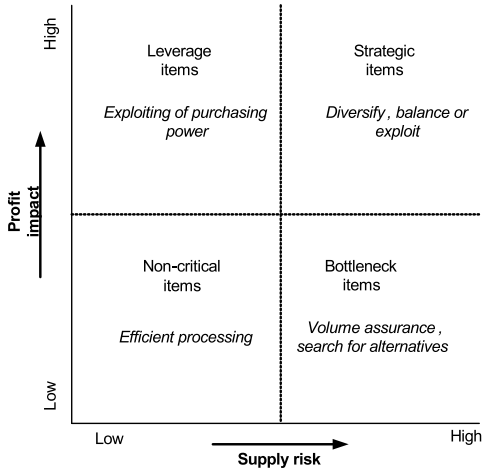

Figure 4: Kraljic's purchasing portfolio (Kraljic, 1983)

In contrast with a growing acceptance and use of Kraljic's purchasing portfolio, there are some problems and unanswered questions (Gelderman and Van Weele, 2003). The authors explain that one of the main problems identified, is the choice of dimensions and accompanying values. What is exactly meant by "profit impact" and "supply risk"? How could or should the dimensions be measured in practice? The theory does not provide prescriptions or procedures for this. Furthermore, Gelderman and Van Weele (2003) notice that the critique of Kraljic, however, does not include the experience of practitioners. As a result, they study how practitioners handle the identified measurement issues and conclude that there is no simple, objective or standardized blue print for the application of the Kraljic matrix. This conclusion is in line with De Boer (1998) who suggests that organizations should use a fully customized approach by determining their own criteria and their own specific threshold values.

Gelderman and Van Weele (2003) show that experienced practitioners have found effective approaches to handle the measurement problems. Organizations translate the original two dimensions, profit impact and supply risk, into dimensions that can be put into practice more easily. Profit impact is for example replaced by value of purchased items or strategic importance of the sourced items. Supply risk is put into practice by the number of alternative suppliers available or the level of dependency in the relationship. This is in line with the interpretation of the dimensions as proposed by Vermunt (2008). He translates the profit impact axis into strategic importance of the sourced items (core or non-core related items). The strategic importance of non-core items is relatively low and the importance of core items is relatively high. The supply risk axis is translated into dominance in the relationship between buyer and supplier. In case the dominance level of the supplier is relatively low, the supply risk will be low. On the other hand, if the supplier has a dominant position in the relationship, the buyer is dependent and as a result the supply risk is relatively high.

Using Kraljic's purchasing portfolio to position logistics services, some decades ago these were positioned between leverage and non-critical items (Andersson and Norrman, 2002). The position on the "strategic importance axis" was based on the fact that, although logistics is a big cost element and an important service element in many organizations, it was normally not the major competitive advantage or cost element. When analyzing the "dominance in the relationship axis" this was often quite low as the buyer has a strong negotiating position and there are a large number of providers in the market. Nevertheless, nowadays, the position of logistics services in the Kraljic's matrix is more differentiated for a number of reasons.

First, the technological innovation has increased the system integration between shippers and logistics service providers. As a result, web-based freight exchange has emerged (An-

dersson and Norrman, 2002). This development drives the position of basic logistics services, especially transportation, downwards in the Kraljic's portfolio to non-critical items.
At the same time, the complexity of logistics outsourcing increases. Literature review makes clear that the bulk logistics services outsourced are still basic logistics services in the areas of transportation and warehousing (Lieb and Bentz, 2005; Lieb and Randall, 1996, Selviaridis and Spring, 2007; Capgemini, 2007). Nevertheless, an altering business environment forces companies to find new ways of working together in the supply chain to gain and maintain competitive advantage. This also results in new demands on logistics. Logistics services are increasingly outsourced in a package of multiple services (Van Laarhoven et al., 2000; Andersson, 1997; Sink and Langley, 1997; Berglund, 2000). At the same time more different activities like value adding services and IT services are included in this package of services (Andersson and Norrman, 2002). Furthermore the level of responsibilities shifted to service providers is changing. The responsibilities handed over nowadays are not limited to an operational level, but can also have a tactical or even strategic character (Capgemini, 2007; Hertz and Alfredsson, 2003; Razzaque and Sheng, 1998). For example, a LSP gets the responsibility for supply chain orchestration activities. As an overall result it may be concluded that the complexity of logistics services purchased is increasing.
Third, logistics services purchased some years ago were usually quite easy to specify, but the recent developments make some of the logistics services more complex and consequently the specification of these services more difficult (Sink and Langley, 1997; Andersson and Norrman, 2002). The development of a scope of work that meets the firm's needs is crucial to the success of purchasing logistics services (Menon et al., 1998; Bagchi and Virum, 1998). The difficulty of service specification is also identified by various authors in the general purchasing literature, because of the differences between goods and services. In comparison to goods services are: intangible, heterogeneous (not standardized), inseparable (difficult to separate production of the service from consumption), and perishable (not possible to stock) (Andersson and Norrman, 2002; Axelsson and Wijnstra, 2002; Ellram et al. 2004; Grönroos, 2000; Lovelock, 2001; Zeithaml et al. 1985, Van der Valk, 2007). Because of these characteristics, the purchase of services is perceived to be essentially different from the purchase of goods (Fitzsimmons et al. 1998; Jackson et al., 1995; Smeltzer and Ogden, 2002; Stock and Zinszer, 1987). Axelsson and Wynstra (2002) argue that some aspects are not only different, but also become more difficult or more important when purchasing services instead of goods. Van der Valk et al. (2005) found that purchasers feel that the developing specifications for services is more difficult than for goods and that it is more difficult to evaluate the performance of providers of services than of suppliers of goods. The last identified problem is a logical result of the first mentioned problem. This is in line with Smeltzer and Ogden

(2002) who state that the complexity of the purchasing process for services depends primarily on the clarity and preciseness of the specification. It will become more difficult to determine the desired service level and the specific content of a service level agreement (SLA) when clear specifications are missing. Furthermore, when a proper specification and SLA are lacking the buying company (nor the supplier) will know what needs to be measured. Therefore it may be argued that the success of purchasing services is primarily determined during the first stage of the purchasing process: specification definition. This specification is not a simple job. Jackson et al. (1995) find that buyers experience that it is more difficult to develop specifications for services than for goods. To overcome these difficulties and to improve service specifications Van der Valk and Rozemeijer (2009) propose to emphasize on the aspect of service specifications during the first stages of a purchasing process. They suggest incorporating two additional steps at the beginning of the process. These additional steps are added after the first step (define specification) and are called request for information (RFI) and detailed specification. The RFI is not only used to pre-select some suppliers, but also to get service providers involved in the process. The detailed specification phase is focused on detailing the specification process by using the information received from the suppliers. Earlier supplier involvement will help to fully benefit from the specific expertise and knowledge of these providers.

Nevertheless, the success of supply chain collaboration will depend on companies' willingness to nurture their relationships, share information, explore opportunities for further collaboration and not revert to traditional "arm's length purchasing methods" (Laarhoven and Sharman, 1994).

Summarized, it may be concluded that nowadays the position of logistics services in Kraljic's portfolio is more differentiated than some decades ago (Andersson and Norrman, 2002). Some logistics services became more complex and moved up to the upper segments of Kraljic's portfolio. At the same time, other services moved downward to lower segments of the portfolio. Two recent case studies by Zeegers (2007) confirm this statement. Figure 5 presents the position of different outsourced logistics services within the Kraljic matrix as positioned by a chemical company located in the Netherlands. Next to this, for each quadrant the corresponding purchasing strategy is depicted. It needs to be noticed that figure 5 is just an example; the exact position o the different logistics services within the portfolio will depend on the specific situation of a company and thus can vary from company by company.

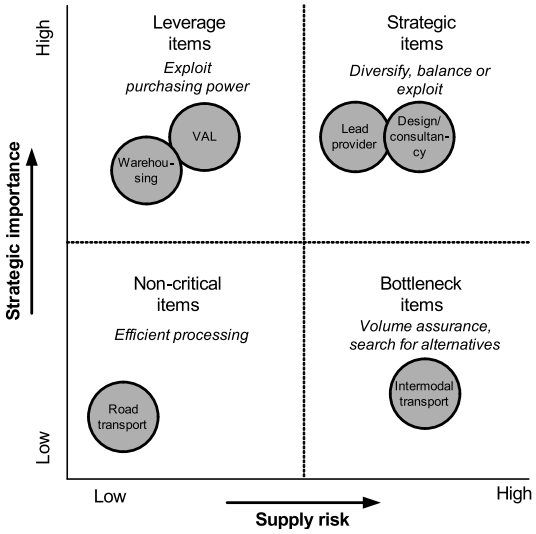

Figure 5: Position of Logistics Services within Kraljic Matrix (adapted from Zeegers, 2007).

Traditionally, purchasers of logistics services often use a transaction-oriented approach to guide the purchasing process (Andersson and Norrman, 2002; Van Laarhoven and Sharman, 1994). This approach is characterized by among others the following keywords: several suppliers, exploit potential of competition, short term, arm's length, avoid coming too close, and price orientation (Axelsson and Wynstra, 2002). The authors explain that buyers who use a transaction-oriented approach are not focused on collaboration with suppliers, but on further strengthening of the buyer's position versus the providers. Suppliers are subsequently not or nearly not actively involved in the procurement process, and buyers do not make an appeal to the suppliers' expertise in this process. The purchasing decision is mainly based on price. Previous research on criteria considered in selecting a logistics service provider stretches the transaction-oriented approach. The contributions show that costs in terms of price together with service are the most important criteria and that costs is often also the first mentioned selection criterion by shippers (Bradley, 1994; Lynch, 2004; Van Hoek, 2000; Van Laarhoven and Sharman, 1994, Van Laarhoven et al. 2000). Other criteria that are mentioned are capabilities of the LSP[4], financial position of the LSP, cultural and strategic fit. Next to this, previous research confirms that buyers try to exploit their power position in a purchas-

4 Possible capabilities are specialized knowledge of the LSP and range of services offered by the LSP.

ing process for logistics services, because of their dominant position in such a process (Van Laarhoven and Sharman, 1984; Laarhoven et al. 2000). Nevertheless, different positions in Kraljic's portfolio require different sourcing strategies and different sourcing approaches. As a result, for more advanced logistics services a more relation-oriented purchasing approach is recommended instead of the traditionally used transaction-oriented approach. This relation-oriented approach supports a higher degree of communication and interaction between buyer and supplier and is characterized by: one or few alternatives, a deal is part of a relationship, exploit potential of cooperation, early involvement of suppliers, long term, total cost and value orientation (Axelsson and Wynstra, 2002).
Besides, it may be argued that general problems for buying business services, as described above, are increasingly applicable for logistics services as well. In line with observations in that section, spending more time and effort on the specification of the services in collaboration with the service providers, could help purchasers to overcome the identified problems. Earlier and a higher level of supplier involvement make it possible to benefit from the expertise and possibilities of logistics service providers.
Nevertheless, less empirical evidence is available about whether shippers also actually have a different purchasing approach for advanced logistics services. Furthermore, the idea of extending the purchasing process as proposed by Van der Valk and Rozemeijer (2009) is drawn on literature review and preliminary empirical research, but it is still conceptual in nature. Therefore also these ideas need further empirical validation. This is supported by Selviaridis and Spring (2007), who propose to focus further empirical research on the process of service definition in purchasing logistics services.

2.4 Concluding remarks

In this chapter logistics outsourcing is defined and introduced by reviewing current literature on this topic. This review makes clear that logistics outsourcing is one of the possible decisions to reach the overall business strategy. This business strategy is leading in defining the logistics strategy. The different levels of decisions taken to design, implement and execute a logistics strategy are widely discussed in the literature. Several authors have defined models to explain the hierarchical levels in logistics decisions. These models do not categorize the same type of logistics decision at the same hierarchical level. Consequently, the exact position of each decision in the hierarchy is arbitrary, but each model is useful to show the wide range of logistics decisions and to show that these decisions differ in terms of scope, frequency and time horizon.
Literature provides more than a few classifications to explain logistics services outsourced differ in complexity from basic logistics services, with a transactional and repetitive char-

acter, towards advanced logistics services which are focused on integration, value adding and management. Traditionally, the bulk of outsourced logistics services concerns single, basic services. A transaction-oriented approach with service and costs in terms of price as the dominating decision criteria is typically used for the purchasing process of these services. Nevertheless, nowadays, the range of logistics services purchased is more diverse. Literature identified three reasons for this: current business trends, increased complexity of logistics outsourcing and service specification difficulties. As a result, the position of logistics services in the Kraljic's matrix is more spread than some decades ago. Subsequently, the purchasing process and approach should be more differentiated, because the traditionally followed sourcing strategy is not mostly preferred for all types of logistics services. More advanced logistics services require a sourcing strategy with a relation-oriented purchasing approach. Specification difficulties could be decreased by focusing on the specification process at the beginning of a purchasing process, and by earlier involving the service provider in the process. However, there is less empirical evidence available about whether the shippers actually have adapted their sourcing approach to the changed situation. Therefore further empirical validation is needed.

3. Collaboration

This third chapter describes the findings of the second literature stream that is reviewed: collaboration. In the previous chapter, we discussed logistics outsourcing. Logistics outsourcing results in a collaborative relationship between shipper and logistics service provider. The topic collaboration has received considerable attention across different academic disciplines including sociology, psychology, marketing and supply chain management (Min et al, 2005). Recently, Van de Vijver (2009) published an extensive overview of contributions on creating and managing collaborative relationships in marketing, operations management and strategic management literature. This chapter discusses collaboration in the context of supply chain management. Nevertheless, also in the context of supply chain management, collaboration has taken several interpretations with focus on different aspects of collaboration: building sales, sharing goals, jointly searching for solutions, joint ownership and long-term character (Groothedde, 2005). Taking these elements into account, we follow Schrage (1990) to define collaboration as follows: an affective, voluntary, mutually shared process where two or more actors work together, have a mutual understanding, a common vision, share resources and achieve common goals. Key dimensions are the cross organizational scope, the commitment to working together, trust and a common bond or goal.

This chapter describes different aspects of collaboration from a theoretical perspective. The chapter is structured as follows. The first subsection discusses different types of supply chain collaboration. Subsequently, factors possibly influencing a collaboration decision are identified. The third section describes drivers and impediments of collaboration. Finally, the chapter concludes with summarizing the main findings of this chapter.

3.1 Classifications of supply chain collaboration

3.1.1 Level of integration

Supply chain collaboration results in inter-organizational relationships. The scope of activities organizations actually perform together in such a relationship depends on the level of integration. Several authors have defined classifications to express to what extent organizations are integrated. A number of these classifications are presented in table 4. The table shows that criteria and terminology used to classify different levels of

collaboration differ but that the distinguished levels of supply chain collaboration are comparable.

Authors	Levels of collaboration	Evaluation criteria to define level of collaboration	Names for different levels of collaboration
Boorsma and Van Oord (1992)	4	• N.A.	• Physical integration • Information integration • Coordination integration • Supply Chain design coordination
Lambert et al. (1996)	3	• Duration • Scope • Closeness	• Operational partnership • Coordination partnership • Strategic partnership
Zinn and Parasuraman (1997)	4	• Scope • Intensity	• Limited cooperation • Focused cooperation • Extensive cooperation • Integrated cooperation
Spekman et al. (1998)	4	• Strategic importance • Complexity	• Open Market negotiation • Cooperation • Coordination • Collaboration
Muckstadt et al. (2001)	4	• Business process integration • Information system integration • Decision system integration	• Collaborator • Cooperator • Coordinator • Communicator
Vos et al. (2003)	3	• Scope • Objective • Horizon	• Operational synergy • Coordination synergy • Strategic synergy
Gulati and Kletter (2005)[5]	4	• Trust • Responsibilities • Commitment	• Arm's length • Bundling • Integration • Strategic partnering

Table 4: Classifications of levels of supply chain collaboration

Last decades organizations increasingly outsource portions of their activities to other organizations. This had led to an explosion of supply chain collaboration and nowadays most organizations have a network of relationships (De Man, 2004). Therefore, different authors argue that not supply chains but networks compete since there are usually mul-

5 Supply chain collaboration is only one of the elements discussed by Gulati and Kletter (2005). In their paper, they also discuss different levels of alliances and intra-organizational collaboration.

tiple suppliers and suppliers to suppliers as well as multiple customers and customers' customers to be included in the total system (Christopher, 2005; Hagdorn, 2007; Pfohl and Buse, 2000). Two of the classifications mentioned in table 4 explicitly focus on collaboration in networks instead of chains: Vos et al. (2003) and Gulati and Kletter (2005). The classifications presented in table 4 assume an evolutionary pattern in the levels of supply chain collaboration. Moving from a transactional relationship to a strategic partnership is described as a stage-wise development which requires energy from inside and outside the organization. The evolutionary character is well illustrated by the synergy typology as defined by Vos et al. (2003). Figure 6 depicts this classification and shows explicitly that the three types of synergy need to be viewed as an intensity trilogy. In this trilogy strategic synergy is defined as the most intensive type of collaboration. Strategic collaboration incorporates operational as well as coordination collaboration, and coordination collaboration incorporates operational collaboration. At the other side, there are also sources in literature that have proved that the assumed stage-wise development process is not always followed in practice, but replaced by a more revolutionary path (Jap and Anderson, 2007). As a result, relationships bypass some levels of collaboration in their development.

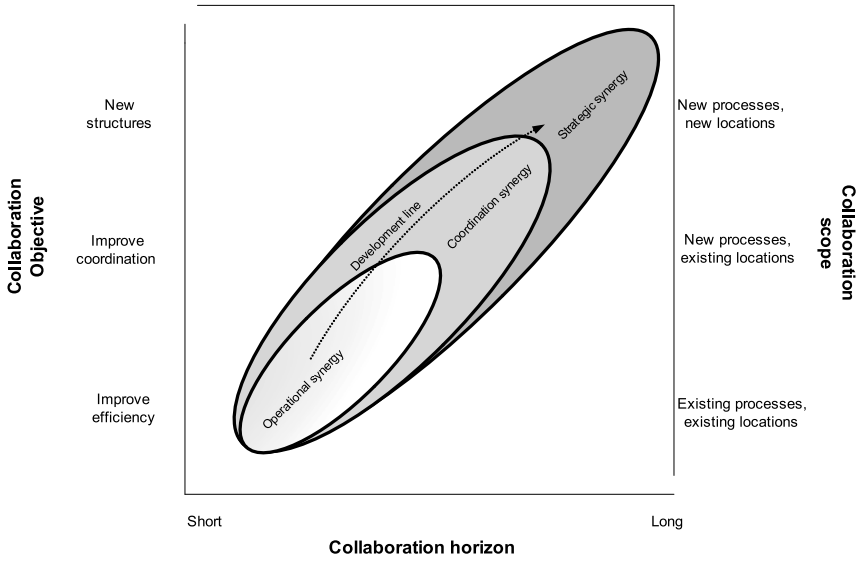

Figure 6: Synergy typology (Vos et al, 2003)

The classification identified by Gulati and Kletter (2005) is the only classification in table 4 that not only links the different levels of collaborative relationships to the activities and responsibilities that are handed over to the partner, but also to the "soft" side of collaboration. They explicitly define trust and commitment as two criteria that determine the level of supply chain collaboration and explain that the development of the levels of trust and commitment is needed to successfully move one step on the relationship ladder. The most basic form of collaboration on the relationship ladder of Gulati and Kletter (2005) is called 'arm's length'. This refers to a relationship in which the company purchases each product or service as an isolated transaction. Moving one rung up from this level, companies work with their suppliers to leverage their operational expertise and knowledge. A short term contract is used to formalize the collaboration. This second level of collaboration is named bundling. On the third level of the relationship ladder, employees from the company and supplier both become integrated in the company's work as part of a team. These activities are often project based and have a midterm horizon. This level on the relationship ladder is called integration. At the highest rung, a company turns its activities completely over to its supplier. The supplier takes ownership of all related decisions and actions. Gulati and Kletter (2005) call this strategic partnering. Strategic partnering has a long term horizon. The relationship ladder as defined by Gulati and Kletter is visible in figure 7.

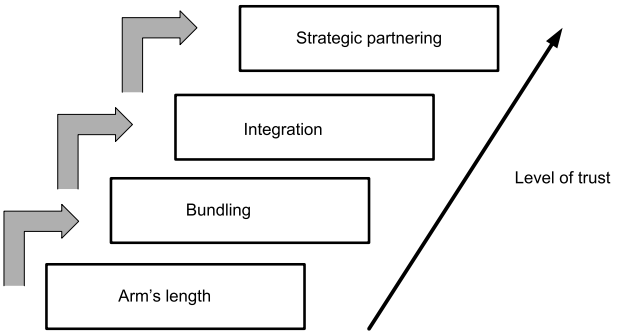

Figure 7: Relationship ladder adapted from Gulati and Kletter (2005)

Based on the classifications in table 4 and the accompanying discussion in this section, three points may be concluded. First, several classifications are available in literature to classify different levels of supply chain collaboration. These classifications show analogy in the names used to identify different levels of supply chain collaboration. In general, it might be concluded that supply chain collaboration can range from arm's length relationships to strategic partnerships. Second, collaboration processes exist between two

actors (bi-lateral) as well as in a network between more than two actors (multi-lateral). Finally, a development path is needed to reach a higher level of supply chain collaboration. This development path includes both hard and soft sides of the relationships. This path can have an evolutionary or revolutionary character. In the remainder of this thesis, we use the relationship ladder as defined by Gulati and Klein (2005) to distinguish between different levels of collaboration, because this classification takes into account both hard (e.g. activities) and soft (e.g. trust) criteria to determine the level of supply chain collaboration.

3.1.2 Forms of collaboration

Simatupang and Sridharan (2002) distinguish three types of supply chain collaboration: vertical, horizontal and lateral collaboration. They define vertical collaboration as collaboration between parties that succeed each other in a particular generation process and therefore have different activities. For example collaboration between two or more organizations such as a manufacturer, distributor, carrier and retailer. Horizontal cooperation is used to refer to concerted practices to share private information, facilities or resources to reduce costs or improve service between companies (competing or unrelated) operating at the same level(s) in the market. Horizontal collaboration occurs for example when two or more unrelated or competing organizations collaborate in a joint distribution center. Finally, Simatupang and Sridharan (2002) define lateral cooperation as a combination of vertical and horizontal cooperation for example to synchronize shippers and LSPs of multiple companies in an effective logistics network. One example is the RRP-case (Port of Rotterdam, 2008). RRP stands for Rotterdam-Rijn-Pijplijn. In this project five chemical companies (horizontal collaboration) start a joint-venture to build and exploit a pipeline between the port of Rotterdam and the Ruhr-area in Germany. The pipeline is used to transport crude oil and oil products. Also some logistics service providers (vertical collaboration) are involved in the project, because the pipeline is connected to their terminals in the Port of Rotterdam. The chemical companies use these terminals to store their products. In total, the pipeline has a length of 219 kilometers and at an annual basis 15.7 millions of tonnes crude oil and 7.9 millions of tonnes oil products are transported via the RRP-system. The joint-venture functions as a separated entity. All the activities to the RRP-pipeline are controlled by this entity in a control centre which is located in Venlo, the Netherlands.

3.2 Variables influencing collaboration decisions

3.2.1 Organizational theory

Organizational theories are often used to explain collaboration in supply chains. In this section organizational theories from three different perspectives are used: (1) an economic perspective, represented by the Transaction Cost Economics and the Agency Theory; (2) a strategic perspective, illustrated by the Resource Based View and the Resource Dependency Theory and (3) a socio-economic perspective represented by the Social Network Perspective. These five theories are selected because they form a natural fit with supply chain management; they provide characteristics of designing collaborative relationships and arguments for selecting types of collaborative relationships (Ketchen and Hult, 2007). At the end of this section, the discussed theories are compared.

Transaction Cost Economics

The Transaction Cost Economics (TCE) builds on Coase (1937), who rationalized the existence of firms, and specified the conditions of market failure. TCE elaborates Coase's views, focusing on the most efficient governance structure for a given type of transaction. The most efficient governance structure means that the total production and transaction costs are, in the long run, less than those of any other governance structure. TCE can be used to argue for the efficiency motive for entering inter-organizational arrangements. Williamson has presented a framework, based on economics, organization theory and contractual law literature, to analyze the costs mentioned above (Williamson, 1975; 1981; 1985). These total costs are determined by three critical dimensions of transactions and two assumptions on human behavior.

The first dimension of transactions is asset specificity what refers to the degree an investment is specific for a certain relation. This characteristic is identified as the most influential attribute of the transaction (Williamson, 1991). It refers to the situation where one or both parties need to engage in specific investments and develop proprietary know-how to make transactions possible. Dedicated investment will often permit production costs reductions but these investments also involve risks: no alternative use of the assets is possible after termination of the contract. The second dimension is uncertainty, because governance structures differ in their capacity to respond effectively to disturbances. Two forms of uncertainty are distinguished: internal and external uncertainty. Internal uncertainty refers to problems that could in determining whether the contract parties perform as originally agreed (Anderson and Weitz, 1992).External uncertainty is related to the impossibility to anticipate all possible contingencies at the moment a contract is concluded. Finally, the third dimension of transactions is frequency. The occurrence frequen-

cy of a certain transaction influences the government structure. Costs of specialized, expensive, governance structures will be easier to recover in case of recurring transactions. Williamson (1985) argues that a high frequency will lead to reduced control system costs. The two assumptions of human behavior that Williamson has distinguished are bounded rationality and opportunism. Bounded rationality refers to the limited capacity of human beings to formulate and solve complex problems and opportunism refers to the lack of candor and honesty in transactions, to include self-interest seeking with guile (Williamson, 1975). Different combinations of the dimensions of transactions and assumptions of human behavior will lead to different optimal governance structures. The essence of the Transaction Cost Economics is summarized in figure 8.

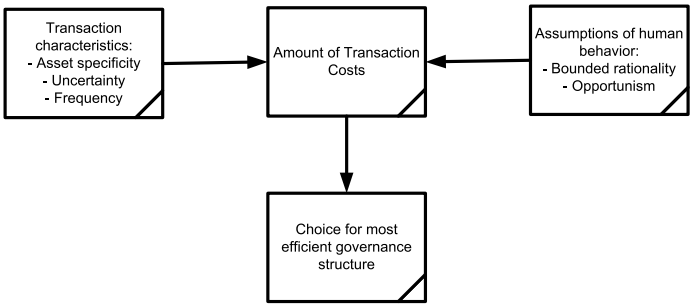

Figure 8: Essence of the Transaction Cost Theory (adapted from Aertsen, 1995)

Although the Transaction Cost Economics approach is widely used to explain and predict organizational behavior, the approach has been criticized for various reasons.

- TCE focuses only on the minimizing of the costs. Inter-organizational relationships are not only about cost minimization, but also about joint value maximization (Kogut, 1988; Zajac and Olsen, 1993).
- TCE is a static approach. It treats each transaction in an independent and a-historical context. It simply assumes that the most efficient forms have survived. This ignores the dynamic process of competition between different firms (Douma and Schreuder, 2002).
- TCE neglects the role of social relationships in economic transactions (Ring and Ven, 1992; Gulati, 1995; Nooteboom, 1999). Many relations between human beings are building on trust. In practice there are many hybrid forms between market and hierarchies that combine market relations with coordinating mechanisms used within organizations.

- TCE is building on the implicit and unrealistic assumption that all firms have the same production functions. However, firms differ in the resources and capabilities they have (Bell, 1996).

Agency Theory

Agency relationships occur whenever a partner in a transaction (principal) delegates authority to another party (agent) and the welfare of the partner is affected by the choices of that agent (Arrow, 1985). While the principal may remain responsible, the actual work is carried out by the agent. From an economic perspective, Agency Theory assumes that both principal and agent are primarily interested in maximizing their own utility (Jensen and Meckling, 1986). Important contingencies in Agency Theory are: asymmetric information between principal and agent, conflicting objectives, task programmability, outcome uncertainty and measurability of outcome (Eisenhardt, 1989). These contingencies are based on three assumptions of human behavior: risk aversion, moral hazard and adverse selection. Risk aversion refers to the assumption that an agent is more risk averse than the principal: costs are involved when the principal shifts risk to the agent, because the agent is willing to accept more risk only if this is offset by a higher expected income. Moral hazard refers to lack of effort on the part of the agent: the agent may simply not put forth the agreed-upon effort. Adverse selection reflects the misrepresentation of ability by the agent: the principal cannot completely verify the agent's skills or abilities. Although moral hazard and adverse selection are the official terms used in Agency Theory literature, they are comparable with the more common used terms opportunism and bounded rationality. Therefore, in the remaining of this dissertation we will use the words opportunism and bounded rationality to identify the human behavioral factors that are incorporated in the Agency Theory.

Because of the contingencies and assumptions of human behavior, monitoring the agent is important to avoid unsatisfactory performance from the principal's point of view (Ross, 1973). This observation gives rise to contractual stipulations that reward or punish an agent's behavior depending on its utility for the principal (Eisenhardt, 1989). In the Agency theory there are two options for contractual design: a behavior-oriented contract (e.g. salaries and hierarchical governance) or an outcome-based contract (e.g. commissions, stock options and market governance). The heart of the Agency Theory is the trade-off between (a) the cost of measuring behavior and (b) the cost of measuring outcomes and transferring risk to the agent (Verduijn, 2004). The right mix of behavioral and outcome-based incentives is necessary to motivate the agent to act in the interest of the principal.

Resource Based View

The Resource Based View (RBV) suggests that competitive advantage of a firm is derived from the unique collection of that firm's resources and capabilities (Teece et al., 1997). According to Amit and Schoenmaker (1993), resources are assets that are either owned or controlled by a firm, whereas capabilities refer to a firm's ability to deploy resources to achieve a desired outcome. The RBV builds on two basic assumptions about the firm's resources and capabilities: (1) resources and capabilities are heterogeneous across firms and (2) resources and capabilities are imperfectly mobile (Hunt and Morgan, 1995). There is a distinction between tangible and intangible resources and capabilities. The distinction acknowledges the difference between tangible resources and capabilities, which can be traded relatively easily between firms (e.g. land, machines and manufacturing facilities) and intangible resources and capabilities, which are hardly transferable among firms (e.g. patents, brand name capital, skills and know-how). The capability notion of the Resource Based View suggests that superior performance is dependent on the manner firms leverage their resources. This explains why one firm performs better than other firms in the same industry with the same resources.

The relational view of the Resource Based View suggests that a firm's critical resources may span firm boundaries and may be embedded in inter-firm resources and routines (Dyer and Singh, 1998). Organizations that combine resources in unique ways may realize an advantage over competing firms that are unwilling or unable to do so (Verduijn, 2004). By cooperating, partners can generate a so-called relational rent. Dyer and Singh (1998) define relational rent as a supernormal profit jointly generated in an exchange relationship that cannot be generated by either firm in isolation, and can only be created through joint idiosyncratic contributions of a specific collaboration partner. There are four sources of relational rents:

1. Specific investments: the potential for relational rents is increasing with investment in relation specific assets.
2. Knowledge sharing routines: inter-organizational learning is critical to competitive success.
3. Complementary resource endowments: resources that collectively generate greater rents than the sum of those obtained from the individual endowments of each partner.
4. Effective governance: to generate relational rents by employing self-enforcement (e.g. trust) rather than third-party enforcement (e.g. legal contracts).

Resource Dependency Theory

In the Resource Dependency Theory (RDT), organizational success is the result of organizations maximizing their power (Aldrich, 1979; Pfeffer and Salanick, 1978). Power may be defined as the ability of one firm (the source) to influence the intensions and actions of another firm (the target) (Emerson, 1962). Within this perspective, organizations are viewed as coalitions, altering their structure and patterns of behavior to acquire and maintain needed external resources. Acquiring external resources needed for the organization comes by decreasing the organization's dependence on other and/or by increasing other's dependence on it, what is modifying an organization's power relations with other organizations.

The RDT argues that inter-organizational relationships exist for two reasons. The first reason is strategic interdependencies, because firms perceive critical strategic interdependence with other organizations in their environment, in which one organization has resources or capabilities beneficial to but not possessed by the other (Levine and White, 1961; Aiken and Hage, 1968). Firms sought out ties with partners who could help them manage such strategic interdependencies. The second reason is complementary resources. The necessity for complementary resources is a key driver of inter-organizational cooperation (Richardson, 1972). By entering coalition activities with firms in their environment, organizations minimize the dependency and uncertainty about acquiring resources from other organizations.

Social Network Perspective

As described earlier, two points of criticism at the Transaction Cost Economics are the static character and the neglection of the role of social relationships in economic transactions. The Social Network Perspective is a theory that incorporates these two elements (Gulati, 1998). This perspective builds on the general notion that economic actions are influenced by the social context in which they are embedded, and that those actions can be influenced by the position of actors in a network. This social explanation that highlights the role of embeddedness does not contradict the economic motives for partnerships. Firms do not form partnerships for their social networks, but base inter-organizational relationships on concrete strategic complementariness that they have to offer each other (Gulati, 1998). An important implication of the embeddedness of firms in networks is the enhanced trust between firms. Trust between firms refers to the confidence that a partner will not exploit the vulnerabilities of the other (Barney and Hansen, 1994). A social network can promote trust through two possible means:

1. Referral networks: a social network serves as an effective referral network. Informal and personal connections across organizations are important in the organization of transactions.
2. "Enforceable" trust: a social network serves as a system of checks and balances and therefore reduces uncertainty. Playing "one shot games" and opportunistic behavior affects your status and reputation.

Mistrust limits greater exchange of confidential information between collaborating organizations. As a result, the lack of confidentiality decreases the level of collaboration. Also other authors stress the importance of confidentiality in collaboration decisions (f.e. Hoyt and Huq, 2002; Li and Lin, 2006).
The production of inter-organizational networks is driven by a dynamic process involving both exogenous resource dependencies, which prompt organizations to seek cooperation, and an endogenous embeddedness, in which the emerging network progressively orients the choice of partners (Gulati and Gargiulo, 1997). Networks are not static social structures: they are also evolutionary products. As a result new relationships are influenced by the social network of prior ties.

Comparing the different theories

Table 5 summarizes and compares the specific characteristics of the five discussed organization theories. The table shows that the different theories identify several factors that may influence inter-organizational relationships, and therefore affect collaboration decisions. The presented organization theories are identified as useful and increase the understanding of the collaboration mechanism. Nevertheless each single theory is insufficient to capture the complexities involved in relationship formation (Barringer and Harrison, 2000). Therefore, the presented theories should be viewed as complementary and not mutually exclusive or as substitutes (Kogut, 1988; Gulati, 1998; Halldorsson et al., 2005; Mentzer et al., 2004; Holcomb and Hitt, 2007). We will follow this line and taken into account all discussed organizational theories when we identify variables possibly influencing logistics collaboration decisions.

	Transaction Cost Economics	Agency Theory	Resource Based View	Resource Dependency Theory	Social Network Perspective
Perspective	economic	economic	strategic	strategic	socio-economic
Decision criteria	-bounded rationality - opportunism - uncertainty - frequency - asset specificity	-bounded rationality - opportunism - risk aversion	-bounded rationality	-bounded rationality -power -uncertainty	-bounded rationality -trust -confidentiality
Problem orientation	efficient governance structure: what are the boundaries of a firm?	contract design: what is the most efficient contract?	competence development: why do firms differ?	creating dependency: how can firms maximize their power?	dynamic relationships: how do firms interact with their environment?
Time Dimension	Static	static	static/ dynamic	static/ dynamic	dynamic
Unit of analysis	transactions	contract	resources and capabilities	resources	relations
Nature of relationships	market failures	efficient division of labor	access to complementary resources	-access to complementary resources -strategic interdependency	access to heterogeneous resources

Table 5: Organization theories compared (adapted from Halldorsson et al, 2005)

Decision variables

Decision variables are forces that influence collaboration decisions positively or negatively. Table 6 lists the variables identified by the organization theories discussed above. Some of the variables are identified by more than one discussed organization theory. Table 7 illustrates in which organization theorie(s) a specific variable is embedded.

Factor	Definition
Bounded rationality	Limited capacity of human beings to formulate and solve complex problems.
Opportunism	The lack of candor and honesty in collaboration. People and organizations are characterized by self-interested behavior.
Trust	The confidence that a partner will not exploit the vulnerabilities of the other.
Confidentiality	The confidence that a partner will keep shared information secret.
Power	The ability to influence the intensions and actions of partners.
Risk aversion	The care about the amount of risk to bear. Persons are willing to accept more risk only if this is offset by a higher expected income.
Uncertainty	The impossibility to oversee all the possible contingencies at a moment a decision is made.
Frequency	Occurrence frequency of a certain transaction.
Asset specificity	The degree to which investments are specific for a certain relation.

Table 6: Variables identified by organization theories

Variable	Transaction Cost Economics	Agency Theory	Resource Based View	Resource Dependency Theory	Social Network Perspective
Bounded rationality	X	X	X	X	X
Opportunism	X	X			
Trust					X
Confidentiality					X
Power				X	
Risk aversion		X			
Uncertainty	X			X	
Frequency	X				
Asset specificity	X				

Table 7: Variables as identified in the reviewed organization theories

3.2.2 Additional variables

Also general management literature apart from the organization theory discusses variables that possibly influence collaboration decisions. Reviewing these contributions results in the identification of the following variables:

- Fit: refers to which potential partners are suited for collaboration (Beer et al., 2005; Douma et al., 2000). Perié (2008) explains the word "fit" in management literature is linked to three different aspects: competence, structure and culture. Competence fit is defined as the degree to which potential partners are suited for collaboration

based on individual or organizational proficiency and experience. Structure fit refers to the suitability of partners' objectives, organizational structure and geographical dispersion. Cultural fit explains the degree to which national and corporate cultures of the partners are suited.

- Commitment: an exchange partner believing that an ongoing relationship with another party is so important to warrant maximum efforts at maintaining it; that is, the committed party believes the relationship is worth working on to ensure that it endures indefinitely (Hunt and Morgan, 1994). This implies that the participating actors are loyal and tolerant to each other's deficiencies; true partners do not constantly worry about being replaced (Min et al, 2005).
- Homogeneity: internal support and commitment of all stakeholders is essential. The internal targets of different departments may not undermine or conflict with the collaborative objectives (Barratt, 2004; Min et al., 2005).
- Transparency: refers to the openness between the cooperating parties in terms of communication and measurability of f.e. costs, benefits and risks (Groothedde, 2005; Gulati and Kletter, 2005).
- Transaction costs: costs incurred when making an economic exchange (Groothedde, 2005). For example, costs for negotiation and project management. This variable is indirectly also mentioned by the TCE, but not explicitly identified as decision variable in collaboration decisions.
- Gain-sharing: is defined as the possibility to share collectively the achieved benefits from the inter-organizational collaboration (Cruijssen, 2006; Gulati and Kletter, 2005).
- Interpersonal interaction: Andersen and Kumar (2006) stress the importance of interpersonal emotions in collaborative relationships between organizations. They consider that the collaboration between two organizations builds on the interaction between individual agents of both organizations.

3.2.3 Discussion

Previous research has widely discussed the topic of logistics collaboration. Van de Vijver (2009) presents an extensive overview of research on collaboration in academic journals between 2000 and 2006 in the fields of marketing, operations management and strategic management. Nevertheless, most previous studies have a limited scope and just focus on a limited number of variables or specific perspective in the organizational theory (Ketchen and Hult, 2007; Selviaridis, 2007). Our literature review process has a wider scope and results in a list containing sixteen variables that are possibly influencing a collaboration decision between organizations. These variables are listed in the left side of table 8. The identification of this relatively large number of variables illustrates that

collaboration decisions are complex decisions. There is consensus in literature that commitment and trust (including confidentiality) are the key variables on this list (Sherman, 1992; Hunt and Morgan, 1994, Bengston and Kock, 1999; Barrat, 2004).
Comparable to our study is the work of Perié (2008). In his dissertation Perié (2008) presents the Delft Factors for Alignment (DFA) model. This model is based on an extensive literature review process around three keywords: business alignment, collaboration factors and collaboration partnership factors. This process resulted in the development of the valuable DFA model that identifies ten constructs for alignment and describes in a detailed manner the factors underlying these constructs. The constructs are: competence fit, structure fit, culture fit, social bonding, trust, dependency, communication, cooperation, commitment and conflict. It may be useful to compare our list of decision variables with the constructs of the DFA model to review the result of our literature search to identify any gaps in our results, because both literature review processes are organized differently.
Making the comparison, it needs to be noticed that more variables are identified in our research than the number of constructs entered into the DFA model. This can be explained by the fact that each construct in the DFA model is divided into one or more smaller factors. This observation makes it possible that one construct is linked to more than one of the variables identified in our literature review process. An overview of the comparison is presented in table 8.

Decision variable	***Construct DFA model***
Bounded rationality	**Not applicable**
Opportunism	Trust
Trust	Trust
Confidentiality	Trust
Power	Dependency
Risk aversion	Commitment
Uncertainty	**Not applicable**
Frequency	**Not applicable**
Asset specificity	Commitment
Fit	**Competence fit, structure fit and culture fit**
Commitment	Commitment
Homogeneity	Commitment
Transparency	Communication
Transaction costs	**Not applicable**
Gain-sharing	Conflict
Interpersonal interaction	Social bonding
Not applicable	Cooperation

Table 8: Comparison of decision variables with DFA model

Table 8 results in the following conclusions:

- Only the construct cooperation is not covered by our list of decision variables. This can be explained by the fact that the DFA model not only identifies constructs that influence the collaboration decision but also constructs that influence the collaboration process itself. The other nine constructs of the DFA model are covered by our list.
- Four variables on our list are not covered by one of the constructs in the DFA model. These four variables are identified in one or more of the five reviewed organizational theories and therefore marked as a possible decision variable in collaboration decisions.
- Our variable fit is split over three different constructs in the DFA model. This clarifies that the variable fit can refer to different aspects. The variable fit needs to be defined and described clearly when the list of variables is used in the remaining part of this research.

As an overall result, we may conclude that the list of decision variables identified in this research project and the list of variables identified in the DFA-model are comparable; though in both projects the literature review process was organized differently.

3.3 Drivers and impediments of collaboration

3.3.1 Drivers

Although collaboration is based on a mutual objective, it is a self-interested process in which firms will participate only if it contributes to their own survival (Simatupang and Sridharan, 2002). Each member seeks to achieve individual benefits such as reducing costs or eliminating redundant functions, because firms only collaborate when there is at least one concrete strategic complementary. Clear strategic intent leads to successful collaborative arrangements, and provides focus for these arrangements.

General management literature provides more than sufficient support for drivers of inter-organizational collaboration. In his dissertation Cruijssen (2006) gives an overview of these driving forces. He explains that on a high level the reasons can be divided in three main groups: reasons related to costs and productivity, customer service and market position.

There are also authors that specifically focus on the drivers of collaboration between shipper and LSP. Positive cost effects have been supposed to be one of the main driving forces for logistics collaboration (Andersson, 1995; Lambert et al., 1996; Zineldin, 2004). Logistics collaboration gives the opportunity to streamline the administration of the logistics system, because a collaborative relationship with a LSP can reduce transaction costs (La Londe and Cooper, 1989). Moreover, positive cost effects can also be achieved

by the economies of scale and scope that are reached by logistics collaboration. Economies of scale occur because in the collaboration between shipper and a LSP serving more than one client, the material flow volumes could be increased and thereby the scale of the activity could be raised. As a result the fixed costs are covered by a larger volume of goods (Andersson, 1995; Ellram and Cooper 1990; Fernie, 1989; Mentzer et al. 2000). In addition to economies of scale it is also possible that economies of scope are achieved by logistics collaboration because of the operational synergies that may occur. Goldhar and Jelinek (1983) explain that such economies will be achieved if production equipment is able to produce several products in a combination compared to the cost of producing them separately. An example is sharing of personnel between a warehouse and a terminal that has a couple of peak loads whereas the work at the warehouse could be allocated over a whole day. By using (at least partially) the same personnel, economies of scope could be achieved (Andersson, 1995).
But the driving forces behind logistics collaboration are not only related to costs. Integrating activities in the supply chain through partnerships can often lead to service improvements for the customers in the form of shorter cycle time and more timely and accurate information (La Londe and Cooper, 1989; Lambert et. al, 1996; Simatupang and Sridharan, 2002). Another benefit of logistics collaboration is that a shipper gains "access". Access in this context means access to missing knowledge or access into new markets (Andersson, 1995; Fernie 1989, La Londe and Cooper, 1989, Lambert et al., 1996, Zineldin, 2004). Finally, risk reduction is an argument for logistics collaboration. The risk could be reduced because neither of the two parties, shipper or LSP, has to bear the full risk of the operation (Andersson, 1995). If a shipper does not own logistics assets he could eliminate the technological and financial risks connected to these assets. On the other hand, the LSP spreads his risks over a larger number of customers (Ellram and Cooper, 1990) or when a LSP invests in assets for the special needs of a specific shipper he takes the risk. This risk can be reduced by establishing a long term relationship with the shipper (La Londe and Cooper, 1989).

3.3.2 Impediments

Next to the drivers and objectives, a spectrum of impediments for supply chain collaboration is mentioned in the literature. These impediments are mainly related to the four areas of loss of control, costs, trust and partner selection. Loss of control is one of the main obstacles of implementing supply chain collaboration (Ohmae, 1989; Andersson, 1995; Zineldin and Bredenlöw, 2003). Also in the specific context of logistics collaboration, shippers lose control over a part of their operation, inventory or customer service; the dependency on third parties increases (La Londe and Cooper, 1989).

Another impediment of supply chain collaboration is related to the costs of collaboration. Participants have difficulties in determining the monetary benefits (Razzaque and Sheng, 1998; Zineldin and Bredenlöw, 2003). Also the literature specifically handling the topic of collaboration between shippers and logistics service providers pays attention to this impediment. Some authors identify that shippers may perceive logistics collaboration as being more expensive than performing activities in-house (Andersson, 1995; McLaren et al., 2002). This is due to the fact that some of the costs that earlier had been hidden in general overhead will be visible (Ellram and Cooper, 1990). At the same time there are elements that add costs. First switching from a current situation to a situation of logistics collaboration is not without any switching costs. Second, logistics collaboration requires additional costs related to coordinating and controlling the collaborative relationship (McLaren et al., 2002; Mentzer et al., 2000). Additionally, parties expect to have difficulties in establishing a fair allocation of the benefits (Lambert et al., 1999; Zineldin and Bredenlöw, 2003).

The third area of impediments is related to the lack of trust between business partners (Andersson, 1995; Mentzer et al., 2000). In case collaboration starts, regardless the lack of trust, the result is often a lack of commitment. As a result the collaborating parties try to limit the information exchange and only choose for a limited area of collaboration.

Finally, finding a reliable partner with whom to cooperate is perceived as one of the impediments for supply chain collaboration. Doubts about the experience and knowledge level of the potential partners are also an obstacle to collaborate with logistics service providers. Moreover, shippers have fears about opportunistic behavior of their partners because of conflicting interests (Simatupang and Sridharan, 2002).

3.4 Concluding remarks

Reviewing literature on supply chain collaboration makes clear supply chain collaboration exists in different forms and at different levels. Three different forms are distinguished: vertical, horizontal and lateral collaboration. All three forms can occur at different levels. Literature provides several classifications to distinguish between these different levels of supply chain collaboration. These classifications are comparable and make three things clear. First, supply chain collaboration can range from arm's length relationships to strategic partnering. Second, supply chain collaboration can be bi-lateral or multi-lateral. Third, to move to a higher level of collaboration the hard side as well as the soft side of the relationship needs to be developed. This development path to a higher level of collaboration can have an evolutionary or revolutionary character.

The review of the organizational theories and general management literature results in a large number of variables that possibly influence a collaboration decision between organizations. There is consensus in the literature that commitment, trust and confidentiality are the key variables on this list. Unfortunately, this literature study does not make clear which of the other identified variables are dominating in the specific context of this research; a collaboration decision between shipper and LSP. This is one of the items that need further empirical validation.

The identified drivers of supply chain collaboration can be divided in three main categories: reasons related to costs, service or market position. On the other hand, there is also a spectrum of impediments described in the literature. These impediments are related to loss of control, costs, (mis)trust and partner selection. Together with the decision variables and the drivers, the impediments are influencing a collaboration decision. This is depicted in figure 9. The arrows in figure 9 represent the relationships between the three elements.

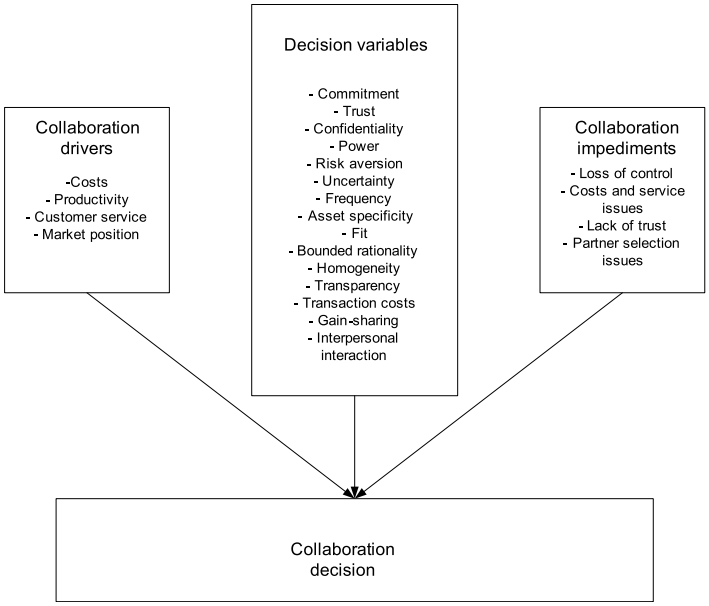

Figure 9: Variables, drivers and impediments of collaboration

4. Decision making behavior

The decision making behavior literature is the third stream of literature that is reviewed in this research project. This chapter describes these review results. As discussed in the first chapter, the logistics and supply chain management literature has not always adequately addressed the human aspects of decision making. Therefore, we adopt the approach of Mantel et al. (2006) that an integration of supply chain management and decision making behavior literature can contribute to closing the research gap in understanding logistics collaboration decisions. This chapter discusses the decision making literature from both an economic and behavioral perspective. The remainder of this chapter is structured as follows. The first section describes the decision making process. Afterwards, the second section discusses different economic perspectives on decision making. Subsequently, the decision making behavior literature is discussed. The fourth section discusses the concept of utility frameworks. Finally, this chapter concludes with summarizing the main findings of this chapter.

4.1 Decision making process

People make decisions every day. Decisions are just part of our daily life. Normally we make so many decisions as a matter of course that only rarely do we realize that we are in fact making a choice. Choice behavior can also be the result of a habit or the imitation of somebody else. Nevertheless all decisions, explicit or implicit, have some things in common. They each involve the existence of at least two possibilities, and they all follow more or less the same process. Choices are the outcomes of these decision-making processes. A number of frameworks have been put forward to describe the phases in such a process (Dewey, 1933; Simon, 1965; Mintzberg et al., 1976; Ben-Akiva and Lerman, 1985). In general, five phases are distinguished in these frameworks. The first stage is the definition of a choice problem. This problem recognition stage is the perceived difference between an ideal and actual state. This is critical because it motivates the decision maker to action. The next step after the problem recognition phase is the generation of alternatives. Which alternatives does the decision maker have for the actual state of his problem? These alternatives are generated by internal and external search.

Internal search refers to searching for information from memory and external search is defined as searching for information from the environment like friends, relatives or published sources. The next step for the decision maker is to evaluate the available alternatives. During this judgment process the decision maker is making evaluations or estimates regarding the likelihood that products or services will possess certain features or perform in a certain manner. The evaluation process is followed by the actual choice by the decision maker. Finally the choice is implemented. Our study mainly focuses on step three and four of the decision making process: evaluation of the alternatives and the actual choice. The different phases in a decision making process are depicted in figure 10. It needs to be noticed, that the model as presented in figure 10 is regarded as an ideal model. In reality, the decision making process may be a little bit different, because decision makers can move back and forward between the stages for a number of times.

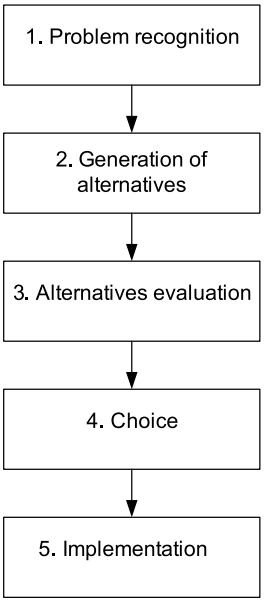

Figure 10: Phases of decision making process (Ben-Akiva and Lerman, 1985)

An example of the definition of a choice problem could be that an employee needs to decide on the mode of travel to work. His environment and the supply of transportation services generate an overview of the alternatives available. In the next step of the decision process the employee needs to evaluate these available alternatives based on the attributes of every available alternative. This information is processed by the decision maker to arrive at the choice of travel mode. To do this, the person applies a decision

rule. This is a specific sequence of calculations such as selecting the fastest mode that costs less than one dollar, irrespective of comfort (Ben-Akiva and Lerman, 1985). The final step in this decision making process is the trip to work itself by using the chosen mode.

The example makes clear that a decision making process is a collection of procedures that contains the following elements: decision maker, alternatives, attributes of alternatives, and decision rule. The unit of decision making can be an individual or a group of persons such as a family. It can also be an organization such as a firm or government. As stated in chapter 1, in this dissertation we only focus on individuals as the unit of decision making. The decision making unit makes a choice from a set of alternatives. This set is called the choice set and includes the alternatives that are both feasible to decision maker and known during the decision process. The feasibility of an alternative is defined by a variety of constraints such as physical availability (availability of train service between the employee's home and workplace), monetary resources (taxi fare might be too expensive in relation to income of the employee), time availability (walking will be infeasible when distance to workplace is too long), information constraints (lack of knowledge about carpool options), and so on (Swait, 1994). Each alternative in a choice set is described in terms of attributes. An attribute is an element that impacts the decision making unit's choice. In our example of the travel mode choice the attributes of each alternative could be for example costs, time and comfort. The attributes are evaluated and measured on a scale of attractiveness by the decision making unit. A choice from a set containing two or more alternatives requires a decision rule. This describes the internal mechanism used by the decision maker to process the information available and arrive at a unique choice (Ben-Akiva and Lerman, 1985).

4.2 Economic literature

For a long time the standard assumption in economics has been that individuals are rational thinking agents. In this orthodox neo-classical world, transactions cause no coordination problems and go without transaction costs. The economy runs smoothly and optimal equilibriums are the automatic results. A decision maker is seen as a fully rational agent and a "homo-economicus", which means in this economic stream that a decision maker maximizes his utility, is only guided by financial incentives, and has full knowledge of all options and consequences (Folmer, 2007).

Later on the new institutional economics literature (see e.g. Coase, 1937; Williamson, 1975; 1981; 1985) questions several assumptions of the neo-classical stream (Mosch, 2004). The new institutional economics still rely on the assumptions of rational maximi-

zation of utility by individual actors who only respond to material incentives, but they question the assumptions of free and complete information and full rationality of the actors as defined in the orthodox neo-classical world. In the institutional economics literature, this assumption of full rationality is replaced by the assumption of bounded rationality. This means that human beings have a limited capability of collecting, storing and processing information. This implies that information is never complete, and the total set of potential future events and their consequences is unknown. As a result uncertainty enters the analysis. Moreover, when information is not freely available, actors have to invest in a certain amount of information, and thus transaction costs appear in economic transactions. As a result, following the new institutional economics, decision makers live in a world with uncertainty, transaction costs and bounded rationality. Nevertheless also the institutional economic approach is criticized, because it neglects the role of social relationships in economic transactions (Ring and Ven, 1992; Gulati, 1995; Nooteboom, 1999). The Transaction Cost Economics and Agency Theory that are discussed in the previous chapter are part of the new institutional economics and based on these assumptions.

The behavioral and experimental economics (see e.g. Camerer et al., 2002; Fehr and Falk, 2002) go one step further. They rely on the assumption that (economic) behavior is not only guided by material incentives, but also by psychological and sociological influences. According to this economic stream, decision makers also derive utility from equality, honesty, reciprocity et cetera. This approach offers new views on collaboration that go beyond the idea that collaboration only results as a result of calculations of expected materials payoff (Mosch, 2004). Although this economic stream is still in its developing phase, the empirical evidence of the experiments show that all sorts of psychological effects interfere with the fully rational kind of decision making as defined by the orthodox and institutional economic approaches. The behaviouralists and experimentalists seem to have incorporated valuable insights from other social sciences, such as sociology and psychology.

In line with behavioral and experimental economics, the evolutionary economics theory rejects the existence of a "rational agent". Evolutionary economics is a relatively new economic and diverse school of thought that is inspired by evolutionary biology. This theory is originally developed by Nelson and Winter (1982) and focuses on the mechanisms that underlie innovations, fundamental changes and transitions (Dosi and Nelson, 1994). This is in contradiction with the orthodox and new institutional economics theories that focus on equilibrium analyzes (Foxon, 2006). The evolutionary economics theorists have backed away from the rational choice theory and adopted a quite different alternative. Evolutionary economics explains that decision makers often face situations where they do not have perfect knowledge of all possible choices at a particular time.

Besides, these decision makers do not have an unlimited power to compute the utility implications of these choices. Therefore, they assume that that decision makers are characterized by bounded rationality, conservatism and risk aversion. Individuals have limitations in their possibilities to collect and process information and as a result they stick to their routines. These routines determine their decision behavior (Foxon, 2006).
The discussion in this section shows that each of the four discussed economic streams is based on its own set of assumptions to explain decision making behavior by individual agents. Table 9 gives a summarized overview of the discussed approaches in this section. The table shows two things. First, it shows whether a specific economic stream views a human being as a fully rational agent. To define the term fully rational agent, the orthodox neo-classical tradition is followed. Second, the table presents an overview of the characteristics of decision making behavior as assumed by each stream.

	Orthodox, neo-classical economics	**New-institutional economics**	**Behavioral and experimental economics**	**Evolutionary economics**
Human beings are fully rational agents:	Yes	Yes	No	No
Decision making behavior is characterized by:	No additional assumptions	• Bounded rationality • Uncertainty • Not all infor-mation is freely available	Individuals also derive utility from non-material pay-offs.	• Bounded rationality • Risk aversion • Conservatism

Table 9: Different economic views compared

Does the comparison in table 9 mean that the neo-classical and new institutional methodologies are poor tools to analyze individual decision making? No, it does not. Although several assumptions of the neo-classical and institutional economics are questioned by the behavioral and evolutionary economics, the core tenets of the two economic approaches are untouched and may even be insightful for other (economic) disciplines (Mosch, 2004). The neo-classical and new institutional approaches form a general analytical framework for analyzing decision behavior, but the restrictions of both methodologies need to be kept in mind. There needs to be an eye for the contributions of the other economic streams that take sociological and psychological factors into consideration, just to be able to embed more fruitfully the concept of decision making. Also Folmer (2007) argues that the dividing line between economics and social sciences must disappear. He suggests that researchers in economics should integrate theories of social

sciences in their research programs, because such a holistic approach will enrich the economic science. Nevertheless, the discussion in this section makes clear that the ecnomic science does not exist. As a result, researchers that follow such a holistic approach should be aware of the fact that different streams in the economic science are based on different sets of assumptions.

4.3 Behavioral decision making literature

4.3.1 From rational to intuitive based decision making

In line with the neo-classical and new-institutional economics view on decision makers, the classical decision-making literature is built on the assumption that individuals are rational agents. By this assumption is understood that individuals have well-defined stable preferences, know and understand all existing alternatives, and maximize their preferences given the existing possibilities however complicated the decision problem is (Koshfeld, 1999) This is known as the rational theory of decision making. The assumption of full rationality in this theory offers several points of criticism. Nobel laureate Simon (1957) argued that actual decision makers have limited computational capabilities to make optimal search for alternatives, evaluations of prospects and selection of options. Simon introduces the model of bounded rationality. In this perspective, actual choice behavior is bought by a sequence of heuristics or rules of thumb that bounded rational agents employ to make judgments and decisions in the (complex) real world (Simon, 1957).

Later on, more intuitive-based decision-making models are developed for situations that are not characterized by full certainty. We discuss successively the Satisfying model as proposed by Simon (1960), the Muddling-through model developed by Lindblom (1959) and the Garbage-can model defined by Cohen et al. 1972.

Simon relies his satisfying model on the assumption of bounded rationality. Based on this assumption a choice is the outcome of the following procedure. First, the decision-maker defines a number of obvious alternatives based on his experience. Afterwards he defines his objectives: his aspiration level. Subsequently, he chooses the first alternative that meets this aspiration level. This choice is called the satisfying solution. Therefore, the Satisfying-model will not always result in selecting the most optimal alternative, because the decision maker 'satisfice' rather than optimize (Foxon, 2006). The decision maker is not invest additional time and money to find a better solution for his problem when his aspiration level is reached. In case there is not any alternative that meets his aspiration level he reformulates his objectives and starts again to define some alterna-

tives. As a result, the aspiration level of the decision maker is not a static variable, but changes based on the alternatives that are available.

Also Linblom (1959) puts forward a justification of the rational decision making model by his "Muddling-through model" or incremental model of decision making. In this model ends and means are intertwined and decisions are made by comparing several immediately available and known alternatives. Lindblom uses his model to explain that decision making is the result of incremental change aimed at arriving at agreed-upon policies which are closely related to past experience. In his view decision making is more an evolutionary in stead of a revolutionary process. The status quo will only change by small steps.

Cohen et al. (1972) have described their vision on non-rational decision making in their Garbage-can model of choice. They use their model to explain that the rational decision-making theory can not be used when consistent, shared goals within an organization are missing. They use the term organized anarchies to identify such organizations. These are situations – or decisions- characterized by three general properties: problematic preferences, unclear technology and fluid participation (Cohen et al, 1972). As a result an organization operates on the basis of a variety of inconsistent and ill-defined preferences, simple trial-and-error procedures and the audiences and decision makers for any particular choice change capriciously. The Garbage-can model relies on the assumption that situations of decision making under goal ambiguity are common in real life. The authors of the Garbage-can model state that to understand processes in organizations, one can view a choice as a garbage can into which various kinds of problems and solutions are dumped by participants (Cohen et al. 1972). A decision is the outcome or interpretation of several relatively independent streams within an organization. These independent streams are:

- Problems: problems are the concerns of people inside and outside the organization.
- Solutions: a solution is somebody's product.
- Participants: participants in an organization come and go. There is substantial variation in participation stems depending on other demands on the participants' time.
- Choice opportunities: these are occasions in which an organization is expected to produce behavior that can be called a decision.

The garbage can process is one in which problems, solutions and participants move from one choice opportunity to another in such a way that the nature of the choice, the time it takes, and the problems it solves all depend on a relatively complicated intermeshing of elements. The heart of the garbage can process is the partial uncoupling of problems and choices.

Reviewing the behavioral decision making literature results more or less in the same conclusion as formulated at the end of the previous section. Also this stream of literature

provides different models to explain how individuals act in decision making processes. There is no consensus in the literature about which model of decision making should be preferred to the others. All these models rely on their own set of assumptions, but overall it may be concluded that there is adequate evidence in the literature that confirms individuals can not be viewed as fully rational agents.

4.3.2 Inertia

Following the classic economic approach or the rational theory of decision making it may be stated that no profitable opportunity should ever remain unexploited. No arbitrage possibility stays unrealized, independent how small the gain actually is. But in practice individuals and organizations are usually reluctant to change and in consequence they do not always respond to relative differences in a rational manner (Hannan and Freeman, 1984). Literature refers to this phenomenon with the word inertia. In popular parlance inertia means a tendency not to move. In most social scientific publications the term is defined as an explanation for why organizations or individuals delay or completely fail to respond to beneficial changes (Gresov et al., 1993). This definition refers to the inverse of an instantaneous rate of change between alternative levels of competitive response. The concept of inertia is also widely discussed in evolutionary economics (Tushman and Romanelli, 1985). The evolutionary economics theory explains that organizations and individuals are characterized by routines. A routine is a regular and predictable pattern of behavior undertaken by organizations or individuals, such as a specific production activity, collaboration decision or R &D activity (Foxon, 2006). These routines exist because individuals and organizations operate in an environment that is characterized by uncertainty, complexity and bounded rationality. The routines employed by a firm or individual at any particular time are those that 'satisfice' according to its chosen criteria. When a particular routine is no longer deemed to be satisfactory, for example, because of changing market conditions, this triggers the search for a new routine. Embedding of routines prevents fundamental change, because decision makers stick to their routines. Evolutionary economics refers to this phenomenon as the lock-in effect. The lock-in effect results in suboptimal decisions, decreasing the overall performance of an organization (Gresov et al. 1993). Fundamental and structural change can only be reached when routines are changed.

The inertia concept offers new views on collaboration that go beyond the idea of the economic orthodox and neo-classical world that collaboration only results from calculations of expected materials payoff. This does not mean that profitable decisions do not matter at all, but it may be that differences do not matter as such the larger they are. Inertia functions as a threshold in the evaluation of alternatives during a decision mak-

ing process. Patosalmi (2003) shows in his dissertation that inertia is also an important issue in the context of logistics and supply chain management, because also managers in this area often stuck to the old way of doing business, being incapable of adopting new management philosophies required to succeed in the changing business environment. Nevertheless, the role of inertia at decision makers in supply chain management has not received much research attention (Smith et al. 2005). Some exceptions are Gresov et al. (1993) who paid attention to the question why some firms respond aggressively to competitive challenges or to disruptions in their supply chain while others do not. Smith et al. (2005) focus on the impact of inertia on the management of the firm's supply chain operations and the effects it can have on a produce-to-stock firm's ability to respond to external market pressure and develop corrective strategies. Finally, Li et al. (2006) highlight the role of switching inertia in a supplier selection process. None of these contributions focus on the role of inertia in collaboration decisions in general or logistics collaboration decisions more particular.

4.4 Utility framework

During the decision making process, decision makers use decision rules to make the final choice. These decision rules can be classified into four categories (Ben-Akiva and Lerman, 1985):

- Dominance: an alternative is dominant with respect to another if it is better for at least one attribute and no worse for all other attributes. In most situations this does not lead to a unique choice, but can be used to eliminate inferior alternatives from a choice set. Additional complexity for this decision rule is the possible existence of a threshold level for each attribute. In such a situation a decision maker will only value one alternative better than another if the difference in the attribute values exceeds the threshold. Thus a cost difference of three percent or less than one alternative may be considered by a decision maker as too small to make a difference in his preference ranking for this alternative.
- Satisfaction: for every attribute assume a level that serves as a satisfaction level. This may be defined as a level of aspiration. An alternative can be eliminated if it does not meet the criterion of at least one attribute. Also this rule by itself will not necessarily lead to a choice.
- Lexicographic rules: the decision maker chooses the alternative that is the most attractive for the most important attribute. In the case the use of the most important attribute will not result in a choice, the decision maker goes on with the second most important attribute and continues until the process results in a unique choice.

- Utility: this class of decision rules assumes comparability of attributes. This means that the attractiveness of an alternative expressed by a vector of attribute values is reducible to a scalar. This vector is a function that expresses the overall value a decision maker attaches to a certain alternative.

Models developed to answer the question why and how individuals make their choices traditionally use the utility decision rule. The models are formulated in a random utility framework and have built upon the postulate of utility maximizing individuals. This means each individual decision maker compares a set of alternatives and chooses the alternative that maximizes his utility. The utility or (attractiveness) of each alternative consists of a systematic (observable) component and a random error (unobservable) term. The general linear utility function can be written as follows:

$$U_j = \beta_0 + \Sigma\beta_k X_{kj} + \varepsilon_j$$

U_j is the overall utility for a particular alternative *j*; β_0 is the constant term; β_k represents the relative utility associated with attribute k (e.g. a specific LSP selection criterion such as costs or service); X_{kj} is the independent variable representing attribute k for alternative j; and ε_j is an error component. Different types of models have been formulated dependent on the specific assumptions regarding the distribution of the error term (Crouch and Louvière, 2000). The most widely used assumption is that the error terms are independently and identically distributed following a Gumbel distribution[6] (Ben-Akiva and Lerman, 1985). The random element of the utility function implies that the utility is related to the probability of an individual making a certain choice rather than directly to the choice itself. Pearmain et al., (1991) state that this is a more plausible approach to modeling choice behavior than the simple assumption of complete consistency in the way individuals express their preferences as used in models without random utility. Not all individuals have the same preferences under comparable circumstances.
In a binary choice problem about traveling by train or car, the utility function of each mode comprises various attributes like time, cost and comfort. The probability of choosing the train instead of the car reflects the difference in the utility between the two modes:

6 The Gumbel distribution is a continuous probability distribution. The probability density function of a Gumbel random vaiable x has two parameters: k (> 0: shape parameter) and **λ** (> 0: scale parameter).

$$Pt = \frac{1}{1 + e^{(Uc - Ut)}}$$

$$Pc = 1 - Pt$$

Where:
- Pt = probability of choosing train
- Pc = probability of choosing car
- Ut = utility of train
- Uc = utility of car
- e = exponent

Based on the same assumptions about the distribution of the error term as explained above.

Utility frameworks are also widely used in the logistics field to model several kinds of decisions[7]. For an overview we refer to Muilerman (2001). His overview shows that utility frameworks can be used for various purposes. Some examples are estimating the market potential of new or improved modes of transportation, exploring the opportunities of modal shift, deducing shippers' sensitivities to changes in different dimensions of service when making mode choice decisions, and obtain monetary values of time. Especially the last one, monetary values of time studies, are often used in cost-benefit analyzes of infrastructure projects in passenger and freight transport, because these projects have transport time savings as one of the major benefits. The studies enable the calculation of the marginal substitution of time for money by providing trade-off ratios between transport time and transport costs (De Jong et al., 2004a). A trade-off ratio of 0.80 implies that an increase in transport time of for instance 10% is regarded as having the same disutility as 8% higher total transport costs.

4.5 Concluding remarks

This chapter reviews decision making literature from both an economic and behavioral perspective. This review makes clear that there are differences in the set of assumptions used by different economic streams to explain decision making behavior by individual agents. The neo-classical economic and new-institutional economics theory are underpinned by the concept of 'rational economic man'. In the neo-classical en new-institu-

7 All mentioned examples represent choice behavior of individual agents. The models are not used to analyze choice behavior in groups.

tional tradition this means a decision maker maximizes his utility and is only guided by financial incentives. This assumption is questioned by the behavioral economic and evolutionary economics theory. Both theories explain that there are reasons why beneficial solutions remain unexploited. Behavioral economics refers to the fact that individuals not only derive utility from material pay-offs, but also from non-material influences. Evolutionary economics explains decision makers are conservative and often prefer to stick to their routines and that this can be a reason to not respond to a relative difference in a rational manner. These contributions need to be taken into account when analyzing decision behavior.

A comparable path can be observed when reviewing the behavioral decision making literature. Also the classical decision making literature see individuals as fully rational agent who maximixes his utility and is only guided by financial incentives. Later on researchers found abundant evidence that decision makers often violate this classic rationalistic paradigm, and that decisions often lead to suboptimal results. As a result, they developed more intuitive based decisions models to explain decision making behavior. Subsequently the Satisfying, Muddling through and Garbage-can model of decision making are discussed. There is no consensus in literature about which model should be preferred, but all theories make clear that decision makers can not been seen as full rational men (or women).

Evolutionary economics and social sciences explain that people's decision behavior frequently displays great inertia. Inertia refers to the reluctance of change that most individuals and organizations display. This explains that collaboration not only results from calculations of the expected material payoffs. Inertia is another reason why the most optimal solution from an economic point of view is not always selected.

Summarized, reviewing decision making behavior literature provides two reasons that function as a threshold for individual decision makers to select the most beneficial option from an economic point of view. The first reason is the fact that individuals can not be seen as fully rational agents as defined in the neo-classical and new-institutional economic tradition. In the remainder of this thesis we follow these economic streams in their definition of a fully rational agent. Second reason is the existence of inertia. These findings are visualized in figure 11. This figure shows that the outcome of a decision is influenced by a number of items. The arrows in figure 11 represent the relationship between these different items.

Nevertheless, empirical evidence for the conclusions in this chapter in the specific context of a logistics collaboration decision is not available. Therefore additional empirical verification is needed. For this empirical verification a model based on the random utility framework can be used, because this is a proved method to answer questions why and how individuals make their choices.

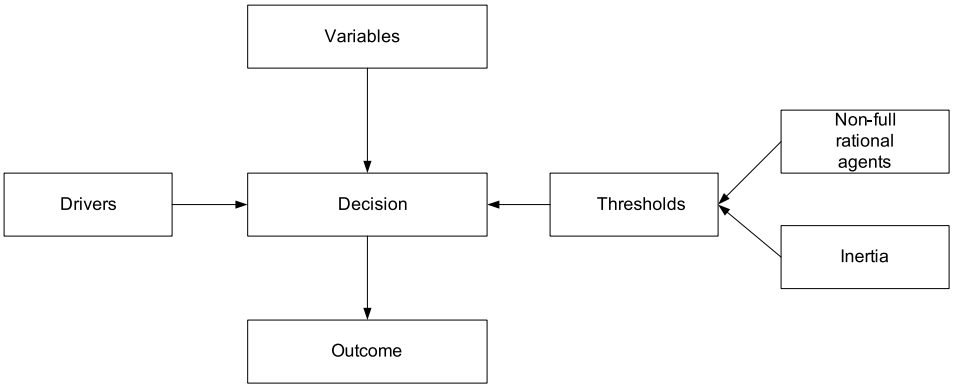

Figure 11: Overview theoretical findings on behavioral decision making

5. Theoretical findings and hypotheses

In the previous chapter we have described the three reviewed literature streams in isolation. Nevertheless, there is some overlap between the streams and all three streams are useful to answer our research question from a theoretical point of view. Therefore, this chapter describes a cross-section of the theoretical findings. These theoretical findings are used to draft hypotheses for the empirical research phase.
The chapter is structured as follows. The first section presents the cross-section of the theoretical findings. Subsequently, the hypotheses for the empirical research phase are introduced in section two. Finally, the third section gives a short introduction to this empirical research phase.

5.1 Cross-section of the theoretical findings

Logistics outsourcing and collaboration are closely related, because logistics outsourcing results in a collaborative relationship between shipper and logistics service provider. A logical result is that there is also some overlap in the topics reviewed in both streams of literature. The drivers identified by both streams are comparable. Furthermore, both streams focus on the variables used to make a collaboration or logistics outsourcing decision. Especially the collaboration stream has resulted in an extensive list of variables that possibly influence a collaboration decision. The literature identified trust, confidentiality and commitment as key variables on this list. On the other hand, the logistics outsourcing stream provides an overview of criteria used to select the most suitable logistics service provider. Costs and service are marked as most important selection criteria in this overview. This means that based on the literature review, we may conclude that costs, service, trust, confidentiality and commitment are identified as most important attributes in a collaboration decision between shipper and LSP. Table 10 shows the definitions of these key variables and the expected impact on a logistics collaboration decision from a shipper's perspective.

Variable	Definition	Expected impact
Costs	Costs of the services provided by a LSP	Negative: shippers prefer collaboration alternatives with lower costs.
Service	Service level offered by a LSP to the shipper in terms of shipments delivered on time	Positive: shippers prefer collaboration alternatives that result in a higher level of customer service.
Trust	The belief that a partner will not harm the interests of the counterpart	Positive: shippers are more willing to cooperate when the level of trust is higher.
Confidentiality	The belief that a collaboration partner keeps shared information confidential	Positive: shippers are more willing to cooperate when the level of confidentiality is higher.
Commitment	Participating actors are loyal and tolerant and do not worry constantly about being replaced	Negative: shippers are more willing to cooperate when the required commitment from their side decreases.

Table 10: Definition and impact of key variables

All three streams of literature discuss the fact that the potential benefits of collaboration are not always fully achieved. They explain that some thresholds do exist which prevents a certain proportion of collaboration from being initiated. The thresholds identified by the logistics outsourcing and collaboration literature are comparable. At the other side, the behavioral decision making literature identifies two thresholds that are not identified by the logistics outsourcing or collaboration literature.

The first threshold is the fact that individual decision makers cannot be seen as fully rational agents[8] as is often assumed in optimizing models used in supply chain management literature. Some streams in economic science and the behavioral decision making literature make clear that collaboration does not only result from calculation of expected pay offs, because also immaterial factors impact a collaboration decision. Individuals do not only derive utility from material benefits. Also the supply chain management and logistics literature mention immaterial incentives like trust, confidentiality and commitment as possible thresholds for collaboration. Nevertheless, they do not go one step further and link this to the nature of the decision makers. These decision makers cannot be seen as fully rational agents and thus derive utility from both material and immaterial incentives. Additionally, the supply chain and logistics literature do not quantify the impact of immaterial benefits or prove that they significantly impact a logistics collaboration decision.

8 To define the term fully rational agent, the neo-classical or new-institutional tradition is followed.

The second threshold that is identified by the behavioral decision making literature is the existence of inertia. Inertia refers to the reluctance of change of most individuals. As a result, decision makers do not always respond to a relative difference in a rational manner. Inertia does not mean that profitable decisions do not matter at all, but it may be that differences do not matter as such the larger they are. Therefore, the existence of inertia can be another reason why potential benefits of vertical logistics collaboration are not achieved in practice.

❖ The theoretical findings are summarized in figure 12. This figure shows that the level of collaboration between shipper and LSP is the outcome of a decision taken by the shipper. The key decision variables that influence this decision are: costs, service, trust, confidentiality and commitment. Next to this, the aspects of "non-full rationality" and "inertia" function as a threshold for a shipper to collaborate with a logistics service provider. These thresholds also influence a shipper's collaboration decision. These theoretical findings are an answer to our first research question: *Which factors hamper a shipper to intensify collaboration with a logistics service provider?* Nevertheless, this conclusion lacks empirical evidence and thus further empirical verification is needed. Next to this, the theoretical findings does not provide an answer to our second research question: *What is the relative importance of the identified factors in a shipper's collaboration decision?* To answer this question further empirical research is required.

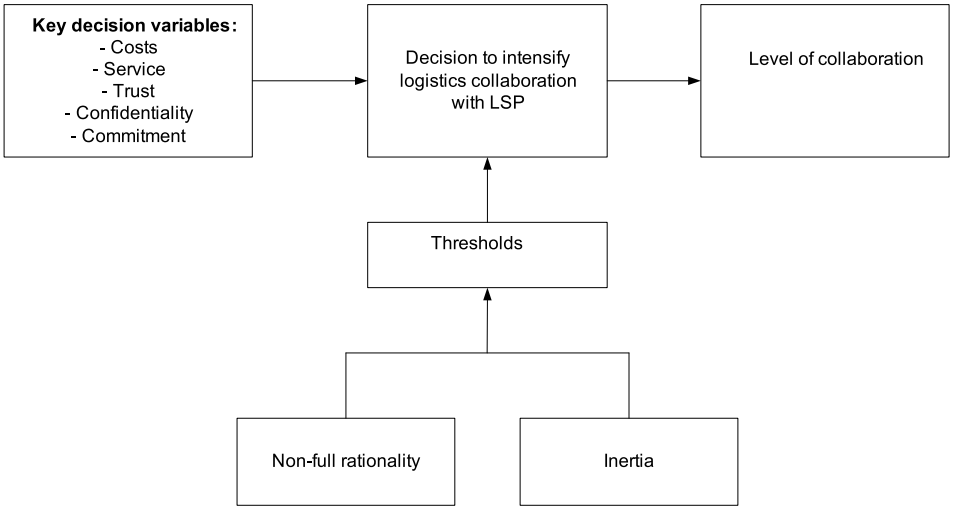

Figure 12: Theoretical findings

5.2 Hypotheses

The theoretical conclusions discussed in the previous section are the starting point to draft a number of hypotheses. An overview of these hypotheses can be found in table 11 at page 61. Hypotheses one till eleven are related to the theoretical finding that decision makers can not be seen as fully rational agents, but they derive utility from both rational and immaterial incentives in logistics collaboration decisions. The five variables identified as key variables[9] in logistics collaboration decisions are used to transform this theoretical finding into hypotheses that can be tested. For empirical testing of the hypotheses a stated preference experiment is used, because a stated preference experiment enables the researcher to determine and quantify the relative importance of variables that are of interest of the researcher[10]. For each of the variables two aspects need to be measured: is the impact of a specific variable significant[11] in a logistics collaboration decision between shipper and LSP and is the impact on such a decision positive or negative. Impact is defined as positive in case it is expected that a decision maker prefers logistics collaboration alternatives with a higher level of the specific variable. On the other hand, impact is defined as negative in case it is expected that a decision maker prefers a logistics collaboration alternative with a lower level of the specific variable. These two aspects can not be tested by one hypothesis. As a result for each of the five key variables two hypotheses are drafted. The five variables incorporate both rational (costs and service) and immaterial (trust, confidentiality and commitment) elements. Therefore, the test results can be used to verify whether the aspect of non-full rationality functions as a threshold to benefit from logistics collaboration (hypothesis eleven) [12]. Next to this, hypotheses twelve till fourteen are related to the theoretical conclusion that decision makers display inertia and that this functions as a threshold to benefit from logistics collaboration. To confirm this theoretical finding, inertia needs to have a significant value in our test results and inertia needs to be valued negatively, because it is expected that a decision maker prefers to stick to his current logistics solutions. These results are used to test hypothesis fourteen: inertia functions as a threshold to benefit from logistics collaboration.

9 These five key variables are explained in table 10 in section 5.1.
10 For a detailed discussion about the selection of the stated preference method to test our hypotheses, we refer to section 1.5.
11 To determine whether a specific variable is significant; the results of the SP experiment are used. A variable is significant at a 95% confidence level, if the t-ratio is greater than 1.96. More details about these tests can be found in section 8.4.3.
12 More details about how the other decision making variables are incorporated in the choice experiment is explained in chapter 8.2.1.

5.3 Introduction to empirical research phase

As discussed in the previous section, a stated preference experiment is used to test our hypotheses. Nevertheless, the empirical research phase starts with a sector study and some case studies; because the results of the literature review alone provide an insufficient base to design a reliable choice experiment[13]. The sector study is used to gather more specific information about the two sectors involved in our study: the chemical and LSP industry. This sector study is described in chapter 6.
Subsequently, case studies are used to get an in-depth understanding of logistics collaboration and outsourcing based on practitioners' knowledge. The results of the literature review are the starting point to identify the topics that will be reviewed during the case studies. Previous section makes clear that costs, service, trust, confidentiality and commitment are identified as the most important variables in a logistics collaboration decision between shipper and LSP. Nevertheless, this theoretical conclusion needs further empirical validation before the variables can be incorporated in the choice experiment. Case studies will be used for this validation.
Additionally, logistics outsourcing is the start of a collaborative relationship with one or more logistics service providers and results in purchasing logistics services. Literature review makes clear that the position of logistics services in Kraljic's purchasing portfolio is more differentiated than some decades ago. As a result, the sourcing approach used for logistics services is also expected to be more differentiated than the traditionally used transaction-oriented approach. Nevertheless, there is less empirical evidence available whether shippers also actually have adapted their sourcing approach to the changed situation. Finally, the case studies are used to analyze the nature of the logistics activities outsourced and the level of logistics collaboration in the chemical industry. The case studies are discussed in chapter 7.

Together with the results of the literature review and the sector studies, the results of the case studies create a solid base to design a realistic stated preference experiment.
The design and results of the stated preference experiment are described in chapter 8.

13 For a detailed discussion about the design requirements for a stated preference experiment, we refer to section 8.1.3.

Theoretical finding	**Hypotheses**	
Individuals do not act as fully rational agents, but incorporate both rational and immaterial incentives in their decision making.	*A. Sign*	
	Costs	1] Costs of services provided by LSP are valued negatively in logistics collaboration decision.
	Service	2] Service is valued positively in logistics collaboration decisions
	Trust	3] Trust is valued positively in logistics collaboration decisions.
	Confidentiality	4] Confidentiality is valued positively in logistics collaboration decisions.
	Commitment	5] Commitment is valued negatively in a logistics collaboration decision.
	B. Impact	
	Costs	6] Costs of services provided by LSP significantly impact logistics collaboration decision.
	Service	7] Service significantly impacts logistics collaboration decision.
	Trust	8] Trust significantly impacts logistics collaboration decision.
	Confidentiality	9] Confidentiality significantly impacts logistics collaboration decision.
	Commitment	10] Commitment significantly impacts logistics collaboration decision.
	C. Threshold	
	Full rationality	11] The aspect of non-full rationality functions as a threshold to benefit from logistics collaboration.
Decision makers display inertia in logistics collaboration decisions	*A. Sign*	
	Inertia	12] Inertia is valued negatively in a logistics collaboration decision.
	B. Impact	
	Inertia	13] Inertia significantly impacts logistics collaboration decision.
	C. Threshold	
	Inertia	14] The aspect of inertia functions as a threshold to benefit from logistics collaboration.

Table 11: Hypotheses for empirical testing

PART II: EMPIRICAL ANALYSIS

6. Focus industries

In this chapter, the industries that are involved in our empirical research are introduced. Our empirical data are collected at shippers and LSPs active in the chemical industry[14]. The chemical sector and the logistics service provider's industry are discussed in this chapter. The first section describes the chemical sector. Successively, the current situation and the different subsectors are explained. Afterwards, the second section focuses on the logistics service provider's industry. This section explains the current situation in the service provider's industry and the different types of LSPs that are active in this market.

6.1 Chemical industry

6.1.1 Current situation

The chemical sector is a key contributor to the European economy. Throughout the European Union (EU), about 1.26 million people are employed in one of the 29,000 chemical companies and the industry provides further employment in a range of downstream industries. In 2008, the industry had an annual turnover of 537 billion euro (Cefic, 2009). This makes the EU one of the chemical blocks in the world. This is also presented in figure 13.

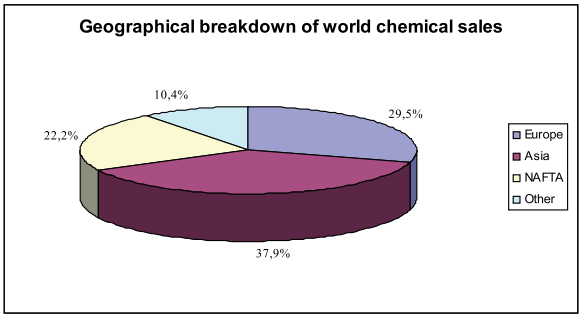

Figure 13: Geographic Breakdown of World Chemicals Sales 2008 (Cefic, 2009)

14 For a detailed discussion about the selection of the chemical industry we refer to section 1.5.

The chemical industry is also unique in supplying every other sector of the economy with essential materials. The competitiveness of all these sectors is partly dependent on the efficient supply of chemical products. It is for that reason that the chemical industry has been described as the "anchor" of a modern economy (Howitt, 2000; McKinnon, 2004; Schreckenbach and Becker, 2006).
In general, the chemical industry has a high intensity in terms of its generation of transportation and logistics activities. On average the chemical industry spends about 8 to 10 percent of its total turnover on logistics and supply chain activities. This is estimated at 60 billion euro and represents 1.5 billion tonnes of movement per year in 2005. This represents five percent of the total tonnes lifted in the EU (Braithwaite, 2005).
Safety and environment are main topics within the chemicals industry. Despite the fact that the chemical industry is one of the most highly regulated industrial sectors, the public perception of the chemical industry is not purely positive. This requires building trust by engaging in dialogue with those stakeholders shaping the environment: customers, regulators, legislators, scientists, opinion-formers, media and the public at large (Cefic, 2006). By building trust, the industry can anticipate and effectively address the important policy and society issues affecting the industry's long-term prospects and competitiveness.

Despite the positive facts and figures, the future for the EU chemical industry might be less bright. The worldwide competition is getting fiercer, and the EU as a major chemical production region is at risk. Developments in the last 10 years show the EU was the leader in world chemicals sales, but has lost its first place in the ranking to Asia in 2005 (Cefic, 2007).
Regulation, energy, transport and investments have a strong impact on the industry's competitiveness. On all four counts, the picture in Europe compares unfavorably to that in other parts in the world (Cefic, 2004). On the regulatory front, the EU is continuing to tighten its health, safety and environmental laws, more than in most other parts of the world.
Besides, the chemical industry is an energy intensive industry, but energy costs in Europe are higher than in Northern America and Asia. Another important disadvantage for the EU chemical industry is the overloaded transport infrastructure in Europe, and the higher logistics costs.
Finally, investments in the EU's chemical sector are shrinking steadily. This includes R&D expenditures as well as capital investments.
Summarized the current developments result in a conflicting cost pressure for the chemical industry in Europe. This conflicting cost pressure is reflected in figure 14. Downward

there is cost pressure by the increased competition from rapid growth of Middle Eastern and Far Eastern chemical industries.
At the same time there is an upward cost pressure by higher fuel and labor costs, tighter environmental and security controls, congested transport infrastructure, and longer distance to customers.

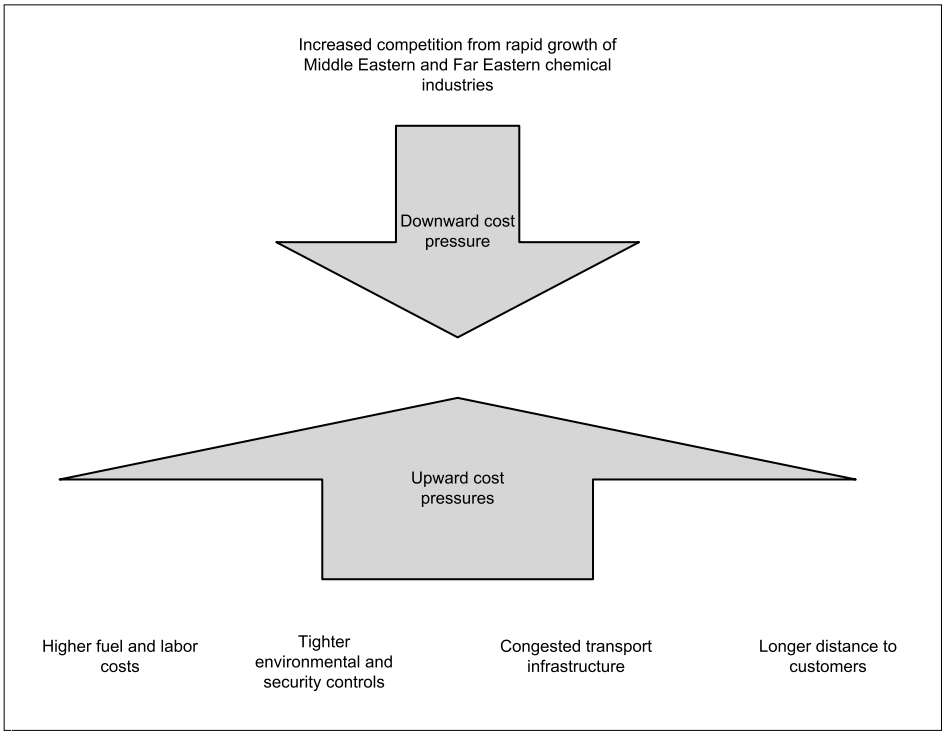

Figure 14: Conflicting cost pressure (McKinnon, 2004)

To secure the industry's long-term competitiveness, decisive action by both the industry and the authorities is required to steer the critical drivers determining the chemical industry in the right direction over the next ten years (Budde et al., 2006; Cefic, 2004; ECTA, 2006). One of these critical drivers[15] is supply chain collaboration (Cefic, 2004; McKinnon, 2004; Roller et al., 2004). This collaboration could take place along similar firms (horizontal collaboration) or along the vertical chain between producers, distributors, customers and logistics service providers (vertical collaboration). The chemical in-

15 Other drivers that are mentioned are innovation and focus on economies of scale

dustry has almost universally outsourced its physical logistics while retaining most of its supply chain control and design (Braithwaite, 2005). Stronger relationships need to be established with the LSPs to find truly innovative and therefore competitive supply chain solutions. Creating win-win relationships between suppliers and LSPs offer major opportunities for value creation, fulfilling customer expectations and competitive differentiation (Engel and Roolfs-Broihan, 2006).

6.1.2 Subsectors in the chemical industry

As many other sectors, the chemical sector exists of a diverse range of products, processes and organizations. Chemical products can be roughly segmented into commodities and specialties. Raw materials and basic chemicals are characterized as commodities. Intermediates and end-products are identified as specialties. Albeit this distinction is common place in the industry, it should be kept in mind that chemical commodities are not equal to commoditized products we know in other sectors of industries. Chemical commodities still offer more opportunities for differentiation (Hofmann and Budde, 2006). It needs to be noticed that the product portfolios of many major players in the chemical industry are quite diverse. These hybrid players have a portfolio ranging from primarily commodity products to specialty products.

The two subsectors not only differ in products supplied, but also in other aspects. Commodities are more capital intensive, are produced in larger volumes, have lower profit margins and the chemical commodities have a highly cyclical character. On the contrary, specialties are characterized by low volumes, high profit margins and high investment risks. These differences also affect the logistics processes. Commodities have a continuous 24/7 production process, and focus on cost reduction and bulk transportation. On the other hand, production processes for specialties are organized in batches, specialties are mainly distributed as packed materials, and this subsector is more customers driven. In the remainder of this thesis, we will use the two identified subsectors to distinguish different types of chemical companies.

6.2 Logistics service providers

6.2.1 Current situation

Last decades, logistics outsourcing increased. Nevertheless, the service providers' industry is facing hard times. There are several causes for this problem: fierce competition in the global market, high fixed cost, fragmentation of transport flows, pressure to decrease CO2 emission, congestion, rising petrol and labor prices and the increasing

expectations of customers in terms of both service and price (Cruijssen et al, 2007; Groothedde et al, 2005; Verstrepen et al, 2009). Overall it may be concluded that the logistics sector as a whole is under pressure with negative or low profit margins. The vicious circle depicted in figure 15 displays the current situation of the LSPs. It shows that the service providers' industry is characterized by low profit margins, strong fragmentation and price competition. As a result, service providers do not have the time and money to develop new skills or undertake new projects to create competitive advantage. Consequently, no innovation or other initiatives are undertaken to structurally improve the level of service. The logistics services will remain a commodity and competition will be focused on the lowest price. This results in even thinner profit margins and stronger competition: starting another iteration of the vicious circle.

As a result of the situation described above, LSPs focus on efficiency by achieving economies of scale and scope. Therefore, during the last decade the LSP industry is characterized by mergers and acquisitions (Carbone and Stone, 2005; Lieb and Bentz, 2005). As a result, the number of large logistics companies has increased.

Besides mergers and acquisitions, economies of scale and scope in a logistics network can also be reached by collaboration. Therefore, collaboration concepts are important for the long term competitiveness of the LSPs. This means the service providers have the challenge to become the customer's partner instead of merely its supplier.

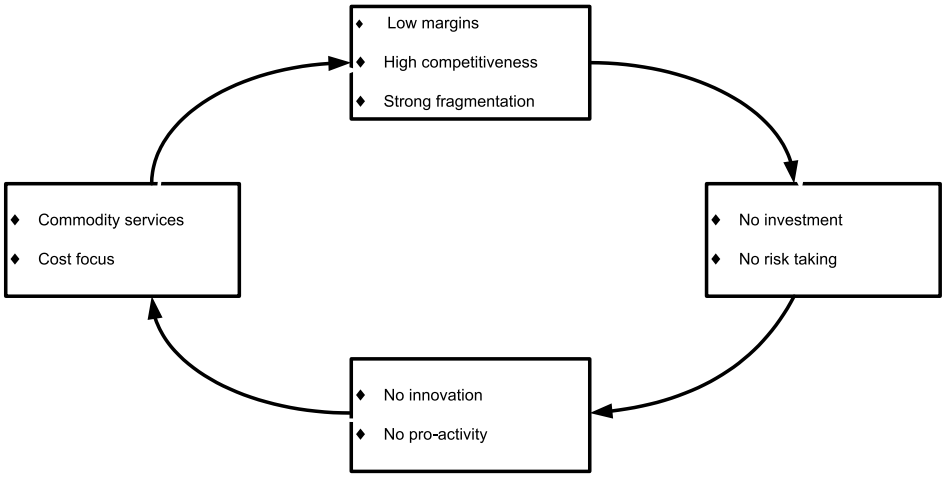

Figure 15: Vicious circle LSPs (Cruijssen, 2006)

The situation described above presents a general picture. It needs to be noticed that there are also companies that are in a more positive situation. Especially companies that have the required economies of scale or focus on niche markets are able to realize higher

margins. Examples are the bulk and tank transporters. The chemical sector is responsible for 70% of the volume handled by tank and bulk carriers (ING, 2004). Figure 16 compares the average profit margins of the transport sector and the profit margins of the bulk and tank transporters over the years 2001 till 2007 in the Netherlands.

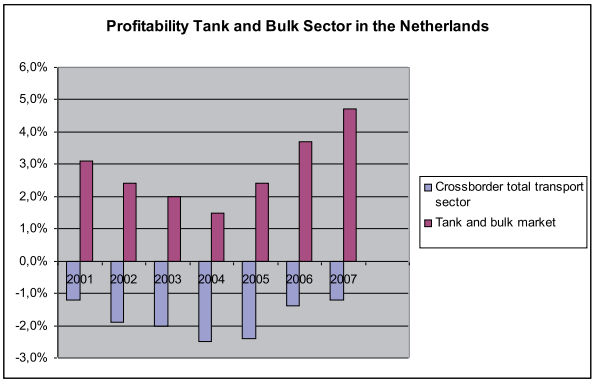

Figure 16: Profitability tank and bulk sector (TLN, 2008)

6.1.2 Different types of LSPs

The buyers of logistics services act on different markets with their own specific requirements. Therefore, the requested logistics services differ case by case. As a result logistics service providers differ in terms of services supplied and assets owned. Literature provides a number of classifications to distinguish different types of LSPs. Examples are the "green / blue world classification" originally provided by Dorp et al. (1992), an asset-based classification from Muller (1993), and a classification based on the degree of integration between LSP and shipper provided by Shary and Skjott-Larsen (2000). In this dissertation we use a classification based on service scope to distinguish different types of LSPs (Vannieuwenhuyse, 2003). This classification is chosen, because it is also used by many players in the market.

- *1st Party-logistics (1PL)*: in a 1PL concept, logistics activities are not outsourced, but performed in-house by the shipper. The 1PL is therefore not an autonomous service provider, but an integrated department of the shipper's firm.
- *2nd Party-logistics (2PL)*: a shipper outsources the operational activities of logistics tasks (transport or warehousing) to a specialized provider, but organization and planning are still be done by the shipper.
- *3rd Party-logistics (3PL)*: a 3PL allows a shipper to outsource a package of logistics services. This LSP takes the responsibility for planning and organization, and in that

role communicates with both the shipper and the receiver(s). A 3PL provider has the possibility to use his own assets, but can also use assets of other providers. In the last case, the provider is an intermediary between his customer and other LSPs. The provider is then characterized as a 3PL+ (Rustenberg et al, 2006).

- *4th Party-logistics (4PL)*: a provider that delivers a comprehensive supply chain solution to the shipper by even taking the responsibility for the management of the logistics activities. A 4PL focuses on this orchestration role and therefore generally does not own logistics assets.

This classification makes it possible to illustrate the development process of the logistics service providers' industry. Carbone and Stone (2005) make clear that there have been three main waves in the development of the service providers market. (Carbone and Stone, 2005). In the early 1960s, traditional services like warehousing and transport were outsourced. Later on, in the early 1980s, the traditional LSPs began providing value adding services through acquisition of specialist capabilities. The last wave dates from the late 1990s when a number of players on the market started to deliver supply chain solutions.

Majority of the players in the logistics services market still focus on basic transportation services from A to B. Just a minority of the players have developed themselves towards a 4PL player that orchestrates the supply chain.

Also the chemical industry is dependent on the resources and capabilities of the service providers industry, because the industry has almost universally outsourced to a range of providers including bulk tanker operators, container lines, terminal operators, packed and bulk trucking companies, warehouse operators, packaging specialists and a range of ICT companies. Not all the players on the logistics services market are active in the chemical sector and none of the players provides a full range of integrated services across modes and geographical areas to the chemical sector (Braithwaite, 2005). Especially in subsegments where there are additional requirements because of the (dangerous) character of the goods, the number of players is limited. Even in conventional 3PL services there are no truly pan-European providers that serve the chemical industry in case of special requirements. Unfortunately, no exact numbers are available about the number of LSPs that are active in the chemical sector.

7. Case studies

This chapter described the case studies. These case studies are conducted to validate some theoretical findings of the literature review and through that create in-depth understanding of the status of logistics collaboration and outsourcing in the chemical industry. This understanding is needed to create a solid base for our stated preference experiment, which is used to test our hypotheses.
This chapter is structured as follows. First, the case study methodology is discussed. In this section the case study design, protocol and drawbacks are described. Furthermore, in section two the seven cases are introduced. Afterwards, section three discusses the results of the cross-case analyzes[16]. Finally, section four concludes with summarizing the main results of this chapter.

7.1 Methodology

7.1.1 Case study design

Within a case study, a researcher has the option of selecting a single or multiple case study design (Yin, 1994; Verschuren and Doorewaard, 2005). The main reason for conducting multiple case studies is replication, because replication would consider the robustness of the findings (Yin, 1994). This research project follows a multiple case approach for the same reason. Although literature does not provide an unambiguous rule-of-thumb for the number of cases required for a multiple case study approach; Eisenhardt (1989) states that usually between 4 and 10 cases are sufficient. Using multiple case studies, there are several strategies possible to analyze the cases and to adjust the theoretical framework. The first strategy is to reflect the case study on the theory, and to adjust the theoretical framework after completion of each case. This implies that after each case study a new case study protocol should be developed reflecting the new insights. The second strategy is to use a single case study protocol for each of the cases, and to analyze the results of the cases after completion of all cases. We follow the sec-

16 The detailed single case descriptions can be found in appendix E.

ond strategy, because this allows a joint or cross-case analysis, and prevents bias in the adjustments made to the framework towards the last completed case study (Yin, 1994).

7.1.2 Drawbacks of case study strategy

Although in general case studies are considered an adequate strategy for in-depth descriptions, interpretations, and explanations of real-life phenomena (Eisenhardt, 1989), case studies also have drawbacks (Yin, 1994; Verschuren and Doorewaard, 2005). First, case studies seldom yield statistically representative results, which inhibits generalizing of findings. This however is no problem when the goal is to build or to validate theoretical findings like in our case study. Second, there are no standard analysis techniques for case study data. To enable ex-post verification by others, case study protocols and analysis procedures should be made as explicit as possible by the researcher. Third, case studies have the risk of yielding biased information, because case studies are often characterized by personal interaction (interviews) between researcher and respondent. Three main potential pitfalls are (Foddy, 1996):

- Failure of respondents to understand the questions as intended.
- A lack of effort, or interest on the part of the respondents.
- Unwillingness to admit to certain attitudes or behaviour.

These pitfalls are caused by various biases (Muilerman, 2001):

- Affirmation bias: answers are conformed to what is expected to be the 'right' answer in the eyes of the researcher.
- Unconstrained response bias: unreliable answers because the respondent does not understand the task, or because the study's topic does not appeal to this respondent.
- Rationalization bias: respondents want to cast behavior in a better light.
- Policy response bias: respondents want to influence the outcome of the study by deliberately manipulating answers, thus trying to affect policy decisions that might be taken as a consequence of the study.

The next subsection explains what is undertaken to avoid these biases in our case studies.

7.1.3 Case study protocol

A case study protocol is the preparation of a case study. It contains the level of analysis, tactics to approach participating organizations, number and type of participants, sources of data collection, instruments (e.g. questionnaire), as well as the general rules

to be followed. The protocol is the major way of increasing the reliability of case study research, and is intended to guide the researcher during the process. Different aspects of a case study are discussed below.

a. Case study objective

The case studies in this research project have an exploratory character and are not used to reach the final research objective. The case studies are conducted to get in-depth understanding of logistics collaboration and outsourcing decisions based on practitioners' knowledge. Through that we create a solid base for the second empirical phase and thus our findings are used as input for the second empirical phase: a Stated Preference experiment.

b. Target group

Where most contributions on outsourcing and collaboration in logistics take a single perspective (Cruijssen et al, 2007; Lieb and Bentz, 2005; Menon et al. 1998; Sink and Langley, 1997), our cases take an integrated perspective. We choose this integrated perspective, because the topic of collaboration decisions is characterized by interaction between at least two parties. The integrated perspective means that both logistics service providers and shippers are involved. As a result, target groups for our cases are shippers and LSPs in the chemical industry. The target is to have at least one of the interviews per case at the shipper's side and at least one at the service provider's side.

c. Unit of analysis

The unit of analysis in each case is a tender process for three reasons. First, a tender process is the starting point of a collaborative relationship between shipper and LSP. Next to this, during a tender process the level of collaboration between both parties is defined. Finally, in a tender process certain criteria are used to select the LSP. Defining a tender process as the central unit of analysis in each case, gives us the possibilities to analyze these subjects.

d. Selection criteria

The goal of our cases is to get a better understanding of the status of logistics collaboration and outsourcing in the chemical industry. The selected cases need to make it possible to reach this objective and therefore have to meet the following criteria. First, both shippers and LSPs should be active in the chemical industry. Furthermore, the purchasing project should not have taken place more than two years ago to ensure participants have required information available. Finally, the sample needs to include various logistics services. As a result the external validity of the study will increase, because the

findings are applicable to different types of logistics services sourced (Eisenhardt, 1989; McCutcheon and Meredith, 1993).
The above mentioned criteria mean that random sampling would be inappropriate. We need to use purposive sampling: cases are chosen on the basis of their relevance with regard to the research goal and the defined selection criteria.

e. Tactics to approach organizations

Representatives of chemical branch organizations are consulted to identify possible cases and accompanying primary contact persons. These persons are contacted to request their willingness to participate and to verify whether all selection criteria are met. In total seven cases at five different shippers are selected[17]. The seven cases are spread over six different LSPs[18]. In the remaining of the dissertation the different projects are identified by the letters A till G to protect the anonymity of the participating companies. Involved shippers are all leading, multinational chemical companies. Also the LSPs operate European- or worldwide and can be characterized as third-party logistics service providers which all offer a wide range of logistics services. The cases differ in type of logistics services sourced.

f. Data collection

Yin (1994) lists five sources for data collection: 1) documents: publications, memos, 2) archival records: contracts, numeric data, 3) interviews: semi-structured, open questions, 4) observations, and 5) physical artefacts: devices and tools. It is not recommended to use one single source for data collection. The principle of triangulation (using multiple sources of data) is strongly advised. Also in our case studies we use multiple sources of data as much as possible. Table 12 depicts which sources of data are used per case study.

	Case A	**Case B**	**Case C**	**Case D**	**Case E**	**Case F**	**Case G**
Documents, memos, publications	x	X	x	x	x	x	X
Archival records, contracts, numeric data	x		x	x	x		
Interviews	x	X	x	x	x	x	X

Table 12: Sources of data per case study

17 Case A and B as well as C and D are tender projects of different business groups of the same shipper.
18 One LSP is involved in case A and B.

Interviews are the main sources of data in all seven case studies. The case study approach entails the use of key informant method, interviewing a limited number of participants. This is consistent with qualitative researchers' recommendations that it is appropriate to depend on the extensive insights of a few key informants to develop a comprehensive understanding of a particular phenomenon (Lincoln and Guba, 1985; McCracken, 1988). Therefore the interviewees are not chosen on a random basis, but through the use of purposive sampling. For each case an exploratory interview with the primary contact person is set up to select the people to be interviewed. Interviewing multiple functional representatives enables data triangulation, which improves validity and reduces biases. In total twenty-five interviews are carried out with representatives involved in the discussed projects. The respondents have a leading position in logistics, purchasing or general management. Each interview lasts approximately fifty to ninety minutes and is conducted at the participant's workplace. The interviews are audio-taped. Table 13 gives an overview of the case study respondents. The table only depicts the business card title of each respondent to ensure the anonymity of the participating respondents and companies.

Case	Interviews at shipper side	Interviews at LSP side
A	• Director supply chain management [1] • Manager sourcing and contracting • Supply chain engineer	• Managing director [3] • Sector manager
B	• Director supply chain management [1] • Senior sourcing and contracting officer	• Managing director [3]
C	• Senior manager physical distribution [2] • Logistics manager • Category manager physical Distribution	• Managing director • Business development manager
D	• Senior manager physical distribution [2] • Supply chain manager	• Operations manager • Account manager
E	• Business manager • Logistics manager	• Marketing & sales director
F	• European supply chain manager	• Managing director • Operations director
G	• Director transportation & logistics • Supply chain manager	• Deputy managing director • Managing director

1) Person was involved in cases A and B. Case A and B are conducted at different business groups of the same company.
2) Person was involved in cases C and D. Case C and D are conducted at different business groups of the same company.
3) Person was involved in two cases. LSP was involved in case A and B.

Table 13: Case study respondents

The interviews are semi-structured, because semi-structured interviews allow for the collection of a large amount of data and wide variety of information while at the same time safeguarding the coverage of all topics. Pre-defined questionnaires are used to guide the interviews. The use of pre-defined questionnaires increases the transparency of the research approach and thus enhances reliability of the study (McCutcheon and Meredith, 1993). The results of the literature review and questionnaires used in similar studies are used to design the questionnaires. As explained above, two types of firms are interviewed: shippers and LSPs. This results in two types of questionnaires. Both cover the same topics, but are specific for different roles the two types of firms have in collaborative relationships. Two pilot interviews are conducted prior to the case studies to test the questionnaires: one pilot at the shipper's side and one at the LSP's side. Examples of both questionnaires can be found in appendix B.

g. Data analysis

The audio-taped interviews are transcribed by the researcher. Coding is used to structure and analyze the collected data at the moment all interviews are completed. A code is a label for assigning units of meaning to the descriptive or inferential information compiled during a study (Miles and Huberman, 1994). These labels can be assigned to words, sentences, or paragraphs in the textual data. In this study, the codes are based on the central research topic and the used questionnaire. Both are accepted guidelines to develop a coding scheme (Miles and Huberman, 1994). The coding scheme can be found in appendix C.

For reliability and dependability of the interpretations the interim conclusions in the coding process are discussed with other researchers in two group discussions. Moreover, two researchers, who were not involved in the case studies or group discussions, validated the interpretation of the interview results. Finally, to enhance external validity and to confirm that our interpretations are consistent with respondents' interpretations a summarized overview of each interview is fed back to the particular participant for verification. Feedback received from the study participants is incorporated in the final conclusions.

f. Data quality

Although in general case studies are considered an adequate strategy for in-depth descriptions, interpretations, and explanations of real-life phenomena, case study research has its drawbacks (Saunders et al., 2007). Therefore issues of validity and reliability need to be addressed. In order to minimize drawbacks and to verify believability of the results, Yin (1994) has defined a set of criteria for ensuring the legitimacy of case study findings. This set is related to the general criteria used to judge scientific research: construct validity, internal validity, external validity and reliability. Table 14 summarizes the tactics used in our case studies to increase the trustworthiness of this research.

Criteria	Methods addressing this criteria in the cases
Construct validity: "establishing correct operational measures for the concepts studied"	- Triangulation of multiple informants - Triangulation of multiple sources of data: interviews, company document and public available sources - All respondents receive draft version of interview report - All respondents receive draft version of case study report - Interpretations and interim conclusions are discussed with other researchers in two group discussions - Researchers who were not fieldwork team members validated the findings
Internal validity: "establishing causal relationships whereby certain conditions are shown to lead to other conditions, as distinguished from spurious relationships"	- Rival explanations are addressed and discussed in the two group discussions
External validity: "establishing a domain in which the study's findings can be generalized"	- Theoretical sampling of the cases to be sure cases meet selection criteria - Use replication logic by selecting multiple cases
Reliability: "demonstrating that the operations of a study can be repeated with the same results"	- Development of interview questionnaires - Development of case study protocol to make research transparent and repeatable

Table 14: Validity and reliability in case studies (based on Yin, 2003)

7.2 Case characteristics

This section is used to explain the characteristics of each case. In three different subsections company, product and supply chain characteristics are discussed. These characteristics are used in the analysis of the case study data and in the stated preference experiment, which will be discussed in chapter 8. For additional information about the cases we refer to appendix D. This appendix provides for each case some market characteristics. The information is solely included for informative purposes.

7.2.1 Company characteristics

Previous chapter explains that chemical products can be roughly segmented into commodities and specialties. Next to this, it is mentioned that there are also many hybrid players that have a product portfolio ranging from primarily commodity products to specialties. Table 15 depicts the type of products supplied bij the shippers in our cases. The table shows the type of products supplied at company level, but also shows the type of products supplied by the specific business units involved in our research. This overview makes clear that 3 business units (43%) are active in the commodity market and that the remaining 4 (57%) supply products to the specialties market. This is in line with the segmentation in the sector: 45% of the turnover is generated in the commodity market and 55% in the specialties market.

Table 15 also shows whether the size of the involved companies is identified as large or small. This identification is based on the company turnover generated on the European market. We follow Budde et al. (2006) and position companies that generate more than 3 billion Euros as large companies. Based on this criterion 2 of the 5 involved shippers are categorized as small and the remaining 3 as large. Unfortunately, there are no data available about the segmentation in the sector.

As explained in section 7.1, data of our case studies are also collected at the service provider side. To classify the different LSPs that are involved in our cases, the classification as selected in chapter 6 is used[19]. The fifth column presents the results of this classification. The information in table 15 makes clear that all involved LSPs can be classified as a 3PL service provider, but that the service providers differ in the geographic region(s) they serve.

Finally, the last column of table 15 identifies the different logistics services sourced per case. This overview makes clear that the logistics services sourced differ per case. This is in line with our case study protocol which recommends including cases with various logistics services.

19 For more information about the classification we refer to section 6.1.2.

Case	Products chemical company	Products business unit	Company size	LSP involved	Logistics services sourced
A	Commodities	Commodities	Small	▪ 3 PL provider ▪ European player	▪ Transport ▪ Customs clearance ▪ VAL ▪ Transportation management ▪ Warehousing
B	Commodities	Commodities	Small	▪ 3 PL provider ▪ European player	▪ Transport ▪ Customs clearance
C	Hybrid	Commodities	Large	▪ 3 PL provider ▪ Global player	▪ Transportation management ▪ LLP / 4PL services
D	Hybrid	Specialties	Large	▪ 3 PL provider ▪ Global player	▪ Warehousing ▪ VAL ▪ Inventory management
E	Hybrid	Specialties	Large	▪ 3 PL provider ▪ Focus Benelux	▪ Warehousing ▪ VAL ▪ Cross docking ▪ Inventory management ▪ Order processing & fulfillment
F	Hybrid	Specialties	Large	▪ 3 PL provider ▪ Focus Western- Europe	▪ Warehousing ▪ VAL ▪ Inventory management ▪ Order processing & fulfillment
G	Specialties	Specialties	Small	▪ 3 PL provider ▪ European player	▪ Transport ▪ Transportation management ▪ Warehousing ▪ Inventory management ▪ Order processing & fulfillment

Table 15: Company characteristics

7.2.2 Product characteristics

Reviewing some product characteristics makes it possible to compare the seven cases. The characteristics that are discussed are chosen based on the theory as provided by Van Goor et al. (2005). The following two aspects will be discussed: value density and package density, Lovell et. al. (2005) and earlier Ploos van Amstel and D'hert (1996) use value density and packaging density to determine which elements are dominant in a logistics cost structure: warehousing and transportation, handling or interest. They suggest using this information as a starting point to define an optimal distribution structure. In our case we use the mentioned criteria of value density and packaging density to determine the characteristics of the products handled in our cases. Both aspects are classified as low or high. We follow Van Goor et al. (2005) and Groothedde (2009) and mark the value density low in case the value is lower than 2500 Euro/m^3 . Based on Van Goor et al. (2005), we define a package density of more than 50 units/m^3 as high. Table 16, shows that most cases have a relativly low value density and low package density. This results in the conclusion that transportation and warehousing are the dominant elements in the logistics cost structure in most of our cases bases on the theory as defined by Lovell et al., (2005) and Ploos van Amstel and D'hert (1996). This finding is confirmed by Kuipers (1999) and McKinnon (2004). Both authors describe the characteristics for the chemical industry and conclude that both product characteristics have a relatively low value. Nevertheless, case E is an exception to this general finding, because in this case the package density is high. This can be explained by the fact that this is the only case where products are delivered to the end user of the products. These end users are farmers, who only use small quantities of the products. As a result, small packages are delivered to each single customer.

Product characteristics	**Case A**	**Case B**	**Case C**	**Case D**	**Case E**	**Case F**	**Case G**
Value density	Low	Low	Low	Low	Low	Low	Low
Packaging density	Low	Low	Low	Low	High	Low	Low

Table 16: Product characteristics per case

7.2.3 Characteristics supply chain structure

Each case has its own supply chain structure. These supply chain structures are compared at the following aspects: stock points, responsibility replenishment stock points, transportation modes used, point of customer order entry, responsibility sourcing subcontractors. These aspects are chosen because information about these aspects could

be useful later on when the stated preference experiment is designed[20]. The results of the comparison are visible in table 17. This table shows that all cases use one or more stockpoints in their supply chain structure. These stockpoints are owned and operated by external logistics service providers in case these stockpoints are not located at the manufacturing sites of the shippers. The orchestration and coordination activities related to the replenishment activities of all stockpoints are done by the shippers. Furthermore, intermodal transportation is only used for stockpoint deliveries. Customer deliveries are done by road transportation by all shippers, but the shipper in case B plans to increase customer deliveries by using intermodal transport. Customer orders for all cases are received by the shippers. In some cases these orders are directly forwarded to the service provider who is responsible for order handling and order fulfillment. In case A, C and G a logistics service provider is used to coordinate transportation activities. The subcontractors used by this LSP are sourced and contracted by the shipper in the cases A and C. Both shippers make this choice for control and dependency reasons.

	Stock points	**Replenishment stock points**	**Transport mode ***	**Customer order entry**	**Sourcing subcontractors**
Case A	Hub structure	Shipper	1. Intermodal 2. Road	Shipper	Shipper
Case B	At plant sites	n.a.**	1. n.a. 2. Road	Shipper	n.a.
Case C	At plant sites and EDC	Shipper	1. Intermodal 2. Road	Shipper	Shipper
Case D	GDC and hubs	Shipper	1. Intermodal 2. Road	Shipper	n.a.
Case E	Country DC	Shipper	1. Road 2. Road	Shipper	n.a.
Case F	EDC	Shipper	1. Intermodal 2. Road	Shipper	n.a.
Case G	At plant sites	n.a.	1. n.a. 2. Road	Shipper	LSP

* Two answers per case: 1. refers to transportation mode used to replenish stockpoints; 2. refers to transportation mode used for customer deliveries.
** n.a. = not applicable

Table 17: Characteristics supply chain structure per case

20 Details about the design of our stated preference experiment can be found in section 8.2.

7.3 Findings: cross-case analysis

In each case the same topics are analyzed and compared. This section presents results of this cross-case analysis. The central subjects in this analysis are: logistics outsourcing, logistics collaboration and the purchasing process for logistics services.

7.3.1 Logistics outsourcing and collaboration

All visited companies have logistics outsourcing as part of their logistics strategy. The drivers for the shippers to outsource (parts of) their logistics activities are in line with the drivers identified during the literature review[21]. Table 18 compares the drivers identified in literature with the drivers identified per case.

Drivers logistics outsourcing identified in literature review	Drivers identified per case
Cost savings	Case A, B
Service improvements	
Focus on core competencies	Case A, B, C, D, E, F, G
Investment related	Case B, G
Missing expertise	
Operational flexibility	Case E, G

Table 18: Drivers of logistics outsourcing

Table 18 shows focusing on core competences is mentioned by all visited companies as reason to outsource logistics activities. This does not mean that all logistics activities are defined as non-core competences by the shippers. The outsourced activities can be classified as operational, coordination or orchestration activities. Table 19 shows which kinds of activities are outsourced in each specific case. Most of these activities have an operational character and these activities are defined as non-core activities. This conclusion is in line with previous studies on this topic, because previous studies show that logistics services frequently outsourced are those with an operational character (Budde et al, 2006; Selviaridis and Spring, 2007). At the other hand, supply chain coordination and orchestration activities are often identified as important and for that reason not outsourced to external service providers. Table 19 shows that shippers of case C, D en G outsource coordination activities. Nevertheless, also these shippers are reserved in outsourcing this type of logistics activities. Shipper in case C explicitly decides to split

21 The drivers of logistics outsourcing are described in chapter 2.2.1

operational and coordination activities between different service providers because of fears about loss of control and increased dependency. Shipper in case D tries to keep the internal logistics knowledge up to date to avoid dependency from external providers. Finally, shipper in case G decides to hand over operational and coordination activities to the same providers, but contracted three service providers for these activities because of dependency reasons too.

	Type of activities			
Case	**Operational**	**Coordination**	**Orchestration**	**Remark**
A	• Transport • Customs & brokerage • VAL • Warehousing • Inventory management • Order processing & fulfillment			
B	• Transport • Customs & brokerage			
C		Transport ation management		Operational activities outsourced to different LSPs
D	• VAL • Warehousing • Inventory management • Order processing & fulfillment	Coordination direct deliveries		
E	• Transport • Cross docking • VAL • Warehousing • Inventory management • Order processing & fulfillment			
F	• VAL • Warehousing • Inventory management • Order processing & fulfillment			
G	• Transport • Site handling • Warehousing • Inventory management • Order processing & fulfillment	Transport ation management		Activities are split over three LSPs

Table 19: Type of activities outsourced per case

The involved shippers also explain their concerns of logistics outsourcing and collaboration. These concerns function as an impediment to increase the level of logistics outsourcing. Table 20 compares the concerns identified in literature with the concerns indicated per case. This table shows that concerns about dependency and loss of control are most often mentioned by our respondents. Also existing literature marks dependency and loss of control as some of the main impediments for logistics outsourcing (Razzaque and Sheng, 1988; Van Laarhoven et al., 2000) [22].

Impediment logistics outsourcing identified in literature review	Impediment logistics outsourcing identified per case
Loss of control	Case C, D, F
Dependency	Case A, B, C, D, E, F, G
Cost issues	
Service issues	
Partner selection	Case G
Trust in business partner	Case B
Lack support management	
Clashing cultures	
Switching costs	
Sunk costs	

Table 20: Impediment logistics outsourcing

Outsourcing logistics activities results in collaborative relationships between shippers and LSPs. The relationship between shipper and LSP in each case is positioned at the relationship ladder as defined by Gulati and Kletter (2005)[23]. Three criteria are used to position a case at this ladder. The first criterion is commitment. Commitment is expressed as the contract term agreed between shipper and LSP. At the lowest level of the relationship ladder, arm's length, services are bought as in isolated transaction and there is no contract or commitment between the parties. At the second level of the ladder, bundling, a short or mid term commitment is used. A contract term of less than three years refers to a short term commitment and a contract term between three and five years refers to a mid term commitment. The next step at the ladder, integration, is characterized by a long term commitment. A contract term of more than five years refers to a long term commitment. At the final stage, strategic partnering, no end date is defined. The second criterion is the type of services outsourced to the involved LSP. In line with

22 Concerns of logistics outsourcing are discussed in section 2.2.2
23 The relationship ladder is discussed in section 3.1.1

table 19, these services are classified as operational, coordination or orchestration services. Arm's length and bundling relationships focus on operational activities. The next level at the ladder, integration, focuses on coordination and the strategic partnering on the orchestration activities. Finally, the third criterion is the objective of the collaboration. Has the shipper the objective to create a win-win situation or does the relationship have an opportunistic character? The lowest two levels at the ladder, arm's length and bundling, normally have an opportunistic character. The level of trust between the parties is relatively low. At the integration and strategic partnering level, the collaborating partners have the objective to build a long term relationship and thus to create a win-win situation for both parties. The level of trust between the parties is relatively high.

Figure 17 shows the position of the seven cases at the relationship ladder. This figure makes clear that case B is positioned between arm's length and bundling. Reasons are the short commitment of 1 year, operational character of the outsourced services and the opportunistic character of the relationship. The shipper hesitates to use longer commitments towards their logistics service providers and prefers tendering on a yearly basis to reduce the logistics costs. Also the involved LSP indicates they are reserved to invest in the relationship, because of the opportunistic behavior of the shipper. As a result, the level of trust between the parties is low.

In addition, figure 17 shows that the cases A, C, E and F are characterized as bundling. Bundling relationships are normally characterized by a short or mid term commitment. Case A, C and E have a mid term commitment of three years. Nevertheless, it needs to be noticed that the motives to choose for this mid-term commitment have an opportunistic character; the shipper does not have the intention to build a long term and stable relationship with the LSP. In case A and E a commitment of three years has been a minimum requirement of the LSP to make operation specific investments. After this period, the shipper will choose for a shorter commitment. The shipper in case C chooses for a mid term commitment to ensure sufficient logistics capacity in the market. At the other hand, case F has a relativly long commitment of five years. This commitment could be an indication for a different type of relationship than bundling. Nevertheless, the reason identified to choose for this longer commitment is not related to the intention to build a long term and stable relationship with the LSP. In line with case C, the shipper tries to avoid price-rises and ensures logistics capacity by using longer contract terms at the moment the situation on the market for logistics services seems to change from a buyer to a seller market. Next to this, cases A, E and F are positioned as bundling, because of the operational character of the outsourced activities. The situation in case C is slightly different. The outsourced activities are at the coordination level. Nevertheless, the responsibilities of the LSP are still limited, because the operational activities that belong to this coordination responsibility are for dependency reasons outsourced to other LSPs.

This reflects a low level of trust between shipper and LSP. As a result, case C is positioned as bundling, in spite of the character of the outsourced services.
Finally, figure 17 makes clear that cases D and G are positioned at the integration level of the relationship ladder, for the following reasons. First, these cases are characterized by a long term commitment of 7 and 5 years. Next to this, the outsourced activities are at coordination level. Finally, parties involved in case D and G have explicitly indicated that the long term commitment is needed to create a stable supply chain and have the possibility to improve the current operation for both the shipper and LSP. As a result, the relationships in the cases D and G are characterized by a relatively high level of trust.

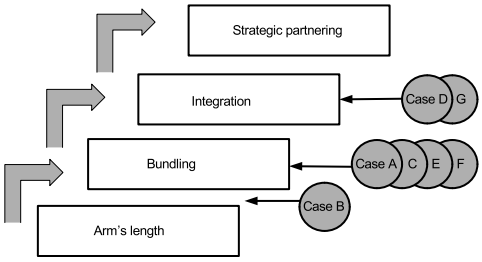

Figure 17: Position of the different cases at the relationship ladder

7.3.2 Purchasing process

Kraljic matrix

As discussed in chapter 2, the Kraljic matrix has become the standard in the field of purchasing models to determine a comprehensive strategy for supply. Therefore, the respondents in our cases are asked to position their tender project in the matrix. This perception of the respondents is presented in figure 18.

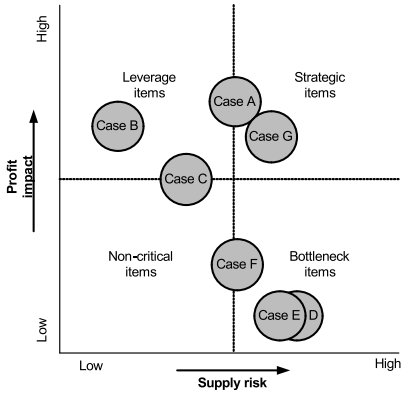

Figure 18: Position cases in Kraljic's matrix: perception respondents

The information in figure 18 is important, because this can help us to determine whether the purchasing approach followed by a shipper is in line with the position of the case in the Kraljic's matrix. Nevertheless, it will also be useful to position cases in the Kraljic's matrix from the perspective of the researcher. This exercise will give the possibility to determine whether there are differences in the perception of the respondents and the valuation of the researcher. Next to this, the researcher will use the same criteria for all cases to determine the place of each case in the Kraljic matrix. This will give us a possibility to compare the cases.

The literature review in chapter 2 makes clear that the theory does not provide prescriptions or procedures of how to use the Kraljic's matrix. To solve this problem, we use the methodology proposed by Groothedde (2009). Originally, Groothedde has designed this methodology to define the preferred type of network for an organization. Nevertheless, the procedure can also be used to position items in other portfolios like Kraljic. Groothedde proposes to break down each axis into a number of factors. The factors together are a proxy for a specific axis in the matrix. The factors are valued at a five point scale by the researcher. The points for each of the factors are added and the total number of points determines the position at a particular axis. Each axis has a value range from 0 till 10. The factors used to breakdown the axis and the accompanying values are determined by using existing publications (Gelderman and Van Weele, 2003; Groothedde, 2009; Vermunt, 2008)[24]. The position at the profit impact axis is determined by two factors: the sourced service expressed as percentage of the turnover and the strategic importance of the service. The position at the supply risk axis is also determined by two factors: number of alternative suppliers available in the market and the power position of the shipper in the purchasing process. The factors and their values are depicted in figure 19. The example used in figure 19 shows a situation where the sourced services are between two and five percent of the turnover and the strategic importance of the sourced services is valued as very low. As a result, the total points for the profit impact axis are three. Next step is to value the supply risk axis. There are between four and six alternative suppliers available in the market that can provide comparable services. Therefore, three points are added to the first factor of the supply risk axis. Next to this, the power position of the shipper is valued high. This results in an additional two points. In total the supply risk axis receives five points. If we then plot the profit impact and supply risk points in the Kraljic matrix, the position in this matrix can be derived. In our example, this results in a position between non-critical and leverage items.

24 More details about the operationalisation of the axis as proposed by these authors can be found in section 2.3.2.

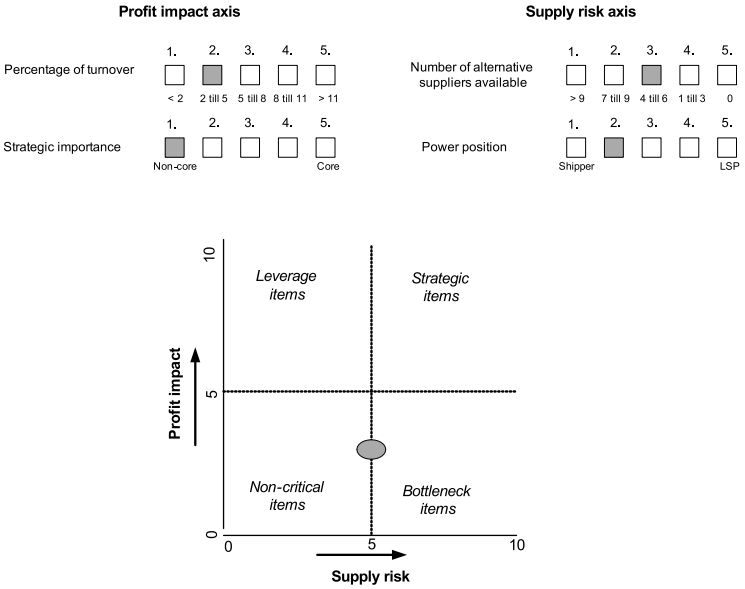

Figure 19: Kraljic's valuation procedure (adapted from Groothedde, 2009)

Using this procedure to position our cases, this results in the following picture.

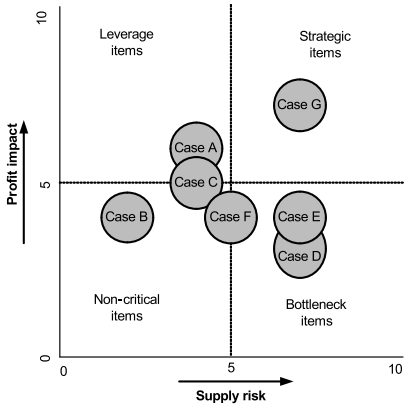

Figure 20: Position cases in Kraljic's matrix: researcher's perception

A comparison of figure 18 and 20 results in the observation that cases A and B are positioned in different quadrants of the Kraljic's matrix by the respondents and the researcher. The respondents position case A as an item between leverage items and strategic items. The valuation by the researcher results in a position in the leverage item

quadrant. This is the result of the researcher's lower valuation of the supply risk. The higher valuation of the supply risk at the shipper's side is explained by the strong fears of being dependent of an external supplier. On the other hand, the researcher concludes that there are enough alternative suppliers available in the market and that the power position of the shipper is relatively strong. Also case B is positioned differently by the respondents and the researcher. The respondents positioned case B as a leverage item and the researcher as a non-critical item. The difference can be explained by the different position at the profit impact axis. The respondents argue that this position is relatively high, because logistics is defined as one of the areas to create competitive advantage. Also the supply chain disruptions caused by the service providers add a significant amount of additional costs. The researcher valued the position at the profit axis lower, because the strategic character of the logistics service contradicts to the strong focus on rates and short term character of the relationship between shipper and LSP. Next to this, the additional costs could be decreased by another way of working.

Tender process

The tender projects of each case are compared at different aspects to analyze the purchasing process and the used purchasing approach. Results of this comparison can be found in table 21. This table shows that all investigated projects followed a standardized, phased process to source the required logistics services. Only the number of phases used differs per case. The projects in case D, E and F use a process consisting of four phases. The companies in case A, B, C and G use a six phased approach. In these projects two additional phases, RFI and Evaluation, are added. In case A, B, C the RFI phase is used to reduce the number of LSPs to continue with. This contradicts to the recommendation of Van der Valk and Rozemeijer (2009)[25] to use a RFI to earlier involve the supplier in the purchasing process. Only in case G the RFI is used to define the logistics concept in consultation with the LSP and thus to get the supplier already involved at the beginning of the purchasing process.

Subsequently, table 21 makes clear that almost all projects investigated have a closed character. Closed refers to the fact that the requested services are already highly specified by the buyers before entering the market place. Most shippers used a so called input specification method to define their requirement. This means shippers do not only specify the services in terms of the required performance (output terms), but the shippers also specify the processes en procedures that need to be followed by the LSPs in deep detail. Consequently, the expertise and knowledge of service providers is not used

25 A detailed explanation of the extended purchasing process as proposed by Van der Valk and Rozemeijer (2009) can be found in section 3.2.2.

to define the service requirements and underlying logistics concept. In more detail, the service providers involved in the projects of case B, D and F are only asked to provide tariffs. Also in the cases A, C and E, the requested services and underlying logistics concept are already defined by the shipper, but in these projects the LSPs have the possibility to suggest improvements in their response documents.
Nevertheless, the projects A till F have in common that the services are specified without consultation of external sources. In project G the situation is different. The shipper in case G uses the RFI phase of the purchasing process to define the final requirements and logistics concept in cooperation with the LSPs. The interviewed LSPs confirm that most tender procedures have a closed character. On the other hand, they also state that they could take the initiative more often to propose suggestions to the shippers. The LSPs indicate that it is hard to find sufficient time to put forward these suggestions, because they are overloaded by RFI's and RFQ's. This issue could be solved by being more selective in deciding which tender proposals are answered and which not.
In addition, table 21 shows the commitment terms used in the seven cases. These commitment terms are already discussed in section 7.3.1. This discussion makes clear that the arguments to choose for a mid-term or long-term commitment in the cases A, C, E and F have an opportunistic character. Only in the cases D and G a long term commitment is given to build a long term and stable relationship with the LSP.
Furthermore, table 21 shows that in all projects a set of criteria is used to select the LSP.

Case	Position in Kraljic's portfolio (respondents' perception)	Phased approach	Use RFI	Departments involved	Supplier involvement in process	Commitment	Decision criteria
A	Between leverage and strategic item	Yes (6 phases)	Yes; to reduce long list of providers	Sourcing, supply chain engineering	Limited; only improvement proposals to predefined scenario	3 years	Costs, service, commitment, trust, financial position
B	Leverage item	Yes (6 phases)	Yes; to reduce long list of providers	Sourcing	No; standard pricing format is used	1 year	Costs, service, switching costs, commitment
C	Between leverage and non-critical item	Yes (6 phases)	Yes; to reduce long list of providers	Logistics BU*, purchasing BU, customer service BU, purchasing corporate	Limited; only improvement proposals to predefined scenario	3 years	Costs, service, trust, confidentiality, capabilities LSP
D	Bottleneck item	Yes (4 phases)	No	Supply chain management, purchasing corporate	No; only asked to price proposed operation	7 years	Costs, service, trust
E	Bottleneck item	Yes (4 phases)	No	Logistics, sales	Limited; only improvement proposals to predefined scenario	3 years	Costs, service, flexibility, confidentiality, capabilities LSP
F	Between leverage and non-critical item	Yes (4 phases)	No	Supply chain management, sales, purchasing	No; only asked to price proposed operation	5 years	Costs, commitment, trust, confidentiality, financial position
G	Strategic item	Yes (6 phases)	Yes; to design logistics concept	Supply chain management BU, logistics corporate	Yes, to define logistics concept	5 years	Costs, service, culture, trust commitment
* BU = Business Unit							

Table 21: Cross-case analysis tender projects

The criteria used in the cases are compared with the collaboration decision criteria identified in the literature review. The results of this comparison are shown in table 22. This table shows how many times each of the decision criteria found in literature is used in case studies. Comparing the results of the literature review and the case studies makes clear that our case studies identify one decision criterion that has not been identified during the literature study. This criterion is flexibility. Flexibility refers to the capability and willingness to handle exceptions. The other criteria used in the cases are also identified during our literature review as criteria that could be used in a collaboration decision. Table 22 demonstrates that there is a strong focus on costs in our cases, because costs is the selection criterion most mentioned in our cases. Next to this, costs was also often the first-mentioned criterion by the respondents. Furthermore, table 22 shows that also service is an important decision criterion in our cases to select a LSP. These findings are in line with our finding in the logistics outsourcing literature that costs and service are the most frequently used criteria to select a logistics service provider. Besides, table 22 makes clear that also trust, confidentiality and commitment are often used as decision criteria in our cases. This is also in line with the findings of our literature review, because this review process made clear that these three variables are identified as key variables in collaboration decisions.

Collaboration decision criteria	Number of cases criterion used
Costs	7
Service	6
Trust	5
Commitment	4
Confidentiality	3
Capabilities of LSP	2
Financial position of LSP	2
Culture fit	1
Transaction costs	1
Flexibility	1
Power	0
Risk aversion	0
Uncertainty	0
Frequency	0
Asset specificity	0
Bounded rationality	0
Homogeneity	0
Transparency	0
Gain-sharing	0
Interpersonal interaction	0

Table 22: Selection criteria used in case studies

The case study methodology provides an opportunity to not only gather information about which decision criteria are used, but also to receive an explanation of what is exactly meant by a specific criterion. This detailed discussion makes clear that the term costs does not refer to a total costs of ownership approach that includes switching costs. The criterion costs only refers to the tariffs calculated by the LSPs. The shipper in case B emphasizes the focus on tariffs in the consideration to use one year commitments towards the contracted LSPs. This short term commitment gives the organization the possibility to tender on a yearly basis which results in the required annual savings. Subsequently, focus on tariffs is also underlined by the considerations of some shippers to sign contracts with a mid-term horizon instead of the normally used short-term horizon. Shippers in cases C and F try to avoid price-rises by using longer contract terms at the moment the situation at the market for logistics services seems to change from a buyer to a seller market. Besides, the shipper in case C decides to source and contract subcontractors itself in stead of outsourcing this to the LLP. This choice gives the shipper the possibility to exploit its own purchasing power. Finally, the shipper in case F chooses for a central supply chain department to better exploit the purchasing power of the organization.

The discussion with our respondents makes also clear that the criterion service is related to the performance as (will be) delivered by the LSP. Depending on the logistics services outsourced, different key performance indicators (KPIs) are defined to measure the service level offered by the LSP. For transport activities the KPIs are often related to the number of shipments delivered on time and/or number of shipments delivered complete. For warehousing these KPIs are for example related to the handling and storage activities.
In addition, the discussions about the term trust result in the conclusion that the criterion trust can refer to different elements in a relationship. Some respondents use the term trust to refer to the people that are involved from the side of the LSP. For these respondents it is important that they are convinced that the people involved from the LSP side will promote the interest of the shipper in the organization of the LSP. Other respondents link the term trust to the general feeling that a LSP will not show opportunistic behavior at the moment decisions need to be made during the operation, for example in the selection of subcontractors. In general, we may conclude that the term trust refers to the feeling that the LSP will not harm the interests of the shipper, but we notice that the exact interpretation of the term trust can differ case by case.
Next to this, table 22 shows that the capabilities of the LSP are mentioned in two cases as one of the used decision criteria to select the LSP. The accompanying discussion makes clear that the term capabilities can refer to the assets of the LSP (transportation equipment, ICT systems, etc.) or to the experience of the LSP with a certain type of products or operation.
Furthermore, the respondents in one of the case that use cultural fit as a decision criterion in their project explain that this criterion is related to the fit between the corporate culture of the shipper and the corporate culture of the LSP. Also transaction costs are only identified in one of the cases as a decision criterion. The term transaction costs in this particular case refers to the costs that result from tendering and switching to a different LSP.
Finally, the discussions about the criteria commitment, confidentiality and financial position clarify that the explanation of these criteria does not differ per case. In all cases, commitment refers to the contract term as agreed. The criterion confidentiality explicitly refers to the belief that the LSP will keep shared information confidential and is thus closely related to the criterion trust. The selection criterion financial position is used to reflect how shippers value whether a LSP is healthy from a financial point of view.
Based on the discussion above, we may conclude that the findings in our cases are in line with our findings in the literature review, because our cases confirm that costs, service, trust, confidentiality and commitment are important decision criteria in a logistics collaboration decision. Nevertheless, the detailed discussions make clear that the explanation/interpretation of a specific criterion can differ case by case. As a consequence, it is

important to explicitly and clearly define the decision criteria when they are used in the remaining of this research.
We have also analyzed whether the used decision criteria differ per subsector in the chemical industry. Table 23 compares the decision criteria used in the cases A, B and C (commodity market) and the cases D, E, F and G (specialty market). Based on the information in table 23, we conclude that there is no indication for a difference in the selection criteria in the two subsectors of the chemical industry. Nevertheless, this conclusion needs further empirical validation, because the number of cases studied is limited.

Criterion	**Commodities (cases A, B, C)**	**Specialties (cases D, E, F, G)**
Costs	3	4
Service	3	3
Trust	2	3
Commitment	2	2
Confidentiality	1	2
Capabilities LSP	1	1
Financial position	1	1
Cultural fit	0	1
Switching costs	1	0
Flexibility	0	1

Table 23: Comparison decision criteria in commodity and specialty market

Based on the detailed discussions in this section about tender process, commitments and decision criteria, it may be concluded that the purchasing approach used in the cases A till F can be characterized as a transaction-oriented purchasing approach[26]. This in spite of the fact that the shippers position the sourced services in different quadrants of the Kraljic matrix and thus a more varied picture could be expected. On the other hand, the purchasing approach followed in case G is different and in line with the expected approach using Kraljic's theory. The approach in case G is characterized by supplier involvement, a long term horizon and focus on total supply chain costs instead of focus on rates offered by the LSPs. The shipper focuses on more solid and closer relationships with the LSPs. Consequently, from the seven investigated projects, case G is the only one where a more relation-oriented purchasing approach is used.

26 For more information about different purchasing approaches we refer to section 2.3.2

Increased complexity of logistics outsourcing

Literature review makes clear that the complexity of logistics outsourcing has increased over the last decades. The literature identifies three reasons for this: business trends, increased complexity of logistics services and specification difficulties. As a result, nowadays the range of logistics services purchased is more diverse and the position of logistics services in the Kraljic's matrix is more spread than some decades ago. Consequently, it is expected that shippers use different sourcing approaches to purchase different type of logistics services. Nevertheless, empirical evidence for this statement is limited. As a result, this aspect is explicitly discussed during our case studies. An overview of the results of these discussions is depicted in table 24. The table shows that only the respondents of case E indicate that the complexity of logistics outsourcing has not increased. All other respondents confirm that the complexity of logistics outsourcing has increased. The reasons given by the respondents are in line with the reasons found in the literature. Current business trends like globalization, consolidation in the LSP market and more demanding customers are mentioned by the shippers in case A, C, D and F as one of the reasons for the increased complexity of logistics outsourcing. The increased complexity of logistics services is identified by the shippers in case A, B, C and G as a reason for the increased complexity of logistics outsourcing. Finally, specification difficulties are only identified by the respondents of case G as a reason for increased complexity of logistics outsourcing. It needs to be noticed that the shipper in case B mentions an additional reason for the increased level of logistics services next to the three reasons identified in the literature. Shipper B argues that the increasing volumes affect the complexity level of the outsourced processes in a negative way.

Nevertheless, table 24 also shows that only the shipper in case G follows a different approach for different kind of logistics services. In line with the theoretical findings, this shipper uses a more relation-oriented purchasing approach for advanced logistics services. This means that tender projects have an open character and the LSPs are early involved in the project to support the supplier to define the final logistics solution. Participants of the other cases do not have different sourcing approaches for different kinds of logistics services. This finding is supported by an empirical study about purchasing strategies for logistics services by Zeegers (2007). In this study, the author shows that in practice companies follow the same purchasing strategy for sourcing logistics services that are in different quadrants of Kraljic's portfolio. Companies acknowledge the need for more differentiated sourcing strategies, but still focus on exploiting their purchasing power for all logistics services bought. Some of the shippers in our cases explain that they respond to the increased complexity of logistics outsourcing, but not by using different sourcing approaches for different kinds of logistics services. Shippers in case C, D and F respond by changing their sourcing strategy in general. For the shipper in

case C this means that it uses longer commitments towards the LSPs and that it splits operational and coordination responsibilities over different LSPs. Shipper in case D also changes its general sourcing strategy for logistics services and decreases the number of contracted LSPs. The shipper in case F responds by setting up a central supply chain management department to better combine the flows of the different divisions and to better use the company's purchasing power. Finally, shipper of case A and B acknowledges the increased complexity of logistics outsourcing, but the shipper does not actively respond to this change.

Based on these observations, it may be concluded that there is very limited empirical evidence for the theoretical finding that shippers respond to the increased complexity of logistics outsourcing by using a more differentiated sourcing approach. The case studies make clear that shippers acknowledge the increased complexity, but respond in different ways.

Case	Complexity increased	Reasons	Reaction	Standardized process for all logistics services
A	Yes	• Trends: globalization • The increased complexity of logistics service: a combination of services is sourced	• None	• Yes; tender projects differ only in duration
B	Yes	• Growing volumes • The increased complexity of logistics service: more advanced logistics services outsourced	• None	• Yes; tender projects differ only in IT-tools used to support the project
C	Yes	• The increased complexity of logistics service: more advanced logistics services outsourced • Trends: globalization • Trends: consolidation in LSP market; power position shipper decreases	• Sourcing strategy changed: longer commitments and operational and coordination activities split over different providers	• Yes
D	Yes	• Trends: globalization • Trends: more demanding customers	• Sourcing strategy changed: less suppliers	• Yes
E	No	• Higher level of automation makes it easier to coordinate more complex flows	• Sourcing strategy not changed	• Yes
F	Yes	• Trend: consolidation in LSP market; power position shipper decreases • Trends: globalization	• Organizational structure changed: central supply chain department	• Yes
G	No	• The increased complexity of logistics service: a combination of services is sourced • Difficulties in defining requirements	• Sourcing strategy changed: different sourcing strategies for different type of services	• No; set up and content tender projects depend on type of service

Table 24: Complexity of logistics outsourcing increased

7.4 Concluding remarks

The case studies described in this chapter are conducted to create an in-depth understanding of logistics outsourcing and collaboration in the chemical sector. This understanding is needed to create a solid base for our stated preference experiment. Next to this, the case studies are used to validate some findings of the literature review. The case studies result in the following conclusions. First, most of the relationships between shippers and LSPs in the cases are characterized as bundling because of the operational focus of the outsourced activities. The shippers are still scared to transfer more responsibilities to their logistics service providers. Fears about loss of control and increased dependency of a certain LSP are reasons given to not intensify logistics collaboration.
In most of the cases, shippers use a transaction-oriented purchasing approach with a strong focus on costs in terms of price and low level of involvement of the supplier during the purchasing process. In addition, in all cases a set of decision criteria is used to select the final LSP. Costs, service, trust, confidentiality and commitment are the most frequently used decision criteria in our cases. These findings are in line with earlier results about this topic. On the other hand, our cases also show that the exact interpretation of a specific criterion can differ per case and as a result criteria need to be defined and explained clearly to a respondent when used later on in this research.
Moreover, the cases show that shippers acknowledge the increased complexity of logistics outsourcing, because of the current business trends, increased complexity of logistics services, specification difficulties and growing volumes. Shippers do not only respond to this increased complexity by using a more differentiated sourcing approach for purchasing different logistics services as was expected based on the literature review results. Our cases make clear that shippers respond in different ways. The results of these cases are used to design our stated preference experiment. This experiment is described in the next chapter.

8. Stated preference experiment

This chapter describes the stated preference (SP) experiment[27] used to test the hypotheses as defined in chapter 5. The remainder of the chapter is structured as follows. The first section starts with an introduction to the selected method. In this section the method, its drawbacks and the SP design template are described. Subsequently, the second section explains our experimental design. Section three focuses on the description of the analysis. Furthermore, section four presents the empirical findings. Finally, section five concludes with a summary of the main findings of this chapter.

8.1 Method

8.1.1 Stated Preference method

SP uses interviews or questionnaires, in which respondents are asked to make choices between alternative product descriptions, so to reveal how respondents value different attributes. SP research is widely used in the fields of marketing and passenger transport analysis. For an overview of SP research in the logistics field we refer to Muilerman (2001) and De Jong (2008). These overviews show that SP techniques can be used for various purposes. Some examples are estimating the market potential of new or improved modes of transportation, exploring the opportunities of modal shift, obtaining monetary values of time and deducing shippers' sensitivities to changes in different dimensions of service when making mode choice decisions.

Using SP techniques, alternatives are presented to the respondents, who are asked to choose every time the most preferred one in a series of options. The alternatives are described as bundles of variables known as "attributes", which are expected to impact respondents' preferences for the proposed options. Together the options are called the "choice set". This framework enables us to observe the choice behavior of the respondents, in order to examine the effect of the attributes that influence preferences (Travisi, 2007). Subsequently, SP results can be used to determine and quantify the relative im-

27 For a detailed discussion about the selection of the stated preference method as the preferred research strategy, we refer to section 1.5.

portance of attributes that are of interest of the researcher. See figure 21 for an example of a choice card from a choice set shown to a respondent in a simple SP experiment about two alternative travel situations. The alternatives differ in time and costs.

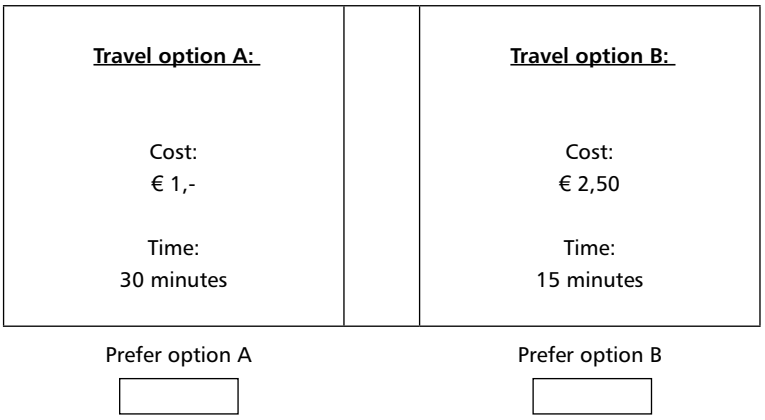

Figure 21: Example of a choice card used to present an alternative to a respondent

SP research is based on the economic concept of individuals deriving "utility" from the consumption of a particular product or service (Pearmain et al, 1991). Utility implies an overall value attached to a product or service by an individual. Under the principle of utility maximization, the decision maker is assumed to select the alternative that gives him or her the highest utility. The attractiveness (or utility) of each alternative consists of a systematic (observable) component and a random error (unobservable) term. The general linear utility function can be written as follows:

$$U_j = \beta_0 + \Sigma\beta_k X_{kj} + \varepsilon_j$$

U_j is the overall utility for a particular alternative j; β_0 is the constant term; β_k represents the relative utility associated with attribute k (e.g. a specific LSP selection criterion such as costs or service); X_{kj} is the independent variable representing attribute k for alternative j; and ε_j is an error component. It is usually assumed that the error terms are independently and identically distributed with a Gumbel distribution, which leads to the MNL model, but other distribution functions are sometimes used as well.

8.1.2 Drawbacks stated preference research

The data deduced by the SP experiment can be expected to provide a more realistic picture of decision-making behaviour. Nevertheless, like all research methods also stated preference research has its own drawbacks. An objection often heard against the use of SP techniques is the fact that it measures intended behaviour and people do not necessarily have to do what they say (Pearmain et al., 1991). Several authors have done studies to compare stated preference and revealed preference data. These experiences show that stated preferences perform well in predicting real-life choices (Green and Srinivasan, 1978; Bates and Roberts, 1986; Louvière, 1988; Wardman, 1988; Ortúzar and Willumsen, 2001). A second drawback is the occurrence of the non-commitment bias (i.e. if the respondent provided unconstrained and unreliable answers because the subject of study does not appeal to her or him (Muilerman, 2001)). A thorough preparation and setup of a realistic experiment can prevent this possible bias. Finally, one of the great advantages of the SP technique is its flexibility: a researcher can design SP experiments based on his ideas. This huge flexibility implies that the design (context and format) could influence the results of the analysis. This drawback can be avoided by using a general SP design template, and again using a realistically designed choice experiment (Ben-Akiva et al., 1994).

8.1.3 Design template

Stated preference requires an elaborate preparation by the researcher. Before the data can be collected, several choices and assumptions are made. The different aspects of such a SP design template are discussed below.

a. SP experiment objective

A SP experiment is used to reach our final research objective: measure the thresholds in a logistics collaboration decision. The choice behavior of the shippers is analyzed by measuring how they value different choice variables. The collected data are used to determine and quantify the relative importance of attributes that influence logistics collaboration decisions.

The data of the SP experiment are only collected at the shipper's side, because the shipper is the purchasing and thus leading actor in a collaboration decision between shipper and LSP.

b. Response type

SP experiments can differ with the type of responses collected. These different types of responses are ranking, rating or choice of options (Pearmain et al, 1991; Louvière et al., 2000).

- In a *ranking* approach all the options are presented at once to the respondents. The respondents are then required to rank the hypothetical options in order of preference, so implying a hierarchy of utility values.
- A *rating* experiment requires respondents to express the strength of their preferences on numerical or semantic scales.
- In a *choice* experiment, the individual simply selects the most preferred options from a pair or group of options.

There is no consensus in the literature for one method over another. In deciding about the method appropriate for the research topic, the researcher should be guided by the suitability of the response method in relation to the choices respondents have to make. In our experiment we will use a choice based experiment, because we wish to ensure as much realism and simplicity as possible in the exercises presented to the respondents. In such a case, a choice based experiment is recommended (Pearmain et al., 1991).

c. Attribute selection

One of the most important activities for a SP researcher is defining which attributes to include in the experiment. It is desirable to include a minimum of three attributes to place the choice experiment in a realistic context, and to reduce the likelihood of respondents recognizing a pattern in the presented options. At the other side, the number of attributes that can be added is not unlimited, because decision makers are by nature characterized by bounded rationality. Therefore, only a limited number of attributes can be taken into account. Subsequently, experimental designs which include a lot of attributes can confuse respondents and are very complex to design. The experiences of several researchers suggest an upper limit of six or seven attributes (Pearmain et al., 1991; Wardman, 2007). Therefore, a researcher should be selective in adding attributes. We follow Sheldon (2007) and Pearmain et al. (1991) who recommend selecting attributes and accompanying levels based on prior qualitative research like literature review, case studies and focus groups. Our attributes are selected based on the previous described literature review and case studies. Besides, it is recommended to define more than two levels for each attribute to have the possibility to measure non-linear effects of the different attributes.

For this experiment an orthogonal design is used[28]. This ensures that the attributes presented to respondents are varied independently from one another, thus avoiding correlation between attributes (Pearmain et al., 1991; Wardman, 2007). The orthogonal plan that belongs to a particular experiment can be easily generated by using the conjoint module of the statistical program SPSS. Based on the number of attributes and the number of levels of each attribute included in a design, SPSS configures a matrix showing the number of options of a full choice set and the level of each attribute for each single choice. The SPSS module is used during our design process.

The number of possible combinations in a SP experiment is the result of the number of levels raised to the power of the number of attributes (Pearmain et al, 1991). Thus, in a design with 2 attributes with 3 levels and 1 attribute of 4 levels this result in $3^2 \times 4^1 = 36$ options. When the number of options becomes high, there is a strong likelihood that respondents will experience fatigue in carrying out the choice exercises and therefore increasing the response error. Kroes and Sheldon (1988) suggest a range of 9 to 16 options as acceptable to present towards a respondent. The practical limit will to some extent depend on the context of the survey in which the stated preference exercise is introduced. For example face-to-face interviews allow a larger number of options than self-completion surveys and also surveys that consist of different parts allow a larger number of choices (Pearmain et al, 1991; Sheldon, 2007). Because of this limitation, in most experiments researchers need to find a way to reduce the number of options presented to each individual respondent. The literature provides different strategies to resolve this problem (Pearmain et al, 1991; Wardman, 2007). In our design we follow two strategies to reduce the number of options. First, we remove those options that are dominant in the choice set. A dominant option is a question where all the attributes of one of the two presented options are better than the other. Second, we randomly separate the remaining options into blocks, in such a way that the full choice set is complete by groups of respondents, each responding to a different subset of options.

d. Interview type

SP surveys may be administered by face to face interviews, by telephone interviews or by self- completion questionnaires on paper or via the internet. In our research project we

28 Currently, orthogonal SP designs are recognized as inefficient, because orthogonality in the design not automatically ensures orthogonality in the data required from the experiment. Nevertheless, "efficient" designs require a-priori assumptions about the expected coefficient values (Ortuzar, 2000)]. To our best knowledge, no previous experiments about logistics collaboration are available. Therefore, an orthogonal design is used and the data of this experiment can be used to make an "efficient" design later on. The orthogonal design of our experiment is improved by removing the dominant choices and using a folding procedure. A folding procedure means that the researcher tries different combinations of attribute levels and selects only those that gave a minimum level of dominant questions.

use face to face interviews, because face to face interviews are recommended for any study which involves a complex or customized SP exercise. Pearmain et al. (1991) state that this is the case in the majority of experiments. Not exclusive to SP work, face to face interviews give the researcher the possibility to monitor the process, and the ability to probe respondents to ascertain their understanding of the alternatives presented. No such controls are possible with self-completed designs. In general self-completed surveys are restricted to cases where the SP tasks are quite straightforward. Besides, as with all self-completion questionnaires, there will be the problem of unknown bias introduced by questionnaires not being returned.
During our face to face interviews a laptop is used to assist the researcher and respondent, because such a system offers significant advantages over manual methods. These advantages include an interesting and flexible presentation format, automatic data coding and storage, reduction of interview times, and the ease to tailor a SP experiment to an individual (Bradley, 1988).
Each interview for this research project lasted approximately 60 to 90 minutes and was conducted at the participant's workplace.

e. Testing

To test a SP survey, Wardman (2007) recommends having at least one pilot interview. The pilot interview is used to validate the design, context and questionnaire of the experiment. Summarized, it is used to ensure a realistic experiment. In our project two cycles of eight pilot interviews have been conducted before the actual SP experiment took place. The results of our pilots are used to fine-tune the levels of the attributes and context of the experiment.

f. Sampling

The interviewees are not chosen on a random basis, because to get reliable results it is a precondition that the individual respondents are experienced in logistics collaboration decisions. Therefore the respondents are selected by the use of purposive sampling. Representatives of chemical and logistics branch organizations are consulted to identify possible organizations and accompanying primary contact persons. These persons are contacted to request willingness to participate in the research project and to identify people to be interviewed. Most companies select representatives from both the supply chain management and purchasing departments as the people to be interviewed. This is in line with the findings of our case studies in the previous chapter, because these case studies show that purchasing and supply chain management departments are often both involved in purchasing projects for logistics services. Two times an interview is cancelled by the researcher, because the company primary contact person identified

a respondent who did not meet the precondition of being experienced in logistics collaboration decisions.
As explained in one of the previous sections, we use face-to-face interviews to collect the SP data, because of the complex and customized character of our experiment. Face-to-face interviews have the disadvantage that relatively a small number of respondents are consulted in comparison to large scale self completion surveys sent via (e)mail. Literature does not provide an unambiguous rule-of-thumb for the sample sizes required for a particular SP experiment. Part of the discussion lies in the nature of the information collected in SP studies. For example, each respondent might give responses to 9 choice situations. With 30 interviews this amounts to 270 data records, which is almost certainly enough to calibrate a significant model (Pearmain et al., 1991). However, this argument fails to make the distinction between two kinds of variations in responses that arise; variation between individuals and variation within each interview (Pearmain et al., 1991). For our study in total 47[29] interviews are conducted. This conforms to the rule-of-thumb as proposed by Sheldon (2007), that around 50 interviews are sufficient. This is also in line with recent, comparable studies (Danielis et al. 2005; Muilerman, 2001; Tsai et al., 2007).

8.2 Experimental design

8.2.1 Attribute selection

Our literature review has resulted in a list of variables that are possibly influencing a collaboration decision between organizations. Subsequently, case studies are used to verify which decision variables are dominating in the specific context of this research: logistics collaboration decisions between shippers and logistics service providers in the chemical industry. Following the design rule that recommends selecting attributes and accompanying levels based on prior qualitative research, we use the results of our literature review and case studies to select the attributes for the experiment. This prior research makes clear that costs, service trust, confidentiality and commitment are the main criteria in a vertical collaboration decision between a shipper and logistics service provider[30]. These five variables are included in our experiment. The other decision variables that are not explicitly included in our design as a separate attribute are represented by the error term of the utility function. Our case studies show that it is important that the explanation of a variable is clearly expressed to a respondent. The definitions of the variables included in our design are depicted in table 25.

29 Five of these 47 respondents are also interviewed during the case studies.
30 For a more detailed description of the main criteria identified in our case studies we refer to section 7.3.2.

Variable	Definition
Costs	Costs of the services provided by a LSP
Service	Service level offered by a LSP to the shipper in terms of shipments delivered on time
Trust	The belief that a partner will not harm the interests of the counterpart
Confidentiality	The belief that a collaboration partner keeps shared information confidential
Commitment	Participating actors are loyal and tolerant and do not worry constantly about being replaced

Table 25: Variables included in the experiment

8.2.2 Context of the experiment

The heart of our SP experiment is to give respondents the choice to reduce logistics costs by implementing a different logistics concept, which requires more intensive collaboration with logistics service providers. To make this choice clear and explicit to the respondents, a standard case description is used. This standard case contains two different logistics concepts: "*basic collaboration*" and "*intensified collaboration*". For the design of the standard case we rely on the results of our case studies and existing case studies about logistics collaboration in the chemical industry as described by Eutralog (2004) and Cruijssen and Verweij (2006). This will be discussed in more detail in the section below.

Concept A: basic collaboration

The starting point of the standard case is a collaborative situation between shipper and LSPs with an operational and repetitive character. This because SP researchers recommend that the experiment needs to be realistic and should be geared to the respondents' perception of their environment (Ben-Akiva et al., 1994). Existing literature and our case studies have shown that most collaborative relationships between shippers and logistics service providers are focused on operational execution of activities. The majority of the relationships between shipper and LSP in our cases described in the previous chapter are characterized as bundling at the relationship ladder defined by Gulati and Kletter (2005). Therefore, the relationship between shipper and LSP in the concept of basic collaboration is also characterized as bundling.

The basic collaboration concept has the following logistics structure. Products are produced in a manufacturing plant owned by the shipper (company X). In line with the cases described in chapter 7, the shipper uses different stock points (hubs) to distribute the products to their customers in Europe. In our case we only focus on one of these hubs. This hub is used to store products and deliver these products to customers in Southern Europe. The hub is owned by a logistics service provider.

Company X has outsourced its warehousing and transportation activities to different LSPs. The concept focuses on these services for two reasons. First, our case studies confirm that basic logistics services in the areas of transport and warehousing are the services most frequently outsourced. Second, our cases and previous research show that value and package density are relatively low in the chemical industry. As a result, transport and warehousing are the dominant elements in the logistics costs structure.
In line with the majority of our case studies the service providers contracted in this concept of basic collaboration are only responsible for the operational execution of the activities. Coordination and orchestration activities are still done by the shipper. This means the service provider at the hub is responsible for receiving the inbound shipments, the temporary storage of the products at the hub and final delivery to the customer. Company X is responsible for replenishing the hub. For the replenishment shipments towards the hub road transport is used, because a high proportion of European chemical traffic currently moves by road (NEA, 2004). Our cases, as described in chapter 7, confirm this statement. The many different LSPs used for the hub deliveries are contracted and managed by company X. The hub is delivered after receiving a sales order from one of the customers. This concept is depicted in figure 22.

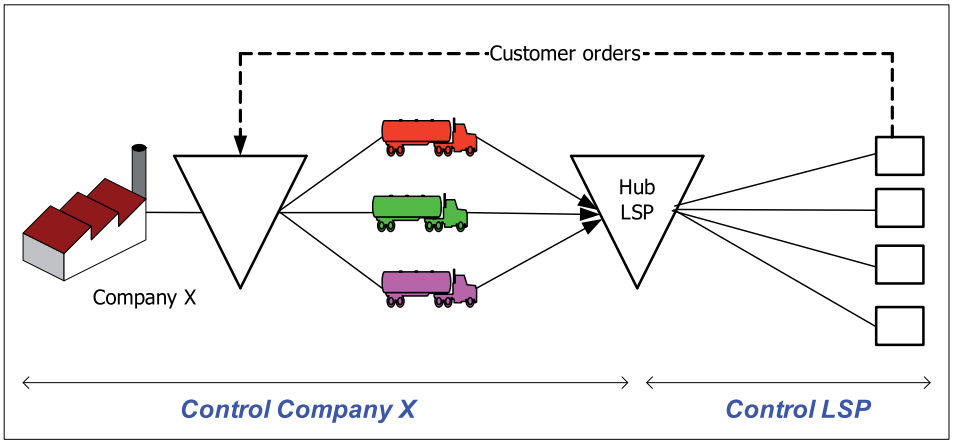

Figure 22: Concept: basic collaboration

Concept B: intensified collaboration

The alternative concept proposed to the respondent is the *intensified collaboration* concept. In this concept a collaboration structure is offered that can be characterized as integration, which is the next level of collaboration at the relationship ladder of Gulati and Kletter (2005) after bundling. Proposing an alternative outbound structure at the

level of strategic partnering is expected not to be geared to the respondents' perception, because our cases have shown that most collaborative relationships between shippers and LSPs have an operational level.

The *intensified collaboration* concept uses different transport modalities in stead of only using road transportation to deliver the logistics hub. This choice is made for the following reasons. First, modal shifts are identified as one of the areas of supply chain improvements within the chemical industry (Cefic, 2004; McKinnon, 2004). Next to this, an intermodal context is chosen because the limited available examples of beneficial collaboration between shippers and LSPs in the chemical industry are examples where a (partial) modal shift is part of the solution (Eutralog, 2004; Cruijssen and Verweij, 2006). The experiences of these best practices are used in our experiment. Besides, one of the shippers in our cases explicitly mentions the ambition to increase the use of intermodal transport solutions.

In principle the hub is delivered by non-road modes, and road transport is used as a fallback scenario. The concept reduces logistics cost significantly[31] and can improve the delivery performance, but also results in a higher degree of mutual dependency between both organizations. This choice is made because existing literature and our cases mark dependency as one of the main impediments for outsourcing and more solid collaboration.

The concept requires a certain level of economies of scale to be profitable, therefore the LSP functions as a central point to manage the split between the modes. As a result, Company X has to transfer more responsibilities to the LSP. The service provider will become responsible for the stock availability at the hub, and managing and contracting the subcontractors used to replenish the hub. As a result the hub LSP functions as a Lead Logistics Provider (LLP). Our cases demonstrate that the use of a central LLP is not unknown for the chemical industry and that such a solution requires a higher level of collaboration compared to the situation that the transport management activities are not outsourced, but coordinated by the shipper.

Besides, in the concept of intensified collaboration more information needs to be shared between Company X and the LSP to plan and control the activities. The transit times of the goods increase, and as a result replenishment of the hub will be based on sales forecast in stead of actual received sales orders. The service provider needs a sales forecast at an aggregated level in order to ensure delivery of the customer orders. The concept of more intensive collaboration is depicted in figure 23.

31 In the proposed cost reduction, switching costs are included.

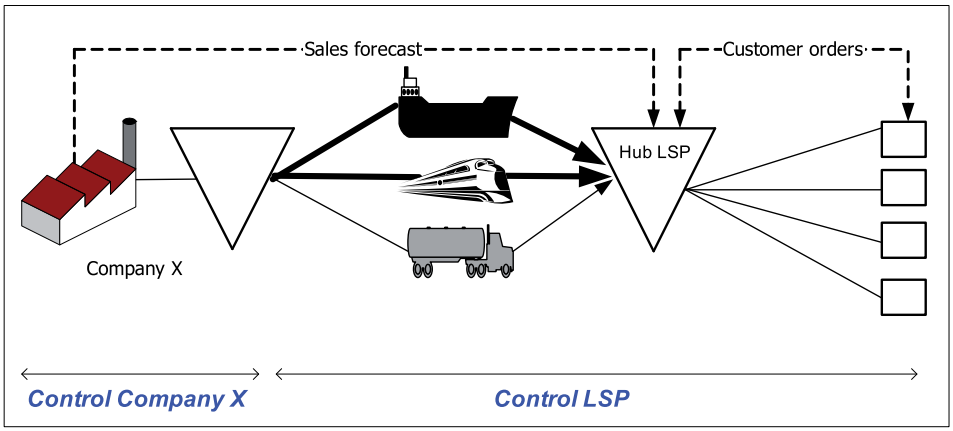

Figure 23: Concept: more intensive collaboration

8.2.3 Three different parts

The heart of our experiment is the choice between the two explained concepts as explained in the previous section. This makes the context of the experiment relatively complex. Therefore, the total experiment is divided into three parts, in order to help respondents by gradually increasing the complexity of the choices. Additionally, designing a SP questionnaire that consists of different parts allows us to propose a larger number of choices to the respondent (Pearmain et al, 1991; Sheldon, 2007). Finally, including different choice experiments in one experiment gives the researcher the possibility to collect a richer set of data.

In the first part respondents are asked to compare logistics collaboration proposals, both revolving around the concept of basic collaboration. Experiments comparing same concepts are a so called within mode experiment (Sheldon, 2007). The proposals shown to the respondent in the first part differ in costs, service and commitment.

The second part of the experiment is a so called between mode experiment, because it focuses on the choice between the two concepts of collaboration: basic versus intensified collaboration. This part includes all selected attributes: costs, service, commitment, trust and confidentiality. Choice cards presenting the basic collaboration concept contain three attributes: costs, service and commitment. Choice cards reflecting the intensified collaboration concept include all five attributes. For this concept, more information needs to be shared between the collaborating parties and more responsibilities are transferred from the shipper to the LSP. Therefore, with this concept, trust and confidentiality are more important.

Finally, in the third part of the experiment, respondents are asked to compare collaboration proposals, both based on the concept of intensified collaboration. These choices include all selected attributes and these attributes are shown on all choice cards.

8.2.4 Attribute levels

Although widely used in transport studies, applying SP research to freight transport is still in its infancy (Danielis et al., 2005). Also Bergkvist (2001) and Tsai et al. (2007) concur that defining and evaluating of freight transport attributes is still infancy compared to passenger transport. To the author's best knowledge, no previous experiments in the context of logistics collaboration decisions are available. To overcome this difficulty attribute levels and values for our SP experiment are defined by consulting existing SP studies where applicable[32], as well as by using findings from our literature review and case studies.

The SP literature recommends to define more than two levels for each attribute, thus enabling the measurement of non-linear effects of the different attributes. Moreover, the inclusion of more levels allows closer estimates of the value attached to each attribute by the respondent. At the other side, the numbers of levels added to each attribute directly impacts the number of possible combinations in a design[33]. Taking these three considerations into account, following attribute levels are defined for our experiment.

Attribute	**Levels Card A + Card B**
Costs	7 % below current costs
	2% below current costs
	Equal to current costs
	1% above current costs
	5% above current costs
Service	4% below current service level
	1.5% below current service level
	Equal to current service level
	2% above current service level
Commitment	1 year
	2 years
	3 years
	5 years

Table 26: Attribute levels part I: basic versus basic collaboration

32 The following SP studies are used as reference document: Danielis et al. 2005; De Jong et al. 2004a; De Jong et al. 2004b; Kouwenhoven et al. 2007.

33 For further explanation see section 8.1.3.

Attribute	Levels basic collaboration Card A	Levels intensified collaboration Card B
Costs	4% below current costs 1% below current costs Equal to current costs 3% above current costs	12% below costs Card A 6% below costs Card A 2% below costs Card A Equal to costs Card A
Service	4% below current service 1.5% below current service Equal to current service 2% above current service	4% below current service 1.5% below current service Equal to current service 2% above current service
Trust		(1) You are not absolutely certain LSP will not harm your interests. This is not contractually agreed. (2) You are not absolutely certain LSP will not harm your interests, but this is contractually agreed. (3) You are convinced LSP will not harm your interests. This is not contractually agreed. (4) You are convinced LSP will not harm your interests. This is contractually agreed.
Confidentiality		(1) You are not absolutely certain information is kept confidential. This is not contractually agreed. (2) You are not absolutely certain information is kept confidential, but this is contractually agreed. (3) You are convinced information is kept confidential. This is not contractually agreed. (4) You are convinced information is kept confidential. This is contractually agreed.
Commitment	1 year 2 years 3 years 5 years	1 year 2 years 3 years 5 years

Table 27: Attribute levels part II: basic versus intensified collaboration

Attribute	Levels Card A + Card B
Costs	7 % below current costs 2% below current costs Equal to current costs 1% above current costs 5% above current costs
Service	4% below current service 1.5% below current service Equal to current service 2% above current service level
Trust	(1) You are not absolutely certain LSP will not harm your interests. This is not contractually agreed. (2) You are not absolutely certain LSP will not harm your interests, but this is contractually agreed. (3) You are convinced LSP will not harm your interests. This is not contractually agreed. (4) You are convinced LSP will not harm your interests. This is contractually agreed.
Confiden-tiality	(1) You are not absolutely certain information is kept confidential. This is not contractually agreed. (2) You are not absolutely certain information is kept confidential, but this is contractually agreed. (3) You are convinced information is kept confidential. This is not contractually agreed. (4) You are convinced information is kept confidential. This is contractually agreed.
Commitment	1 year 2 years 3 years 5 years

Table 28: Attribute levels part III: intensified versus intensified collaboration

In order to further increase realism in the experiment, the values for the attributes costs and service are customized for each respondent. Levels shown for these attributes depend on the respondent's current costs for physical distribution and current service level. At the beginning of each interview a respondent is asked to select the pre-defined cost range mirroring his current logistics costs level[34], as well as the current percentage of

34 This cost level selected by each respondent not always mirrors the company's total logistics costs. It can also reflect the cost level of a specific business unit or geographical region. This depends on the respondent's responsibilities and knowledge.

orders delivered on time to the customers. These data are entered into the Excel file which is used to program our SP experiment. Subsequently, the program automatically generates the customized levels for each respondent at the choice cards. The defined attribute levels and customization possibilities are validated during the pilot interviews.

8.2.5 Outline of the questionnaire

Each interview starts with general questions about logistics outsourcing and collaboration with logistics service providers. This general information is used to obtain a general idea about the current status of logistics outsourcing and collaboration with the visiting company. This provides valuable information for the interpretation of the results of the SP experiment later on. The interview continues with the choice experiment. As discussed in section 8.2.3, in the first part of the choice experiment respondents compare collaboration alternatives both based on the concept of basic collaboration. In total, the first part of the experiment consists of six choices. An example of such a choice is depicted in figure 24.

Option A: Basic collaboration		**Option B: Basic collaboration**
Cost: € 52.500.000 (+5%)		Cost: € 49.000.000 (-2%)
Percentage orders delivered on time: 97,0%		Percentage orders delivered on time: 93,0%
Contract term: 1 year		Contract term: 3 years
Prefer option A ☐		Prefer option B ☐

Figure 24: Example first part of the experiment

The experiment continues with the second part of the experiment. This between mode experiment asks respondents to compare collaboration alternatives with different logistics concepts: basic collaboration and intensified collaboration. In total this part proposes eight choices to the interviewer. Figure 25 shows a possible choice of this second part of the experiment.

Option A: **Basic collaboration**		**Option B:** **Intensified collaboration**
Cost: € 148.500.000 (-1%)		Cost: € 138.105.000 (-7%)
Percentage orders delivered on time: 97,0%		Percentage orders delivered on time: 98,0%
		You're *not absolutely certain* LSP will not harm your interests.
		You're *convinced* and have contractually agreed LSP keeps shared information confidential.
Contract term: 1 year		Contract term: 5 years
Company X controls replenishment		LSP controls replenishment
Prefer Concept A ☐		Prefer Concept B ☐

Figure 25: Example second part of the experiment

Finally, in part three of the experiment,alternatives are proposed which are both based on the concept of intensified collaboration. This part contains seven choices. One of them is a "dominant" question, for which all the attributes of one option are better than the other. This question is used to identify respondents who do not appear to answer the questions in a sensible manner. The responses to the dominant question are not used in the model analysis. Example of a choice in part three is depicted in figure 26.

Option A: **Intensified collaboration**		**Option B:** **Intensified collaboration**
Cost: € 52.500.000 (+5%)		Cost: € 49.000.000 (-2%)
Percentage orders delivered on time: 97,0%		Percentage orders delivered on time: 93,0%
You're *convinced and have contractually* agreed LSP will not harm your interests.		You're *not absolutely certain* LSP will not harm your interests.
You're *convinced* LSP keeps shared information like sales forecast confidential.		You're *convinced* LSP keeps shared information like sales forecast confidential.
Contract term: 3 years		Contract term: 5 years
Prefer option A ☐		Prefer option B ☐

Figure 26: Example third part of the experiment

In total this results in an experiment with 21 choices. Each of the three parts contains some additional questions to verify whether the respondents understand the experiment and whether the choices are realistic for the respondents. An example of a complete interview manuscript, containing general questions and choice experiment, can be found in appendix G.

8.3 Analysis

Various modelling approaches can be used to analyze the data collected in an SP experiment. Based on the assumed Gumbel distribution of the error term in the overall utility function, the binary logit approach is used. The binary logit approach is one of a family of discrete choice models, which are widely used to examine the choices made by individuals, households or firms, in choosing one of a set of mutually exclusive alternatives (Ben Akiva and Lerman, 1985). Using a binary logit approach to analyze the collected data we also take into account the requirement as formulated in chapter 1.5: select an analytical tool that supports the random aspect of decision making. Alogit version

4.2[35] is used to estimate the binary logit model-coefficients for the collected data. All 47 questionnaires are included in the analysis there were no reasons to remove respondents from the sample due to incomplete or inconsistent responses. Additionally, the respondents value the presented choices as realistic and representative for their businesses. All respondents answered the dominant question in the correct way and indicated that they were able to compare the proposed choices. In total, during all the 47 interviews, 987 choices are proposed to the different respondents. The answers to the dominant question are not included in the analysis. Besides, 14 times a respondent indicated that he was not able to make a choice, because he valued both options at the choice cards as unacceptable. This is still a valid choice, so these respondents are not excluded from the sample size, but only specific choices are removed from the number of observations used for the analysis. In total 926 observations are included in the analysis. Table 29 shows the number of observations included in our analysis:

	Choices per experiment		Number of interviews		Total
Total number of observations	21	x	47	=	987
Dominant question	1	x	47	=	47 -
No choice					14 -
Total observations for analysis					**926**

Table 29: Observations included in the analysis

We have reviewed the results of the second part of our experiment, the between mode experiment, to examine whether respondents made a trade off between the choice alternatives. Trading is required in order to be able to investigate how the attributes influence collaboration decisions, and to eventually get reliable results. The Venn-diagram in figure 27 shows how the 47 respondents traded between basic collaboration and intensified collaboration The numbers in the Venn-diagram represent the number of respondents who chose a specific collaboration alternative. 39 respondents trade between basic and intensified collaboration. Two of these 39 respondents also did not make a choice between basic and intensified collaboration in some choices. We see that most respondents make a trade off between the two collaboration concepts, and thus we conclude that the level of trading is good.

35 Alogit is software that can be used for the estimation and analysis of logit choice models. The software was originally designed by the Hague Consulting Group.

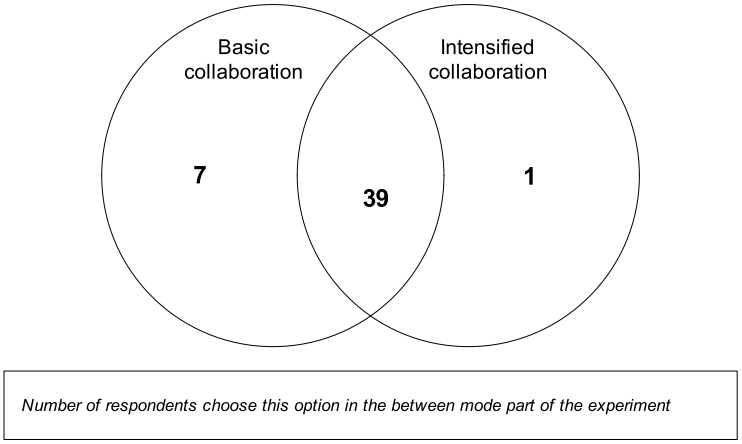

Figure 27: Trading between collaboration alternatives

The initial specification of our choice model includes one alternative constant, three discrete variables (trust, confidentiality and commitment) and two continuous variables (costs and service). At the beginning of the model estimation procedure, several tests are undertaken to validate the quality of our data (Swait and Louvière, 1993). The first test explicitly analyzes whether the same variables in the three different parts of the experiment are valued differently by the respondents. This test makes clear that there are no separate scaling factors applied to the different parts of the experiment, because the test confirms that the scaling factors do not differ significantly from 1, at a significance level of 95%. The analysis procedure continues on the assumption that the scaling factor for all three parts of the experiment is 1.

Two separate tests are undertaken to determine whether there is any evidence from the SP data of non-linearity in the value of the two continuous variables, namely costs and service. Therefore, we compare different model specifications. For each model specification the following statistics are depicted:

Statistic	Definition
Model	This defines the number of the model run.
Observations	The number of observations included in the model estimation.
Final log (L)	This indicates the value of the log-likelihood (LL). The log-likelihood is defined as the sum of the log of the probabilities of the chosen alternatives, and is the function that is maximized in the model estimation. The value of log-likelihood for a single model has no value. Comparing the log-likelihood of two models with different specifications allows the statistical significance of new model specifications to be assessed properly.
D.O.F.	Degrees Of Freedom, the number of coefficients estimated in the model. Note that if a coefficient is constrained to a fixed value, f.e. 0, then it is not counted as a degree of freedom.

Table 30: Model statistics explained (Kouwenhoven et al., 2007)

The LL is used to compare different model estimations. This is done in a formal statistical test: the Likelihood ratio test. This test compares the negative of twice the difference of the LL values (Δ LL) to a chi-square value (X^2) from published tables[36] (Kouwenhoven et al., 2007). The value in the table depends on the confidence interval chosen (in this research 95%) and the degrees of freedom of the model. For example with a 95% confidence interval and minus one degree of freedom, the critical value in the X^2 table is 3.84. Therefore, if twice the difference in LL values between two models where one has one extra degree of freedom is equal or more than 3.84, the specification of the model with the extra degree of freedom (coefficient) is considered to give a significant improvement in the fit of the model.

To test the valuation of costs, a number of dummy variables are added for the cost attribute. New estimations are made for the model which includes the dummy variables. The estimation results of this model are compared to our original model. This comparison makes clear that the delta of the log-likelihood is not significant. As a result, costs can be considered as linear. The same procedure is repeated for the service attribute. Also in this case, the comparison of the model including the dummy variables and the original model makes clear that the delta of the log-likelihood is not significant. The test does not provide evidence of non-linearity in the value of service. The results are summarized in table 31.

36 We use the standard table of the X^2 distribution published by Thompson (1941)

Test:	LL original model	LL model with dummies	Δ LL	Δ D.O.F	Conclusion
Costs linearity	-283.0	-282.6	0.4	3	Not a significant improvement of the model: linear model better fits the data
Service linearity	-492.0	-497.0	5	8	Not a significant improvement of the model: linear model better fits the data

Table 31: Linearity test costs and service

The next step is to find the model with the best overall fit. Therefore we compare again a number of different model specifications via a step by step procedure. The Logliklihood ratio test is also used for this comparison. As part of this model estimation procedure, different model specifications are defined to analyze whether observed heterogeneity in the total sample size results in a better overall model. Another part of the estimation procedure was focused on the discrete variables, because in the estimation results of the initially defined utility function not all levels of the discrete variables were valued significantly. Moreover, a significant difference was not always measured in the valuation of the different levels of the discrete variables. Aggregating some levels of a discrete variable or putting some levels to zero, can improve the overall fit of a model, because the error term of the total model is reduced (Kouwenhoven et al., 2007). In total fourteen different model specifications are estimated. Overview of the model estimation procedure is provided in table 32. This table contains a description, model statistics and interim conclusion for each of the fourteen models. At the end of the model estimation procedure, we have concluded that model number fourteen best fits our data. This model will be discussed in more detail in section 8.4.3.

Model	Description	Observations	Final log (LL)	D.O.F*	Δ (LL)	Interim conclusion	Remark
1	Initial utility function	926	-497,0	12	not applicable		
2	Identify the optimal specification of costs: absolute or relative values for the costs attribute. Model 2 contains absolute values for the costs attribute.	926	-519,6	12	-23	Δ loglikelihood value = -23. Model 1 and 2 have the same D.O.F. The LL of model 1 is closer to 0 and coefficients are significant at 95% confidence level. Model 1 better fits the data than model 2	
3	Subsamples logistics costs: (1) <=10 million Euro (2) > 10 million Euro	926	-491,8	13	5,2	Δ loglikelihood value = 5,2. This is a significant improvement at a 95% confidence level of a Likelihood ratio test**. Model 3 better fits the data than model 1.	Costs, trust and confidentiality attributes valued differently by respondents with costs level of < = 10 million and respondents with a cost level of > 10 million. These attributes need further verification.
4	Subsamples logistics costs: (1) <=10 million Euro (2) < 100 million Euro (3) > 100 million Euro	926	-493,6	14	-1,8	Δ loglikelihood value = -1,8. This is not a significant improvement at a 95% confidence level of a Likelihood ratio test. Model 3 better fits the data than model 4	
5	Subsampel logistics costs and variable trust. *Costs <= 10 million: trust level 2, 3 and 4 aggregated *Costs > 10 million: trust level 2, 3 and 4 put to 0	926	-489,9	12	1,9	Δ loglikelihood value = 1,9. This is a significant improvement at a 95% confidence level of a Likelihood ratio test. Model 5 better fits the data than model 3	
6	Subsampel logistics costs and variable confidentiality. *Costs <= 10 million: confidentiality level 2 and 3 aggregated *Costs > 10 million: confidentiality level 2 and 4 aggregated; level 3 put to 0	926	-489,8	12	0,1	Δ loglikelihood value = 0,1. Model 5 and 6 have same D.O.F. The LL value of model 6 is closer to 0, but not all coefficients are significant at a 95% confidence level. Model 5 better fits the data than model 6	
7	Subsampel logistics costs and variable confidentiality. * All costs levels: confidentiality level 2 and 4 aggregated; level 3 put to 0	926	-491,9	10	-2,0	Δ loglikelihood value = -2,0. This is a significant improvement at a 95% confidence level of a Likelihood ratio test. Model 7 better fits the data than model 5.	
8	Subsampel logistics costs and variable confidentiality. * All costs levels: confidentiality level 2 and 4 aggregated	926	-489,9	11	2,0	Δ loglikelihood value = 2,0. This is a significant improvement at a 95% confidence level of a Likelihood ratio test. Model 8 better fits the data than model 7.	
9	Subsample chemical industry: 1) Base chemicals 2) Specialty chemicals	926	-496,8	13	0,2	Δ loglikelihood value = 0,2. This is not a significant improvement at a 95% confidence level of a Likelihood ratio test. Model 1 better fits the data than model 9	No significant difference in the valuation of the attributes between the two identified subgroups: fine and base chemicals
10	Subsampel responsibility respondents: 1) supply chain management 2) purchasing	926	-487,3	14	9,7	Δ loglikelihood value = 9,2. This is a significant improvement at a 95% confidence level of a Likelihood ratio test. Model 10 better fits the data than model 1	Costs and service attribute are valued differently by respondents with a supply chain / logistics function and respondents with a purchasing function.
11	Subsample responsibility and logistics cost. 1) supply chain management 2) purchasing 3) Costs < = 10 million 4) Costs > 10 million	926	-480,7	16	6,6	Δ loglikelihood value = 6,6. This is a significant improvement at a 95% confidence level of a Likelihood ratio test. Model 11 better fits the data than model 11	
12	* Subsampel responsibility and Logistics costs * Variable confidentiality as in model 8	926	-480,7	15	0,0	Δ loglikelihood value = 0,0. This is a significant improvement at a 95% confidence level of a Likelihood ratio test. Model 12 better fits the data than model 11	
13	* Subsampel responsibility and logistics costs * Variable confidentiality as in model 9 * Variable trust as in model 5	926	-479,2	14	1,5	Δ loglikelihood value = 1,5. This is a significant improvement at a 95% confidence level of a Likelihood ratio test. Model 13 better fits the data than model 12	
14	* Subsampel responsibility and logistics costs * Variable confidentiality as in model 9 * Variable trust as in model 5 * Variable commitment level 2 and 3 put to 0	926	-479,4	12	-0,2	Δ loglikelihood value = -0,2. This is a significant improvement at a 95% confidence level of a Likelihood ratio test. Model 14 better fits the data than model 13	
* D.O.F: degrees of freedom in the model							
** To determine whether the delta of the Loglikelihood value is a significant improvement, a standard table of the X^2 Distribution Function is used (Thompson, 1941)							

Table 32: Model estimation procedure

8.4 Findings

8.4.1 Sample size

Company characteristics

In the period March until July 2008 the 47 SP interviews are carried out with representatives from 17 chemical companies. Table 33 shows some characteristics of the companies involved. The second column shows the type of products supplied by the company. In line with our findings in chapter 6 and the classification used in chapter 7, three different types of companies are distinguished: commodities, specialties and hybrid. The third column in table 33 shows the type of products supplied by the business unit that is involved in the research. This makes clear that from one of the companies (number 7) two business units are involved: one that supplies commodity products and one that supplies specialty chemicals. In total, 8 of the 18[37] involved business units (44%) are active in the commodity market and the remaining 10 (56%) are supplying products to the specialty market. The last column in table 33 shows the size of the company. In line with the criterion used in chapter 7, a company is categorized as large in case the annual company turnover in Europe is larger than 3 billion Euros. As a result, 8 of the 17 companies (47%) are categorized as small companies. The remaining 9 companies (53%) are positioned as large. These 9 large companies are all present in the top 30 major chemical companies in the world (Cefic, 2009).

37 Two of these seventeen business units were also involved in the case studies.

Company	Products chemical company	Products business unit	Company size
1	Commodities	Commodities	Small
2	Specialties	Specialties	Large
3	Specialties	Specialties	Small
4	Specialties	Specialties	Small
5	Hybrid	Commodities	Large
6	Hybrid	Commodities	Large
7	Hybrid	Commodities	Large
		Specialties	
8	Hybrid	Commodities	Large
9	Specialties	Specialties	Small
10	Hybrid	Specialties	Small
11	Hybrid	Specialties	Large
12	Hybrid	Specialties	Large
13	Commodities	Commodities	Small
14	Specialties	Specialties	Small
15	Commodities	Commodities	Large
16	Specialties	Specialties	Small
17	Commodities	Commodities	Large

Table 33: Company characteristics SP experiment

To obtain reliable results, it is important that the selected sample is representative for the sector. Next to this, we used our case study results to design our SP experiment. Therefore, we would like to know whether the samples of both empirical research parts are comparable. Table 34 compares the sample used in the case studies, the SP experiment and the chemical sector as a whole. This comparison makes clear that the distribution over the two subsectors in both samples is comparable. This distribution is also almost as good as the distribution in the sector. Next to this, the table shows that the split between small and large companies is comparable in both samples. Unfortunately, sector data about this aspect are not available.

	Case studies	SP experiment	Sector
Type of products:			
▪ Commodities	43%	44%	45%
▪ Specialties	57%	56%	55%
Company size:			
▪ Large	40%	47%	Not applicable
▪ Small	60%	53%	Not applicable

Table 34: Comparison sample sizes

The data in table 34 do not give any indication that the sample used in our SP experiment is not representative for the sector or that the samples used in the case studies and the SP experiment are not comparable. Additionally, we compare the services outsourced most frequently by our SP respondents, case study participants and the sector. This comparison makes clear that logistics services most frequently outsourced by our SP respondents are those that have an operational and repetitive character. Figure 28 shows that transport and warehousing are outsourced by (almost) all visited companies. These findings are in line with previous studies about this subject in the chemical sector (Budde et al, 2006), our case study findings as presented in chapter 7 and the context used in our SP experiment. As a result, also the findings on this subject do not provide any indication that the sample used in our SP experiment is not representative for the sector.

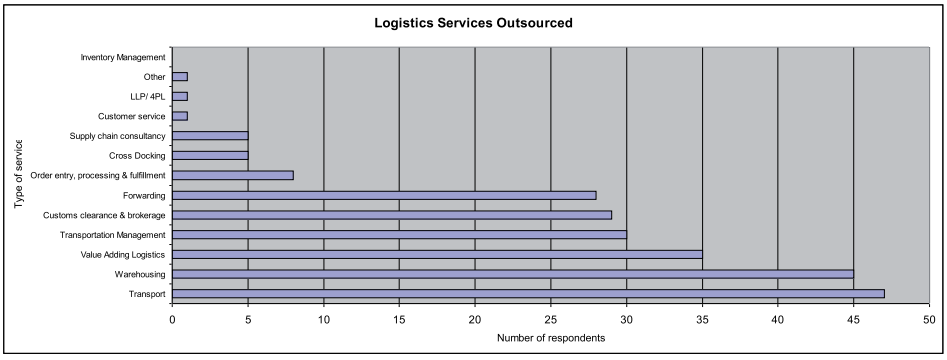

Figure 28: Logistics services outsourced

Respondent level

As defined in section 8.1.3, it is important that our respondents are experienced in logistics collaboration decisions to get reliable results. All our respondents have this experience. Next to this, they have a leading position in logistics, supply chain management or purchasing. Table 35 shows an overview of the respondents per chemical subsector and depicts how many have a position in supply chain management/logistics or purchasing. On request of some interviewees names of respondents and companies are kept confidential. For a detailed overview of the position of each respondent and an overview of the number of respondents per company, we refer to appendix F.

	Supply chain managers / logistics	Purchasers	**Total**
Commodity chemicals	12	11	**23**
Specialty chemicals	16	8	**24**
Total	**28**	**19**	**47**

Table 35: Segmentation sample size

The respondents are located in different European countries: The Netherlands, Belgium, Germany and Switzerland. Figure 29 shows the spread of the respondents over these different countries.

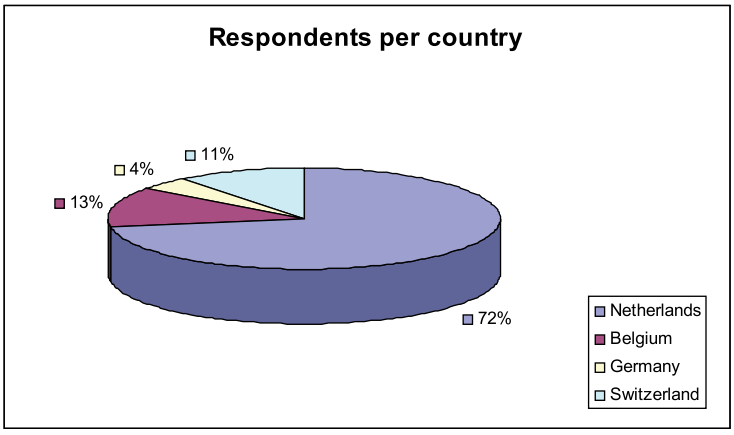

Figure 29: Respondents per country

8.4.2 Findings general questions

Each interview started with general questions about logistics outsourcing and collaboration with logistics service providers. This general information is used to get an idea about the current status of logistics outsourcing and collaboration of the visited company. These results are discussed below.

Logistics outsourcing

During the interviews the respondents' expectations about the developments of logistics outsourcing in the near future are discussed. Figure 30 makes clear that more than half of the respondents expect that the number of services outsourced will increase. Main criteria mentioned for outsourcing additional services is cost reduction followed by avoiding investments in assets. On the other hand, 40% of the respondents do not expect to outsource additional logistics service. The higher level of dependency of service providers is the most mentioned criterion for not outsourcing additional logistics activities. This finding is in line with our findings in the literature study and our case study results. Also the case used in our SP experiment stresses this point.

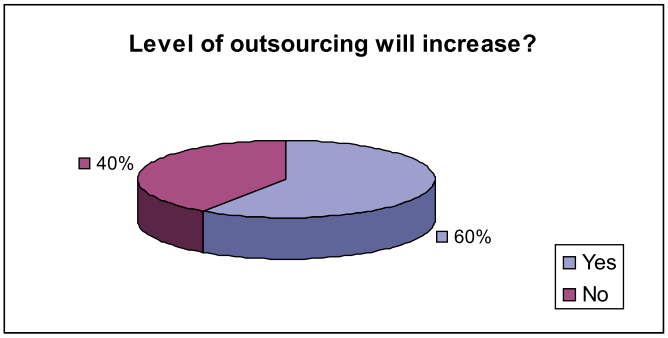

Figure 30: Expectations about level of logistics outsourcing

Interviewees are explicitly asked whether they expect to insource back some of the outsourced activities. Nine respondents (almost 20%) answered positively on this question. Reasons for insourcing back activities are shown in figure 31. This figure shows that lower than expected cost or service levels are the most mentioned reasons for insourcing back some outsourced activities. It needs to be mentioned that according to some respondents outsourcing or insourcing decisions are not based on a fixed (logistics) strategy, but can differ case by case.

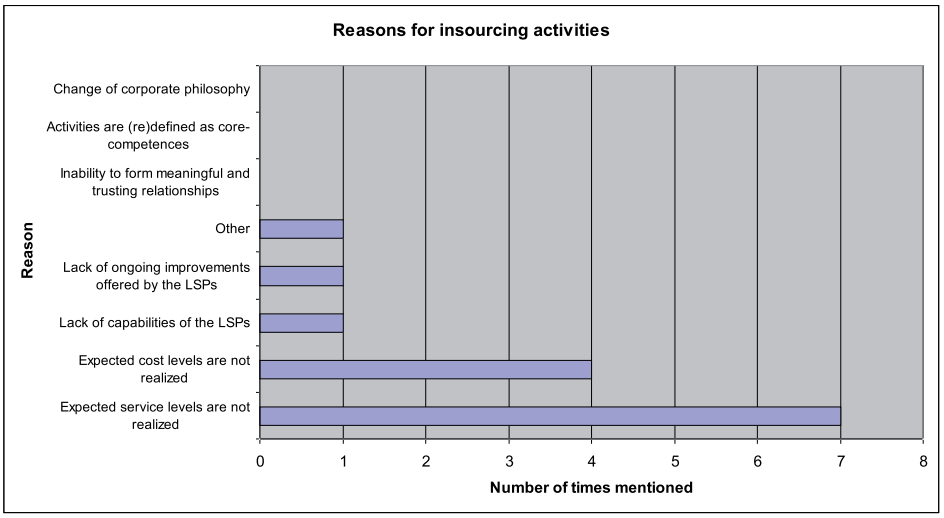

Figure 31: Reasons for insourcing back logistics activities

Collaboration

The previous subsection made clear that outsourced services often have an operational and repetitive character. As a result, the focus in the collaborative relationship is also on operational management and execution of the activities. Shippers are still scared to transfer more responsibilities to a service provider and to start collaboration on a higher level. Fears about loss of transparency, fears about dependency of a certain provider and problems to find a reliable and capable partner are reasons given to not intensify collaboration. Other shippers have identified supply chain design and control as one of their core businesses. Physical logistics is defined as non-core activity by almost all companies. Also our case studies confirm this statement.

The majority of the companies have a certain portfolio of contracted LSPs and do not outsource their service to a single provider. Companies are scared to become too dependent of one or a limited number of providers. Next to this, the providers market is too fragmented. In comparison to an average chemical company, service providers are too small to service a chemical company as a whole or to be competitive in all geographic regions. At plant or business unit level there are still possibilities for closer collaboration. Figure 32 shows that almost 40% of our respondents considers closer collaboration with some of their LSPs.

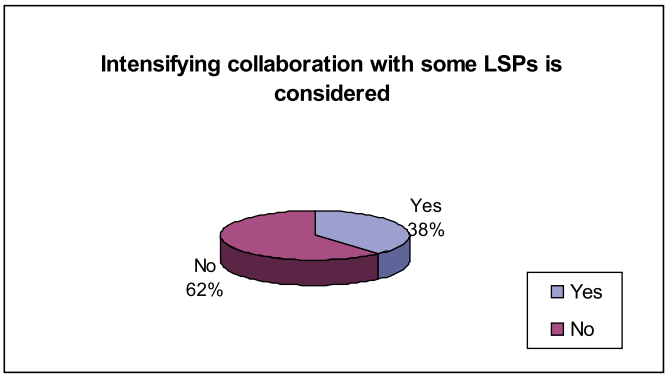

Figure 32: Companies considering closer collaboration

8.4.3 Choice experiment: variables

As discussed in section 8.3, a model estimation procedure is used to find the model with the best overall fit. Table 36 depicts the final results. This table presents the coefficient values of our final model together with the respective t-ratios. Coefficients are significant at a 95% confidence level, if the t-ratio is greater than 1.96. Each coefficient represents the relative importance of an explanatory variable in our binary logit model. The alternative constant that is mentioned in table 36 results from the between mode part of the experiment: the part that respondents choose between basic and intensified collaboration. When interpreting the values in table 36, it should be borne in mind that the coefficients of the quantitative and qualitative variables are presented differently. The coefficients of the continuous variables (cost and service) are multiplied by continuous variables in the final utility function and therefore reflect the disutility per unit of the variable. As a result, these variables have only one coefficient. The coefficients of the discrete variables (trust, confidentiality and commitment) are applied to categorical variables which reflect the total utility increase or decrease for that variable. Therefore, these variables have a coefficient for each level in the choice experiment[38].

38 Except level 1, because for n categories of a discrete variable the model contains at most n-1 dummy variables. Level 1 is the minimum level used in the experiment and therefore set to 0 for the model estimation procedure. Other cofficients should be interpreted as relative to this level.

Title	Final model	
Observations	926	
Final logL	-479.4	
Degrees Of Freedom	12	
Parameters	**Coefficient**	**T-ratio**
Alternative constant	-2.26	(-9.0)
Costs SCM function <= 10 million	-17.00	(-6.1)
Costs SCM function > 10 million	-26.40	(-7.6)
Costs Purchasing function <= 10 million	-5.27	(-2.1)
Costs Purchasing function > 10 million	-17.70	(-6.3)
Service SCM function	44.60	9.8
Service Purchasing function	25.40	5.5
Trust level 4 costs > 10 million	1.03	3.9
Trust level 3 costs > 10 million	0.00	(*)
Trust level 2 costs > 10 million	0.00	(*)
Trust level 2 + 3 + 4 costs <= 10 million	0.77	3.7
Confidentiality level 2 + 4	0.80	3.9
Confidentiality level 3	0.46	2.3
Commitment level 4	-0.32	(-2.6)
Commitment level 3	0.00	(*)
Commitment level 2	0.00	(*)
ScalePart 1	1.00	(*)
ScalePart 2	1.00	(*)
ScalePart 3	1.00	(*)

Table 36: Final estimation results

Table 36 shows the estimated coefficients of the attributes including their signs. Before we collect the data for our SP experiment, we have made assumptions about how each attribute impacts a logistics collaboration decision. A positive sign of a coefficient indicates that the larger the value of this attribute in a particular collaboration alternative, the greater the likelihood that the collaboration will be chosen. On the other hand, a negative sign means that the greater the value of this attribute in a collaboration alternative, the lower the likelihood that the specific collaboration alternative is chosen. Our assumptions are reflected in a series of hypotheses which are described in chapter 5[39]. Table 37 compares our assumptions with the final estimation results. Based on this table, we conclude that the impact of each attribute on a logistics collaboration decision is as assumed, because all estimated coefficients have the signs as expected upfront. Therefore, the related hypotheses are accepted.

39 For a detailed overview of all hypotheses we refer to section 5.1.2

Variable	Hypotheses	Estimation result
Costs	Costs of services provided by LSP are valued *negatively* in logistics collaboration decision.	Negative (-)
Service	Service is valued *positively* in logistics collaboration decisions.	Positive (+)
Trust	Trust is valued *positively* in logistics collaboration decisions.	Positive (+)
Confidentiality	Confidentiality is valued *positively* in logistics collaboration decisions.	Positive (+)
Commitment	Commitment is valued *negatively* in a logistics collaboration decision.	Negative (-)

Table 37: Expected and estimated signs coefficients

During the estimation procedure we explicitly tested whether heterogeneity in the total sample size would result in a better overall model. This makes clear that some subsegments in the total sample can be distinguished. The first subgroup is related to the cost level of the respondent. At the beginning of each interview a respondent was asked for his current logistics cost level to place the experiment in a realistic context for the respondent. The estimation procedure shows that respondents with logistics costs of more than 10 million Euros value the attributes costs and trust differently than respondents with logistics costs less or equal to 10 million. The cost and trust element are more important in the logistics collaboration decision for the first group.

All our respondents have a leadership position in supply chain management / logistics or purchasing. These two different responsibilities are also distinguished in the model estimation procedure. Table 38 shows that the coefficients for the attributes costs and service representing respondents working in logistics and supply chain management have a significant higher value than the coefficients for these variables representing respondents with a purchasing responsibility. As a result, it can be concluded that respondents with a function in logistics or supply chain management attach more value to these two variables in their logistics collaboration decision. The other attributes (trust, confidentiality and commitment) are not valued differently by the two subgroups of respondents.

Finally, the tests on heterogeneity also focus on the product type subgroups distinguished within the chemical industry. Our sample size contains respondents from the two subgroups: commodity and specialty chemicals. The model estimation procedure makes clear that there is no significant difference in the valuation of attributes by respondents representing these two subsegments. This confirms our finding in the case studies as presented in chapter 7.

Table 38 provides an overview of the values attached to each attribute by the subgroups distinguished in our sample.

	Subgroup			
Coefficient	**SCM function and costs <= 10 million**	**SCM function and costs > 10 million**	**Purchasing function and costs <= 10 million**	**Purchasing function and costs > 10 million**
Alternative Specific Constant	-2.26	-2.26	-2.26	-2.26
Costs	-17.00	-26.40	-5.27	-17.70
Service	44.60	44.60	25.40	25.40
Trust level 4	n.a.	1.03	n.a.	1.03
Trust level 3	n.a.	0.00	n.a.	0.00
Trust level 2	n.a.	0.00	n.a.	0.00
Trust level 2 + 3 + 4	0.77	n.a.	0.77	n.a.
Confidentiality level 2 + 4	0.80	0.80	0.80	0.80
Confidentiality level 3	0.46	0.46	0.46	0.46
Commitment level 4	-0.32	-0.32	-0.32	-0.32
Commitment level 3	0.00	0.00	0.00	0.00
Commitment level 2	0.00	0.00	0.00	0.00
n.a. = not applicable for this specific subgroup				

Table 38: Coefficients per subsegment

The second part of the model estimation procedure focuses on the impact of the different attributes on a logistics collaboration decision. The estimation results depicted in table 36 demonstrate that the attributes costs and service are valued as highly significant by all respondents. These are the most important variables in their collaboration decision. These findings are consistent with the findings on decision criteria in our previous research (chapter 2) and our case studies (chapter 7). Moreover, the estimation results show that service and costs are not the only significant variables in a logistics collaboration decision. The experiment proves that some levels of the three immaterial attributes significantly influence the respondents' logistics collaboration decision. These findings are used to test our series of hypotheses that are related to the impact of the five variables on a logistics collaboration decision. Table 39 compares our hypotheses and estimation results. Based on the results of this table, we conclude that all hypotheses related to the impact of the variables on a logistics collaboration decision are accepted. These findings are in line with previous qualitative studies that emphasize human factors like trust and commitment as being important impediments for collaboration between shipper and LSP (e.g. Mentzer et al., 2000; Simatupang and Sridharan, 2002; Verduijn 2004). Unfortunately, no other stated preference studies are available to compare our results.

Variable	Estimated impact	Hypotheses
Costs	Significant	Costs of services provided by LSP *significantly* impact logistics collaboration decision.
Service	Significant	Service *significantly* impacts logistics collaboration decision
Trust	Significant	Trust *significantly* impacts logistics collaboration decision.
Confidentiality	Significant	Confidentiality *significantly* impacts logistics collaboration decision.
Commitment	Significant	Commitment *significantly* impacts logistics collaboration decision.

Table 39: Estimated and expected impact variables

Previous discussion makes clear that decision makers in a logistics collaboration decision not only derive utility from service and cost benefits, but also from immaterial aspects. As a result, decision makers not always choose for the most profitable collaboration decision from an economic point of view. This confirms our hypothesis that the aspect of non-full rationality functions as a threshold to benefit from logistics collaboration. As a result, it may be concluded that decision makers do not act as fully rational agents as defined in neo-classical and new-institutional economics[40]. Models used in the supply chain management literature to prove the potential of vertical collaboration between a shipper and LSP are usually based on these economic streams.

8.4.4 Choice experiment: inertia

The estimation results provide the possibility to explicitly analyze the inertia level of our respondents. Table 36 shows that the value of the Alternative Specific Constant (ASC) is highly significant at a 95% confidence level and has a negative sign. This means that the respondents have a preference for the alternative that was called basic collaboration in our experiment. The ASC represents the resistance to switch to a situation of more intensive collaboration and thus refers to the respondents' inertia level. As a result, this coefficient can be used to test our hypotheses related to inertia. Table 40 compares our inertia hypotheses and estimation results. The table shows that both hypotheses are accepted, because the coefficient of the ASC is valued negatively and has a significant impact. The experiment shows that our respondents display inertia. As a consequence, they do not always respond to relative differences in a rational manner and leave profit-

40 As discussed and conluded in chapter 4, this dissertation follows the neo-classical and new-institutional economics in their definition of fully rational agents.

able collaboration alternatives unexploited. This conclusion confirms our hypothesis that inertia functions as a threshold to benefit from logistics collaboration. This is also in line with our findings in the behavioral decision making literature. Unfortunately, there are no quantitative data available to compare our results.

Estimation	Hypotheses
Negative (-)	Inertia is valued *negatively* in a logistics collaboration decision.
Significant	Inertia significantly impacts a logistics collaboration decision.

Table 40: Estimated and expected results inertia

Table 41 shows a more detailed analysis of the ASC term. In this table the ASC term is expressed as a percentage of the current logistics cost level for each subgroup distinguished in our sample. Next to this, for each of these percentages the respective t-ratio is depicted. This table shows that those purchasers with logistics costs less than or equal to 10 million Euros have the highest resistance to change. They need more than a 35% cost saving to switch to a more intensive type of logistics collaboration. At the other side, respondents with a logistics or supply chain management responsibility and a cost level of more than 10 million Euros have the lowest inertia level of the four subgroups in our sample. They are willing to switch to a different type of logistics collaboration when the cost saving is almost 9%.

	SCM function and costs <= 10 million	SCM function and costs > 10 million	Purchasing function and costs <= 10 million	Purchasing function and costs > 10 million
Observations	297	255	155	219
Final logL	-148.2	-114.6	-89.0	-116.2
Degrees Of Freedom	7	7	7	7
Alternative constant	0.133 (-4.3)	0.0861 (-4.8)	0.354 (-4.3)	0.125 (-4.5)
Costscale	1.00 (-5.0)	1.00 (-6.3)	1.00 (-2.6)	1.00 (-5.6)

Table 41: ASC expressed in terms of costs

The ASC analysis can also be used to determine the monetary value of service. This monetary value is defined as the ratio of the percent change of service to the percentage change in costs. These results distinguished per subgroup are depicted in table 42. This shows that respondents with a supply chain or logistics responsibility with logistics costs less or equal to 10 million Euros a 1% service improvement is equivalent to a cost reduction of 2.76%. The second group, supply chain responsibility and a cost level of more

than 10 million Euros, is willing to pay 1.75% more for a service improvement of 1%. For the last two subgroups these percentages are 1.19% and 2.00%.

	SCM function and costs <= 10 million	SCM function and costs > 10 million	Purchasing function and costs <= 10 million	Purchasing function and costs > 10 million
Observations	297	255	155	219
Final logL	-148.2	-114.6	-89	-116.2
Degrees Of Freedom	7	7	7	7
Service	-2.76 (7.2)	-1.75 (6.6)	-1.19 (1.5)	-2.00 (5.3)
Costscale	1.00 (-5.0)	1.00 (-6.3)	1.00 (-2.6)	1.00 (-5.6)

Table 42: Monetary value of service

8.5 Concluding remarks

This chapter describes the design and results of the conducted stated preference experiment. This experiment is used to test the literature review results presented in chapter 5. In chapter 5, we conclude that behavioral decision making literature identifies two elements that can function as a threshold to benefit from logistics collaboration next to the impediments that are already described in the logistics outsourcing and collaboration literature. These two aspects are: non-full rationality of individual decision makers and the existence of inertia. Both aspects can be a reason to not select the most beneficial collaboration option from an economic point of view. Our SP experiment is used to verify these theoretical findings and to quantify the impact of these aspects.

The results of this experiment show that decision makers in logistics collaboration decisions value trust, confidentiality and commitment as significant variables in their collaboration decision. This finding confirms that individuals making vertical collaboration decisions cannot be seen as fully rational agents, because they take immaterial aspects into account in such a decision. We conclude that the aspect of non-full rationality functions as a threshold to select the most profitable collaboration alternative from an economic point of view. Next to this, the experiment proves that the respondents have a significant level of inertia which constrains the intensification of logistics collaboration. Also inertia functions as a threshold to fully exploit the potential service and costs benefits of vertical logistics collaboration. Therefore, it may be concluded that the SP experiment confirms our theoretical findings. Finally, the stated preference results make it possible to quantify the impact of each single variable relative to cost in a shipper's collaboration decision.

PART III: CONCLUSIONS AND RECOMMENDATIONS

9. Conclusions and recommendations

This is the final chapter of this dissertation. In this chapter, the main conclusions of this research are summarized. Furthermore, scientific and managerial contributions are highlighted. Finally, limitations and directions for further research are discussed.

9.1 Conclusions

Given the observation that in practice a number of thresholds prevent the potential benefits of logistics collaboration from being exploited, it is the objective of this research project to measure these thresholds. To reach this final objective, the research has started with reviewing three streams of literature: logistics outsourcing, collaboration and behavioral decision making. The literature review ends with the presentation of a cross-section of the theoretical findings. This cross-section shows the connection between the three streams and also illustrates the two main conclusions that result from the theoretical part of the thesis. First, literature review results in an extensive list of variables that possibly influence a logistics collaboration decision. Costs, service, trust, confidentiality and commitment are identified as the five key variables on this list. Second, the behavioral decision making literature identifies two additional thresholds of logistics collaboration compared to the impediments that are described in the logistics outsourcing and supply chain collaboration literature. One of these additional thresholds is the fact that individual decision makers cannot be seen as fully rational agents as defined in the neo-classical and new-institutional economics. This means individuals do not only derive utility from material incentives, but also immaterial aspects impact a collaboration decision. By contrast, full rationality of decision makers is often assumed in optimizing models used in supply chain literature to prove the potential of logistics collaboration. In addition, the behavioral decision literature mentions also the existence of inertia as a threshold for collaboration. As a result, decision makers are reluctant to change and do not always respond to potential savings in a rational matter.
The empirical setting of this research consists of seven explorative case studies and a stated preference experiment. The case studies are used to validate theoretical findings and through that create a solid base for the stated preference experiment. The case

studies result in three main findings. First, our cases confirm the theoretical conclusion that costs, service, trust, confidentiality and commitment are the key variables in a logistics collaboration decision between shipper and logistics service provider. Furthermore, the cases show that logistics services most frequently outsourced have an operational and repetitive character. Next to this, the majority of the collaborative relationships between shippers and LSPs in our cases are characterized as bundling because of the operational character and short term focus. The shippers are still scared to transfer more responsibilities to the logistics service providers. Finally, the shippers in our cases use a traditional purchasing approach with a strong focus on costs, in terms of price, and low level of involvement of the supplier during the purchasing process despite the fact that the complexity of logistics services increases and the logistics services sourced are positioned in different quadrants of Kraljic's purchasing portfolio.

A stated preference experiment is used to reach the final research objective: measuring the thresholds in a logistics collaboration decisions between shipper and LSP. Based on the results of the literature review and case studies, the design of the experiment includes five variables: costs, service, trust, confidentiality and commitment. The stated preference experiment results in the following main conclusions. The experiment confirms our theoretical finding that the fact that decision makers are not fully rational agents, functions as a threshold to benefit from logistics collaboration. The experiment shows that rational elements like costs and service are the most important variables in logistics collaboration decisions, but also proves and quantifies the significant impact of immaterial incentives like trust, commitment and confidentiality. Further analysis of the stated preference data shows there are differences in how respondents value the five variables in a logistics collaboration decision, because of their responsibility in the organization or their current costs level. Decision makers with a supply chain management or logistics responsibility attach more value to the variables costs and service in a logistics collaboration decision than their colleagues with a purchasing responsibility. The immaterial variables, trust, commitment and confidentiality, are valued equally by both subgroups. Besides, respondents with relatively high logistics costs value the attributes costs and trust differently from respondents with relatively low logistics costs. The costs and trust variables are more important in the logistics collaboration decision for the first group.

The stated preference experiment also confirms the existence of inertia which constrains the intensification of logistics collaboration. This inertia level is significant and quantified in terms of service and costs. As a result, our empirical data prove the theoretical finding that inertia functions as a threshold to benefit from logistics collaboration. A more detailed analysis of the inertia levels explains there are differences in the inertia

levels depending on the subgroups identified in our sample: supply chain management / logistics versus purchasing responsibility and high versus low logistics costs.
The findings discussed above can be used to answer our two research questions. In our answer to the first question, we conclude that both the existence of inertia and the non-full rationality of decision makers hamper a shipper to intensify collaboration with a logistics service provider. With regard to the second question, we conclude that the research results quantify the impact of trust, commitment and confidentiality in a shipper's collaboration decision to intensify collaboration with a LSP. Next to this, the research results quantify the minimum cost savings needed before a shipper is willing to intensify collaboration with a logistics service provider. These cost savings differ for the subgroups distinguished in our sample.

9.2 Contributions

9.2.1 Scientific contributions

Supply chain management and decision making behavior are usually separated fields that are studied by different groups in academia. This research integrates both fields and shows the decision making behavior literature is useful to understand the complexity of logistics collaboration decisions. Models used in supply chain management literature, that aim to prove the potential of vertical collaboration between a shipper and LSP, often involve simplified representation of human behavior. At the other hand, the behavioral decision making literature emphasizes that immaterial aspects significantly impact collaboration decisions. Our empirical data quantify the impact of these aspects and also prove their significant role. As a result, this research contributes to the academic debate of logistics collaboration decisions between shippers and LSPs. This research shows that this debate should not only improve cost-benefit considerations and analysis, but also shift the attention to the immaterial side of these decisions. In addition, better incorporating human behavior into the existing models will yield more realistic insights and thus improve the precision and rigor of these models.
Next to this, the behavioral decision making literature also clarifies that decision makers not always respond to a relative difference in a rational manner, due to the existence of inertia. Our research explicitly focuses on and verifies the existence of inertia in logistics collaboration decisions. To our best knowledge, no empirical research has been conducted earlier to quantify and test the level of inertia in such decisions. Focus on the concept of inertia helps to understand why the potential benefits are not always achieved in practice and shows that this concept is an interesting research area that deserves more attention in the future.

This research uses a stated preference experiment to reach the final research objective. This method is widely used in marketing and passenger transport studies, but has not been used very often in research about logistics outsourcing and collaboration. Our experiment is specifically designed for this specific context and can be used by other researchers to model decisions in the logistics field. Besides, hopefully the results of this research encourage the logistics scientific community to more often select research methods that are relatively new for the logistics field, but proved and used by other fields. This is not a goal to be reached, but gives the possibility to integrate findings, increase our understanding of a specific phenomenon and enhance the validity of research.

9.2.2 Managerial contributions[41]

The insights obtained from the case descriptions may be used by practitioners for reflecting on their own business processes and making improvements. Especially in the organization and design of a tender process for advanced logistics services, they can be useful, because the content and organization of such processes are important to come to a situation where shipper and LSP benefit more from logistics collaboration. The cases show that especially tender processes with an open character and higher involvement of the LSP give better possibilities to define a logistics concept that fits into the current operations of a logistics service provider. As a result, this makes it possible to decrease the total costs for shipper and LSP. It is as if the way of tendering determines the result. Furthermore, this research proves that immaterial incentives are significant factors in a collaboration decision between shipper and LSP. These insights stretch the importance of relationship management in a collaborative relationship between shipper and LSP. Especially LSPs should be aware of this and pay attention to such aspects in a tender process. Emphasizing only the possible cost savings of a certain logistics solution is insufficient to convince the other party to change its routines. In addition, relationship management is not only important during a tender process, but also after implementation. The entire contract term gives a LSP the possibility to present improvement proposals to the customer. Such a way of working will require an active attitude of the LSP. Nevertheless, it also increases the level of trust and commitment at the shippers' side, and thus helps to relieve the thresholds of logistics collaboration. In addition, LSPs could make better use of best practices from other customers to convince a shipper of a different from of collaboration.

41 The managerial contributions present in this section are based on a discussion session with 20 representatives of the chemical and LSP industry in April 2009.

Also, our study shows a significant level of inertia at the shippers' side to intensify the level of collaboration with logistics service providers. As a result, profitable collaboration alternatives between shipper and LSP remain unexploited. This makes clear that in the logistics field more attention needs to be paid to different aspects of change management to relieve the existing thresholds.
Next to this, it is important that shippers develop long term logistics objectives and that these objectives are supported through the entire organization including the top management level. At the moment, shippers often act without such logistics objectives and that does not create a solid base to benefit form logistics collaboration. Long term objectives and corresponding commitments also support LSPs to invest in the relationship with a particular customer.
Finally, the findings of our study should also encourage the different branch organizations in the chemical industry to keep the subject of supply chain collaboration at their agendas. In the past, the branch organizations have defined supply chain collaboration as one of the important aspects to ensure the long term competitiveness of the chemical industry (ECTA, 2006; McKinnon, 2004). Stronger relationships need to be established between shippers and LSPs to find truly innovative and competitive supply chain solutions. This study proves that there are thresholds to come to these stronger relationships and it quantifies the aspects that are taken into account in a logistics collaboration decision. Therefore, the next step for the branch organizations is to support the industry to relieve the existing thresholds. This can be done by stimulating their members to share best practices of stronger collaboration between shipper and LSP. These best practices should quantify the benefits of a stronger form of logistics collaboration, explain what the underlying logistics concepts are and explain how the change towards a stronger form of logistics collaboration can be reached.

9.3 Limitations and further research

Despite the contributions this research made, there are some limitations and areas for further research. Concerning the data collection, two limitations arise. First, data collected in this research project are limited to the chemical sector. As a result our findings cannot be directly generalized to other industries. This should be accomplished through additional verification: more companies and industries should be examined. Second, data for the stated preference experiment are only collected at the shippers' side, because a shipper is the purchasing and thus leading actor in collaboration decisions between shippers and LSPs. Including the service providers' side in further research may result in additional insights regarding logistics collaboration decisions between shippers

and LSPs. This means that the design of the stated preference experiment needs to be adapted to the different roles both types of firms have in collaborative relationships.
Other limitations can be found in the design of our experiment. The number of variables included in the design is limited, because decision makers are restricted in the number of variables that they can take into account in their decision and including too many variables in a design makes a choice experiment too complex. The included variables are identified as key variables in logistics collaboration decisions between shippers and LSP's in our literature review and case studies. The remaining variables are represented by the error term in the utility function. It is possible that the key variables in logistics collaboration decisions change over time. Therefore, we recommend to periodically research the key variables in logistics collaboration decision making between shippers and LSPs to notice a possible change in the importance of each variable. The stated preference design needs to be adapted in case a change in the key variables is identified.
Next to this, our experiment gives a respondent the choice to reduce logistics costs by implementing a different logistics concept which requires more intensive collaboration with a logistics service provider. To make this choice clear and explicit to the respondent a standard case description is used. Therefore, the results of our experiment are related to this specific situation and cannot directly generalized to collaborative relationships between shipper and LSP in general. This could be achieved through additional empirical research; the current design needs to be developed further to analyze whether different situations will also result in different conclusions.
In addition, the results of the stated preference experiment identify areas for further research. The data show that respondents from different subgroups value some of the choice variables differently and have different levels of inertia. Nevertheless, our research does not explain why these differences exist. Further work could focus on understanding these differences. Next to this, our results do not show whether there is any relation between the differences in inertia level and the differences in the valuation of the choice variables by the subgroups. This relation can be an area for further research.
Furthermore, the designed experiment is used to measure the thresholds in logistics collaboration decisions and to quantify the relative importance of the underlying factors of these decisions. This information can be used in further research projects to derive recommendations for removing or relieving these thresholds. A longitudinal study is useful to measure whether the thresholds of logistics collaboration decrease over time after implementation of these recommendations. The stated preference experiment of this study can be used to collect the data for this longitudinal study. Also Selviaridis and Spring (2007), suggest using longitudinal studies in logistics to examine the development of research topics over a certain period of time.

Finally, based on the results of our case studies further research could be aimed at sourcing strategies for logistics services. Our cases show that most practitioners acknowledge the increased complexity of logistics outsourcing, but do not all respond by differing their sourcing strategies as expected based on the literature. Shippers also respond by changing their outsourcing strategy and internal organization to respond to the increased complexity of logistics outsourcing. Further research is needed to better understand this phenomenon and to define what the effect of the different responses is.

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List of Figures

Figure 1: Logistics costs as percentage of sales (1987 – 2013) 18
Figure 2: Outline thesis 26
Figure 3: Business and Logistics Strategy 33
Figure 4: Kraljic's purchasing portfolio 37
Figure 5: Position of Logistics Services within Kraljic Matrix 41
Figure 6: Synergy typology 47
Figure 7: Relationship ladder adapted from Gulati and Kletter 48
Figure 8: Essence of the Transaction Cost Theory 51
Figure 9: Variables, drivers and impediments of collaboration 63
Figure 10: Phases of decision making process 66
Figure 11: Overview theoretical findings on behavioral decision making 77
Figure 12: Theoretical findings 81
Figure 13: Geographic Breakdown of World Chemicals Sales 2008 87
Figure 14: Conflicting cost pressure 89
Figure 15: Vicious circle LSPs 91
Figure 16: Profitability tank and bulk sector 92
Figure 17: Position of the different cases at the relationship ladder 111
Figure 18: Position cases in Kraljic's matrix: perception respondents 111
Figure 19: Kraljic's valuation procedure 113
Figure 20: Position cases in Kraljic's matrix: researcher's perception 113
Figure 21: Example of a choice card used to present an alternative to a respondent 126
Figure 22: Concept: basic collaboration 133
Figure 23: Concept: more intensive collaboration 135
Figure 24: Example first part of the experiment 139
Figure 25: Example second part of the experiment 140
Figure 26: Example third part of the experiment 141
Figure 27: Trading between collaboration alternatives 143
Figure 28: Logistics services outsourced 149
Figure 29: Respondents per country 150
Figure 30: Expectations about level of logistics outsourcing 151
Figure 31: Reasons for insourcing back logistics activities 152

Figure 32: Companies considering closer collaboration 153
Figure 33: Supply chain structure case A 201
Figure 34: Position case A in Kraljic's matrix: respondents' perception 202
Figure 35: Case A Kraljic valuation procedure 203
Figure 36: Position case A in Kraljic matrix: researcher's perception 203
Figure 37: Position case A at relationship ladder 206
Figure 38: Supply chain structure case B 207
Figure 39: Position case B in Kraljic's matrix: respondents' perception 208
Figure 40: Case B Kraljic valuation procedure 209
Figure 41: Position case B in Kraljic matrix: researcher's perception 209
Figure 42: Position case B at relationship ladder 211
Figure 43: European supply chain structure 213
Figure 44: Position case C in Kraljic's matrix: respondents' perception 214
Figure 45: Case C Kraljic valuation procedure 214
Figure 46: Position case C in Kraljic matrix: researcher's perception 215
Figure 47: Position case C at relationship ladder 217
Figure 48: Supply chain structure case D 219
Figure 49: Position case D in Kraljic's matrix: respondents' perception 220
Figure 50: Case D Kraljic valuation procedure 220
Figure 51: Position case D in Kraljic matrix: researcher's perception 221
Figure 52: Position case D at relationship ladder 223
Figure 53: Flows coordinated by Dutch country organization 224
Figure 54: Position case E in Kraljic's matrix: respondents' perception 226
Figure 55: Case E Kraljic valuation procedure 226
Figure 56: Position case E in Kraljic matrix: researcher's perception 227
Figure 57: Position case E at relationship ladder 229
Figure 58: Supply chain structure case F 230
Figure 59: Position case F in Kraljic's matrix: respondents' perception 231
Figure 60: Case F Kraljic valuation procedure 231
Figure 61: Position case F in Kraljic matrix: researcher's perception 232
Figure 62: Position case F at relationship ladder 234
Figure 63: Supply chain structure case G 235
Figure 64: Position case G in Kraljic's matrix: respondents' perception 236
Figure 65: Case G Kraljic valuation procedure 237
Figure 66: Position case F in Kraljic matrix: researcher's perception 237
Figure 67: Position case G at relationship ladder 240

List of Tables

Table 1: Terminology used to describe logistics outsourcing phenomenon 30
Table 2: Classifications of logistics services, adapted from Zeegers 34
Table 3: Reasons for outsourcing logistics, summary of previous surveys. 35
Table 4: Classifications of levels of supply chain collaboration 46
Table 5: Organization theories compared 56
Table 6: Variables identified by organization theories 57
Table 7: Variables as identified in the reviewed organization theories 57
Table 8: Comparison of decision variables with DFA model 59
Table 9: Different economic views compared 69
Table 10: Definition and impact of key variables 80
Table 11: Hypotheses for empirical testing 84
Table 12: Sources of data per case study 98
Table 13: Case study respondents 100
Table 14: Validity and reliability in case studies 102
Table 15: Company characteristics 104
Table 16: Product characteristics per case 105
Table 17: Characteristics supply chain structure per case 106
Table 18: Drivers of logistics outsourcing 107
Table 19: Type of activities outsourced per case 108
Table 20: Impediment logistics outsourcing 109
Table 21: Cross-case analysis tender projects 116
Table 22: Selection criteria used in case studies 118
Table 23: Comparison decision criteria in commodity and specialty market 120
Table 24: Complexity of logistics outsourcing increased 123
Table 25: Variables included in the experiment 132
Table 26: Attribute levels part I: basic versus basic collaboration 136
Table 27: Attribute levels part II: basic versus intensified collaboration 137
Table 28: Attribute levels part III: intensified versus intensified collaboration 138
Table 29: Observations included in the analysis 142
Table 30: Model statistics explained 144
Table 31: Linearity test costs and service 145

Table 32: Model estimation procedure 146
Table 33: Company characteristics SP experiment 148
Table 34: Comparison sample sizes 149
Table 35: Segmentation sample size 150
Table 36: Final estimation results 154
Table 37: Expected and estimated signs coefficients 155
Table 38: Coefficients per subsegment 156
Table 39: Estimated and expected impact variables 157
Table 40: Estimated and expected results inertia 158
Table 41: ASC expressed in terms of costs 158
Table 42: Monetary value of service 159

Appendix A:
Overview explorative interviews

Name	Title at Business card	Organization	Date
Frank Otten	General Manager Physical Distribution	DSM	October 2006
Cathy Demeestere	Secretary General	European Petrochemical Association (EPCA)	December 2006
Rose-marie Pype	Logistics Manager	European Chemical Transport Association (ECTA)	December 2006 February 2008
Leen de Rijke	President	De Rijke	November 2007

Appendix B:
Questionnaires case studies

Shippers

1. Introduction

1.1 Introduction to the research project:
- Topic
- Objectives

1.2 Personal introductions:
- Tasks and responsibilities of the respondent
- Background of the researcher

1.3 Discuss the possibility to participate anonymous (organization and persons)

1.4 Duration of the interview: approximately one and half hour

1.5 Explain structure of the interview.
- 1) Introduction
- 2) General questions about the company and supply chain characteristics
- 3) Questions about logistics outsourcing
- 4) Questions about a specific tenderproject
- 5) Closing of the interview

2. General questions about company and supply chain characteristics

2.1 Can you explain the organizational structure of the company?
- Where is logistics / supply chain management represented?
- Is logistics used to create competitive advantage?
- Where are you positioned in this structure?

2.2 What are the main characteristics of the overall business strategy?
- Which external and / or internal developments influence this strategy?
- How is the logistics strategy related to the overall business strategy?

2.3 Can you give a high level overview of the supply chain characteristics of your company?
- What are the main product flows?

- Number and location of production plants?
- Number and location of stock points?
- Kind of transport modes used?
- What is the order entry procedure?

2.4 What are the characteristics of the market where your products are sold?

- Number of competitors?
- Where are your main customers located?
- Is there any supply uncertainty?
- Is demand predictable?

2.5 Can you explain some characteristics of your products?

- Value density
- Package density

3. Logistics outsourcing

3.1 To what extent are logistical activities outsourced to LSPs?

3.2 What were the internal or external drivers to outsource (some) logistics activities?

3.3 Are there any concerns to increase the level of logistics outsourcing?

3.4 How many different LSPs are contracted?

3.5 Do you think the complexity of logistics outsourcing has changed over the last 5 years?

- In case the answer is yes; more or less complex?
- In case the answer is yes; reasons
- In case the answer is yes; response to this change?

4. Questions about specific tender project.

The respondent is asked to choose a tenderproject that has taken place not longer than three years ago.

4.1 Which kind of logistics activities were sourced during the tender?

4.2 How important are the services sourced in this project for the overall performance of the company?

- Is the profit impact of the services sourced high or low?
- Is their a (non-delivery) risk for the sourced services? High or low?
- Is substitution of the service supplier difficult?
- Are many other service suppliers available?
- Is it a standard service or is special knowhow required?

4.3 How many phases contained the followed tender process?

4.4 What was the content of each phase?

- What was the role of the LSP in each phase?

4.5 Which departments were involved in the tender process?
- Where all the people involved in all phases?
- Who was responsible for the final decision?

4.6 Which decision criteria were used to make the final decision?

4.7 Is the structure and contents of the tender process different for other logistics services?

4,8 How should you characterize the relationship with the selected LSP?
- What is the balance of power in the relationship (dominant party)?
- Do you characterize this service provider as a critical supplier?
- What is the duration of the contract?
- Is it the first time you collaborate with this LSP?

5. Closing

5.1 This interview will be transcribed. I would like to ask you to review the transcript and case study report to be sure everything is understood well.

5.2 To summarize agreements made during the interview:
- Anonymity of the company in research publications
- Sending additional information
- Reviewing interview transcript and case report

5.3 Do you have any remarks or observations in consequence of this interview?

5.4 Thank respondent for participation.

LSPs

1. Introduction

1.1 Introduction to the research project:
- Topic
- Objectives

1.2 Personal introductions:
- Tasks and responsibilities of the respondent
- Background of the researcher

1.3 Discuss the possibility to participate anonymous (organization and persons)

1.4 Duration of the interview: approximately one and half hour

1.5 Explain structure of the interview.
- 1) Introduction
- 2) General questions about logistics network and business strategy
- 3) Questions about tenderproject of a specific shipper
- 4) Closing of the interview

2. General questions about logistics network and business strategy

Logistics network of the company

2.1 Can you explain the organizational structure of the company?
- Where are you positioned in this structure?

2.2 What are the main characteristics of the overall business strategy?
- Which external and / or internal developments influence this strategy?

2.3 Characterize you your company as a 2PL, 3PL or 4PL service provider?

2.4 Can you give a high level overview of the logistics network of your company?
- Logistics services supplied?
- Different transport modes used?
- Number and location of distribution centres / hubs?

2.5 What is your competitive position in the market?
- Who are your main competitors?
- Who are your main customers?

2.6 In which sectors are your main customers operating?
- Chemical, high tech, fashion, automotive, retail etc.?

3. Questions about tender project of specific shipper.

The respondent is asked to answer the following questions for the same tender project as discussed with the shipper.

3.1 Which kind of logistics services were sourced during the tender project?

3.2 How important is this customer for the overall performance of your company?
- Is this shipper one of your main customers?
- Percentage of the turnover?

3.3 Would it be difficult for your customer to substitute you as its supplier?
- *Are there many competitors available in the market?*

3.4 How many phases contained the tender process?

3.5 What was the content of each phase?
- What was the role of the LSPs in each phase?

3.6 Which departments were involved during the tender process?
- Where all the people involved in all phases?

3.7 Do you know which decision criteria were used by the shipper to select you as its LSP?

3.8 How should you characterize the relationship with your shipper?
- What is the balance of power in the relationship?
- Can the relationship be characterized as a partnership?
- What is the duration of the contract?
- Is this the first time you collaborate with this shipper?

4. Closing

4.1 This interview will be transcribed. I would like to ask you to review the transcript and case study report to be sure everything is understood well.

4.2 To summarize agreements made during the interview:
- Anonymity of the company in research publications
- Sending additional information
- Reviewing interview transcript and case report

4.3 Do you have any remarks or observations in consequence of this interview?

4.4 Thank respondent for participation.

Appendix C:
Coding scheme case studies

Main groups	Subgroups
Case characteristics	Organizational structure Market information Productinformation Strategy Role logistics Position Kraljic portfolio SCM structure
Logistics outsourcing	Drivers Barriers Type of activities Complexity increase Response
Logistics collaboration	Type of activities Joint activities Commitment Level of trust
Tenderprocess	Phases Departments Differentiated approach Decision criteria

Appendix D:
Market characteristics case studies

Case	Strategy	Market structure	Supply uncertainty	Demand uncertainty
A	Market development	Open competition	Low	High
B	Market penetration	Open competition	Low	High
C	Market penetration and market development	Open competition	Low	Low
D	Market penetration and market development	Open competition	Low	Low
E	Market penetration	Open competition	Low	High
F	Market development	Open competition	Low	Low
G	Market development	Open competition	Low	High

The market characteristics are described to compare the business strategies of the case study companies. The strategy is classified by using a classification provided by Ansoff (1957). In this classification four different strategies are distinguished: market penetration, product development, market development and diversification. The table above shows that the shippers in the cases follow different strategies to achieve the companies overall objectives. The market situation in each case is compared by using the following typology: monopoly, oligopoly, limited competition, open competition. All shippers operate at a market that is characterized by open competition. During the interviews shippers stress the strong and increasing competition in the chemical industry.
Next to this, we use the uncertainty framework provided by Lee (2002) to compare the supply and demand uncertainty of each case. Lee has defined his framework by expanding on the ideas of Fisher, who found that products can be categorized as either primarily functional or primarily innovative based on their demand characteristics. Lee adds also the supply side of the chain and defines a two by two uncertainty matrix. In this matrix the horizontal axis represents the demand uncertainty. This uncertainty is low or high. The vertical axis reflects the supply uncertainty and also this is classified as low or high. These two dimensions are also used to classify demand and supply uncertainty in

our cases. We follow Hopp and Spearman (2008) and use the variability in the demand and supply to define whether the supply or demand uncertainty is low or high.
They explain that the variability of a flow can be calculated by dividing the standard deviation of the number of demands (or supplies) per period of time by the mean of demands (or supplies) per period of time[42]. The uncertainty is low in case this value is less than or equal to 1.04 and high in case this value is larger than 1.04 (Hopp and Spearman, 2008). The supply uncertainty is defined as low in all cases. The shippers explain that the inbound flow is relativly constant. Next to this, they mention that there are sufficient suppliers available and that pipelines are often used to transport the products to the plants. The demand side shows a more heterogeneous picture. Case A, B, E and G are characterized by a high level of demand uncertainty. Also here the shippers confirm this conclusion. Shippers in case A, B and G explain that they operate in a volatile market and that they do not have long term agreements with their customers that fix prices and volumes for a certain period of time. As a result, the demand fluctuates strongly because of the speculative character of the market. The shipper of case E explains that the demand uncertainty is high, because the business unit operates in the crop protection market which is highly influenced by seasonal influences and weather circumstances. On the other hand, the demand uncertainty of the shippers in case C, D and F is marked as low. Shippers explain that they have mid and long term agreements with their customers about prices and volumes that will be delivered in a certain period. These agreements lower the demand uncertainty.

42 The accompanying formula is: $c = \sigma_t/\mu_t$ (Hopp and Spearman, 2008).

Appendix E:
Single case study reports

Case A: Hub operation

Introduction

Case A is conducted at the Polymer division of a global operating chemical company. The Polymer division has activities in three regions: Europe, Asia and America. The European region is headquartered in the Netherlands. This division is responsible for the sales and distribution activities of the Polyolefin products at the European market. These products are manufactured in the Far East. Afterwards, the products are exported to Europe. The management of the Asian region is responsible for these manufacturing and distribution activities. The central European supply chain department takes over the responsibility at the moment the products arrive in a European port. For the distribution of the Polyolefin products within Europe a hub structure is used. All five hubs are owned and operated by logistics service providers. Four different service providers are contracted to run the hub operations for dependency reasons. Moreover, the shipper prefers to contract medium sized service providers, because in comparison to the large players these medium sized providers show a higher level of commitment to the shipper, the organizations are more transparent and the shipper's negotiation position in better. For the replenishment of the hub intermodal transport is used; for the final delivery to the European customers mainly road transport is used. The European supply chain structure is depicted in figure 33.

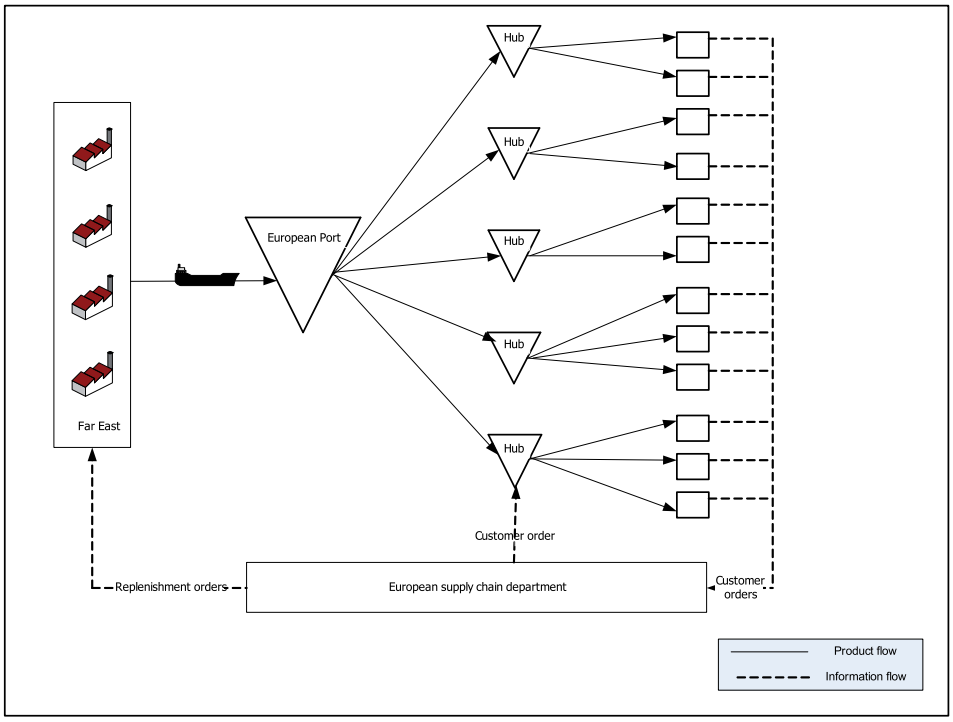


Figure 33: Supply chain structure case A

The Polyolefin market can be characterized as a commodity market, because Polyolefin are standard products and there are a large number of competitors. Competitive advantage in the market can be gained by product performance or service offered to the customer. Two types of service are distinguished. First, logistics service defined as delivering the right product at the right moment in the right quantity. Second type of service is technical marketing. This last type of service refers to the support given to customers to install their production machinery in such a way that the product performance is most optimal. Although logistics service is marked as a way to gain competitive advantage, the customers are not wiling to pay a higher price for a higher level of logistics service. As a result logistics within this company is strongly cost driven. Nevertheless, the shipper has the aim to use a more integral approach for logistics decisions in the near future to secure supply of logistics services. This integral approach means that not only pricing, but also elements like transaction costs and service aspects are taken into account.
The current five hubs are not longer sufficient to serve all European customers, because the Polyolefin market is growing, especially in Eastern Europe. For this reason an extra hub is needed to serve the Eastern European customers. A purchasing project is started

to select the service provider for this hub in Eastern Europe. The selected service provider will be responsible for the following activities: customer clearance and brokerage activities after the products arrive in the port of Antwerp, (intermodal) transport of the products to the Hub in Eastern Europe, repack and storage of the products at the hub and coordination of the deliveries of the products to the customers in Eastern Europe. The activities will be handed over to one single provider to keep the coordination of these activities in one hand and to limit the number of contracted suppliers. At the other hand, the subcontractors used to deliver the customers are sourced and contracted by the shipper for dependency and control reasons.
The shipper positions the package of service sourced for the hub operation in Eastern Europe between leverage and strategic items in Kraljic's purchasing portfolio. The position on the profit impact axis is valued relatively high, because logistics service is identified as one of the major competitive advantages. The position at the supply risk is in between low and high, because there are not many suppliers in the market that can provide the package service required, but the negotiation position of the shipper is still strong, because of the difference in size between both companies.

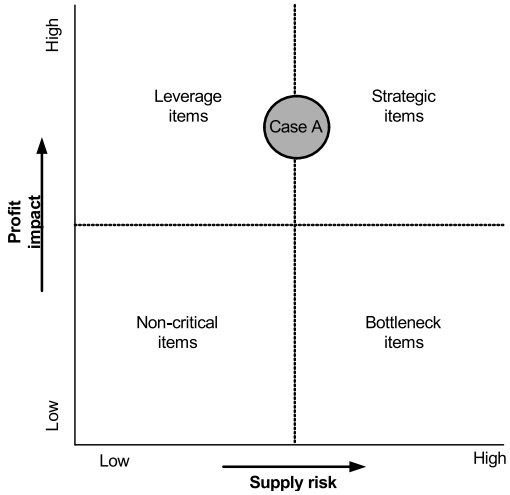


Figure 34: Position case A in Kraljic's matrix: respondents' perception

The case is also positioned in the Kraljic's matrix by the researcher. We use the methodology as explained in chapter 7. This results in figure 35 and 36. Figure 35 is used to determine the positions at the axis and figure 36 depicts the position in the Kraljic matrix.

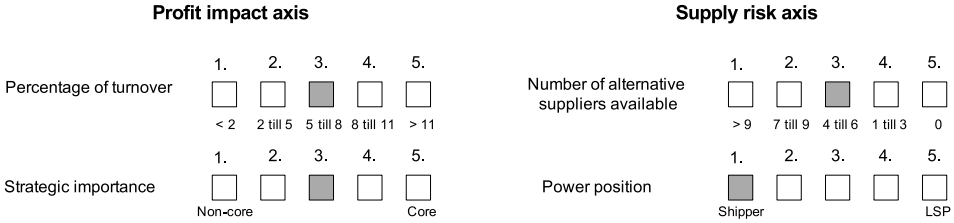


Figure 35: Case A Kraljic valuation procedure

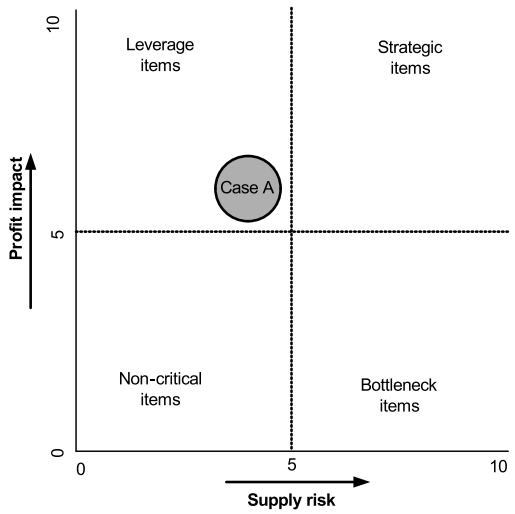


Figure 36: Position case A in Kraljic matrix: researcher's perception

The LSP that is involved in this case is headquartered in the Netherlands. It is a medium sized logistics service provider specialised in intermodal transport and storage of bulk products and liquids. The LSP has the possibility to use its own assets for their operations, but also subcontract other providers. Therefore, the LSP can be characterized as a 3PL provider. The LSP focuses especially on Northern and Eastern Europe.

Logistics outsourcing

Logistics outsourcing is part of the logistics strategy of the Polymer division, because the shipper does not want to invest in logistics assets, specialised providers are able to execute the logistics operations at lower costs and the operational execution of logistics activities is not defined as core business. On the other hand, supply chain structuring and orchestration activities, amongst other things, replenishment shipments for the Eu-

ropean market, inventory management and order fulfilment are defined as core competences and for that reason not outsourced to external service providers.
The shipper indicates that the complexity of the logistics outsourcing has increased over the last decades, because of the global character of the current Polyolefin market. Especially the increasing number of customers and competitors in Eastern Europe increase the complexity of the logistics outsourcing process. Besides, the shipper purchases the different outsourced logistics services more and more as a package of logistics services like in the case of the hub operation to reduce the number of suppliers contracted. Nevertheless, for all kind of services the same sourcing approach and a standard tender process are used. The organization and content of this process is not different for different kind of services or changed over the last decade. The only difference between tender projects for basic versus more advanced services is the length of the process. Tender processes for advanced services, like the hub operation in this case, take longer.

Purchasing process for hub operation

A tender project is started to select the service provider for the hub in Eastern Europe. The project is the responsibility of the sourcing department which is part of the European supply chain organization. The supply chain organization is a central department that works for all the business units that are active in the European region and thus also for the Polymers division. Next to the sourcing department, the supply chain organization consists of the following departments: planning, customer service and engineering. The director of the supply chain organization reports directly to the board of directors of the European region. Project team consists of people from the sourcing department. They are supported by people from the engineering department who are also active members of the project group. Final decision is taken by the manager of the sourcing department and approved by the director of the European supply chain organization.
The total tender project consists of six phases: internal preparation, request for information (RFI), evaluation, request for quotation (RFQ), negotiation and final choice. During the internal preparation the team members define the requirements for the package of services sourced. The project team uses input from the European planning department, plants in the Far East and sales representatives to define the final requirements for the package of services sourced. Also external representatives like port authorities and potential subcontractors are consulted to come to the final RFI document. The RFI document contains the possible scenarios for the hub operation including the preferred location, quantities and service requirements. At the end of the internal preparation a long list of twenty service providers is defined. These twenty service providers are invited to price the proposed scenario. They also have the possibility to make some improvements to the proposed scenario. The responses of the service providers are evaluated

and a short list of five service providers is defined by the project team. Subsequently, a RFQ document is defined. The RFQ document is comparable to the RFI document. It repeats the preferred concept for the hub operation and describes the requirements and updated quantities. The five service providers at the short list receive the RFQ. These providers are asked to respond again and accentuate their quotation. The responses on the RFQ are used to start the negotiation process. At the end of the negotiation process one LSP is selected. This final selection is based on the following criteria: costs, service, financial position of the LSP, commitment of the service provider and trust (people who are involved at the side of the LSP will look well after the interests of the shipper). The length of the tender project was six months. Afterwards implementation of the operation is started by the engineering department.

Type of collaboration

The relationship between shipper and LSP in this case can be characterized as bundling using the relationship ladder[43] as defined by Gulati and Kletter (2005). Bundling is chosen because the shipper has the intention to build a long term relationship with the selected LSP, because the shipper marks a stable hub operation as important to deliver the customers in Eastern Europe. Nevertheless, the signed contract has a term of three years, and thus the actual commitment is three years. After that period the shipper would like to have the possibility to switch to a different provider when there is any motive. Possible motives are: price level, performance level or a significant change in the customer database which requires a new location for the hub. Besides, the activities handed over to the LSP have an operational character. The coordination and orchestration activities related to hub like replenishment, sourcing subcontractors, inventory management or order fulfilment are done by the shipper. Moreover, both parties indicate that the focus in the relationship is on the operational performance of the hub operation. Discussions about developments in both organizations and consequences of these developments for the partnership between both organizations are not taken place. Finally, joint actions or joint investments are not under discussion.

43 The relationship ladder is described in section 2.1.1

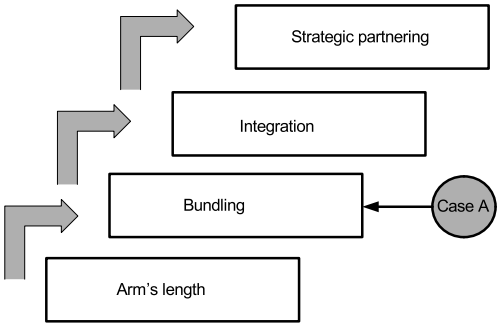


Figure 37: Position case A at relationship ladder

Case B: European transport

Introduction

Case B is conducted at the Intermediates division of the same global operating company as case A. The European headquarter of this division is based in the Netherlands. The European division is responsible for manufacturing, distribution and sales activities of all chemical Intermediates in Europe. There are three plants in Europe. These are located in the Netherlands, Germany and the United Kingdom. Products are stored after production at the plant sites and delivered to the customers after an order is received by the supply chain department. For this delivery process mainly road transport is used. The supply chain structure of this case is visible in figure 38.

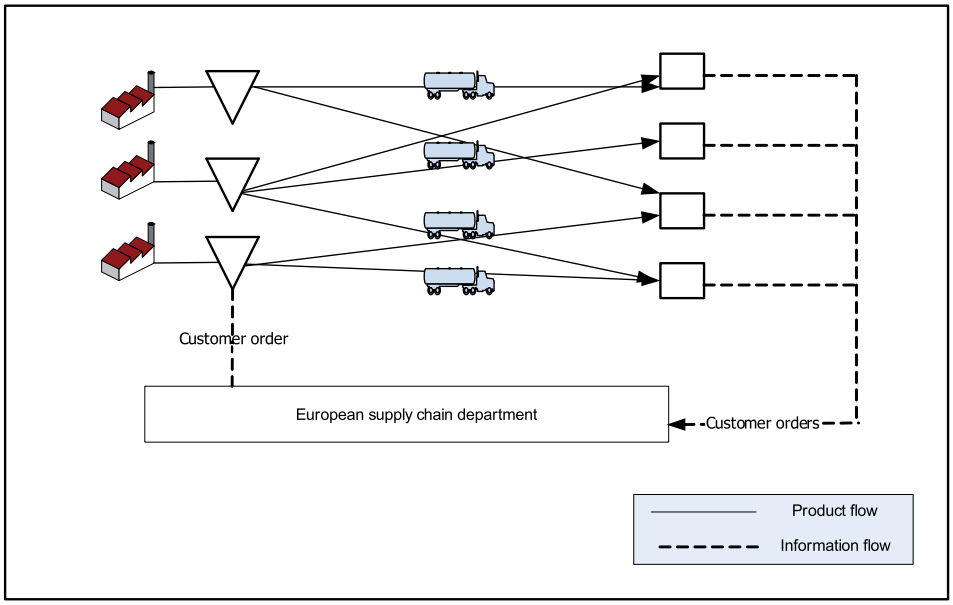


Figure 38: Supply chain structure case B

The intermediates market can be characterized as a commodity market, because the intermediates are standard products and there are a large number of competitors. As a result logistics is strongly cost driven. At the other hand, senior management of the Intermediates division has identified logistics as one of the three areas that need be used to create competitive advantage.

The supply chain of Intermediates division is characterized by interruptions. These interruptions are caused by the fact that service providers do not always show up at the plant to pick up the products as agreed in the contract, because the logistic providers can earn more money at the spot market. As a result, the logistics service delivered to the customer is at risk. At the same time the European division has defined an ambitious grow path to double their volumes at the European market by selling more products to existing and new customers.

After production, the Intermediates are distributed to the customer. For this distribution activities mainly road and sometimes intermodal transport is used. The shipper plans to increase the intermodal part in their European distribution activities to ensure that the transportation capacity will be sufficient in the near future and is cost effective at the same time. Around fifty service providers are contracted to take care of the transport from the plants to the customer. These service providers are also responsible for the accompanying customs activities. All providers are contracted for a period of one year. As

a result the European transportation services are tendered on a yearly basis. In line with their colleagues of the Polymer division, the Intermediates division prefers to contact medium sized service providers, because these service providers have a stronger commitment to the shipper than the large LSPs. Next to this, the shipper's negotiation position is stronger comparing medium sized providers to large providers.
The transportation services sourced for the Intermediates division are positioned as leverage items in Kraljic's portfolio by the shipper. The position on the profit impact axis is relatively high because logistics is identified as one of area's used to create competitive advantages. Besides, the impact of the disruptions caused by the service providers is appreciable; the effort needed to repair the disruptions results in additional costs. The position at the supply risk matrix is low, because there are many suppliers in the market available and the negotiation position of the supplier is strong. The position of case B in the Kraljic's matrix is depicted in figure 39.

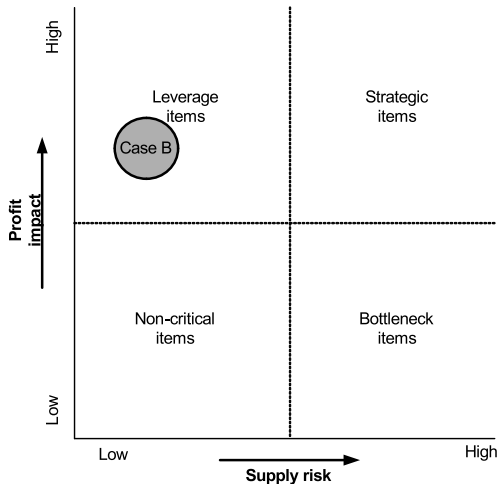


Figure 39: Position case B in Kraljic's matrix: respondents' perception

The case is also positioned in the Kraljic's matrix by the researcher. This results in figure 40 and 41. Figure 40 is used to determine the positions at the axis and figure 41 depicts the position in the Kraljic matrix.

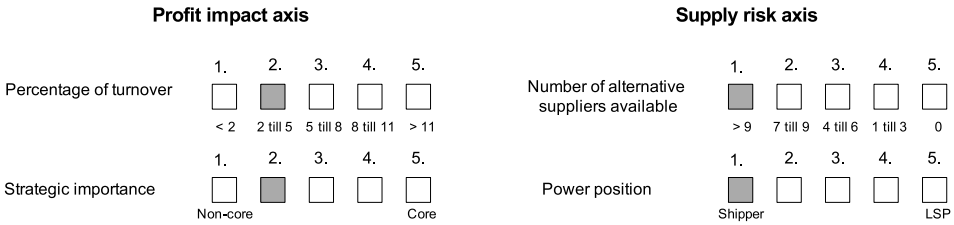


Figure 40: Case B Kraljic valuation procedure

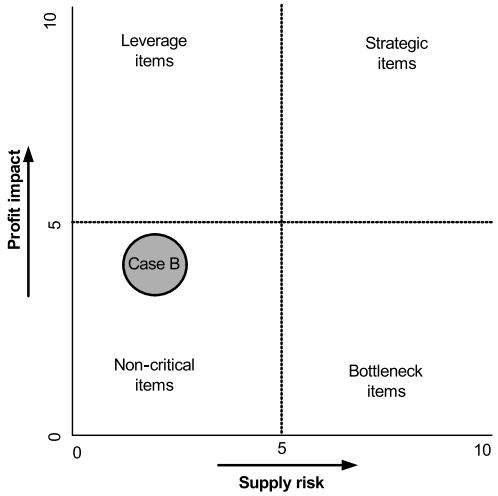


Figure 41: Position case B in Kraljic matrix: researcher's perception

In total fifty different LSPs are contracted for the European transportation activities of Intermediates division. One of them is involved in this case study. This is the same LSP as contacted in case A.

Logistics outsourcing

The transportation activities of the Intermediates division are outsourced for three reasons. First, costing motives; specialized providers can run transport activities at lower cost because of their network and return shipments. Second, the shipper does not want to invest in transportation assets. Finally, the physical transport activities are not marked as core activities by the shipper. Orchestration and coordination activities like transportation management are not outsourced to external providers.

The shipper indicates that the complexity of the outsourced transport operation increases for two reasons. First, the number of disruptions in the supply chain increases,

because of the growing volumes of the Intermediates division. Second, the planned grow of the intermodal transport activities change the requirements for the services sourced. Nevertheless, the sourcing approach including the organization and content of the tender process is not changed to respond to this increased complexity. Only, the number of criteria used to select the providers is changed. Some years ago, price was the only selection criteria. Nowadays, also price, switching costs and commitment of the provider is taken into consideration. Beside, internal there is a discussion about changing the standard contract term from one to three years as a possibility to extend the shipper's commitment to the service providers. Nevertheless, senior management of the central supply chain organization is not convinced that this will improve the delivery performance to the customer for three reasons. First, the opportunistic character of many service providers; providers do not always show up as agreed in the contract. Moreover, the cost impact of the change is not clear. What will happen with the tariffs when the prices at the transport or oil market decrease or increase? Finally, savings can still be reached with the current way of working with short commitments and yearly tendering.

Purchasing process for European transport

To select the service providers for the European transport operation a tender project is done on a yearly basis. The sourcing department of the central supply chain organization is responsible for this project. No other departments are consulted during the tender process and the final decision is proved by senior management of the sourcing department. This approval process is different when a complete new service provider is added to the portfolio. In such a case, the manager of the central supply chain organization needs to give his approval.

The total tender process consists of six phases. The project starts with the internal preparation phase. During this phase the RFI document and a long list of around seventy service providers is defined. The RFI document contains all the European lanes, quantities per lane, type of transport per lane and a standard answer format for the service providers. Subsequently, the RFI is sending out to all service providers at the long list. The responses of the service providers are evaluated by the shipper by uploading the answers in a software tool. The tool compares the responses on price and proposes a short list per lane. As a next step, the RFQ document is send out to the service providers at the short list. This RFQ document has the same content as the RFI document and request the providers to sharpen their prices. The received quotations are used to start the negotiation phase which result in the selection of the preferred shipper per lane and the selection of a back up shipper per lane. For this final selection the following selection criteria are used: costs, service, switching costs and commitment. All providers are contracted for the term of one year. The total project takes three months.

Type of collaboration

The collaboration between the shipper and the service providers contracted for the European transport operation can be positioned between arm's length and bundling using the relationship ladder of Gulati and Kletter. This position is chosen for the following reasons. First, transportation is not sourced at the spot market, but the commitments given to the service providers are short. Moreover, the shipper does not have the intention to build a long term relationship with the providers. Besides, the relationship is focused on the execution of the transport operation. These activities have an operational and repetitive character. Finally, there is a strong focus on price which results in opportunistic behavior from both sides and as a result a low level of trust between both parties.

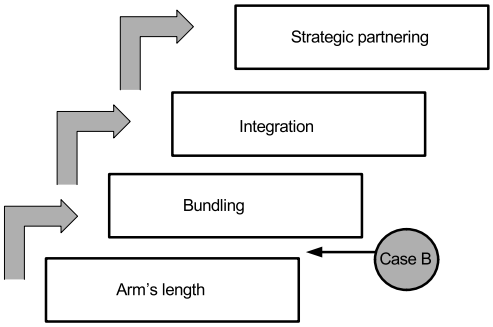


Figure 42: Position case B at relationship ladder

Case C: Lead logistics provider

Introduction

Case C is conducted at a global operating chemical company that focuses on shifting its portfolio to the specialties market, because the specialties market grows faster and delivers more stable and higher earnings. The company has built a decentralized organization structure around business groups. These business groups are empowered to carry out all business functions. They are supported by a number of corporate departments. The corporate departments supply inter-group services like purchasing, research facilities and human resource management. The corporate departments are contracted by the business groups if needed. The company's headquarter is based in the Netherlands. This case is conducted at the European division of one of the business groups. This business group is the leading supplier of pharmaceutical ingredients. The globalization has increased the competition in this market, because new players have entered the market. As a result, the business group has defined a strategy that is aimed to maintain the leadership position by focusing on customer intimacy, product innovation and cost effective-

ness by off shoring production to low cost countries. The logistics strategy is aligned to this overall strategy and thus there is a strong focus on costs. Supply chain problems are identified and solved for the short run, but are not used as a trigger to critically analyze the supply chain concept and solve the problems for the long term. A long term vision about which supply chain concepts are needed to be and remain competitive in this market is not defined.

Figure 43 depicts a high level overview of the supply chain structure of the European division. This figure makes clear that the European division has five plants. These plants are located in four different countries. Each plant has its own distribution centre. This distribution centre is used to store the finished products after production and to deliver the products to the customers in Europe. For these European deliveries intermodal transport is used. One of the distribution centres functions also as a European distribution centre (EDC). Products that come from plants outside Europe are received and stored in this EDC. Customers that order products that are manufactured outside Europe are delivered from the EDC. Also products manufactured in Europe that need to be supplied to other regions are collected in the EDC. For deliveries outside Europe sea freight is used.

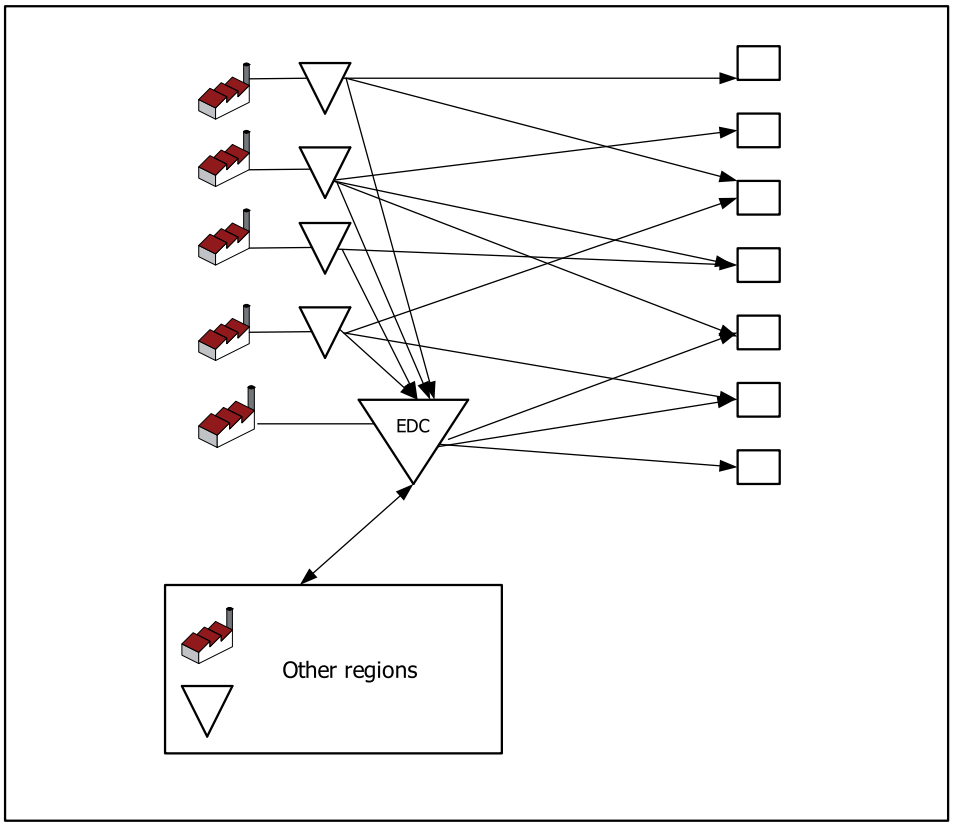


Figure 43: European supply chain structure

The logistics department in Europe is responsible for the coordination of the activities depicted in figure 43. The department uses external logistics service providers for the operational execution of the activities. This case focuses on the selection of one of these providers. The selected provider functions as a Lead Logistics Provider (LLP) that coordinates all transports between the distribution centres and the customers.
The shipper position the service sourced in this case between leverage and non-critical items in Kraljic's purchasing portfolio. The position on the profit impact axis based on the fact that logistics is an important service element, but it is not the major competitive advantage in this market. The position at the supply risk is quite low, because there are a large number of providers in the market that can provide this service and the shipper has a strong negotiation position.

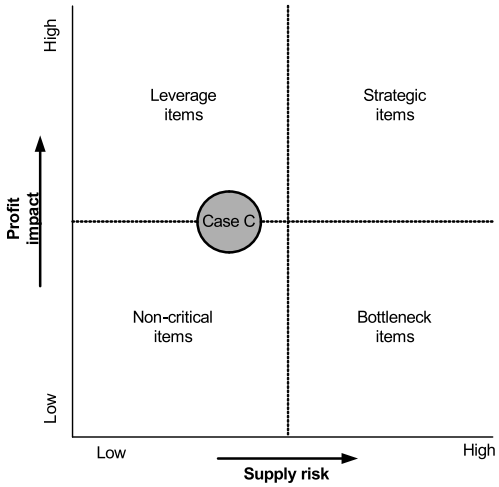


Figure 44: Position case C in Kraljic's matrix: respondents' perception

The case is also positioned in the Kraljic's matrix by the researcher. This results in figure 45 and 46. Figure 45 is used to determine the positions at the axis and figure 46 depicts the position in the Kraljic matrix.

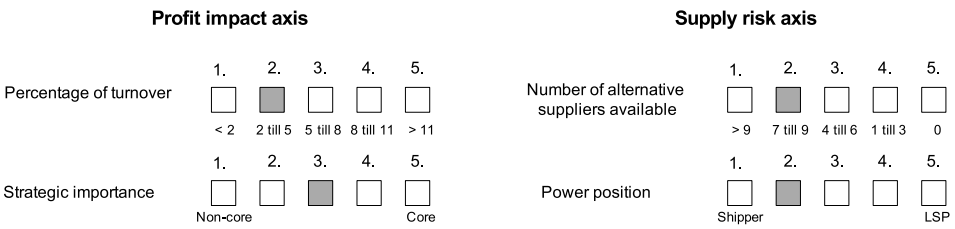


Figure 45: Case C Kraljic valuation procedure

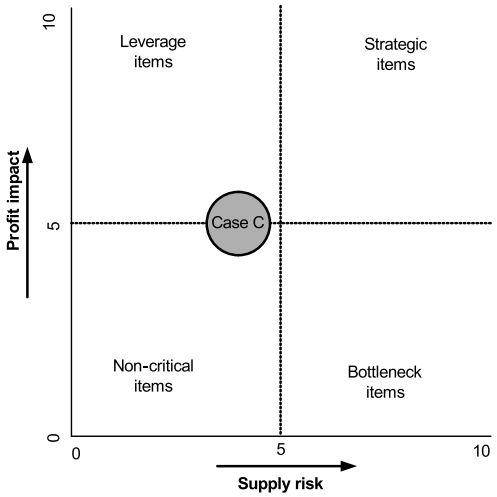


Figure 46: Position case C in Kraljic matrix: researcher's perception

The LSP involved in this case is a worldwide operating 3PL service provider. The home market of the service provider is Europe. The company has been founded more than forty years ago and grew to a service provider of integrated logistics services. Services supplied are: European distribution, air and ocean freight, warehousing and value added activities like fiscal representation, packing and re-packing. Some of the warehouse locations are suitable for the store of environmentally dangerous goods.

Logistics outsourcing

Outsourcing logistics activities is part of the business group's strategy, because the business group would like to concentrate on their core activities and logistics is not identified as a core competence. Physical transport, transport management, warehousing and some value added activities are outsourced to external providers. At the other hand, sourcing of subcontractors and supply chain orchestration are defined as core competence and for that reason done by the shipper. It needs to be noticed that the warehouse that functions as EDC is an exception to this strategy. The EDC is insourced back some years ago, because of cost saving reasons.

The shipper indicates that the complexity of logistics services has increased for three reasons. First, more advanced logistics services are outsourced to external providers. Second, the globalization of the market of pharmaceutical ingredients results in a more complex logistics structure. Third, the consolidation in de service provider's market negatively influences the power position of the shipper. This increased complexity results in less transparency of the outsourced operations and increases the dependency of the

shipper from certain LSPs. The shipper changes the logistics outsourcing strategy to respond to these developments. As a result, the collaboration with service providers gets a more long term character by giving longer commitments to the LSPs. Concrete, commitments given to service providers that are responsible for the physical transportation of the goods change from one to three years. This to ensure capacity at acceptable costs. Moreover, packages of outsourced logistics service are split up into such a way that coordination tasks and the operational execution of the activities are not done by the same provider. The selection of the LLP in this case is the result of this changed strategy. The project is described in the next section.

Purchasing process for Lead Logistics Provider

A tender project is used to select the required LLP for the business group in Europe. The project team consists of people from the logistics, customer service and purchasing departments of the business group and a representative of the corporate purchasing group. The project team prepares the selection of the service provider. This selection needs to be approved by the logistics manager of the business group. The tender project consists of six phases: internal preparation, request for information, evaluation, request for quotation, negotiation and final selection. The internal preparation phase starts with the definition of the objectives for the project: 1) increase cost transparency, 2) decrease dependency of LSP, 3) increase customer focus, 4) save costs. To reach the first two objectives, a different logistics concept is defined. In the old situation the LLP functions as a 3PL provider which not only coordinates the European transports, but is also responsible for selection of the subcontractors. This situation is changed and the LLP selected by this tender process will only function as a central point of contact that is responsible for the coordination of the transport activities. The subcontractors will be sourced and contracted by the shipper. This change results for the shipper in the required higher level of transparency and decreased level of dependency. At the same time, this new situation gives the shipper a possibility to save costs by exploit the shipper's own purchasing power towards the subcontractors. As a next step, in the internal preparation phase a request for information (RFI) document is defined. This document explains the chosen concept and required capabilities of the LSP (experience in the market). At the end of the internal preparation phase, a long list of ten providers is defined. These providers are invited to respond to the RFI document by explaining how they will fill out the role of LLP and by costing the proposed operation. The responses of the LSPs are evaluated and a short list of four providers is defined. These LSPs are asked for a revised quotation and visited during the RFQ phase. The results of the RFQ phase are the starting point for the negotiation process. The tender process ends with the selection of the provider. The following criteria are used to make the final selection: costs, service (number of shipments

delivered on time), trust (people involved from the side of the LSP), confidentiality and capabilities of the LSP (experience in the sector). Both parties agree on a contract term of three years. The total tender project takes almost nine months.

Type of collaboration

The relation between shipper and LSP is characterized as bundling using the relationship ladder of Gulati and Kletter (2005). This position is chosen for three reasons. First, the limited responsibility of the LLP. The LLP is only responsible for the coordination of the transport movements. The sourcing and contracting activities are done by the shipper. As a result, the activities done by the service provider have an operational character. Second, the level of trust in this relationship is relatively low. Choices made by the shipper are based on fears of dependency and loss of transparency. Third, there is not any intention at the shipper's side to intensify this collaborative relationship by extending the scope of operation of the LSP. No joint actions or joint investments are planned. It needs to be noticed that this is not confirmed by the LSP. The involved LSP believes there is a possibility to extend the scope by also takes responsibility for the sourcing and contracting activities.

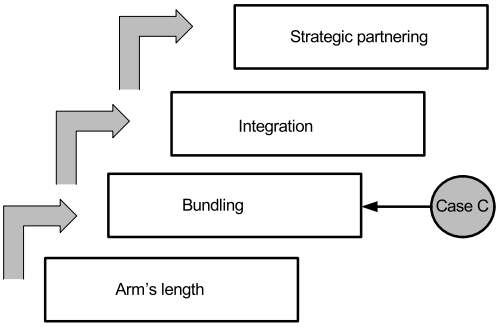


Figure 47: Position case C at relationship ladder

Case D: Global distribution centre

Introduction

Case D is conducted at the same company as case C, but at a different business group. The business group in this case is world's leading supplier of fine chemicals to the food and pharmaceutical industry. The globalization has increased the competition in this market. As a result, margins and market share decrease. The business group has defined a strategy to respond to this changed situation. The adapted strategy is aimed to keep the current market share and margins by focusing on cost savings and grow. The required growth should be achieved by acquisitions and own product innovations. The logistics strategy has a strong focus on costs. The current situation in the market strengthens this.

The business group is divided in three divisions which are responsible for sales activities at a specific market. Each division reports to the executive board of the business group. The supply chain management department functions as a central staff department that supply services to all three divisions. Nevertheless, the department is not represented in the executive board of the business group. The supply chain manager reports to the central operations director which is responsible for all manufacturing sites, purchasing and supply chain management activities.

The business group has a central supply chain structure. There is one global distribution centre (GDC) located in the Netherlands that has three functions: replenish the regional distribution centres, deliver European customers, and coordinate direct deliveries from one of the plants to the customer. In total, the business group has fifty-five different manufacturing plants across the globe. The deliveries from the plants to the GDC and from the GDC to the RDC are done by intermodal transport; for all other movements road transport is used. The central supply chain management department is responsible for all activities in the supply chain, but outsource some of the activities to external providers. The supply chain structure of this case is depicted in picture 48.

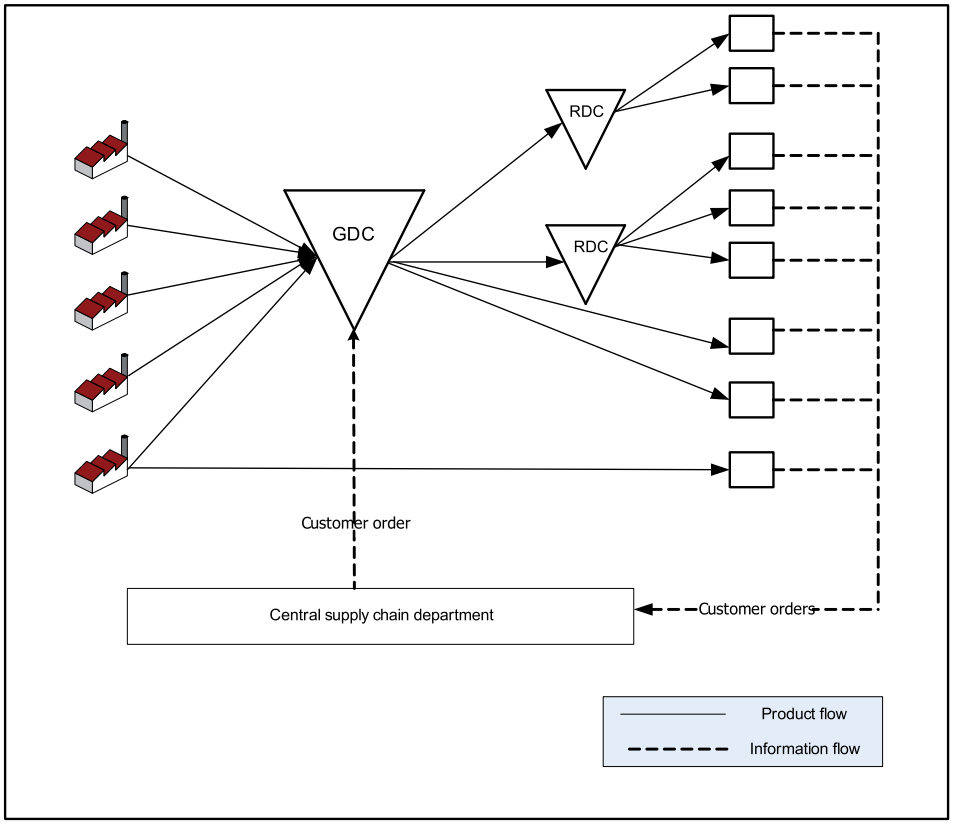


Figure 48: Supply chain structure case D

An external service provider is used to run the operation in the GDC. This case describes the tender project to select this LSP. The selected service provider will be responsible for the coordination of the direct deliveries and all activities in the global distribution centre: receiving, storage, picking, packing and some value adding activities like labelling.

The shipper positions the services sourced in this case as bottleneck item in Kraljic's purchasing portfolio. The position on the profit impact axis is relatively low based on the fact that logistics is not identified as an important service element. Moreover, the logistics cost are only a small percentage of the group's turnover. The position at the supply risk is quite high, because the global distribution centre has a central position in the supply chain concept of the business group. At the same there are not many service providers that can meet the required quality and safety standards defined for the storage of these kinds of products.

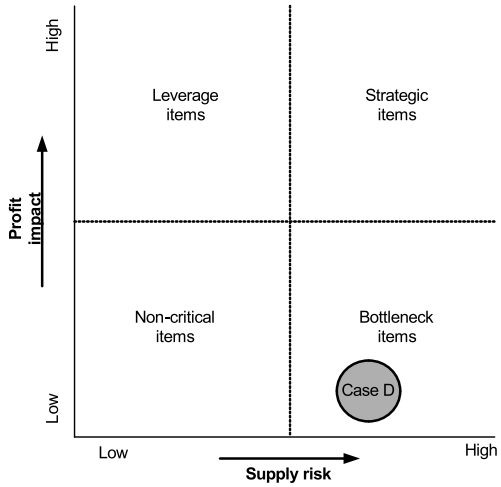


Figure 49: Position case D in Kraljic's matrix: respondents' perception

The case is also positioned in the Kraljic's matrix by the researcher. This results in figure 50 and 51. Figure 50 is used to determine the positions at the axis and figure 51 depicts the position in the Kraljic matrix.

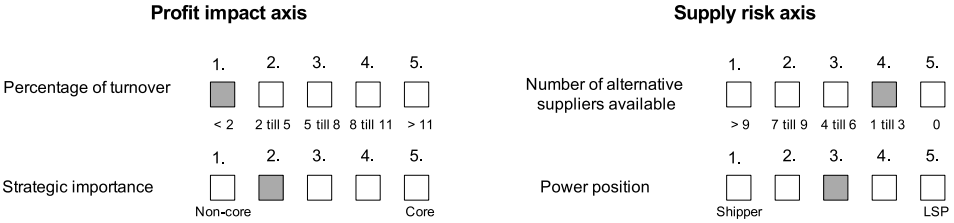


Figure 50: Case D Kraljic valuation procedure

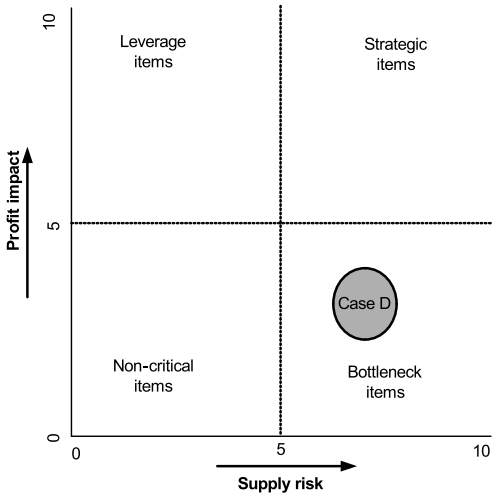


Figure 51: Position case D in Kraljic matrix: researcher's perception

The LSP that is involved in this case is global 3PL logistics provider that is active in more than hundred countries. The headquarter of the service provider is located in Europe. The service provider starts as a transportation company, but developed to a provider of full logistics services. The following services are supplies: distribution (groupage and express), air & ocean freight, warehousing, supply chain management and value added services. The provider services customers is several industries: healthcare, electronics, consumer goods, automotive and chemical.

Logistics outsourcing

The business group has all transport, transport management, customer & brokerage, warehousing and some value adding service outsourced, because the business group would like to concentrate on its core competences: developing, manufacturing and selling specialty products to food and pharmaceutical industry. Supply chain structuring and orchestration is done by the central supply chain division, because the own organization has a higher level of logistics knowledge than the service providers. The shipper indicates that the margins in the service providers are low and as a result the service providers do not have the possibility to invest in the required knowledge.

The shipper indicates that the complexity of logistics outsourcing has increased over the last years for two reasons. First, the increased globalization results in more complex supply chains. Second, customers are more demanding in terms of quality and safety. As a result, also the requirements defined by the shipper for their outsourced operations change. The shipper has the experience that most LSPs have difficulties to meet these

increased requirements. The shipper responds to this changed situation by decreasing the number of contracted service providers. A reduced number of contracted LSPs give better possibilities to control and coordinate the outsourced operations. Moreover, the shipper has extended the commitment to some providers to give these providers the possibility to make operation specific investments. The shipper indicates that the organization or content of tender projects is not changed.

Purchasing process for global distribution centre

A tender project is used to select the service provider for the global warehouse operation. The supply chain management department is responsible for this project. The supply chain manager is part of the project group and responsible for the final decision. Approval from the central operations manager is only needed in case the project result in a change of the supply chain structure. Two representatives of the corporate purchasing departments support the project team, because they have experience with these kinds of projects in other business groups. The tender process used for this project consists of four phases: internal preparation, request for quotation (RFQ), evaluation & negotiation and final selection. During internal preparation phase the current supply chain structure is discussed. The project team concludes that current concept is still the best choice for this business group in spite of increasing congestion and transportation costs, because the market is characterized by relatively long lead times and for all products a make-to-stock principle is used. The internal preparation continuous with de definition of the RFQ document. This document explains the functions of the GDC, activities that take place in the GDC and the quantities that need to be handled. At the end of the internal preparation phase, a list of possible suppliers is defined. The current provider that already runs the GDC operation for more than ten years is one of the suppliers at this list. The RFQ document is send to the providers at the list and these LSPs are asked to price the proposed operation. These responses are the input for the evaluation and negotiation phase. The tender project ends with the selection of the service provider for the GDC. The project team decides to renew the contract with the current provider. This selection was based on the following criteria: costs, service and trust. Trust refers to the belief and the experience that the service provider will look well after the interests of the shipper after implementation. The new contract between shipper and service provider has a term of seven years. The first five years are fixed and the last two years are flexible. This means that both parties have the possibility to terminate the contract after the five years fixed period. The contract is based on an open book cost plus method. Both parties have explicitly chosen for this costing structure for two reasons. First, such a method better supports long term collaboration than a standard tariff structure. Second, this method enforces the shipper to keep the internal knowledge about the outsourced operation

up to date. The shipper marks this as important to avoid becoming too dependent on a certain provider.

Type of collaboration

The relationship between the shipper and LSP in this case can be characterized as integration level at the relationship ladder as defined by Gulati and Kletter (2005). Integration is chosen for three reasons. First, the long term character of the relationship. Both parties express their intention to build a long term relationship in the relatively long contract term. Second, the LSP has both operational and coordination responsibilities, because the provider runs the GDC operation and coordinates the direct deliveries to the customers of the business group. Finally, the chosen pricing methodology expresses a relatively high level of trust between collaborative parties.

The relationship is not characterized as strategic partnerships because no joint investments are done or planned. The shipper use a relatively long contract term to show its commitment to the LSP and to give the LSP the possibility to make operation specific investments. Besides, shipper has still some fears to be too dependent on the service provider.

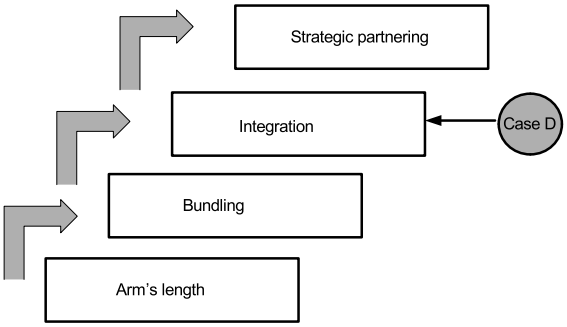


Figure 52: Position case D at relationship ladder

Case E: Warehousing and distribution activities for the Dutch market

Introduction

Case E presents a project at the Crop Protection division of a large chemical company with a broad portfolio of base and speciality chemicals. The Crop Protection division is responsible for twenty percent of the total turnover. The division is headquartered in France and most European countries have their own country organization to serve the local customers. The Dutch country organization is responsible for the inbound flows from external suppliers and the inbound flows from the own production facilities in Germany and France, the storage of these products in a country specific warehouse and the final delivery of the products to the customers in the Netherlands. It needs to be noticed that products sourced from the own plants are always stored in the country specific warehouse before delivered to the customers, but that the products coming from external suppliers can also be delivered directly to the customer. For all movements road transport is used. An overview of the flows coordinated by the Dutch country organization is depicted in figure 53.

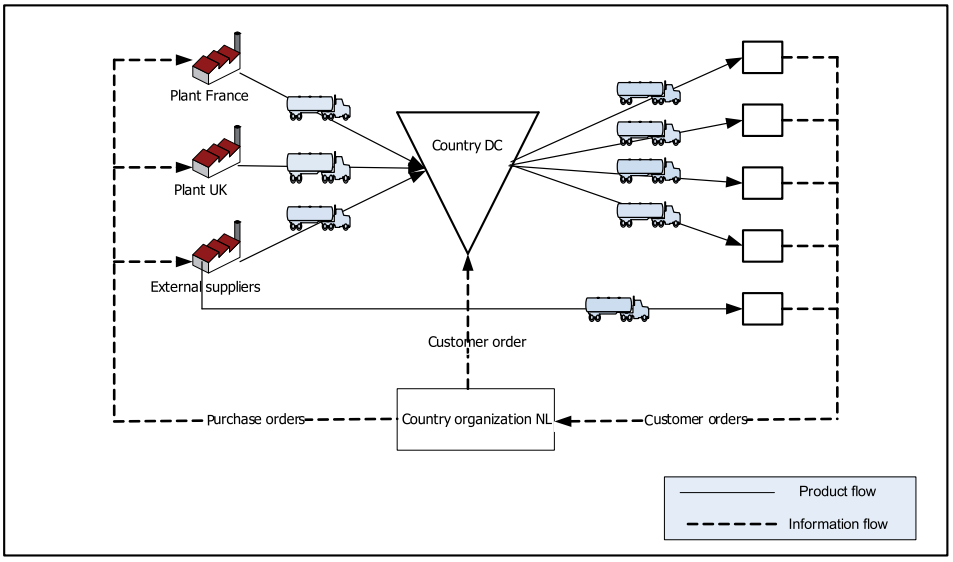


Figure 53: Flows coordinated by Dutch country organization

The product life cycle of crop protection products is shortening and therefore the time to earn back all invested money is decreasing. As a result, the business unit focuses on managing the product life cycle of each product which has to result in stronger position at the current markets.

Since some years, there is a general believe within the Dutch country organization that supply chain management is one of the disciplines needed to manage the product life cycle well. Logistics does not only add costs, but a good organized logistics process results in a higher level of customer satisfaction and thus add to the overall result of the business unit. An example of this changed attitude towards logistics is the fact that members of the supply chain management department are part of a project group at the moment an external organization and accompanying product flows need to be integrated in the Crop Protection organization after a merger or acquisition.
The demand for crop protection products is variable and highly characterized by seasonal influences. Moreover, weather circumstances within a particular season influence the demand. Customers expect a high level of flexibility from their supplier. The Dutch country organization outsources some of their logistics activities to meet the flexibility requirements of their customers. The country organization still coordinates the described processes because of dependency reasons. The shipper uses logistics service providers to execute some operational activities. This case study describes the tender project used to select a provider that can support the shipper to run the logistics operation in the Netherlands. The selected provider will be responsible for: warehousing activities in the Netherlands, outbound distribution to customer in the Netherlands and value added activities in the warehouse like labelling.
The shipper characterized the package of services sourced in this project as a bottleneck item using Kraljic's purchasing portfolio. The position on the profit impact axis is low because logistics cost are only 1,1% of the business unit's turnover. The position at the supply axis is relatively high, because there are just a few service providers at the Dutch market that have the required permissions to handle and store environmental critical products like the crop protection products in this case. Besides, the shipper indicates that the LSP is an important partner for the business unit, because the LSP is responsible for the final delivery to the customer and thus the directly represents the shipper. Figure 54 depicts the position of case E is Kraljic's portfolio.

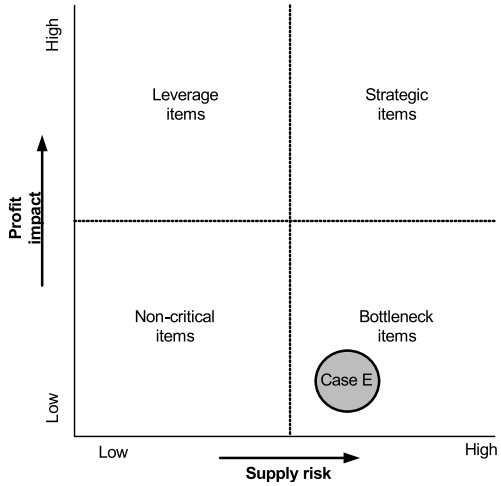


Figure 54: Position case E in Kraljic's matrix: respondents' perception

The case is also positioned in the Kraljic's matrix by the researcher. This results in figure 55 and 56. Figure 55 is used to determine the positions at the axis and figure y depicts the position in the Kraljic matrix.

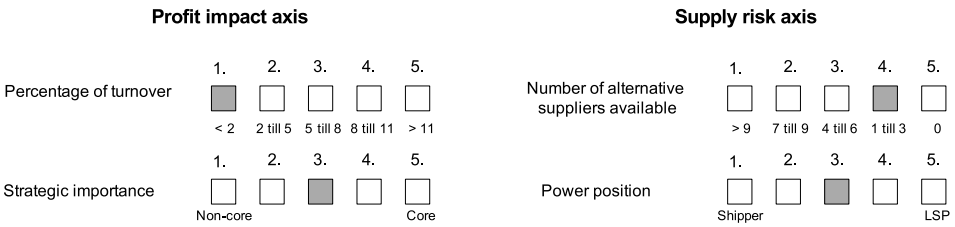


Figure 55: Case E Kraljic valuation procedure

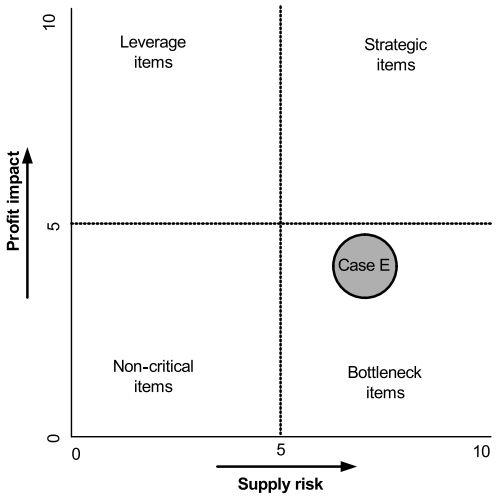


Figure 56: Position case E in Kraljic matrix: researcher's perception

The LSP that is involved in this case is a 3PL service provider that operates in niche market by focussing on environmental critical products. The competition in this specific market is less than in others parts at the logistics providers market, because there are not many suppliers that have the required permissions needed to handle dangerous goods. The customers of the LSP are mainly active in the chemical and automotive sector. The LSP supplies the following services: 1) warehousing: locations in Netherlands and Belgium, 2) distribution: Benelux with own equipment and remaining part of Europe with pre-selected partners 3) value added services like re-packing and labelling. The LSP can be characterized as a European player, but is mainly focused on the Benelux.

Logistics outsourcing

Logistics outsourcing is part of the logistics strategy of the Crop Protection division, because logistics is not identified as core activity. Besides, as explained in the previous section the customer demand has an unstable character. The required level of flexibility can be better reached by using external providers than using own assets which results in high level of fixed cost. The outsourced activities have an operational character. Coordination and orchestration activities are done by the shipper.

The shipper indicates that the complexity of logistics outsourcing is not changed over the last years. The higher level of automation and some renewed information systems makes it easier to coordinate the outsourced flows and to share data with external providers. This makes it easier to meet the increasing flexibility requirements of the customers. Tender processes are standardized and the set up is not changed over the last years.

Purchasing process for the Dutch operation

A standard tender project is used to select a service provider to run the Dutch warehouse and outbound distribution activities. The logistics manager of the business unit is responsible for this project. He proposes the selected service provider to the business manager who needs to give his final approval. This business manager is responsible for both sales and logistics activities in the business unit.

The tender project consists of four phases: 1) internal preparation, 2) RFQ, 3) negotiation and 4) final choice. The internal preparation starts with defining the priorities for the logistics organization. These priorities are defined as follows: on time delivery, complete delivery, response time, meet packaging and quality requirements, product availability, information availability and costs. These priorities are used to compose the RFQ document. This document describes the expected volumes for the warehouse operation, distribution and value added activities. Moreover, the expected delivery points for the distribution activities are explained. Finally, the RFQ document specifies the required ICT facilities to control the entire process. A list of four service providers is defined at the end of the internal preparation phase. These providers are invited to respond to the tender. The service providers are asked to price the activities described in the RFQ document and submit some improvement proposals for the existing processes when available and appropriate. The responses to the RFQ document are input for the negotiation process which ends with the selection of the LSP. For this final selection the following criteria are used: costs, service (products delivered on time, inventory accurately and handling times), flexibility (willingness and capability to handle exceptions), confidentiality and capabilities (ICT systems). Confidentiality is important for the shipper, because also some of their direct competitors are using the same service provider. The shipper and LSP agree on a contract of three years, because the LSP only starts a new warehouse operation for at least three years. This period is needed to earn back the money invested to set up a new customer. After this period of three years the shipper has the possibility to shorten its commitment and renew the contract by one year.

Type of collaboration

The collaboration between shipper and LSP in this case is characterized as bundling using the relation ladder of Gulati and Kletter (2005). First, the relationship is focused on the operational execution of the outsourced activities. All coordination, control and design activities are done by the shipper. Second, the shipper has given a mid-term commitment of three years to the service provider, because the LSP needs this to do operation specific investments. Afterwards the commitment is shorten and the contract is renewed year by year. This gives the shipper the possibility to start a tender project in case there is a reason because of costs or performance issues. Finally, information that

is shared between both organizations is limited. The Crop Protection unit has a detailed planning cycle that contains detailed information about the expected volumes for the Dutch market. This is also valuable information for the LSP in order to plan and optimize their warehouse operation, but this information is not shared. Nevertheless, joint actions between shipper and LSP or joint investments are not under discussion.

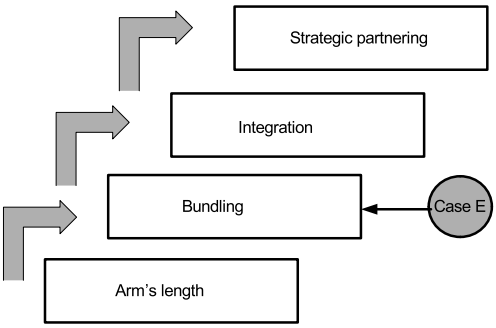


Figure 57: Position case E at relationship ladder

Case F: European distribution center

Introduction

Nowadays, the company in case F is one of world's leading companies in supplying specialties chemicals. The last decades, the company focuses on transforming the product portfolio from base chemical to specialty products, because a portfolio with special products provides more stable cash flows with less cycle movements. The strategy of the company focuses on maintaining their leadership position through faster growth and operational excellence. Growth need to be established through a combination of organic growth and acquisition. Especially the emerging markets are defined as area to grow. The company is divided in three divisions. This case is conducted at the division that focus on coating products. These products are supplied to the marine, building, aerospace and automotive industry. The organizational structure of the coating division distinguishes four regions: Europe & Africa, Americas, Asia and the Pacific. All these four regions reports to the central board of the division. This case focuses on a project in the European division. Recently, the European division has set up a separate supply chain department that coordinates all replenishment activities for the different sites, makes the production planning and coordinates the warehousing and distribution activities. The European supply chain manager is responsible for the central supply chain department. He reports to the global supply chain manager who is a member of the central board of the coating division. Before, these activities are organized decentrally and done

by each of the five European manufacturing plants. This change in the organizational structure makes clear that the importance of logistics is recognized and the position of supply chain management in the division is increased. Nevertheless, logistics is still cost and short term driven. Logistics is not identified as an element that can be used to gain competitive advantage. Competitive advantage can be gained by price and the technological characteristics of the product.

The supply chain management department coordinates the European activities, but the physical operation is partly outsourced to external providers. A European distribution centre is used to centrally store the finished products of the five manufacturing plants and to deliver the customers. For the customer deliveries from the plants to the EDC intermodal transport is used; for the deliveries to the customers road transport is used. The supply chain structure of this case is depicted in figure 58.

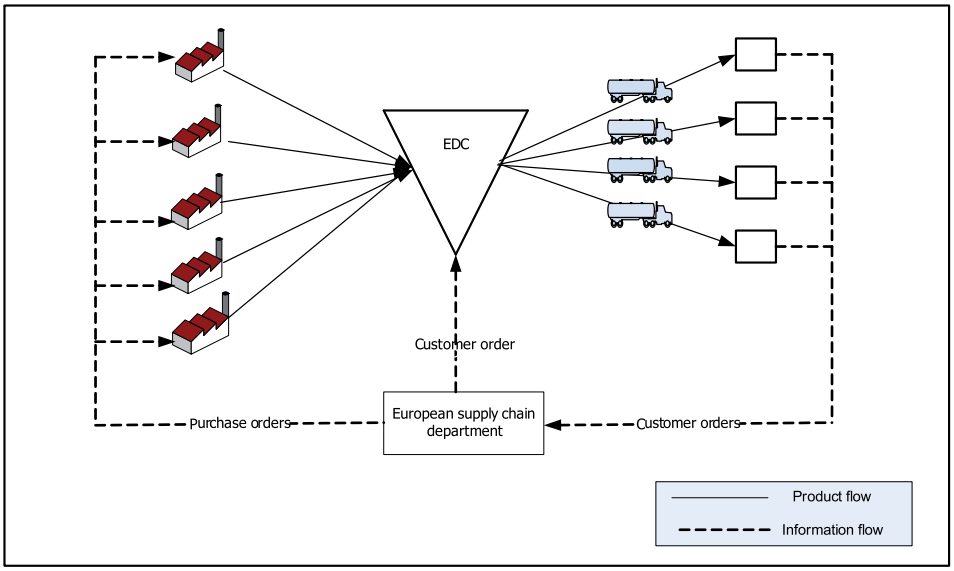


Figure 58: Supply chain structure case F

A LSP is needed to run the European distribution centre. The tender project for the selection of this provider is discussed in this case. The selected LSP will be responsible for the entire European warehouse operation and some value added service like labelling and mixing of coatings.

The shipper positions the services sourced in this case between non-critical and bottleneck-item in Kraljc's purchasing matrix. The position on the profit impact axis is low be-

cause logistics cost are only 3% of the division's turnover. Besides, logistics not identified as an important service element. The position at the supply axis is marked between low and high, because there are less service providers available compared standard transportation services, but there still is variety of choices for the shipper and competition between the LSPs. Figure 59 depicts the position of case F is Kraljic's portfolio.

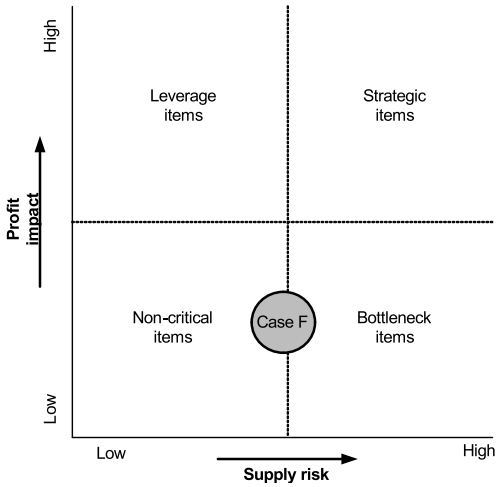


Figure 59: Position case F in Kraljic's matrix: respondents' perception

The case is also positioned in the Kraljic's matrix by the researcher. This results in figure 60 and 61 Figure 60 is used to determine the positions at the axis and figure 61 depicts the position in the Kraljic matrix.

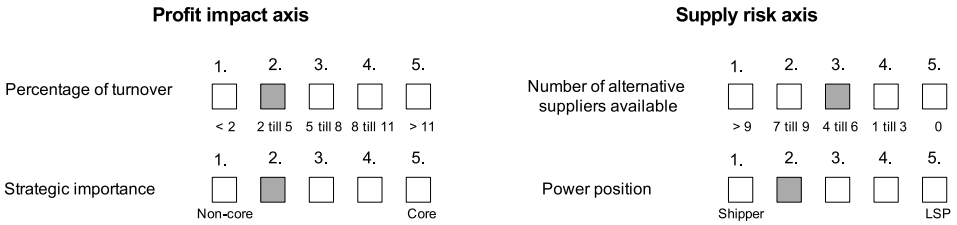


Figure 60: Case F Kraljic valuation procedure

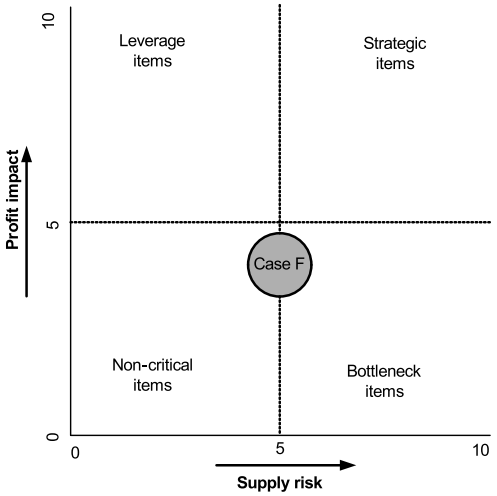


Figure 61: Position case F in Kraljic matrix: researcher's perception

The 3PL provider involved in this case is a 3Pl service provider that is specialized in the storage of hazardous materials. Services supplied to the market are: road transportation, warehousing and value adding services. For the transport activities in the Benelux and Germany own equipment is used. Other parts of Europe are done with pre-selected partners. The service provider owns six warehouse locations in Europe. Most customers of the service provider are active in the chemical and automotive industry.

Logistics outsourcing

Logistics outsourcing is part of the logistics strategy, because the division prefers to focus on their core competencies and external providers can provide some logistics services at lower costs. All transport, customer & brokerage, forwarding and warehousing activities are outsourced. Also some value added activities are done by external service providers. Supply chain coordination and orchestration are done by the central supply chain department to keep the control in the hands of the own organization and to avoid that dependency of external logistics service providers increases.

The shipper indicates that the complexity of the outsourced operation increases for two reasons. First, power position of the shipper decreases because of the mergers and acquisitions in the service providers market and the current scarcity of transportation capacity. Second, the globalization changes the productions flows. The increasing flows to emerging markets makes the supply chain more complex and increases the logistics costs. The shipper has already responded to these changes by changing the organiza-

tional structure and centralizing the coordination of the supply chain activities. A central supply chain department has the possibility to cut logistics costs by bundling the flows of the different manufacturing plants. Beside, the negotiation position of the central supply chain management is stronger compared to the negotiation position of each single manufacturing plant. The increased complexity of logistics outsourcing does not influence the sourcing approach including the set up and content of tender projects; only the department that is responsible for the tender projects moves from the logistics department at the plant to the central supply chain department.

Purchasing process for European distribution centre

A tender project is used to select the service provider to run the European distribution centre (EDC). The project team consists of people from the supply chain management, sales and purchasing departments. Besides, an external consultant is hired to guide the process and support the team with his knowledge of the service provider's market. The project team reports to the European supply chain manager. The project consists of four phases: internal preparation, request for quotation (RFQ), negotiation and final selection. The internal preparation phase is used to define the scope of the project. At the start of the project, there was a discussion of the selected service provider will also be responsible for the inbound and outbound transportation to and from the EDC. The project team decides that these transportation activities will be tendered separately to decrease the dependency of a certain supplier and to keep the control over the transport operation. As a result, the scope of the project is the European warehousing activities, including some value added service like labelling and mixing. The internal preparation phase is also used to define the criteria that will be used to make the final selection. Subsequently, a list of possible service providers is defined. The internal preparation phase ends with drawing up the RFQ document. This RFQ document contains general information about the shipper, product information and volumes of the products that needs to be handled. The RFQ is send to the pre-selected providers. These providers are asked to design and quote the proposed warehousing operation. The responses of the service providers are evaluated by the project team. At the end of the evaluation phase, the project team defines a top three of possible providers. These three providers are visited and after the site visits the final selection is made. For this final selection the following criteria are used: 1) costs, 2) commitment asked by the provider, 3) financial position of the service provider, 4) confidentiality, 5) trust (opportunistic behavior). The aspects of confidentiality are important because also products of the competitors are handled by the same service providers.

A contract of five years is signed by both parties. Five years is chosen to give the service provider the possibility to invest in operation specific equipment and to ensure sufficient

logistics capacity at acceptable costs for the coming years. These last two aspects create stability in the supply chain of the European division.

Type of collaboration

The relationship between shipper and LSP is characterized as bundling at the relationship ladder of Gulati and Kletter. The position of bundling is chosen for three reasons. First, the LSP is only responsible for the operational execution of the warehouse activities. All coordination and orchestration activities are done by the shipper. Second, the shipper does not have the intention to extent the scope of operation of this service provider, because of fears about dependency and loss of control. Third, the level of trust between both organizations is relatively low, because both organizations are reserved to share additional information that can improve the current operation. The shipper is reserved to share forecasted volumes, because also competitors have stored their products in the warehouse of the LSP. Also the LSP does not take initiative to share the ins and outs of the operation, because the LSP is afraid that the shipper takes advantage of this information to negotiate lower prices. It needs to be noticed that the commitment is relatively long for a relationship that is characterized as bundling. The commitment term of five years could be an indication for a different type of collaboration. Nevertheless, the reasons identified to choose for this longer commitment are partly related to cost saving motives for the own organization and are not related to motives that support the development of the relationship.

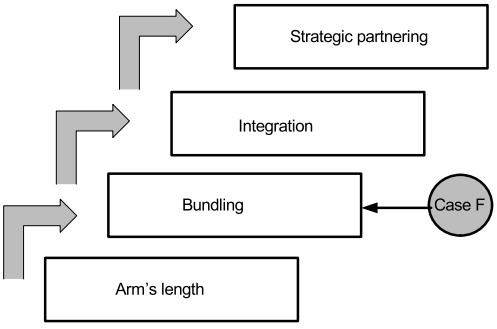


Figure 62: Position case F at relationship ladder

Case G: Site and transport operations

Introduction

Case G is conducted at a global manufacturer and marketer of special chemicals. The focus on special chemicals is a strategic choice, because the margins at specialties are higher and the sensitivity of specialties for cyclic movements is less compared to commodity chemicals. As a result, the commodity divisions are sold to other players in the market. The company's headquarter is based in the United States.

The case focuses on the European division of the Polyurethanes business unit which is headquartered in Belgium. The European division has plants in the Netherlands, Italy and Germany. The finished products are stored at the production sites. These stocks are used to deliver the customers. For these customer deliveries road transport is used. Figure 63 shows the supply chain structure of this case.

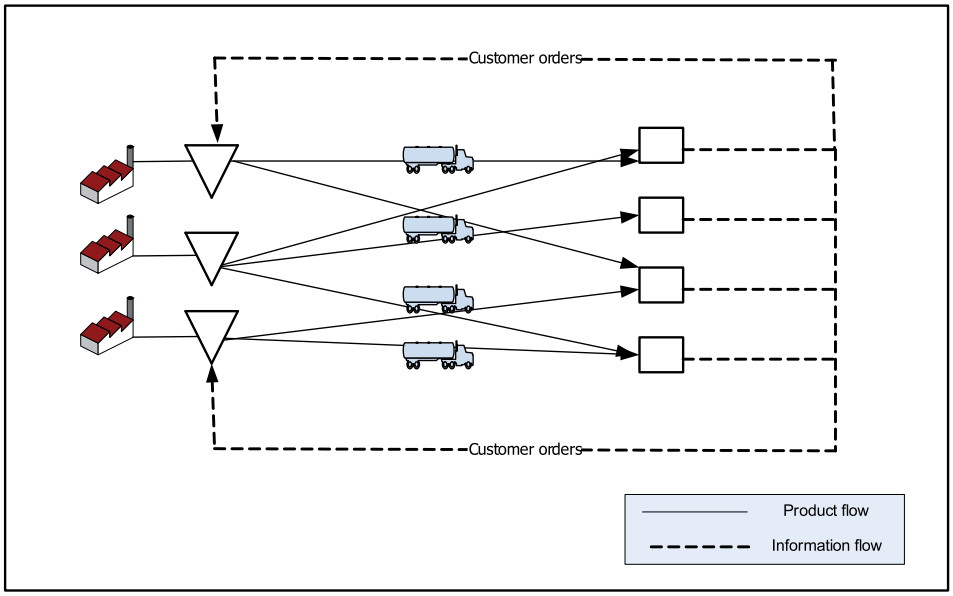


Figure 63: Supply chain structure case G

Products of the Polyurethanes division are used by the construction, automotive, footwear and furniture industry. In spite of the fact that the products are characterized as specialties, the shipper characterizes the market as a commodity market. There are enough other suppliers with comparable products and the possibilities to create competitive advantages are limited to technical marketing, supply chain performance and supply chain innovation. Especially supply chain innovation gives possibilities to achieve

cost savings that are required to remain competitive and profitable. Since some years this is not only the vision of the supply chain management departments, but also acknowledged by other disciplines within the company. As result, supply chain management department has a representative in the senior management of the business management in line with finance and sales departments. The focus on cost savings, service improvements and supply chain innovation has resulted in a project for redesigning all logistics activities at the sites as well as the outbound transportation activities. For these redesign activities a tender process is started, because the activities are outsourced to external providers.

The shipper positions the package of services sourced in this project as a strategic item in Kraljic's purchasing portfolio. The position at the supply risk is relatively high, because there are not many suppliers available that can deliver the required services and have sufficient knowledge to support the business unit in the redesign process at the same time. Also the position on the profit axis is relatively high, because both supply chain performance and supply chain innovation are marked as major areas to create competitive advantage in the market.

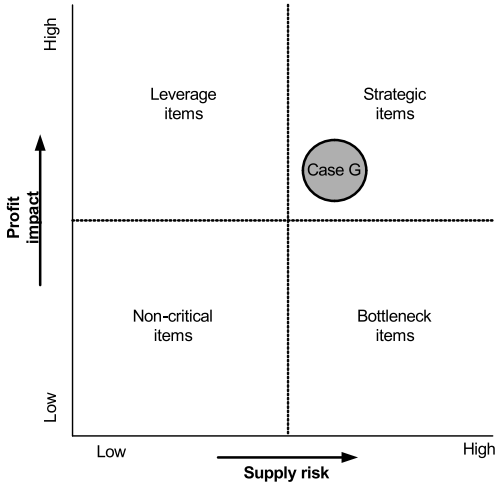


Figure 64: Position case G in Kraljic's matrix: respondents' perception

The case is also positioned in the Kraljic's matrix by the researcher. This results in figure 65 and 66. Figure 65 is used to determine the positions at the axis and figure 66 depicts the position in the Kraljic matrix.

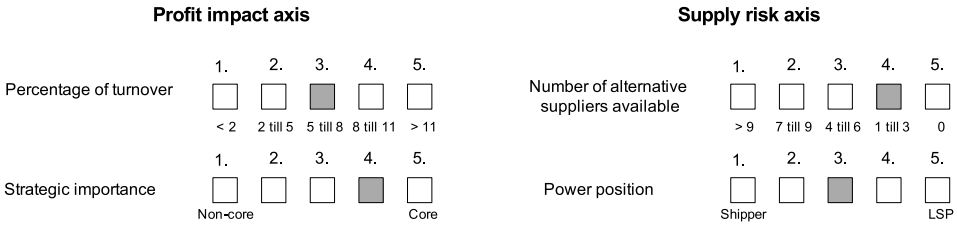


Figure 65: Case G Kraljic valuation procedure

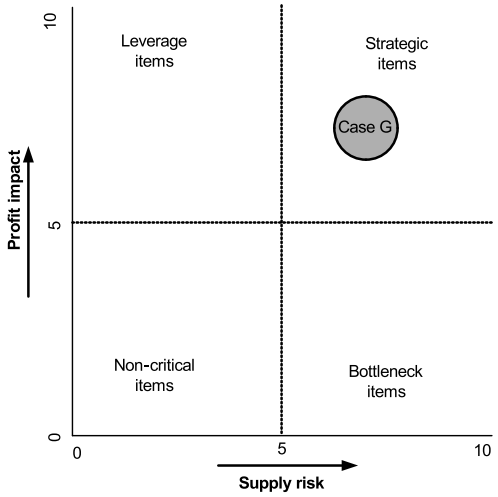


Figure 66: Position case F in Kraljic matrix: researcher's perception

The involved LSP is one of the three service providers that are selected to run the operations as sourced in the case. This LSP is started as a transport company and developed to a full service 3PL provider. The service provider uses own equipment and subcontractors to service their customers. The service provider focuses primarily on the chemical sector and the European market.

Logistics outsourcing

The core competences of the Polyurethanes division are manufacturing and selling products. Therefore, the shipper does not want to invest in logistics assets. All warehousing, on site handling activities, transportation, transportation management and inventory management activities are outsourced to external providers. Beside, the shipper uses external providers for the logistics activities to have a higher level of flexibility in terms

of capacity and costs. Supply orchestration activities are not outsourced, because supply chain performance and supply chain innovation are identified as areas that need to be used to create competitive advantage. Besides, the order entry activities are not outsourced although these activities are characterized as non-core activities and have an operational character. The reason is that these activities are almost entirely automated; outsourcing will not bring many advantages in terms of reducing internal work load or logistics costs.

The shipper indicates that the complexity level of logistics outsourcing has increased for two reasons. First, a combination of logistics services are more and more outsourced as a package of services to a limited number of providers. Second, the shipper experiences difficulties in defining requirements for such a package of services. The higher level of complexity was one of the reasons to change the sourcing approach and the content of the tender process for advanced logistics services. The changed sourcing approach focuses more on supply chain concepts and total cost of ownership of these concepts in stead of the pricing of each single activity of the supply chain process. Another reason for the shipper to change the content of the tender process is the situation at the service providers market. The service providers market is characterized by low margins. Therefore, the possibilities to achieve the required cost savings by a standard tender which only focuses on pricing are decreasing. The shipper believes that these required cost savings can only be reached by organizing the tender process in such a way that the service provider is involved in designing the processes and results in a solution that fits better to the service providers' existing network.

Purchasing process for site and transportation operations

The logistics department is responsible for the tender process described in this case. This logistics department is a central staff department that works for all business units in Europe. Also the supply chain manager of the Polyurethanes business unit participates in the tender project, because he will be responsible for the implementation and contract management after implementation.

The total tender project takes nine months and consists of six phases: internal preparation, request for information (RFI), evaluation, Request for Quotation (RFQ), negotiation and final selection. During the internal preparation the RFI document is defined. The volumes, product flows and future developments are described in this document. During the internal preparation phase also a long list of eighteen service providers and the final selection criteria are defined. The RFI document is send out to the providers at the long list with the request to define solutions for the presented case. The service providers are explicitly asked to not present a costing in their response to enforce that both internal and external involved parties actively focus on the solutions. Five service providers sub-

mit a response. These responses are evaluated by the project team of the shipper. Subsequently, the RFQ document was defined. This document contains the same information as the RFI document; only the provided data are updated and in this document the service providers are asked to submit both solutions and costing. The responses to the RFQ document are the input for the negotiation process between shipper and service providers. The project ends with the selection of three providers to run the operation. These service providers use both own equipment and subcontractors to run the operation. The possible subcontractors are reviewed by the shipper. Three service providers are selected for two reasons. First, selecting three in stead of one provider decreases the dependency on a single provider. Second, the fragmented character of the service providers market makes it difficult to select a service provider that can serve the entire European market. The project uses the following selection criteria: costs, service (on time deliveries), culture (organizational culture), commitment (contract term asked by provider) and trust (belief that people involved from the LSP side will promote the interests of the shipper in their internal organization) and commitment. The shipper and service providers agreed on a contract term of five years to give the service provider the possibility to invest in equipment that is needed to implement proposed solutions. Moreover, a term of five years gives both organizations the possibility to create a stable supply chain operation. The projects has resulted in a supply chain solution using more intermodal transport, using floating stock concepts and increasing pay loads per shipments

Type of collaboration

The relationship between the shipper and LSP in this case can be characterized as integration level at the relationship ladder as defined by Gulati and Kletter (2005). Integration is chosen for three reasons. First, the long term character of the relationship. Second, the LSP has not only operational but also coordination responsibilities. Finally, the explicit involvement of the LSP in defining and implementing improvements. The relationship is not marked as strategic partnering, because the shipper does not outsource orchestration activities and the required investments are only made by the service provider. Besides, there are still fears to be dependent of one of the selected partners and the shippers would like to give their approval for the subcontractors used by the providers; this makes clear that the level of trust needs to be developed before the relationship can be marked as strategic partnering. There are possibilities that the relationship develops to the stage of strategic partnering, because the shipper and three LSPs discuss the possibility to improve horizontal collaboration between the three service providers by creating independent entity for the collaboration activities. This entity should make it possible to define and implement joint actions, make joint investment and share revenues.

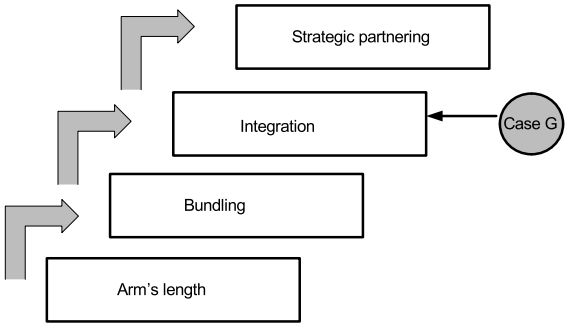


Figure 67: Position case G at relationship ladder

Appendix F:
Overview SP respondents

Company	Respondent	Title at Business Card	SCM/Purchasing	Commodities / Specialties
1	1	Logistics Manager	SCM	Commodities
	2	Logistics Manager	SCM	Commodities
	3	Logistic Coordinator	SCM	Commodities
2	4	Vice President Coprorate Logistics	SCM	Specialties
	5	Vice President Operations	SCM	Specialties
	6	Strategic Purchaser Logistics	Purchasing	Specialties
3	7	Senior buyer	Purchasing	Specialties
	8	Project Manager Replenishment & Distribution	SCM	Specialties
4	9	Supply Chain Team Manager	SCM	Specialties
	10	European Supply Chain Manager	SCM	Specialties
	11	Purchasing Manager Land Transport EMEA	Purchasing	Specialties
5	12	EUAF Land Logistis Manager	SCM	Commodities
	13	Contract Manager Land Logistics	SCM	Commodities
	14	Procurement manager	Purchasing	Commodities
6	15	European Operations Leader	SCM	Commodities
	16	European Supply Manager	Purchasing	Commodities
	17	Global Supply Chain Director Speciality Plastics	SCM	Commodities
	18	Supply Chain Manager	SCM	Commodities
	19	European Supply Manager	Purchasing	Commodities
7	20	Transport Manager EMEA	SCM	Specialties
	21	Logistics Manager Europe	SCM	Commodities
	22	European Supply Chain Manager	SCM	Specialties
	23	Purchasing Transport Manager	Purchasing	Specialties
8	24	Logistics Manager	SCM	Commodities
	25	Procurement Manager Logistics	Purchasing	Commodities
	26	Logistics Manager	SCM	Commodities
	27	Logistics Manager	SCM	Commodities
9	28	Logistics Manager EMEA	SCM	Specialties
	29	Logistics Procurement Manager	Purchasing	Specialties
10	30	Logistics Manager	SCM	Specialties
	31	Procurement Manager	Purchasing	Specialties
11	32	Logistics Coordinator EA	SCM	Specialties
	33	Supply Chain Manager	SCM	Specialties
12	34	Logistics Manager	SCM	Specialties
	35	Supply Chain Manager	SCM	Specialties
13	36	Senior Sourcing & Contracting Officer	Purchasing	Commodities
	37	Manager Sourcing & Contracting	Purchasing	Commodities
	38	Senior Sourcing & Contracting Officer	Purchasing	Commodities
14	39	Transport Coordinator EMEA	Purchasing	Specialties
	40	Logistics Manager	SCM	Specialties
	41	Senior Sourcing Manager	Purchasing	Specialties
15	42	Logistics Procurement Manager	Purchasing	Commodities
	43	Director Services Supply Europe	Purchasing	Commodities
16	44	Logistics Director EMEA	SCM	Specialties
	45	Logistics Manager	SCM	Specialties
17	46	Sourcing Specialist Distribution	Purchasing	Commodities
	47	Manager Logistics Purchasing	Purchasing	Commodities

Appendix G:
Questionnaire SP experiment

Introduction

- Personal introductions:
  - Tasks and responsibilities of the respondent
  - Background of the researcher

- Introduction to the project:
  - Research topic
  - Objective of this interview

- Explain structure of the interview.
  - Type of questions: most closed questions to shorten interview time
  - The interview consists of two parts:
    1) General questions about logistics outsourcing and collaboration
    2) Choice experiments that focus on logistics collaboration and outsourcing decisions. Will be introduced in more detail later on.
  - Duration of the interview: approximately one and half hour
  - Confidentiality closure: all information provided during this interview will be kept confidential.

Part 1:
General questions logistics outsourcing and collaboration

The questions below refer to the logistics outsourcing and contracting situation in your organization.

1. Which logistics activities are outsourced? More than one answers possible.
   - o Transport
   - o Customs clearance & brokerage
   - o Forwarding
   - o VAL (labeling, packaging etc.)
   - o Transportation management
   - o Cross docking
   - o Warehousing
   - o Inventory management
   - o Supply chain consultancy
   - o Order entry, processing & fulfillment
   - o Customer service / after sales services
   - o LLP / 4 PL services
   - o Other .....

2. How many LSPs are, approximately, contracted to execute the outsourced activities?

   .....

3. Do you plan to increase the number of service providers contracted?
   - o Yes
   - o No

4. Do you plan to reduce the number of service providers contracted?
   - o Yes
   - o No

5. Do you consider intensifying the collaboration with some of your LSPs?
   - o Yes, because .....
   - o No, because .....

6. Do you expect to outsource more logistics activities in the near future?
   Yes, because of the following reasons. More than one answers possible.
   - o Cost reduction
   - o Improve service level
   - o Focus on core businesses
   - o Avoid investments
   - o Access to emerging markets
   - o Access to new technologies
   - o Access to specialized knowledge
   - o Other, ...

   No, because of the following reasons. More than one answers possible.
   - o Remaining logistics activities are core competences of the organization
   - o Cost would not be reduced
   - o Control would decrease
   - o Required service levels would not be realized
   - o We have more expertise
   - o Corporate philosophy excludes further outsourcing
   - o Capabilities of service providers need improvement
   - o Inability to form trusting relationships
   - o Other,.....

7. Do you expect to insource some of the activities that are outsourced at this moment in time?
   Yes, because of the following reasons. More than one answers possible.
   - o Expected cost levels are not realized
   - o Expected service levels are not realized
   - o Lack of the capabilities of the LSPs
   - o Inability to form meaningful and trusting relationships
   - o Lack of ongoing improvements offered by the LSPs
   - o Activities are (re)defined as core-competences
   - o Change of corporate philosophy
   - o Other,.....

   No

8. Which department is primarily responsible for designing the supply chain structure?
   ……

9. Which other departments are involved in designing the supply chain structure?
   ……

10. Which department is primarily responsible for contracting logistics service providers?
    ……

11. Which other departments are involved in contracting logistics service providers?
    ……

12. At which level are the logistics activities organized within your company?
    - o At business unit level
    - o At national level
    - o At regional level
    - o At European level
    - o Globally
    - o Other .....

13. *Which type of industry best describes the sector you are active in?*
    - o Raw materials
    - o Basic chemicals
    - o Intermediates
    - o Consumer goods
    - o Pharmaceuticals
    - o Other ……

Part II: Choice experiment

Customize the experiment

- This part of the interview is used to help us in understanding how practitioners evaluate logistics collaboration alternatives proposed by logistics service providers: LSPs, for short in the remaining of the interview. This part consists of three short parts that will be introduced separately. In total there are 21 short questions.

- To customize the questions in this part of the questionnaire, I would like to have some idea about your current logistics cost and service level. I do not need to know the exact numbers, but hopefully you would like to give an indication. The information given will be processed confidentially and **only** used as a point of reference to customize the questions in this part of the questionnaire. As a result the upcoming questions will be placed in more realistic context.

14. What are the yearly physical distribution costs? Please select category that is most close. Physical distribution costs refer to the cost to deliver products after production to your customers. à Use card for respondent to show categories.
    - o € 50.000,- (50 thousand)
    - o € 100.000,- (100 thousand)
    - o € 500.000,- (500 thousand)
    - o € 1.000.000,- (1 million)
    - o € 5.000.000,- (5 million)
    - o € 10.000.000,- (10 million)
    - o € 25.000.000,- (25 million
    - o € 50.000.000,- (50 million)
    - o € 100.000.000,- (100 million)
    - o € 150.000.000,- (150 million)
    - o € 200.000.000,- (200 million)
    - o € 300.000.000,- (300 million)

15. What is, on average, the current outbound delivery performance? Please enter the percentage of orders delivered on time.

    .....

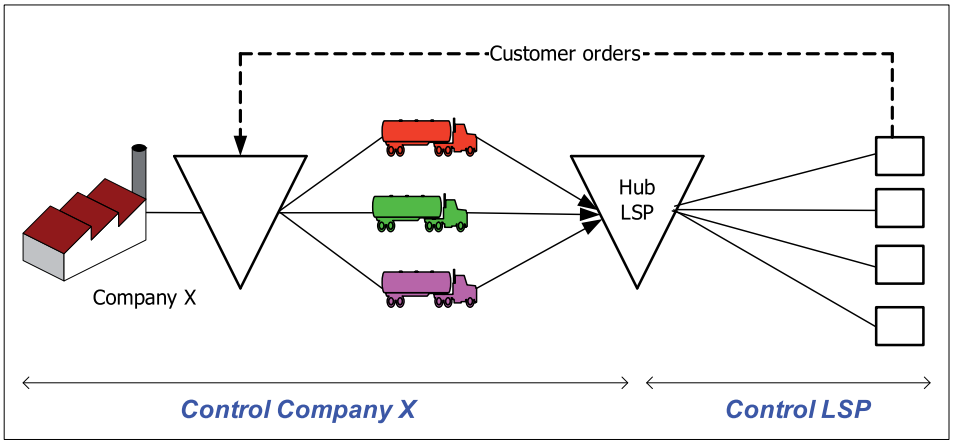
16. Is this percentage generally accepted by the market?

    .....

17. Physical distribution costs and service levels can be calculated from different perspectives. Please, indicate which perspective you have taken in the previous two questions about the current cost and service levels.
    - ○ Business unit perspective
    - ○ National perspective
    - ○ Regional perspective
    - ○ European perspective
    - ○ Global perspective
    - ○ Other .....

Introduction SP Experiment to respondent: experiment 1

The first choices represent two hypothetical tender proposals from two different LSPs. These proposals have the following logistics concept → use card to explain to respondent



Characteristics:

- Logistics hub is managed by a LSP and used to deliver customers in Southern-Europe
- The LSP at the hub is responsible for receiving the inbound shipments as well as the temporary storage of the products at the hub.
- For all shipments towards the hub road transport is used. The many different subcontractors used for these deliveries are contracted and managed by Company X.
- The hub is delivered after receiving a sales order from one of the customers.
- Company X controls replenishment of the hub

- The choices presented differ from each other on the following factors → use example choice card for respondent
  - Costs: Refer to the total cost yearly spent on physical distribution: after production till delivery to the customer. Inclusive transport, handling and inventory cost. No switching cost / cost for tender procedures. Beside the absolute level of the cost also the change in percentages in comparison to your base level,<<repeat base level respondent>>, is shown.
  - Service: refer to the percentage of orders that will be delivered on time to your customers proposed by the LSP. Keep in mind your base level is <<repeat base level respondent>>
  - Commitment: refer to the fact that partners do not have to worry about being replaced; expressed in the contract term agreed with the LSP.
- Values for each of these variable vary on the cards shown
- Please assume that any other factors which are not incorporated in the choices proposed are the same for both proposals.

Choice cards

- Please look at each option carefully and indicate which you would have preferred. We emphasis that there are no correct answers to these questions, we are simply interested in what would have been your response if only these options were available.

18. Which option do you prefer?

Option A: Basic collaboration		**Option B: Basic collaboration**
Cost: € 52.500.000 (+5%)		Cost: € 49.000.000 (-2%)
Percentage orders delivered on time: 97,0%		Percentage orders delivered on time: 93,0%
Contract term: 1 year		Contract term: 3 years
Prefer option A ☐		Prefer option B ☐

Question 19 till 23: another 6 choice options are presented to the respondent

24. Were you able to make the comparison in this set of choices?
    - o Yes
    - o No, because.....

25. For each choice, did you understand each of the characteristics that we described?
    - o Yes
    - o No. Please indicate what was not clear .....

26. Which of the following indicates the way you selected the most preferred proposal?

- Comparison of *all* provided information
- Comparison of *one* of the characteristics. Please select one of the following options.
    - o Cost
    - o Service
    - o Commitment

- Comparison of a *combination* of two characteristics.
  - Cost and service
  - Cost and commitment
  - Commitment and service
- Random
- Intuition
- Other,.....

27. Do you think the proposals presented are realistic?
    - Yes
    - No. Please indicate what was not realistic …… ....

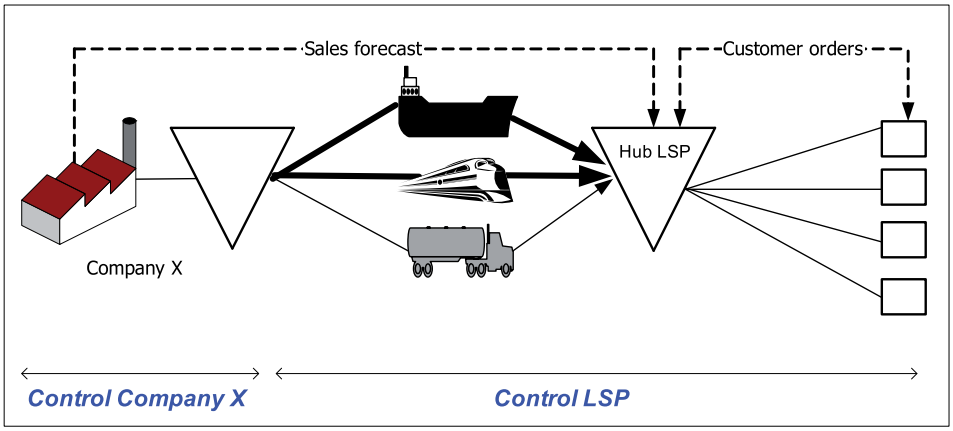
Introduction SP Experiment to respondent: experiment 2

Introduction

On the following pages you will be presented again with a number of choices that represent two hypothetical tender proposals. Nevertheless there is a difference with the choices presented in the previous section. Now there are two proposals of the same LSP. Please assume you have decided to renew the contract with one of your LSP, this LSP propose two different logistics concepts.

- The two concepts presented by this LSP are called:
  - Concept A: Basic collaboration → concept as in the previous experiment. The concept where you control replenishment of the hub and contracting of the subcontractors
  - Concept B: More intensive collaboration. → Use card to explain concept to respondent.

- Concept B, more intensive collaboration, represents the following situation:



Characteristics concept B:

- The heart of this concept is using different transport modalities in stead of only using road transportation to deliver the hub.
- Hub replenishment responsibilities are partly shifted to the LSP → to achieve economies of scale
- In this concept more information need to be shared between Company X and the LSP to plan and control the activities. The transit times of the goods increase, and as a result replenishment of the hub will be based on sales forecast in stead of actual received sales orders. The service provider needs sales forecast at an aggregated level in order to ensure delivery of the customer orders.
- This concept has the possibility to reduce logistics cost significantly and improve delivery performance, but the responsibility for replenishing the hub is transferred from Company X to the LSP.

Choice variables

- Choosing this concept means that also variables like trust and confidentiality are more important. Therefore these elements are incorporated in the choices presented now.
- The choice cards presented will look like this example → use example card to show respondent.
- Card A: refer to concept A and variables shown are like the cards in the previous experiment: cost, service and contract term.

- Card B: refer to concept B and differ from each other on the following factors:
  - Cost: refer to the total cost yearly spent on physical distribution measured in Euros
  - Service: refer to the percentage of orders that will be delivered on time to your customers.
  - Trust: refer to the feelings you have about this LSP. The belief the LSP will (not) harm your interests for example in selecting subcontractors. Beside the belief there will also be given some information about the possibility to put this aspect in the contract. The following four levels will be used during experiment → explain four levels.
  - Confidentiality: Refer to the belief that the LSP will use shared information confidentially yes or no. In line with the variable trust, also for this aspect there are four different possibilities → explain 4 levels used.
  - Commitment: refer to the fact that partners do not have to worry about being replaced. Expressed in the contract term agreed with the LSP.
  - Control replenishment: refer to the party who is responsible for replenishing the hub. Refer to the two different concepts.

- Again the values for these variables will vary in each choice presented.
- Please assume that any other factors which are not incorporated in the choices proposed are the same for both proposals.
- However it is likely that the proposed context differs from the current situation in your organization; please assume that you have to deal with the described situation.

Choice cards

- Please look at each option carefully and indicate which you would have preferred. We emphasis that there are no correct answers to these questions, we are simply interested in what would have been your response if only these options were available.

28. Which option do you prefer?

Concept A: **Basic collaboration**		**Concept B:** **More intensive collaboration**
Cost: € 148.500.000 (-1%)		Cost: € 138.105.000 (-7%)
Percentage orders delivered on time: 97,0%		Percentage orders delivered on time: 98,0%
		You're *not absolutely certain* LSP will not harm your interests
		You're *convinced* and have contractually agreed LSP kept shared information confidential
Contract term: 1 year		Contract term: 5 years
Company X controls replenishment		LSP controls replenishment
Prefer Concept A ☐		Prefer Concept B ☐

Question 29 till 36: another 8 choice options are presented to the respondent

37. Where you able to make the comparison in this set of choices?
    - o Yes
    - o No, because

38. In the choice, did you understand each of the characteristics that we described?
    - o Yes
    - o No. Please indicate what was not clear .....

39. Which of the following indicates the way you selected the most preferred proposal?

- Comparison of *all* provided information
- Comparison of *one* of the characteristics. Please select one of the following options.
  - Cost
  - Percentage orders delivered on time
  - Trust
  - Confidentiality
  - Contract term
  - Company X controls replenishment hub
  - LSP controls replenishment hub
- Comparison of a *combination* of two or more characteristics. Please select from the list below.
  - Cost
  - Percentage orders delivered on time
  - Trust
  - Confidentiality
  - Contract term
  - Company X controls replenishment hub
  - LSP controls replenishment hub
- Random
- Intuition
- Other,.....

40. Do you think the proposals presented are realistic?
  - Yes
  - No. Please indicate what was not realistic .....

Introduction SP Experiment to respondent: experiment 3

- In the last questions again some choices are presented. Now the compared proposals are both based on the concept of intensive collaboration. But these are proposals of two different LSPs. Thus, the concept where:
  - Different transport modalities are used.
  - LSP is responsible for replenishing the hub.
  - Hub replenishment based on sales forecast in stead of actual orders.
  - Sales information need to be shared

Choice variables

- Proposals shown differ from each other on the following factors: → show example choice card to respondent. Now the following variable on both cards:
  - Cost: refer to the total cost yearly spent on physical distribution measured in Euros
  - Service: refer to the percentage of orders that will be delivered on time to customers.
  - Trust: refer to the belief the LSP will not let his own interests prevail in selecting subcontractors. Explain 4 levels used during experiment.
  - Confidentiality: Refer to the belief that the LSP will use shared information confidentially. Explain 4 levels used during experiment.
  - Commitment: refer to the fact that partners do not have to worry about being replaced. Expressed in the contract term agreed
- Please assume that any other factors which are not incorporated in the choices proposed are the same for both proposals.

- However it is likely that the proposed context differs from the current situation in your organization; please assume that you have to deal with the described situation.

41. Which option do you prefer?

Option A: **More intensive collaboration**		**Option B:** **More intensive collaboration**
Cost: X52.500.000 (+5%)		Cost: X49.000.000 (-2%)
Percentage orders delivered on time: 97,0%		Percentage orders delivered on time: 93,0%
You're *convinced and have contractually* agreed LSP will not harm your interests.		You're *not absolutely certain* LSP will not harm your interests.
You're *convinced* LSP kept shared information like sales forecast confidential		You're *convinced* LSP kept shared information like sales forecast confidential
Contract term: 3 years		Contract term: 5 years
Prefer option A ☐		Prefer option B ☐

Question 42 till 47: another 7 choice options are presented to the respondent

48. Were you able to make the comparison in this set of choices?

- o Yes
- o No, because.....

49. In the choice, did you understand each of the characteristics that we described?

- o Yes
- o No. Please indicate what was not clear .....

50. Which of the following indicates the way you selected the most preferred proposal?

- Comparison of *all* provided information
- Comparison of *one* of the characteristics. Please select one of the following options.
  - Cost
  - Service
  - Commitment
- Comparison of a *combination* of two characteristics.
  - Cost and service
  - Cost and commitment
  - Commitment and service
- Random
- Intuition
- Other,.....

51. Do you think the proposals presented are realistic?
  - Yes
  - No. Please indicate what was not realistic .....

Part III: Closing

- Ask respondent if there are any remarks or observations in consequence of this interview?
- Thank respondent for participation.
  - Summary of the first part will be send for review
  - Results will be fed back in a separated report after finishing this phase of the project.

Summary

Introduction

Collaboration is a required key competence for organizations in nowadays volatile business environment where organizations focus on their core competences and outsource other activities to specialized providers. Therefore, stronger relationships with other entities in a supply network are needed to achieve and contain competitive advantage. This general observation is also applicable for the logistics field. Logistics is one of the activities often identified as non-core competence and for that reason outsourced to specialized providers. Simultaneously, the complexity of outsourced logistics services has been increased over the last decades for two reasons. First, more different services are outsourced to logistics service providers (LSPs). Second, these different services are not bought in isolation, but as a package of logistics services. As a result, closer collaboration between shipper and logistics service provider is becoming increasingly important. Empirically, the potential benefits of closer logistics collaboration in terms of costs and service advantages are proved by recent research projects. In practice, collaborative relationships between shipper and LSP often stand at an operational level, because several thresholds exist to intensify the level of collaboration. As a result, the benefits of logistics collaboration are not exploited fully.

Operations research models used to prove the potential benefits of logistics collaboration usually assume that individual decision makers act as a fully rational agent. On the other hand, there is abundant evidence in the decision making behavior literature that this assumption of full rationality is not correct. Also in the supply chain management and logistics field there are publications emphasizing that human factors, like trust and commitment, function as a threshold to intensify logistics collaboration. Nevertheless, these publications do not quantify the impact of these factors. Therefore, it is the aim of this research to identify the factors that function as a threshold in a shipper's decision to intensify collaboration with a LSP and also to quantify the impact of these factors.

Methodology

The research project starts with a review of three streams of literature: logistics outsourcing, collaboration and behavioral decision making. Afterwards, the findings of these separated streams are combined, and a cross-section of the theoretical findings is

presented. This cross- section is used to solve our research problem from a theoretical point of view.
This literature review is followed by two phases of empirical research: case studies and a stated preference experiment. The cases are conducted to validate theoretical findings based on practitioners' knowledge, and through that creating a solid base to design the stated preference experiment. The stated preference experiment is used to reach our final research objective. The chemical industry is chosen as the focus industry for this research. This means the empirical data of this research are collected at companies or logistics service providers that are active in the chemical sector.

Literature review

Logistics outsourcing is a possible decision to reach the overall business strategy. The bulk of outsourced logistics activities still have an operational character. As a result, a transaction-oriented purchasing approach is typically used to purchase the outsourced activities. Literature identifies service and costs, in terms of price, are the dominating decision criteria in this process. Nevertheless, literature identifies three areas that increase the complexity of purchasing logistics services: changing business environment, increased complexity of outsourced services, and service specification difficulties. As a result, some logistics services moved to upper segments of Kraljic's purchasing portfolio and the purchasing approach for logistics services should be more differentiated. The transaction-oriented approach is not longer the most preferred approach for all types of logistics services, because advanced logistics services require a sourcing strategy with a relation-oriented purchasing approach.
Logistics outsourcing results in collaborative relationships between shippers and LSPs. The collaboration literature provides quite a few classifications to distinguish between different levels of integration in these relationships. Terminology used in these classifications differs per author, but the distinguished levels are comparable. In general, three points may be concluded:

- Levels of integration can range from arm's length to strategic partnering.
- Logistics collaboration exists between two actors (bi-lateral) or in a network (multi-lateral).
- To move to a higher level of collaboration the hard as well as the soft side of a relationship needs to be developed.

As a next step, different organization theories are reviewed to identify factors that may influence a collaboration decision. Each single theory offers a unique perspective on the formation of collaboration relationships. Nevertheless, none of the theories is holistic and sufficient to capture the complexity of collaboration decisions. Therefore, the different perspectives should be viewed as complementary. As a result, in this research the

different organizational theories are used to compose a list of variables that possibly influence a collaboration decision. The variables trust, confidentiality and commitment are identified as key variables at this list.
As a third stream, the behavioral decision making literature is studied. This literature shows that individuals not only derive utility from material benefits, but also from immaterial factors. Besides, the behavioral decision making literature makes clear that individuals are often reluctant to change and as a consequence they not always respond to relative differences in a rational manner. Summarized, the findings in behavioral decision making literature indicate that reluctance to change and the aspect of non-full rationality function as thresholds to fully benefit from the economic benefits of more intensified logistics collaboration. These findings conflict with the assumptions of neoclassical and new institutional economic theory that are often used in the logistics field and assume individual decision makers act as fully rational agents.
The literature section ends with a cross-section of the theoretical findings of the three different streams. This cross-section shows that the main decision variables for a logistics collaboration decision are: costs, service, trust, confidentiality and commitment. Next to this, the cross-section shows that the behavioral decision making literature identifies two thresholds for logistics collaboration that are not identified by the logistics outsourcing or collaboration literature: non-full rationality and inertia. These findings provide an answer to our research question from a theoretical point of view. Nevertheless, the literature does not provide empirical evidence to support this conclusion and does not indicate how large the thresholds are.

Case studies

Seven case studies have been conducted to dig deeper for nuances and insights about the current status of logistics collaboration between shipper and logistics service provider. Each case represents a collaboration decision between a shipper and logistics service provider. Data are collected by means of semi-structured interviews and company documents at both the shipper and logistics service provider side. In total 25 interviews are carried out.
The cases confirm a volatile situation at both the shippers' and LSPs' market. As a result, respondents indicate there is an increased awareness of the need for more intensive collaboration to meet the upcoming challenges. Nevertheless, not many shippers have already rethought or adapted their logistics strategy to the altering environment. As a result, the collaborative relationships between shipper and logistics service provider often still have an operational character. Shippers are still scared to intensify collaboration by transferring more responsibilities to the service provider. Fear about loss of control and fear to be dependent of a certain provider are reasons most frequently mentioned

to not transfer more responsibilities to a LSP. These findings are in line with the reasons found in the literature.
Our cases confirm the increased complexity of logistics outsourcing as identified in the literature. As a result, a differentiated sourcing approach to purchase logistics services was expected. This is not confirmed by our cases. The case study results make clear that the shippers respond to the increased complexity in a more varied way. Using a differentiated sourcing approach is just one of the options, next to changing the logistics organization or outsourcing strategy. In addition, the cases show that most shippers use a transaction-oriented purchasing approach, independent from the position of the purchased service in the Kraljic's matrix. This means that there is a strong focus on costs reduction by yearly rate negotiations with their service providers, instead of a focus on establishing relationships to create competitive advantage. The respondents indicate that they do not only use costs in terms of price as decision criterion, although price was the most often mentioned and dominating criterion. Our respondents also indicated service, trust, commitment and confidentiality as important decision criteria. This conclusion validates the findings of the literature review.

Stated preference experiment

A stated preference (SP) experiment is used to reach the final research objective. Stated preference research is based on the classical economic concept of individuals deriving utility from the consumption of a particular product or service. Utility implies an overall value attached to a product or service by an individual and is derived from both material and immaterial incentives. In a stated preference experiment different alternatives are proposed to a respondent. This respondent is assumed to choose the alternative that gives them the highest utility. In our experiment the proposed alternatives represent different levels of collaboration between shipper and LSP. The proposed alternatives are described as bundles of attributes that are expected to impact respondents' preference. The attributes of our alternatives are selected based on the prior conducted literature review and case studies. This prior research made clear that the main decision criteria in a vertical collaboration decision between shipper and logistics service provider are: costs, service, commitment, trust and confidentiality. These attributes are incorporated in our experiment.
The heart of our SP experiment is giving respondents the choice to reduce logistics costs by implementing a concept that requires more intensive collaboration with logistics service providers. To make this choice clear and explicit to the respondents, a standard case description is used. In short, the case describes two different logistics concepts of "*basic collaboration*" and "*intensified collaboration*". Both concepts have the same logistics structure; products are produced in a manufacturing plant owned by the shipper, and

via a logistics hub owned by a logistics service provider, distributed to the end customers. The starting point for the respondent is the concept of basic collaboration. This is a situation wherein only basic logistics services, such as warehousing and transportation, are outsourced. The LSP at the hub is only responsible for the operation activities at the hub. Accompanying coordinating and sourcing activities are still done by the shipper. The alternative proposed to the respondents is the intensified collaboration concept. This concept is characterized by transferring sourcing and replenishment responsibilities to the logistics service provider of the hub. In this second concept, the LSP functions as a Lead Logistics Provider, this results in a higher degree of mutual dependency between both organizations.

The data of the experiment are collected by interviewing 47 representatives from 17 different chemical companies. All respondents have a managerial function in supply chain management or purchasing management. The results of the experiment can be summarized as follows:

- The experiment shows that the attributes costs and service are the most important variables in logistics collaboration decisions, but the experiment also proves the significant impact of immaterial incentives like trust, commitment and confidentiality.
- The stated preference data show there are differences in how respondents value the five variables in a logistics collaboration decision, because of their responsibility in the organization or their current costs level. Decision makers with a supply chain management or logistics responsibility attach more value to the variables costs and service in a logistics collaboration decision than their colleagues with a purchasing responsibility. The immaterial aspects, trust, commitment and confidentiality, are valued equally by both subgroups. Besides, respondents with high logistics costs measured in absolute numbers value the attributes costs and trust differently from respondents with low logistics costs. The costs and trust variables are more important in the logistics collaboration decision for the first group.
- The stated preference experiment confirms the existence of inertia. The existence of inertia constrains the intensification of logistics collaboration. The minimum cost saving that a shipper needs to switch to a situation that requires a higher level of collaboration with LSPs differ per subgroup identified in our sample.

Summarized, we may conclude that the stated preference results confirm our theoretical findings: the existence of inertia and the aspect of non-full rationality of decision makers function as a threshold in a shipper's decision to intensify collaboration with a logistics service provider. As a result, profitable collaboration options may remain unexploited in practice. Next to this, the results of our experiment quantify the thresholds.

Contribution and limitation

Our empirical research prove that the thresholds, as identified in the behavioral decision making literature, also exist in a shipper's decision to intensify collaboration with its LSP. These results show that the integration of behavioral decision making literature within the logistics field is useful to understand why the potential benefits of logistics collaboration are not achieved in practice. In addition, our results show that decision makers in logistics cannot be seen as fully rational agents. This finding shows that better incorporation of human behavior into the existing models, used to prove the potential of logistics collaboration, will enhance the precision and rigor of these models and yield more realistic results. Next to this, the research uses a stated preference experiment to reach the final objective. This method has not been used very often in the logistics field. This research shows that selection of a different research method provides a possibility to increase the understanding of a specific phenomenon.

Also from a managerial point of view this research provides a number of opportunities. The conducted case studies provide insights, for both shippers and LSPs, of the current status of and difficulties with logistics collaboration and purchasing logistics services. Subsequently, the research makes clear which factors function as a threshold to fully benefit from closer logistics collaboration and shows how large these thresholds are. These insights can be used to provide actions for removing or at least reducing these thresholds.

Despite the merits of this research, a few critical comments need to be raised as well. A first limitation can be found in the fact that our data collection was limited to companies in the chemical sector. Therefore, our findings cannot be directly generalized to other industries. This can be accomplished through additional empirical verification. Concerning data collection, also another limitation arises because the data of the stated preference experiment are only collected at the side of the shipper, because the shipper is the purchasing and thus leading actor in a collaboration decision between shipper and LSP. Including the logistics service providers' side in further research may result in additional insights. Furthermore, in our stated preference experiment a standard case description with a specific collaboration situation between shipper and LSP is used. As a consequence, the results cannot be directly generalized to collaborative relationships between shipper and LSP in general. This could be accomplished through additional empirical verification.

Continuing along the lines of research employed in this dissertation, future research could also be aimed at obtaining a more detailed understanding of how the identified thresholds can be reduced.

Samenvatting (summary in Dutch)

Introductie

De laatste decennia concentreren bedrijven zich in toenemende mate op kun kernactiviteiten. Niet-kernactiviteiten worden vaak uitbesteed aan derden. Door het uitbesteden van deze activiteiten wordt samenwerking met andere bedrijven belangrijker om concurrentievoordeel te behalen en te behouden. Logistiek is één van de activiteiten die vaak wordt uitbesteed aan een gespecialiseerde dienstverlener. Tegelijkertijd is de complexiteit van logistieke uitbesteding de afgelopen decennia toegenomen. Hiervoor zijn twee redenen aan te wijzen. Allereerst worden er meer verschillende soorten logistieke diensten uitbesteed aan een logistieke dienstverlener (LSP) dan in het verleden. Daarnaast worden deze verschillende diensten niet afzonderlijk ingekocht maar als een gecombineerd pakket van diensten. Deze beide ontwikkelingen maken intensievere samenwerking tussen verlader en LSP steeds belangrijker.

De potentiële kosten en service voordelen van intensievere logistieke samenwerking tussen verlader en LSP zijn aangetoond in diverse onderzoeksprojecten. Desondanks blijft in de praktijk de samenwerking tussen beide partijen vaak steken op een operationeel niveau. Er bestaan drempels die een intensievere vorm van samenwerking tegenhouden. Het gevolg is dat de voordelen van logistieke samenwerking in de praktijk niet ten volle worden benut.

Om de potentiële voordelen van logistieke samenwerking aan te tonen wordt vaak gebruik gemaakt van operations research modellen. Deze modellen zijn meestal gebaseerd op aannames die veronderstellen dat een individu volkomen rationeel handelt. Er is echter voldoende bewijsvoering in de besluitvormingsliteratuur die aantoont dat deze aannames niet realistisch zijn. Ook binnen de vakgebieden supply chain management en logistiek zijn er publicaties die benadrukken dat menselijke factoren, zoals vertrouwen en commitment, ervoor zorgen dat individuen niet volkomen rationeel handelen. Deze factoren kunnen de besluitvorming van een individu beïnvloeden en daardoor een belemmering vormen om logistieke samenwerking te intensiveren. De publicaties kwantificeren de impact van deze factoren echter niet. Het is daarom het doel van dit onderzoek om enerzijds de factoren te identificeren die belemmerend werken in een beslissing van een verlader om intensiever samen te werken met een LSP. Anderzijds heeft dit onder-

zoek ook ten doel om te bepalen in welke mate deze factoren een dergelijke beslissing beïnvloeden.

Methode

Dit onderzoek start met een literatuurstudie. In deze literatuurstudie staan drie thema's centraal: logistieke uitbesteding, samenwerking en besluitvormingsgedrag. Nadat deze thema's zijn bestudeerd, worden de afzonderlijke bevindingen per thema vergeleken. Deze vergelijking resulteert in een doorsnede van de theoretische bevindingen. De doorsnede wordt gebruikt om vanuit een theoretisch perspectief een antwoord te formuleren op de onderzoeksvragen De literatuurstudie wordt gevolgd door empirisch onderzoek. Dit empirisch onderzoek bestaat uit twee delen: case studies en een stated preference experiment. De case studies worden gebruikt om enkele theoretische bevindingen te valideren in de praktijk. Deze validatie is nodig om een solide basis te creëren voor het ontwerp van het beoogde stated preference experiment. Het stated preference experiment wordt uitgevoerd om het uiteindelijke onderzoeksdoel te realiseren. Beide delen van het empirisch onderzoek worden uitgevoerd in de chemische industrie. Dit betekent dat alle data zijn verzameld bij producenten (verladers) of logistieke dienstverleners die actief zijn in de chemie.

Literatuurstudie

Het merendeel van de logistieke activiteiten die worden uitbesteed, hebben een operationeel karakter. Het gevolg is dat de inkoopmethode die wordt gehanteerd om deze diensten in te kopen, ook vaak een sterk transactioneel karakter heeft. Service en kosten worden geïdentificeerd als dominante selectiecriteria tijdens het inkoopproces. Daarnaast beschrijft de literatuur drie redenen die ervoor zorgen dat de complexiteit van het inkopen van logistieke diensten toeneemt: veranderende ondernemingsomgeving, toenemende complexiteit van het uitbesteden van diensten en de moeilijkheden met het specificeren van de ingekochte diensten. Het gevolg van deze toenemende complexiteit is dat de positie van logistieke diensten in de Kraljic matrix is veranderd. Er is een gevarieerd beeld ontstaan met als gevolg dat logistieke diensten in diverse kwadranten van de Kraljic matrix zijn terug te vinden. Dit betekent dat de transactionele benadering voor het inkopen van logistieke diensten niet langer toereikend is voor het inkopen van alle logistieke diensten. De complexere diensten vereisen, op basis van hun plaats in de Kraljic matrix, een inkoopbenadering die zich meer richt op de ontwikkeling van de relatie met de LSP.

Logistieke uitbesteding resulteert in een samenwerkingsverband tussen verlader en logistieke dienstverlener. De literatuur over samenwerking beschrijft een aantal classificaties die gebruikt kunnen worden om verschillende niveaus van integratie in dergelijke

samenwerkingsverbanden te onderscheiden. Op basis van deze classificaties kan het volgende worden geconcludeerd:

- Het niveau van integratie kan variëren van puur transactioneel tot een strategisch partnerschap.
- Logistieke samenwerking kan bestaan tussen twee actoren (bilateraal) of in een netwerk van actoren (multilateraal).
- Om een relatie te ontwikkelen naar een hoger niveau van samenwerking moeten zowel de harde als de zachte kant van de relatie ontwikkeld worden.

Vervolgens zijn een aantal organisatietheorieën bestudeerd om factoren te identificeren die een beslissing tot samenwerking mogelijk beïnvloeden. Elke theorie geeft een unieke visie op de vorming van samenwerkingsverbanden, maar geen van de theorieën geeft een holistische benadering die toereikend is om de veelzijdigheid van complexe samenwerkingsverbanden te beschrijven. Daarom worden in dit onderzoek de verschillende theorieën complementair gebruikt om tot een lijst te komen van variabelen die een samenwerkingsbeslissing mogelijk beïnvloeden. De variabelen vertrouwen, commitment en geheimhouding worden in de literatuur aangemerkt als belangrijkste variabelen in deze lijst.

Besluitvormingsgedrag is het derde thema dat bestudeerd wordt. Besluitvormingsliteratuur toont aan dat individuen niet enkel worden gedreven door materiële motieven, maar dat ook immateriële motieven een rol spelen in het besluitvormingsproces. Daarnaast maakt de besluitvormingsliteratuur duidelijk dat individuen vaak weerstand hebben tegen verandering. Het gevolg is dat ze niet altijd rationeel kiezen en dus niet altijd kiezen voor het alternatief dat economisch gezien als beste wordt aangemerkt. Samenvattend kan gesteld worden dat de weerstand tegen verandering en het feit dat individuen niet volkomen rationeel handelen, het besluitvormingsgedrag van individuen beïnvloeden. Beide factoren kunnen een belemmering vormen om de potentiële economische voordelen van intensievere logistieke samenwerking te kunnen benutten. Deze bevindingen conflicteren met de aannames van de neoklassieke en nieuw institutionele economie. Deze economische stromingen liggen vaak ten grondslag aan modellen die worden gebruikt om de voordelen van logistieke samenwerking aan te tonen en veronderstellen dat individuele besluitvormers wel volkomen rationeel handelen.

De literatuurstudie eindigt met een doorsnede van de bevindingen uit de drie stromingen. Deze doorsnede toont de belangrijkste variabelen die een logistieke samenwerkingsbeslissing beïnvloeden: kosten, service, vertrouwen, commitment en geheimhouding. Daarnaast toont de doorsnede aan dat de besluitvormingsliteratuur twee factoren beschrijft die een drempel kunnen vormen voor intensievere logistieke samenwerking die niet worden beschreven in de logistieke uitbestedings- en samenwerkingsliteratuur.

Deze twee factoren zijn: beperkte rationaliteit van besluitvormers en weerstand tegen verandering. Deze bevindingen geven een antwoord op de onderzoeksvragen vanuit een theoretisch perspectief. De literatuur verschaft echter geen empirische bewijsvoering om deze conclusie te onderschrijven en kwantificeert de invloed van beide aspecten evenmin.

Case studies

Zeven case studies zijn uitgevoerd om meer inzicht te krijgen in de huidige status van logistieke samenwerking tussen verladers en logistieke dienstverleners in de chemische industrie. Elke case beschrijft een tenderproces waarbij een aantal logistieke diensten worden ingekocht. De data voor de case studies zijn verzameld door gebruik te maken van semi-gestructureerde interviews en bedrijfsdocumenten aan zowel de zijde van de verladers als aan de zijde van de LSPs. In totaal zijn er vijfentwintig interviews gehouden. Zowel de verladers als de LSPs bevestigen in interviews dat zij voortdurend te maken hebben met een sterk veranderende markt. Dit maakt zowel de verladers als de LSPs bewust van de noodzaak om intensiever met elkaar samen te werken. Toch zijn er nog maar weinig verladers die ook daadwerkelijk hun strategie hierop aangepast hebben. Verladers blijken terughoudend om samenwerking met dienstverleners te intensiveren en aldus meer verantwoordelijkheden over te dragen aan de dienstverleners. Het gevolg is dat de samenwerkingsverbanden tussen verlader en LSP in de praktijk vaak een sterk operationeel karakter hebben. Deze constateringen komen overeen met de bevindingen in de literatuur.

De cases bevestigen de toegenomen complexiteit van logistieke uitbesteding zoals beschreven in de literatuur. De verwachting dat dit direct leidt tot een gevarieerdere manier van inkopen van logistieke diensten wordt niet bevestigd door de cases. In de praktijk hebben verladers namelijk ook andere manieren om te reageren op de toegenomen complexiteit van logistieke uitbesteding. Een gevarieerdere inkoopstrategie is namelijk slechts één van de mogelijkheden. Daarnaast zijn er verladers die als reactie op de toegenomen complexiteit hun uitbestedingstrategie veranderen of de organisatie van de logistieke activiteiten wijzigen. De cases laten bovendien zien dat de meeste verladers een transactionele benadering hanteren voor het inkopen van logistieke diensten, onafhankelijk van de positie die deze diensten innemen in de Kraljic matrix. Dit resulteert in een zeer sterke focus op de kosten en het veelvuldig tenderen in plaats van het creëren van concurrentie voordeel door het versterken van een relatie met de LSP.

Het criterium kosten vormde het meest dominante besluitvormingscriterium in de onderzochte cases. Kosten werden niet alleen het vaakst genoemd als criterium dat werd meegenomen in de samenwerkingsbeslissing, het criterium kosten werd daarnaast vaak als eerste genoemd. De cases laten ook zien dat alle verladers een set van criteria gebrui-

ken om hun samenwerkingsbeslissing te nemen. Andere belangrijke criteria die werden gebruikt in de cases waren: service, vertrouwen, commitment en geheimhouding. Deze bevindingen bevestigen het beeld zoals verkregen op basis van de literatuur.

Stated preference experiment

Een stated preference (SP) experiment wordt uitgevoerd om het uiteindelijke onderzoeksdoel te bereiken. Stated preference onderzoek is gebaseerd op het klassieke economische principe dat individuen nut ontlenen aan de consumptie van een bepaald goed of dienst. Nut wordt gedefinieerd als de totale waarde die een individu toekent aan een bepaald product of dienst. Deze waarde wordt bepaald door zowel materiële als immateriële prikkels. In een SP experiment worden aan de respondenten in een interview of enquête diverse alternatieven voorgelegd. De respondenten worden verondersteld het alternatief te kiezen waaraan zij het meeste nut ontlenen. In ons experiment betreffen deze alternatieven twee verschillende vormen van samenwerking tussen verlader en LSP. Elk alternatief wordt gekenmerkt door een aantal variabelen. De variabelen die gebruikt worden in ons experiment zijn geselecteerd op basis van de resultaten van de literatuurstudie en de case studies. Deze studies hebben aangetoond dat in een verticale samenwerkingsbeslissing tussen verlader en LSP de belangrijkste besluitvormingsvariabelen zijn: kosten, service, vertrouwen, commitment en geheimhouding. Deze variabelen, ook wel attributen genoemd, zijn opgenomen in het stated preference experiment. De kern van het SP experiment is dat respondenten de keuze hebben om hun logistieke kosten te verlagen door een intensievere vorm van samenwerking aan te gaan met een LSP. Om deze keuze uit te leggen aan de respondent wordt tijdens de interviews een standaard case beschrijving gebruikt. Samengevat beschrijft deze standaard case twee verschillende logistieke concepten: "*basis samenwerking*" en "*intensieve samenwerking*". Beide concepten hebben dezelfde logistieke structuur. De producten worden geproduceerd in een fabriek van de verlader. De producten worden vervolgens opgeslagen op een logistieke hub van een LSP en tenslotte worden de producten door diverse dienstverleners gedistribueerd naar de klant. Het vertrekpunt voor de respondent is de situatie van basis samenwerking. Dit is een situatie waarin basis logistieke diensten, zoals opslag en transport, zijn uitbesteed door de verlader. De LSP van de hub is alleen verantwoordelijk voor de operationele uitvoering van de activiteiten op de hub. De coördinatie ten aanzien van de hub bevoorrading, coördinatie van de distributie activiteiten naar de klanten als ook het contracteren van de LSPs die de distributie verzorgen, is de verantwoordelijkheid van de verlader. Het alternatief dat de respondent krijgt gepresenteerd, is het concept van intensieve samenwerking. In dit concept zijn een aantal verantwoordelijkheden verschoven van de verlader naar de LSP. De LSP van de hub wordt nu tevens verantwoordelijk voor het bevoorraden van de hub en het contracteren van

subcontractors die de leveringen naar de klanten verzorgen. In dit tweede concept krijgt de LSP die de hub beheert, de rol van lead provider. Het tweede concept resulteert in een hogere mate van wederzijdse afhankelijkheid.

Voor het experiment zijn 47 respondenten van 17 verschillende chemische bedrijven geïnterviewd. Al deze respondenten hebben een management functie binnen supply chain management of inkoop. De resultaten van het experiment kunnen als volgt worden samengevat:

- Het experiment laat zien dat de variabelen kosten en service de belangrijkste besluitvormingscriteria zijn in de logistieke samenwerkingsbeslissing van een verlader. Daarnaast laat het experiment zien dat ook immateriële prikkels als vertrouwen, commitment en geheimhouding een significante invloed hebben op het besluitvormingsgedrag van de verlader.
- Het experiment toont aan dat de verantwoordelijkheden van een respondent in een organisatie en zijn huidige logistieke kostenniveau in absolute zin, bepalen hoe hij de verschillende besluitvormingsvariabelen waardeert. Besluitvormers met een supply chain management of logistieke verantwoordelijkheid vinden de variabelen kosten en service belangrijker in een logistieke samenwerkingsbeslissing dan hun collega's met een inkoopverantwoordelijkheid. De immateriële variabelen, zijnde vertrouwen, commitment en geheimhouding, worden gelijk gewaardeerd door de twee subgroepen. Daarnaast waarderen respondenten met hoge logistieke kosten de variabelen kosten en vertrouwen anders dan de respondenten met lage logistieke kosten. De variabelen kosten en vertrouwen zijn belangrijker voor de eerste groep.
- Het experiment bevestigt en kwantificeert de weerstand tegen verandering bij individuele besluitvormers. Deze weerstand tegen verandering beïnvloedt de beslissing van een verlader en vormt daardoor een drempel om logistieke samenwerking te intensiveren. Het minimale kostenvoordeel dat behaald moet worden voordat een verlader bereid is over te stappen naar een intensievere vorm van samenwerking is afhankelijk van de functie van de respondent en zijn huidige logistieke kostenniveau.

Samenvattend kan geconcludeerd worden dat het stated preference experiment de theoretische bevindingen bevestigt. De weerstand tegen verandering en het feit dat individuen niet volledig rationeel handelen, vormen een drempel om de potentiële voordelen van logistieke samenwerking volledig te benutten. Het gevolg is dat economisch interessante opties tot samenwerking onbenut blijven. Daarnaast wordt de invloed van beide factoren op het besluitvormingsgedrag van een verlader met behulp van het experiment gekwantificeerd.

Bijdragen en beperkingen

De resultaten van dit onderzoek bewijzen dat de drempels zoals geïdentificeerd in de besluitvormingsliteratuur ook van toepassing zijn in een beslissing van een verlader om samenwerking met logistiek dienstverleners te intensiveren. Door deze constatering mogen we concluderen dat de integratie van besluitvormingsliteratuur in het logistieke vakgebied bijdraagt aan de vergroting van kennis over logistieke samenwerking. Daarnaast tonen de resultaten aan dat ook besluitvormers in de logistiek niet gezien kunnen worden als rationele besluitvormers. Het integreren van dit aspect in de bestaande modellen die gebruikt worden om het potentieel van logistieke samenwerking te bepalen, kan de uitkomsten van deze modellen realistischer maken. Tenslotte maakt dit onderzoek gebruik van een stated preference experiment om het onderzoeksdoel te bereiken. Deze onderzoeksmethode wordt niet vaak gebruikt binnen het logistieke vakgebied. Dit onderzoek laat echter zien dat het gebruik van onderzoeksmethoden die minder gangbaar zijn binnen een specifiek vakgebied, een mogelijkheid bieden om onbeantwoorde vragen te beantwoorden.

Ook hebben de resultaten van dit onderzoek een praktische relevantie. De resultaten van de case studies geven zowel verladers als logistieke dienstverleners inzicht in de huidige status en moeilijkheden ten aanzien van de inkoop van logistieke diensten. Bovendien toont het onderzoek aan welke factoren een drempel vormen om de voordelen van intensievere logistieke samenwerking te benutten en kwantificeert het onderzoek deze drempels. Deze inzichten kunnen benut worden om acties te definiëren die deze drempels kunnen wegnemen of verlagen.

Ondanks de inzichten die dit onderzoek heeft verschaft, zijn er ook een aantal kantekeningen te plaatsen. Een eerste kantekening is het feit dat de dataverzameling in dit onderzoek zich heeft beperkt tot de chemische sector. Als gevolg hiervan kunnen de bevindingen niet direct gegeneraliseerd worden naar andere sectoren. Hiervoor is aanvullend onderzoek nodig. Ten aanzien van de dataverzameling voor het stated preference experiment moet tevens opgemerkt worden dat de data alleen bij verladers zijn verzameld. Deze keuze is gemaakt omdat de verladers de inkopende partij zijn en daarmee leidend zijn in de besluitvorming. Het ontwikkelen en uitvoeren van een experiment voor dataverzameling aan de kant van de LSPs zou kunnen leiden tot aanvullende inzichten. Ten derde is tijdens de interviews voor ons stated preference experiment een standaard case beschrijving gebruikt. Deze case beschrijft een specifieke situatie van een samenwerking tussen een verlader en een LSP. Het gevolg hiervan is dat de resultaten van het experiment niet direct gegeneraliseerd kunnen worden naar alle vormen van samenwerking. Hiervoor is aanvullend onderzoek nodig. Vervolgonderzoek zou zich tenslotte ook nog kunnen richten op de mogelijkheden om de geïdentificeerde drempels te verlagen.

About the author

Lenny Visser was born on the 9th of January 1979 in Tilburg, The Netherlands. In September 1997, she started her university education in Business Administration at Tilburg University, The Netherlands. She chose for a specialization in logistics management. In March 2002 Lenny obtained her Master's degree with the completion of a thesis about outsourcing of logistics services as part of an internship at Otto. Before graduation she studied five months at the Copenhagen Business School in Denmark.
In June 2002, she started to work as a logistics engineer at Océ Technologies in Venlo within the division Manufacturing and Logistics. In 2004 she moved to UPS Supply Chain Solutions. There she worked in the position of solutions analyst.
Following her scientific ambition, in January 2006, Lenny started her PhD study at Fontys University of Applied Sciences at the Engineering and Logistics department under supervision of Professor Kees Ruijgrok of the Tilburg University.
Currently, Lenny is working in the position of a lecturer at Fontys University of Applied Sciences at the Financial Management department.

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