Doctoral Thesis

Collaborative planning in heterarchic supply networks

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Collaborative planning in heterarchic supply networks

A dissertation submitted to the SWISS FEDERAL INSTITUTE OF TECHNOLOGY ZURICH for the degree of Doctor of Sciences

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Abstract

Supply chain management (SCM) is widely viewed as key to building a sustainable competitive edge. However, research indicates that supply chain integration is still the most difficult challenge facing manufacturers today. While most research on supply chain integration has been on large-firm, strategic supply chains, less research exists on decentralized or heterarchic supply chains with multiple power centres. Against this backdrop it has been suggested that collaborative planning is a key enabler of supply chain integration. Despite collaborative planning’s integration promise, there is a dearth of research on its mechanisms and antecedents, especially from a human point of view.

To address this void in research this study develops a framework of collaborative planning mechanisms and antecedents grounded in SCM, organization studies, and applied psychology literature. To tackle the complexity of the phenomenon under study adequately, this research, while primarily quantitative in focus, integrates different theoretical stances (cognitive network and enactment theory) and methodologies (functionalist and social constructionist). Collaborative planning is explored and tested in two heterarchic supply networks, both incorporating the Swiss forestry and timber industry. Qualitative interview and survey data was collected from a sample of active participants in each supply network. Findings from statistical analyses and cause mapping largely support quantitative assumptions and qualitatively reveal new insights into collaborative planning. The following key conceptual and empirical findings emerged:

Firstly, while process integration in strategic networks is based on hierarchy, in heterarchic supply networks process integration must emerge through lateral coordination of local processes. Secondly, the effectiveness of collaborative planning in achieving this process integration largely depends on actors’ ability to integrate robust plans with situated actions. The key ingredients of this kind of integrated planning are as follows: continuous and early exchange of knowledge; joint definition of robust goals; and adjustment of situated planning. Thirdly, mutual perspective taking and the enactment of shared meaning are found to facilitate collaborative planning and supply network integration. Fourthly, this study sheds some light on an inherent tension of networks, that is, the paradoxical relationship between interdependence and organizational autonomy. Findings show interdependence among network actors to facilitate collaborative planning only for those with low or medium autonomy but not for actors with high autonomy. Finally, this research highlights the importance of systems thinking as a means of coping with network dynamics.
These findings and the extended framework provide some new insights into collaborative planning and heterarchic supply networks. It is hoped that the implications of this thesis could provide some helpful orientation to practitioners navigating the complex landscape of heterarchic supply networks. Theoretical implications clearly show the need for further scholarly contributions to the rapidly growing field of SCM especially from a social science perspective.
Zusammenfassung


Aufbauend auf einer umfassenden interdisziplinären Literaturanalyse (Supply Chain Management, Organisationswissenschaften, Arbeits- und Organisationspsychologie) wird im Zuge der hier vorliegenden Arbeit ein Rahmenmodell zur Kooperativen Planung entwickelt. Im Mittelpunkt stehen dabei die Einflussfaktoren Kooperativer Planung. Die vorliegende Arbeit beleuchtet das Thema aus verschiedenen organisationstheoretischen (Kognitive Netzwerk-Theorie versus Enactment-Theorie) und methodologischen (funktionalistisch versus sozialkonstruktivistisch) Perspektiven. Im Sinne eines multimethodalen Ansatzes wird das Forschungsmodell zur Kooperativen Planung zwar primär aus quantitativer (Fragebogenstudie) aber auch aus qualitativer (Interviewstudie) Sicht empirisch getestet und erweitert. Die Studie basiert auf Daten aus zwei heterarchischen Logistiknetzwerken der Schweizer Forst- und Holzwirtschaft. Die Ergebnisse verschiedener statistischer und qualitativer Analysen bestätigen die Grundannahmen des Forschungsmodells. Die zentralen Ergebnisse lassen sich wie folgt zusammenfassen:


Preface

Planning is pervasive in organizations. Planning is indispensable as it prepares minds for situated action. Planning is about the construction and the enactment of plans; one does not work without the other. In collaborative planning two minds must jointly create and enact plans. To construct and enact a Ph.D. thesis is as much an individual endeavour as it is a collective sense-making process. Hence I wish to thank my advisor Professor Gudela Grote for her invaluable academic and personal support. Her enactment of autonomous and supportive working structures enabled me to appreciate the precious intellectual and personal experience of writing a Ph.D. thesis. My further thanks go to my co-advisor Professor Paul Schönsleben who through his teaching and writing spurred my fascination with supply chain management. I wish to thank Oliver Thees and Renato Lemm for preparing the site of practice for this study, that is, the forestry and timber industry, and for generously sharing their expertise in forestry. This research would not have been possible without the generous help of workers, entrepreneurs, and managers from two forestry supply networks who invested considerable time and effort in this study. Financial support from the Swiss Federal Institute of Technology Zurich (ETH) and the Swiss Federal Institute for Forest, Snow and Landscape Research (WSL) is gratefully acknowledged. I wish to thank my colleagues and friends in Switzerland and Europe for countless scientific discussions and for their tremendous personal support during this scientific and personal endeavour. My thanks in particular go to: Christian Bonk, Daniel Boos, Dominik von Burg, Gian-Claudio Gentile, Marius Gerber, Sven Grund, Michaela Kolbe, Barbara Künzle, Marco Kunz, Joanna Metcalfe, Philip Moscoso, Sabine Raeder, Johann Riedel, Christian Schmid, Craig Shepherd, Cees de Snoo, Alexandra Totter, Toni Wäfler, Johann Weichbrodt, Anna Windischer, and Anette Wittekind. Furthermore, I wish to thank Anita Stockburger for her good humoured support during the writing of this thesis. I wish to thank Oswald Frick for his support in developing the schedule for this research project and for many inspiring discussions. Finally, my thanks go my parents, Josef and Heidemarie, and my brothers, Björn and Manuel, for their loving encouragement and support and firm belief in me.
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Chapter 1

Introduction to the research

Connectivity to an interorganizational network and competence at managing collaborations have become the drivers of the new logic of organizing.


1.1 Introduction

This chapter introduces the study on collaborative planning in decentralized supply networks. I highlight the importance of supply chain management and outline the research problem. The purpose of the study is indicated before the research approach is delineated in some detail. Reasons are given as to why a pluralistic approach is chosen for studying collaborative planning in decentralized supply networks. Finally I describe the empirical approach of the study and its contributions to the existing literature.

1.2 Supply chain management

Christopher (1998) states that “the real competition is not company against company but rather supply chain against supply chain” (p.16). Handfield and Bechtel (2004) suggest that organizations are “increasingly recognising that it is not the best single organisation, but the best supply chains that will win the competition” (p. 4). Several other researchers have highlighted that effective supply chain management (SCM), that is in provisional terms, the coordination of activities from supplier to the ultimate user, gives companies a critical competitive edge (Akkermans, Bogerd, & van Doremalen, 2004; Croom, Romano, & Giannakis, 2000; Ellinger, 2000). A wide range of benefits has been attributed to SCM, including reduced costs, increased market share and sales, and solid customer relations. Hewlett-Packard, IBM, Dell, and Procter & Gamble provide telling examples for companies who through close supply chain cooperation have gained a competitive advantage (Simatupang & Sridharan, 2005). Despite the virtues of SCM, there is some evidence to suggest that SCM has not lived up to expectations. A more recent international survey for example, finds that “supply chain integration is more a rhetoric than reality in most industries.
2 Introduction to the research

in Europe” (Bagchi, Chun, Skjoett-Larsen, & Soerensen, 2005, p. 288). Supply chain integration describes the extent to which business processes, organizational activities, and technologies are streamlined across organizational boundaries (cf., Elbanna, 2007). Chen and Paulraj (2004) similarly conclude that SCM has so far “received more lip service than accomplishment, except in a few leading-edge companies” (p. 151). These insights are supported by findings from the 2006 Global Survey of Supply Chain Progress (CSC & SCMR, 2006), a survey on 134 companies from 22 industries jointly conducted by the Computer Sciences Corporation (CSC) and the Supply Chain Management Review (SCMR). An alarming 56 percent of the 134 responding companies indicated that they had not yet moved beyond the stage of intra-firm optimization in their SCM activities. Similar results were found for forecasting, planning, and scheduling processes, as more than 50 percent of companies were mostly concerned with optimizing their internal planning. In short, supply chain integration seems to be to a considerable extent still only a promise (Barratt & Oliveira, 2001). In view of these modest levels of uptake and effectiveness, one would expect interest in developing means for supply chain integration to be bourgeoning. Moreover, it has been argued that supply chain integration is indeed the most difficult challenge facing manufacturers today (Bagchi et al., 2005; Yusuf, Gunasekaran, Adeleye, & Sivayoganathan, 2004). However, as I will discuss shortly, significant gaps remain in the literature with regard to the question as to how to integrate processes in supply chains.

1.3 Research problem

Several authors suggest that in order to integrate processes in supply chains, companies must collaboratively plan and execute production, storage, and distribution processes (Barratt, 2004a; Barratt & Oliveira, 2001; Dudek & Stadtler, 2005). Stanford University, Northwestern University, INSEAD, and formerly Anderson Consulting conclude from joint research that industry partners must “collaborate on planning and execution of supply chain strategy to achieve a synchronized supply chain” (Barratt & Oliveira, 2001, p. 266). Collaborative planning, that is in provisional terms the lateral alignment of planning processes across organizational boundaries, has moved to the forefront of SCM research over recent years (cf., Barratt & Oliveira, 2001; Danese, 2006). Various procedures and models of planning have been developed, most importantly the Collaborative Planning, Forecasting and Replenishment model (www.cpfr.org). It is probably safe to say that collaborative planning has emerged as the “latest potential enabler of supply chain integration” (Barratt, 2003, p. 59).
However, much of the research on supply chain integration has concentrated upon large-firm strategic supply chains where a dominating actor provides scope definition and leadership (Human & Provan, 1997; Jarillo, 1995). Little research exists on supply chain integration in decentralized supply networks where power is distributed and synchronization of processes open to negotiation. A systematic literature review, conducted in the realm of this thesis, confirms this proposition. Thus, there seems to be a chance to further our understanding of integration and collaborative planning in decentralized supply chains. More specifically, it has remained unclear as to how to integrate processes via collaborative planning in supply chains which lack authorized leadership. Given its practical relevance and theoretical needs, it seems warranted to analyze processes and mechanisms of collaborative planning in decentralized supply chains further. Hence, the overarching research question of this study can be formulated accordingly: How can collaborative planning contribute to integration in decentralized supply chains?

1.4 Research purpose

To investigate this question, I first explore the characteristics of decentralized supply chains by drawing on findings from SCM (e.g., Akkermans et al., 2004) and organizations studies (e.g., Stark, 2001; Sydow & Wndeler, 2004) literature. I then advance the view that more rigorous research is needed on enablers and barriers of collaborative planning in decentralized supply chains, especially from a human point of view. This study suggests that insights into planning processes from the applied psychology literature (e.g., Grote, 2004; Windischer, 2003; Windischer & Grote, 2003; Windischer, Grote, Mathier, Meunier Martins, & Giardon, in press) may help to extend our understanding of collaborative planning in decentralized supply chains. By drawing on this literature this study highlights two key domains of enablers and barriers of collaborative planning in supply chains: cognitive processes and relational structures. I use the term relational structure in a broad sense to denote any kind of structure facilitating the building and maintaining of social relationships (cf., Cook & Howard, 1992). This study proposes that by simultaneously investigating the impact cognitive processes and relational structures have on collaborative planning, it becomes possible to develop a more integrative framework of collaborative planning mechanisms and antecedents.

More specifically, this study promotes the view that cognitive processes facilitates the integration of business processes (cf., Galinsky, Ku, & Wang, 2005; Parker & Axtell, 2001). This view is based on the finding that supply chain integration is threatened by actors’
difficulties in thinking across organizational boundaries as differences in cultures, professions, and reference frames might be quite marked (Bromme & Nueckles, 1999; Clegg, 1994; Tjosvold, 1992; Vlaar, Van den Bosch, & Volberda, 2006). A wide range of dysfunctional outcomes arising from these differences have been identified in the literature, such as misunderstandings, conflicts, and coordination breakdowns (Griffin & Hauser, 1996; Williams, 2002; Yan & Louis, 1999). Coordination is defined in this work as the achievement of concerted action in situations of task interdependence (van Fenema, Pentland, & Kumar, 2004). To guard against such dysfunctional outcomes, actors must understand their co-actors' worldviews; this not only necessitates a change in perspectives but would also give rise to a joint construction of meaning in order to develop a more congruent understanding (cf., Mohrman, Gibson, & Mohrman, 2001).

Further, this study explores in what way relational structures enable collaborative planning processes. Relational structures emerge in the context of network arenas such as specific buyer-supplier relationships and shape collaborative planning processes (cf., Bouwen, 1998). In his highly cited review on interorganizational relations, Galaskiewicz (1985) aptly highlights a structural dilemma most organizations face: Organizations strive for autonomy but to secure organizational survival they must enter procurement relationships with other actors. Similarly, actors in supply chains often face the dilemma that in order to reap significant benefits they must integrate their processes across organizational boundaries which inevitably increases interdependencies (cf., Christopher & Jüttner, 2000; Dubois, Hulthén, & Pedersen, 2004). If one accepts the proposition that actors in supply chains think of interdependence as impairing their autonomy, it becomes obvious why actors might resist supply chain integration processes. The picture that emerges is one of an organization striving to maintain its autonomy while "knowing that it must engage in interorganizational relations in order to procure the resources it needs" (Galaskiewicz, 1985). This study, therefore, explores the two relational structures at the core of the dilemma highlighted by Galaskiewicz (1985): interdependence and autonomy.

1.5 Research approach

In line with Vlaar (2006) this study argues that to do justice to complex and multifaceted organizational phenomena, such as collaborative planning, one must "crisscross paradigms" (p. 45) and entertain multiple theoretical and methodological perspectives. The rationale behind this argument is that paradigmatic accounts are inherently selective and thus blind researchers partly to the complexity of the phenomenon under study (cf., Burrell & Morgan,
Indeed, most researchers nowadays acknowledge that “a single paradigm is necessarily limiting, helping expose certain facets of organizations while obscuring others” (Lewis & Kelemen, 2002, p. 252). In response to recent calls for pluralistic accounts, this study explores collaborative planning in supply chains from different methodological stances. The proposition set forth in this study is that there might be a “greater opportunity for fruitful crossdisciplinary and cross-perspective dialogue than is often realized” in studying collaborative planning in supply chains (Oliver & Ebers, 1998, p. 573).

While the larger part of this study is grounded in the dominant positivist perspective, it also entertains a social constructionist stance (Lewis & Kelemen, 2002, cf., textbox 1 for details).

Textbox 1: Comparison of research perspectives

**Positivist versus social constructionist perspective**

In line with Hudson and Ozanne (1988), I use the terms positivist and social constructionist as summary labels to rather broadly refer to two approaches that differ with regard to their philosophical underpinning and their assumptions about the nature of social reality, that is, their ontology.

Positivists think of organizations as intersubjective realities or objective entities that are made up of “divisions, departments, occupations, levels, recruitment, and reward strategies” (Benson, 1977). Organizations are thought of as physical entities clearly separable from the individuals populating these entities (cf., Bouwen, 1998; Weick, 1979). On the basis of this “entitative perspective” (Bouwen, 1998) scholars engage in research activities to uncover the “truth”, that is, the one intersubjective reality (Hudson & Ozanne, 1988). Positivists commonly refer to a variance methodology (cf., textbox 2) and consequently follow research approaches such as laboratory experiments or questionnaire studies (cf., Burrell & Morgan, 1979; Hudson & Ozanne, 1988).

Social constructionists, in contrast, reject the notion of intersubjective reality and assume that multiple realities exist. Realities are socially constructed (Berger & Luckmann, 1966; Giddens, 1984; Orlikowski, 2000; Weick, 1979). Thus, no ontological difference exists between individuals and organizations as organizations only emerge through individual or social activities. Consequently, natural science methods are deemed to be inappropriate at capturing the realities of the social world. Instead, it is argued that social realities can be best understood by developing “thick descriptions” of them (Geertz, 1973), which affords paying particular attention to context- and time-dependent experiences (cf., Provan & Sydow, in
press). Social constructionists pursue process methodological approaches and often conduct research in a naturalistic or ethnographic manner (cf., Hudson & Ozanne, 1988).

To reiterate, this study blends different theoretical perspectives on collaborative planning in supply chains; more specifically, this study builds on cognitive network theory (Ibarra, Kilduff, & Tsai, 2005; Krackhardt & Kilduff, 2002) and enactment theory (Weick, 1979; 2001; 2003). These theories to be explored in detail in this study differ in some important ways; in general terms, cognitive network theory mainly adheres to positivist assumptions whereas enactment theory adopts a social constructionist stance. In line with its pluralistic stance, this thesis uses quantitative (to a larger extent) and qualitative approaches (to a minor extent) to assess collaborative planning in supply chains.

1.6 Empirical basis and site of the study

Data stem from two forestry supply networks in Switzerland. Each supply network consists of multiple interrelated supply chains encompassing hundreds of organizational actors with various professional backgrounds such as timber industry, logistics and transportation, and forestry (cf., Harland, Zheng, Johnsen, & Lamming, 2004). In order to signify that the organizations under study have the structure of networks and not chains, the term supply network is used in the remainder of this monograph. While most studies on SCM in forestry and the timber industry have been conducted in countries like Sweden, Finland, Chile, Canada, and New Zealand (Carlsson & Rönnqvist, 2005) research in Switzerland has only increased more recently (e.g., Oswald, Riechsteiner, Thees, & Lemm, 2004). Researchers’ attention has been sparked by a chain of catastrophes placing significant financial pressure on forestry actors in Switzerland; firstly, the after-effects of the hurricane Lothar in 1999 (cf., Gaillard et al., 2003), which uprooted the equivalent of several annual yields contributed significantly to the decline in wood prices; secondly, in the years following Lothar, bark beetle infestation caused additional damage and compulsory felling. In response to the resulting economic difficulties, various studies (Jaakko Pöyry, 2002; Oswald, Riechsteiner, Thees, & Lemm, 2004) were conducted in order to define countermeasures. Findings showed Swiss forestry lagging behind competing countries, as for example Austria and Finland. It was made clear that restructuring in forestry was inevitable and that efficiency had to be increased (Jaakko Pöyry, 2002). Indeed, it was found that by improving interorganizational cooperation costs in the forestry supply chain could be significantly decreased. Against this backdrop, this study was set up to help overcome difficulties in the forestry supply networks by exploring enablers and barriers of cooperation in detail. 52 structured and semi-structured
interviews form the basis for the qualitative analysis of the study. The quantitative data, in contrast, stems from the 107 respondents of a questionnaire survey. It is important to note that this study limits its scope to the analysis of the economic role of forests. However, it is crucial to bear in mind that SCM in forestry not only has an economic dimension, but is also heavily entrenched with ecological and social issues. Forests provide ecological stability, protect against natural hazards, and serve as a means for recreation (cf., Perman, Ma, McGilvray, & Common, 2003). In short, the social and ecological value of forests cannot be overstated. This study however, deliberately focuses on their economic dimension.

1.7 Contribution of the study

This study seeks to develop and test a framework of collaborative planning in decentralized supply networks. Firstly, the concept of decentralized supply networks is grounded in theory from organization studies and applied psychology. This study therefore, not only contributes to the rapidly growing body of research conducted at the interface of cognitive and work psychology (cf., Hodgkinson, 2003), but it also answers to the often repeated call that SCM as a discipline needs further theoretical and conceptual underpinning (e.g., Chen & Paulraj, 2004; Croom et al., 2000; Giannakis & Croom, 2004; Harland et al., 2004). It is somehow a truism to suggest that the management of supply chains is likely to benefit from theoretical grounding. But although this truism is generally accepted, more effort is needed to develop a coherent theoretical framework for SCM. As a second step, I carry Grote and Windischer’s (2003) work on collaborative planning within firms in the context of interorganizational networks forward by combining different theoretical perspectives and empirical approaches. Thirdly, this study develops and tests an integrative framework of collaborative planning mechanisms and antecedents, thereby providing new perspectives on network integration.

1.8 Structure of the study

This first chapter has served as an introduction to this study, its overarching research question, methodological approach and contributions. Throughout the second chapter, I will not only develop a definition of heterarchic supply networks but also describe and contrast cognitive network theory and enactment theory. During the third chapter, I will introduce collaborative planning as a means of flexible coordination appropriate for coping with high degrees of uncertainty. I will highlight the increasing importance of collaborative planning for SCM and propose a definition of collaborative planning based on the organization studies
and applied psychology literature. In chapter four, a framework on collaborative planning mechanisms and antecedents is derived from an extensive literature review, and hypotheses to be tested are formulated. Further, I propose a qualitative research question on the preconceptions held by network actors. In the fifth chapter, the research site is described in detail before quantitative and qualitative measures are explained. Subsequently, data analyses are outlined: I describe quantitative approaches, such as mediation and moderation analysis, before outlining qualitative approaches, such as cause mapping and process analysis. Chapter six presents the quantitative and qualitative findings of the study. The theoretical and practical implications of the study are expounded in chapter seven, after which the limitations of the study and possibilities for future research are addressed.
Chapter 2

Heterarchic supply networks

There is a danger in network analysis of not seeing the trees for the forest. Interactions, the building blocks of networks, are too easily taken as givens. Partly, this is because of the perspective of the network analyst, whose purpose is to focus on the forest. The interactions that make it up are only necessary as starting point. Yet why interactions exist cannot be ignored when considering the role of networks in a theory of organization.


2.1 Introduction

In this chapter, I start by introducing the topic of Supply Chain Management (SCM). I go on to investigate three major trends in SCM research: (1) continuous calls to study supply networks (instead of supply chains), (2) the acknowledgment of the importance of interorganizational relationships in supply networks, and (3) an increasing interest in studying decentralized forms of supply networks. On the basis of these trends I develop a definition of heterarchic supply networks. Subsequently, I describe and contrast two theoretical perspectives which are found to be particularly helpful in furthering our understanding of the role of individuals in heterarchic supply networks, that is, cognitive network theory and enactment theory. Both theories, while having important commonalities, favour different techniques for exploring heterarchic supply networks, which is why this study not only builds on quantitative methods but also uses a qualitative approach.

2.2 Introducing Supply chain management

A plethora of different labels has been used to refer to practices for managing supply chains, e.g., value chain management, supply chain synchronization and network sourcing (e.g., Croom et al., 2000). Accordingly, a staggering variety of definitions of SCM exist in the literature (Croom et al., 2000; Handfield & Nichols, 1999; Mentzer et al., 2001; Schnetzler, Sennheiser, & Schönsleben, 2006). Table 1 outlines a sample of definitions on SCM.
Table 1: Definitions of Supply Chain Management

<table>
<thead>
<tr>
<th>Authors</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Christopher (1998)</td>
<td>Network of organisations that are involved, through upstream and downstream linkages, in the different processes and activities that produce value in the form of products and services in the hands of the ultimate consumer.</td>
</tr>
<tr>
<td>Cooper and Ellram (1990)</td>
<td>Supply chain management is “an integrative philosophy to manage the total flow of a distribution channel from supplier to the ultimate user.”</td>
</tr>
<tr>
<td>Ellram (1991)</td>
<td>A network of firms interacting to deliver product or service to the end customer, linking flows from raw material supply to final delivery.</td>
</tr>
<tr>
<td>Handfield and Nichols (1999)</td>
<td>Supply chain management is the integration and management of supply chain organizations and activities through cooperative organizational relationships, effective business processes, and high levels of information sharing to create high-performing value systems that provide member organizations a sustainable competitive advantage.</td>
</tr>
<tr>
<td>Jones and Riley (1985)</td>
<td>An integrative approach to dealing with the planning and control of the materials flow from suppliers to end-users.</td>
</tr>
<tr>
<td>Schönsleben (2004)</td>
<td>Supply chain management (SCM) is the coordination of strategic and long-term cooperation among co-makers in the total supply chain for the development and production of products, both in production and procurement and in product and process innovation. Each co-maker is active within its own area of core competence. The chief criteria when choosing co-makers is their potential contribution towards realization of short lead times.</td>
</tr>
</tbody>
</table>

Table 1 does not provide a comprehensive review of supply chain definitions, but rather highlights some of the contrasting approaches to SCM found in the literature. On the one hand this variety underlines the increasing relevance of SCM in various research fields, for example, operations management, marketing, industrial economics, and to a limited extent organizational behaviour (Croom et al., 2000; Lejeune & Yakova, 2005). On the other hand these contrasting definitions of SCM illustrate that no universally accepted definition of SCM exists and that the scope of the concept is somehow ambiguous (Dubois et al., 2004; Tan, 2001).

Furthermore, little research exists on supply chain integration in decentralized or heterarchic supply networks where power is distributed (Human & Provan, 1997). In contrast, research on supply networks has shown considerable interest in centralized, strategic networks (e.g., Grandori & Soda, 1995; Jarillo, 1995). Strategic supply networks require a hub firm, that is, a dominating actor, to provide scope definition and leadership (Grandori & Soda, 1995; Jarillo, 1995). For example, this can be found in the automotive industry (Mitsubishi, cf., Child & Faulkner, 1997), or the fashion industry (Benetton, cf., Harland et al., 2004; Sydow &
Windeler, 1998). Coordination in the strategic network builds on hierarchical means known from bureaucratic or mechanistic organizations (Sydow & Windeler, 1998; Vincent, 2006). To substantiate the proposition that research has not yet paid adequate attention to parity-based (Grandori & Soda, 1995) or heterarchic supply networks, systematic keyword searches were performed using the online resource ISI Web of Science. A total of 439 articles were identified by searching for “network”, “supply chain”, and “supply network” with the words “hierarchical”, “centralized”, “strategic”, “heterarchic”, and “decentralized”. Out of the total of 439 articles only 50 dealt with decentralized forms of supply networks. This finding provides support for the hypothesis that further research is needed on decentralized supply networks. In order to address this research void adequately and in light of the rather ambiguous scope of SCM, I will firstly develop a definition of heterarchic supply networks. I do so by building on three key trends in SCM research (cf., Storey, Emberson, Godsell, & Harrison, 2006).

### 2.3 Trends in the thinking on SCM

Firstly, scholars’ focus has more recently started to shift from studying supply chains towards investigating supply networks. Secondly, more emphasis has been put on understanding interorganizational relationships in supply networks. Thirdly, drawing on the wider network literature, there is an increasing awareness that research has overly focused on strategic networks while not paying adequate attention to decentralized networks. These trends are to be seen as building blocks of the definition on heterarchic supply networks which will be developed.

#### 2.3.1 Supply networks – not supply chains

Various scholarly efforts to make sense of SCM literature start from distinguishing supply chains from supply networks (Harland et al., 2004; Jahre & Fabbe-Costes, 2005; Knight & Harland, 2005). Some fifteen years ago, Christopher (1992) had already started urging researchers to replace the word chain with network to make explicit that multiple suppliers cooperate with multiple customers. However, it has only been more recently that researchers explicitly addressed supply networks. Harland, Zheng, Johnsen, and Lamming (2004) argue that supply networks essentially consist of “interconnected supply chains, encompassing both upstream and downstream relationships” (p. 1). In line with this argumentation they define supply networks as follows:

> Consequently, firms have sought to integrate individual operational functions, and externalize the focus of their management of operations beyond the firm boundary,
upstream into their suppliers, into suppliers’ suppliers, and downstream into their customers and customers’ customers; here these extended webs of operational relationships are termed “supply networks” (p. 1).

Supply networks are messy and complex, similar to networks in general, with “lateral links, reverse loops, and two-way exchanges” (Harland, Lamming, Zheng, & Johnsen, 2001, p. 22). To appreciate the complexity of supply networks fully, I refer to the wider literature on organizational networks (Borgatti & Foster, 2003; Sydow, 2006a). An interorganizational network, if seen as an organizational form consists of economically related but legally autonomous firms (Sydow & Windeler, 1994, 2004). In very general terms organizational networks can be referred to as “a form of governance” (Provan, Fish, & Sydow, 2007, p. 481). More specifically interorganizational networks are described as “modes of organizing economic activities through inter-firm coordination and cooperation” (Grandori & Soda, 1995, p. 184). What is crucial about this mode of organizing is the fact that it functions differently compared to markets and hierarchies (Sydow & Windeler, 1998). Whereas hierarchies involve relations of dependence and markets involve relations of independence, networks involve relations of interdependence (Child & Faulkner, 1997; Sydow, 2006b).

2.3.2 Relationship view

Sydow and Windeler (1998) point out that the management of interorganizational networks is mainly about designing and coordinating relationships between organizations. Similarly, Christopher (1998) locates the management of relationships as being at the core of SCM. And Larson and Halldorsson (2004) more recently, suggested that the key in SCM is “managing relationships (...) rather than optimising individual components of the system” (p.18). The literature on relationship quality stresses the point that the management of relationships is pivotal for supply chain performance (Chen & Paulraj, 2004; e.g., Dubois et al., 2004; Fynes, de Burca, & Marshall, 2004; Günter, Shepherd, Moscoso, de Snoo, & Riedel, 2007). The focus on supply network relationships is theoretically embedded in the relationship view, which has been introduced in the SCM literature and further elaborated by Christopher (1998), Christopher and Jüttner (2000), and Harland and colleagues (2001; 1999; 2004). According to this view, interorganizational relationships consist of two kinds of ties; institutional and individual ties. Institutional ties are forged, for example, by signing formal contracts, co-investing in research and development activities, and by aligning companies’ strategies. Individual ties emerge through interaction, communication, and cooperation. The importance of individual ties has been clearly acknowledged in literature. It has been stated that it is not organisations that interact per se, but rather the individual
actors within these organisations who are closely involved in building and maintaining interorganizational relationships (cf., Organ, 1971; Osborn & Hunt, 1974). However, despite the importance ascribed to individual ties in the building and maintaining of network relationships, research on supply networks has often only addressed the institutional and organizational level (Marchington, 2005; Schultze & Orlikowski, 2004; Williams, 2002). Fortunately, some more recent accounts have taken the central role of individual actors in networks more carefully into account. This applies especially to the boundary spanning literature, which finds that the building, maintaining, and refining of interorganizational relations heavily depends on those actors holding positions at the boundaries of organizations (Alter & Hage, 1993; Floyd & Wooldridge, 1997; Marchington, 2005; Yan & Louis, 1999).

... in practice, interfirm relations are typically instantiated by individual members who enter into boundary spanning interactions (at the microlevel) to accomplish joint exchange on behalf of their respective firms (Schultze & Orlikowski, 2004, p. 88).

Boundary spanning actors are more closely involved in interorganizational relationships than other members of the organization and tend to interact with their counterparts to a greater extent (Friedman & Podolny, 1992). Interaction between boundary spanning individuals becomes necessary whenever materials or information cross organizational boundaries. Such crossings are referred to as interfaces in the literature (Yan & Louis, 1999). On the one hand, interfaces provide opportunities to increase mutual awareness and initiate joint learning processes among boundary spanning actors (Håkansson, Havila, & Pedersen, 1999). On the other hand, interfaces are potential sources for disturbance, conflict, and misunderstanding. Conflicts and misunderstandings between boundary spanning individuals can arise from “differences in meanings, assumptions, and contexts” (Kellogg, Orlikowski, & Yates, 2006, p. 24). To prevent these coordination difficulties from happening, actors must adopt the role of cultural brokers (Trevillion, 1992), that is, boundary spanners must understand how other actors define issues in relation to their own interests and motives (Hosking & Morley, 1991; Williams, 2002; Yan & Louis, 1999). If cultural brokering fails, interfaces can decelerate and corrupt the flow of materials and information in supply networks.

2.3.3 Heterarchies

While this study proposes that further research on decentralized supply networks is needed, it is crucial to take existing findings into account as they provide important insights into the
functioning and nature of decentralized (supply) networks. Relevant findings stem from Sydow’s research on regional networks (Sydow, 2006a; Sydow & Windeler, 2004), from studies in operations management on decentralized supply chains (Akkermans et al., 2004; Chen, 1999; Lee & Whang, 1999), and from sociological research on organizational heterarchy (Girard & Stark, 2002; Neff & Stark, 2003; Stark, 2001). This monograph mainly draws on the notion of heterarchy (Stark, 2001). Stark refers to heterarchy as an organizational form with minimal hierarchy, distributed accountability, multiple – sometimes competing – power centers, and organizational heterogeneity (Girard & Stark, 2002; Neff & Stark, 2003; Stark, 2001). Heterarchies further have no brand through which affiliate network members could signal their collective identity (Hedlund, 1993; Stark, 2001). Heterarchy in a supply network context implies that through the absence of hierarchy multiple actors with different worldviews and assumptions concurrently shape the structure of the supply network. Actors do not follow a commonly defined network strategy. Instead, network actors often have diverging interests, often-conflicting objectives, and pursue personal agendas; in short, they often optimize their individual objective functions (e.g., Sahin & Robinson, 2005).

2.4 Definition of heterarchic supply networks

By bringing together insights and findings from the three tends on supply networks, interorganizational relationships, and heterarchies (Harland et al., 2004; Schultze & Orlikowski, 2004; Stark, 2001), the following definition of heterarchic supply networks emerges:

_Heterarchic supply networks are polycentric webs of operational relationships constructed by boundary spanning actors along the path of material flow._

It is felt that this picture of heterarchic supply networks derived by merging literature from different disciplines captures real-world complexities adequately. However, while this definition highlights the importance of human agency, it still lacks a more fundamental theoretical underpinning. In order to provide this underpinning I will introduce two theoretical perspectives on the human side of organizations and networks.

2.5 Theoretical perspectives on supply networks

I will provide further support for the argument that an analysis of individual processes can significantly increase our understanding of processes at the network level. I draw on two
different theories which both stress the importance of human agency, that is, cognitive network theory (Ibarra et al., 2005; Krackhardt & Kilduff, 2002) and enactment theory (Weick, 1979; 2001). While cognitive network theory explicitly addresses organizational networks, enactment theory traditionally focuses on processes within organizations and has only recently been discovered by scholars investigating interorganizational relationships and networks (cf., Vlaar et al., 2006).

2.5.1 Cognitive network theory

Cognitive network theory has only more recently been shaped but appears as a very promising area in network research (Ibarra et al., 2005; Krackhardt & Kilduff, 2002). While having its origins in structural sociology (Mizruchi, 1994), it strives to overcome limitations of traditional structural network approaches which mainly focus on the impact network structures and actors' positions have on human behaviour. Subjective factors and cultural influences are assumed to be of less importance, and therefore rarely taken into account in traditional network approaches. Based on the guiding assumption that "psychology and structuralism have much to offer each other" (Kilduff & Krackhardt, 1994, p. 88) cognitive network approaches try to reunify structural and individual approaches. Individual cognition is therefore a subject of great interest to cognitive network scholars (Casciaro, Carley, & Krackhardt, 1999; Kilduff & Krackhardt, 1994). Cognitive network researchers investigate, amongst other things, the perception of networks (Ibarra et al., 2005) and how actors develop the perceptions they hold (Borgatti & Foster, 2003). In the same vein, cognitive network scholars tend to focus on microstructures in networks, either dyads, triads, or clusters, and assume networks are built through bottom-up processes. Lomi and Pattison (2006), for example, suggest a more fundamental shift in interpreting network structures, "as constructed from the bottom up through processes of local interaction among neighbouring social units" (p. 315).

Studies conducted in the tradition of cognitive network research have assessed, for example, actors' cognitive accuracy in network perception. It has been found that actors are likely to see themselves in a more central position in a network than they really are (Johnson & Orbach, 2002). It has also been found that accuracy in perception of networks varies

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1 Readers interested in recent accounts on social network research are referred to Kilduff, Tsai, and Hanke (2006) and Borgatti and Foster (2003).
depending on social rank and reputation (Krackhardt, 1990). These findings help to explain why individual actors often perceive different networks and network relationships even when looking at the same structures (Krackhardt & Kilduff, 1999). While studies on the accuracy of managers’ perceptions are rare, existing findings indicate that managers’ perceptions of structures are often inaccurate (Weick, Sutcliffe, & Obstfeld, 2005, p. 415). From a cognitive network perspective this inaccuracy has far reaching consequences as perceptions of network structures are said to influence actors’ practices irrespective of the accuracy of these perceptions (Nisbett & Ross, 1980; Schwarz, 1998). Indeed, it has been found that actors’ perceptions of network structures shape their actions beyond the influence that structural properties have on actors’ behaviour (Ibarra et al., 2005).

Findings show that actors’ perceptions of the social structure of networks influence “group processes such as consensus formation, decision making, and structural change” (Batchelder, 2002, p. 261). A topic often used for demonstrating the significant impact cognition has on organizations is power (Schwarz, 1998). Individuals who perceive themselves to be highly dependent on resources of co-actors will invest considerably more time in strengthening these relationship ties in comparison to actors who perceive themselves to be self-sustaining. Actors who falsely assume themselves capable of carrying out tasks independently without referring to other’s activities might invest too little effort in collaborating, thus threatening the relationship and its effectiveness (McCann & Ferry, 1979). The importance of cognition in networks is further supported by findings which show that the position of actors is strengthened if others consider them as having exclusive access to needed resources (Kilduff & Krackhardt, 1994). This is illustrated metaphorically in the following event:

*At the height of his wealth and success, the financier Baron de Rothschild was petitioned for a loan by an acquaintance. Reputedly, the great man replied, "I won't give you a loan myself; but I will walk arm-in-arm with you across the floor of the Stock Exchange, and you soon shall have willing lenders to spare" (Cialdini, 1989; cited from Kilduff & Krackhardt, 1994, p. 87).*

Obviously, if others think of an actor as having access to needed resources, such as strong ties to powerful leaders or financiers like Baron de Rothschild, this attribution – whether correct or incorrect – will strengthen actors’ position when bargaining and negotiating with others.
2.5.2 Enactment theory

Enactment theory (Weick, 1979; 2001; 2003)\(^2\) opposes rational behaviour theories which, in general terms, assume that actions flow from rational decision making, that is that cognition precedes action (Brunsson, 1982). Enactment theory, on the contrary, postulates that action precedes cognition, which in turn implies that understanding often only comes after the fact. People enact their environments under the influence of preconceptions formed through past experiences. Past experiences are stored in individuals’ minds in form of networks of cause-effect relationships or, in short, cause maps. As cause maps shape individuals’ actions and organizational processes an understanding of cause maps is key to understanding organizations. In order to more fully develop this line of argument I introduce three images of organizations proposed by enactment theory (Weick, 1979): flows of experience, cause maps, and social constructions.\(^3\)

2.5.2.1 Organizations as flows of experience

Organizations are thought to emerge through the very act of organizing. Organizing is about reducing equivocality, that is, ambiguity or uncertainty, and creating order through individual and collective sensemaking. Sensemaking, in this study, is used in a rather broad sense to denote “the ongoing retrospective development of plausible images that rationalize what people are doing” (Weick, Sutcliffe, & Obstfeld, 2005, p. 409). The focus of this study, however, is on the process of organizing (Weick, 1979). Organizing consists of several intertwined sub-processes detailed in the enactment-selection-retention (ESR; cf., fig. 1) model which is conventionally referred to as enactment theory (Weick, 1979; Weick et al., 2005)

![ESR Model](adapted from Weick et al., 2005)

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\(^2\) This monograph refers to enactment in the Weickian sense (1979; 2001; 2003), thereby deliberately excluding other important and influential notions of enactment (cf., Giddens, 1984; Orlikowski, 2000).

\(^3\) Those elements of enactment theory which are not essential for understanding the basic line of argumentation in this thesis, are not reported. Readers interested in more thorough accounts of enactment theory are referred to Weick for more details (1979; 2001; 2003).
To view organizations as flows of experience (Weick, 2001) indicates that ecologies and organizations are constantly in flux (cf., fig. 1, step 1). Actors confronted with this flux of ambiguous and equivocal ecological raw data constantly generate, single out and bracket some of this data for closer exploration, in other words, enact their environment (cf., fig. 1, step 2). In the selection process actors impose different schemes of interpretation, cause maps, traditions and subjective theories on the enacted raw material trying to make sense of these unequivocal inputs (cf., fig. 1, step 3). If resulting interpretations prove to be plausible they might stabilize over time and context and are thus retained (cf., fig. 1, step 4). The essence of enactment theory is captured in the phrase “How can I know what I think until I see what I say?”

2.5.2.2 Organizations as cause maps

Resulting interpretations, that is, the outcomes of retention processes, are best thought of as a network of causal sequences or, in short, of as a cause map, that is, a specific kind of cognitive map. A cognitive map is a visual representation of an individual's own knowledge used to understand organizational situations (cf., Weick & Bougon, 1986). On the basis of this understanding of cognitive maps, Weick and Bougon (1986) define cause maps as “a form of cognitive map that incorporates concepts tied together by causality relations” (p. 106). Cause maps are cognitive representations of the variables (represented as nodes) and causal relationships (represented as arrows) inferred by individuals from past experiences (cf., Ambrosini & Bowman, 2001). In other words, individuals retain means-ends maps in their minds that have proven to be plausible in the past. However, cause maps are not static, but continuously constructed and re-constructed which is why Bougon, Weick and Binkhorst (1977) refer to depictions of cause maps as snapshots of organizations. To give an example of such a snapshot, figure 2 depicts a cause map of an individual musician of a jazz orchestra (Bougon et al., 1977). Drawing on prior experience, the jazz musician might realize that the quality of the tune played depends on the credibility attributed to the composer of the particular tune. The higher regarded the composer is, the more attention is paid, for example, to notes which again increases the quality of tunes when judged retrospectively. This positive judgement then further enhances the credibility attributed to the composer. These cause

\[\text{If one accepts the enactment perspective, one can argue that any (!) kind of understanding - including scientific understanding - works according to this same "irrational" principle of "How can I know what I think until I see what I say?" (cf., Feyerabend, 1975, pp. 25-26).}\]
Individuals, therefore, bracket and single out flows of experience under the influence of past experiences stored in their minds in form of cause maps. Thus, cause maps which result from individuals' enactment and selection processes impinge and constrain future processes of organizing. Individuals select raw data under the guidance of preconceptions and often "shape these elements in the direction of preconceptions" (Weick, 2001, p. 226). This is why "action tends to confirm preconceptions" (Weick, 2001, p. 226) and explains why actors "become the authors of their own problems" (Weick, 1979, p. 135; 2003, p. 186). Or, as most concisely put by Srivasta and Cooperrider (1990): "By the way we think, we create the organisation we later discover" (cited from Bouwen, 1998, p. 302). Consider as an example how stock traders' preconceptions influence their stock trading behaviour:

*Rumors that a stock trader has an unusually high hit rate often draw attention to that person's trading, which leads others to duplicate the trader's pattern of buying, which increases the action around a stock, which often raises its value, which seems to confirm that the trader is "hot", which attracts more buyers and purchases and temporary uptickets. (Weick, 2003, p. 187)*

This example of stock-trading is fascinating not only because it exemplifies some of the irrational and self-enforcing cycles reigning stock markets, but more so because it shows the power of enactment processes. Firstly, it shows that traders' preconceptions (about the presumably skilful trader) influence their behaviour (traders start mimicking the presumably...
skilful trader). Secondly, by mimicking someone else's behaviour, traders enact an environment (collectively constructed uptickets of those stocks the presumably skilful trader holds) that eventually confirms their preconceptions (that the trader is particularly skilful). In short, actors create the environment they later discover.

To analyze cause maps and to understand their dynamics’ researchers have referred to systems theory (cf., Maruyama, 1963; Weick, 1979; Weick & Bougon, 1986). Systems theory provides means to analyze causal relations given that there is a “circularity of action (…) between the parts of a dynamic system” (Ashby, 1957, p. 53). Circularity of action is given if a change in variable x affects variable y which in turn causes some response in variable x. According to systems theory, such loops (which are either referred to as closed loops or as feedback loops) can be deviation-amplifying or deviation-counteracting, depending on the number of negative links in the loop (cf., Maruyama, 1963). If there is an even number of negative links then the loop is a deviation-amplifying (Weick, 1979). Once an element starts moving in a particular direction, either positively or negatively, the system continues to move in this direction as there is no counteracting force (Weick, 1979). What is important about deviation-amplifying loops is that they run counter to the managerial axiom of fate control because any small deviation can develop into a large deviation (cf., Weick, 1979). Deviation-amplifying loops undermine human agency as they develop a life of their own. In the form of vicious circles they can be dangerous, or even destroy organizations (Masuch, 1985). While deviation-amplifying loops destabilize systems, deviation-counteracting loops, in contrast, facilitate human control and create stable social structures. As deviation-counteracting loops have an odd number of negative signs there will be at least one factor in the loop that counteracts the increase of other system variables by decreasing, and vice versa (cf., Lehmann & Gallupe, 2005). The elements in this deviation-counteracting (i.e., self-regulating) loop will thus fluctuate around some middle value, thereby stabilizing the system (cf., Pitt, 2005). The fate of the whole system, in contrast, depends not on the number of negative signs but on the number of negative loops. A negative loop contains an odd number of negative signs and is therefore deviation-counteracting. If there is an even number of such deviation-counteracting loops the system is inherently instable:

*If the system contains an even number of negative loops, then their effects will cancel one another, and the remaining positive cycles will amplify whatever deviations may occur* (Weick, 1979, p. 76).

If the number of negative loops is odd, the system is a deviation-counteracting one, as the one remaining deviation-counteracting cycle would balance out the deviation-amplifying
cycles. In general terms, one might say, that organizations, as they try to control their fate, strive for achieving an overall deviation-counteracting effect as this stabilizes the system (cf., Woodside, 2006). The reader will notice that these statements highly simplify system realities, as for example, they do not account for the effect of exogenous variables or differential speeds with which cycles evolve (cf., Weick, 1979). However, in line with Weick (1979), I argue that cause maps, if used in the way described above, are merely means to portray complex and highly interdependent situations which might further researchers’ (and practitioners’) understanding of these situations and provide some common ground for practitioners for initiating change processes.

Finally, it is important to note, that cause maps represent only one side of the coin of enacted environments, that is, the subjective, private or internal version of enacted environments (cf., Bougon et al., 1977; Weick, 2001). This internal side is complemented by one external side of enacted environments that exists in the form of a social product that is usually visible to others; this product can exist as a material artefact such as a technology, or as an immaterial artefact such as a rule written down in a rule book. Enactment theory does not question the existence of such artefacts but their meaning and the degree to which communication about such artefacts is possible. Firstly, even though that the enacted environment is visible to others, what is seen by actor A might not correspond with what is seen by actor B, and indeed, often does not correspond. Enactment theory thus rejects the notion of the environment or the organization as objective entities that can be perceived by actors. Secondly, any material artefact is meaningless to actors unless it is “acted upon and then incorporated retrospectively into events” (Weick, 2001, p. 226). Material artefacts therefore only gain relevance in the process of enactment.

### 2.5.2.3 Organizations as social representations

Enacted environments are necessarily idiosyncratic and bound to individual histories, assumptions, and positions within organizations (Allard-Poesi, 2005). Obviously, individuals’ images of enacted environments, that is, their cause maps, can therefore be incongruent. In face of such incongruence the crucial collective act, according to Weick (2001), is to reach some form of workable agreement as to which variables and relationships appear to be reasonable and to thereby jointly “shrink the possible meanings attached to an equivocal input” (Weick, 2001, p. 203). If communication leads to a greater overlap of individuals’ cause maps it becomes more likely that individuals interlock their activities so that synchronized processes become possible. According to enactment theory, these synchronized processes can be seen as chains of mutually interlocking behaviours of two actors. Behaviors are interlocked if person A’s actions evoke reactions in B, which is then in
turn, responded to by A. This complete sequence of action-reaction-counteraction is referred to by Weick (1979) as double interact. Seen from an enactment perspective, double interacts are the basic building blocks of organizations. In a nutshell, organizations and thus networks, are made of an immense number of intertwined processes, each of which can be thought of as a sequence of loosely coupled double interacts.

### 2.5.3 Cognitive network versus enactment theory

While both theories – cognitive network and enactment theory - attribute a key role to cognition for understanding organizations and therefore supply networks, they largely differ in terms of philosophical underpinning and methodology\(^5\) (cf., tab. 2).

<table>
<thead>
<tr>
<th><strong>Table 2: Cognitive network theory versus enactment theory</strong></th>
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<tbody>
<tr>
<td><strong>Role of individual</strong></td>
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<tr>
<td><strong>Criterion of validity of cognition</strong></td>
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<tr>
<td><strong>Organization</strong></td>
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<tr>
<td><strong>Environment</strong></td>
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<tr>
<td><strong>Methodology</strong></td>
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</table>

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\(^5\) This work adopts the definition of methodology given by Hudson and Ozanne (1988): "Second, we use the term "methodology" to refer to how one answers research questions. Methodology includes not only the data-gathering techniques, but also the research design, setting, subjects, analysis, reporting, and so on" (p.508-509).
Firstly, both theories differ with regard to their view of the individual-organization relationship. Cognitive network theory adopts a “computational perspective” (Hodgkinson, 2003), according to which individuals are fallible perceivers whose performance is partly determined by the accuracy with which they perceive the organization. Individual and organization, therefore, are considered separate entities existing independently of each other. Enactment theory, in contrast, entertains a social constructionist perspective according to which individuals are pragmatic sense-makers whose cognition can be more or less plausible and sensible. Indeed, enactment theory suggests plausibility, and not accuracy, is the key criterion in order to assess the quality of managerial practices. No ontological difference exists between individual and organization as “organizational realities are socially constructed” (Hodgkinson, 2003, p. 8). Secondly, both theories hold different assumptions pertaining to the environment. While cognitive network theory assumes an open system perspective according to which organization and environment influence each other, it does not question the boundary between organization and environment. Enactment theory, in contrast, rejects the notion of boundaries. Thirdly, as cognitive network theory and enactment theory have different epistemological roots, theories call for different methodological approaches. Cognitive network theorists primarily adopt a variance methodology perspective, whereas enactment theory builds on process theory thinking (cf., Langley, 1999; Mohr, 1982); the differences between both methodologies are outlined in textbox 2.

Despite existing incompatibilities, both theories – cognitive network and enactment theory - have important commonalities. Firstly, both theories adopt a cognitive perspective in their analysis of organizational processes. Both theories start with the individual actor in mind and assess cognition through self-respondent methods. Secondly, based on the proposition that dyads or double interacts are the key building blocks of organizations, the theories favour a bottom-up perspective on network structures. By highlighting that global structures can be explained by exploring local processes, both theories provide theoretical means to explain the co-existence of different managerial and working styles within one network. Thirdly, while enactment and cognitive network scholars emphasize agency they try to balance structure and agency equally, adopting a dialectic approach (cf., Ibarra et al., 2005). Fourthly, both theories highlight actors’ difficulties in manoeuvring complex multi-actor landscapes; while cognitive network theory highlights misperceptions of individuals, enactment theory points to actors’ difficulties in breaking away from past ways of thinking. Building on these findings I am now in a better position to challenge a notion that is at the core of SCM: total integration.
Textbox 2: Comparison of methodologies

**Variance theory versus process theory methodology**

Figure 3 illustrates the "variance theory" and the "process theory" methodology (cf., Langley, 1999; Mohr, 1982) on basis of the issue of structural change in networks.

<table>
<thead>
<tr>
<th>Variance theory</th>
<th>Process theory</th>
</tr>
</thead>
<tbody>
<tr>
<td>Explaining network structure change with a variance model</td>
<td>Explaining network structure change with a process model</td>
</tr>
<tr>
<td>Attributes of</td>
<td>Extent of network structure change</td>
</tr>
<tr>
<td>• Environment</td>
<td></td>
</tr>
<tr>
<td>• Triggering entities</td>
<td></td>
</tr>
<tr>
<td>• Relationship quality</td>
<td></td>
</tr>
<tr>
<td>• Performance</td>
<td></td>
</tr>
<tr>
<td>Y = f(x1, ...., xn)</td>
<td></td>
</tr>
</tbody>
</table>

Variance theories appear in the “normal, causal regression form” (Pfeffer, 1983, p. 321) aiming to explain causal relationships between independent and dependent continuous variables. In variance theory the independent variable is both a necessary and sufficient condition to explain the state of the dependent variable (Mohr, 1982, p. 38). Variance theories strive to determine the relative influence of the chosen independent variables on the dependent variable (Van de Ven & Poole, 2005). It is important to note that the label variance is actually misleading as variance theory encompasses any statistical analysis which explains the state of a dependent variable in the manner described here. Variance theories are often tested deductively which gives rise to the definition of hypotheses and variables before data is gathered. Methods common in variance theory approaches are experimental designs and survey studies.

Process theories, in contrast, explain the unfolding of processes and how a sequence of discrete states, events, activities or choices ordered over time leads to a particular outcome (Langley, 1999). Mohr (1982) himself refers to process theories as "little story about how something comes about" (p. 44). However, the precursor is only a necessary condition to
explain the outcome - not a sufficient one. Whereas variance theories proclaim causal relationships between precursor and outcome process theories state probabilistic processes by which precursor and outcome are linked; thus, sequential ordering of discrete events is often critical. To reiterate, while variance theories mainly deal with “snapshots” of organizations, process theories can be thought of as “movies” of organizations (Mohr, 1982, p. 43). Process theory intends to gather rich data mainly through observations, interviews, or archival analysis. Inductive approaches, such as interpretive accounts, are common means of making existing underlying patterns of activities or events visible.

2.6 Total integration in heterarchic supply networks?

I repeat and summarize. Heterarchic supply networks have some distinct characteristics: structures are enacted locally; multiple power centres co-exist; authority cannot be delegated vertically but emerges laterally; disparate organizing principles co-exist; and local cause maps, worldviews, and activities are often not compatible. While some of these characteristics of heterarchic supply networks can be found in other types of networks as well, such as public-sector networks (Provan & Milward, 2001), knowledge networks (Hansen, 2002), or R&D networks (Newell & Swan, 2000), I argue that these characteristics are particularly bothersome for supply networks. Consider as an example the characteristic of organizational heterogeneity, that is, the co-existence of different organizing principles, worldviews, and value systems. Such diversity might actually be an asset for knowledge or innovation networks, as it can stipulate rivalries of ideas and can result in more thoughtful business and product solutions (cf., Girard & Stark, 2002). In heterarchic supply networks however, such diversity is generally seen as an impediment to the overriding purpose of supply networking, that is to ensure a seamless flow of material from suppliers to end-customers at the lowest cost, shortest lead-time, and highest quality possible. In more general terms, one might say that characteristics of heterarchic supply networks seem to run counter towards some of the core purposes of SCM. Indeed, characteristics of heterarchic supply networks seem to be incompatible with the underpinning design principle of SCM, that is, total supply chain integration (cf., Jahre & Fabbe-Costes, 2005). This design principle demands that instead of optimizing sub-systems of supply networks one should aim for optimizing the whole system to ensure that all decisions taken in the system are aligned in order to accomplish global supply chain objectives (Fugate, Sahin, & Mentzer, 2006; Sahin & Robinson, 2005). Processes should be streamlined throughout the supply chain starting from the suppliers’ suppliers through to customers’ customers. This view is grounded in systems thinking, which is “the underpinning philosophy mentioned most often in the SCM process
literature” (Bechtel & Jayaram, 1997, p. 21). While such “holistic optimization of the entire supply chain” (Bechtel & Jayaram, 1997, p. 21) is certainly intuitively and theoretically appealing, its practical meaning for heterarchic supply networks is to be challenged (cf., Christopher, 1992). Holmström, Främling, Tuomi, Kärkkäinen and Ala-Risku (2002), for example, argue that “practice indicates that it is difficult, or maybe even impossible, to get a large network consisting of independent companies to agree on and implement a centralized planning and control solution” (p. 40). Stadtler (2005), on the basis of a review on advanced planning in supply chains, concludes that “in an interorganizational SC (...) hierarchical coordination is no longer possible” (p. 576). Against this backdrop it seems plausible to argue that total integration is not a viable option for heterarchic supply networks. Put more aptly, streamlining supply networks in a global manner appears as the antonym of heterarchic network coordination. Thus, given heterarchic network structures, actors must find the means to build synchronized networks in a bottom-up manner. In other words, heterarchic supply networks cannot be coordinated centrally but synchronized processes must emerge through local coordination. This brings me to collaborative planning, which has been suggested as a means of enabling decentralized coordination.
Chapter 3

Collaborative planning

As Ambrose Bierce said, to plan is to “bother about the best method of accomplishing an accidental result”. (Weick, 1979, p. 11)

3.1 Introduction

In this chapter, I introduce collaborative planning as a means of flexible coordination appropriate for coping with high degrees of uncertainty. I highlight the increasing importance of collaborative planning for SCM and propose a definition of collaborative planning based on the organization studies and applied psychology literature.

3.2 Coordination in the face of uncertainty

Davis (1993) argues that the real problem with any complex supply network is the “uncertainty that plagues it” (p. 36). Uncertainty is also one of the main reasons why companies have to build slack into their operations, for example by holding access inventory or by increasing lead times (cf., Christopher, 1998; Christopher & Lee, 2004). The reduction of this uncertainty is thus seen as one major objective of supply chain integration and collaboration (cf., Holweg, Disney, Holmstrom, & Smaros, 2005). Uncertainty manifests itself in supply networks in diverse ways and is captured by questions such as: What will our customers order? Will we be able to deliver products in time? Will our suppliers deviate from prescribed time schedules? Will a long-term contract increase or decrease our competitiveness? How many products do we have to have in stock? On the one hand, these questions can be seen as inherent to SCM. On the other hand, they bear the potential to disrupt supply network processes and to increase costs significantly. Network actors, thus, seem to constantly fight uncertainties in order to avoid late deliveries, cancellations of orders, and high inventory levels. The literature has proposed different means to cope with uncertainties in supply chains and interorganizational relations (cf., Galaskiewicz, 1985; van der Vorst & Beulens, 2002). Despite the multitude of potentially available modes of coordination, it is generally accepted that means of coordination should be chosen in direct
relation to and with dependence upon context conditions. Modes of coordination are
described as mechanisms through which concerted action in situations of task
interdependence can be reached (cf., van Fenema et al., 2004). Given a working context
complete with uncertainties, flexible modes of coordination, such as lateral communication or
autonomous work structures, are most suited to achieve concerted organizational action.
Given low uncertainty, programmed means of coordination, such as fixed rules and authority,
are to be favoured (cf., Argote, 1982; Van De Ven, Delbecq, & Koenig, 1976; van Fenema et
al., 2004). These propositions are grounded in the contingency view of coordination
according to which the use of modes of coordination should match environmental demands
(Faraj & Xiao, 2006; Lawrence & Lorsch, 1967; van Fenema et al., 2004). In line with this
contingency view, this study proposes that within the context of heterarchic supply networks
distributed and flexible means of coordination provide the necessary resources to cope with
uncertainties and to reach concerted action (cf., Poundarikapuram & Veeramani, 2004).
More specifically, this study proposes and investigates a single mode of flexible coordination,
that is, collaborative planning. This proposition might sound paradoxical as planning is often
perceived to be a rigid coordination mechanism undermining flexibility. However, in line with
planning is seen as an orientation device and not as a blueprint for action, it can be used as
a flexible mode of coordination. I will develop this argument in more detail in the remainder of
this chapter.

3.3 Importance ascribed to collaborative planning in the literature

A systematic literature review reveals that the number of scholars addressing the dearth in
research on collaborative planning has remarkably increased more recently. I used the online
resource ISI Web of Science to conduct a literature analysis on collaborative planning. A total
of 240 articles was identified by searching for "collaborative planning" and "cooperative
planning". These results were then sifted through to identify articles specifically concerned
with collaborative or cooperative planning in an interorganizational context. 29 articles met
this criterion. Only 6 out of these articles were published before 2003. The other 23 articles
published since 2003 stem from operations management, SCM, and management science.
This increase in publications since 2003 underlines the rising importance attributed to
collaborative planning by scholars in recent years. However, the results of the literature
review suggest that the increase in number of publications is mainly due to an increase in
conceptual work on collaborative planning and that there is still a dearth of empirical
research on collaborative planning. Some of the conceptual findings from this literature
review are presented in the following; I start with reviewing the SCM literature before highlighting key insights into collaborative planning from the organization studies and applied psychology literature.

### 3.4 Collaborative planning in the SCM literature

Collaborative planning is seen as a defining and integral element of SCM (Barratt, 2004a; Lambert, James, & Ellram, 1998; Schönsleben, 2004) and has received tremendous interest from the SCM community (Danese, 2006; Simatupang, Wright, & Sridharan, 2004). Indeed, collaborative planning is seen as “the latest potential enabler of supply chain integration” (Barratt, 2003, p. 59). Several authors suggest that in order to synchronize processes in heterarchic supply networks organizations must collaboratively plan and execute production, storage and distribution processes across organizational boundaries (Barratt, 2004a; Dudek & Stadtler, 2005). It is hoped that collaborative planning facilitates the synchronization of manufacturing and technical details in the supply network (for example, scalability of products, measurement methods, materials in use) and the orchestration of interconnected network processes to meet a given delivery schedule (Dhanaraj & Parkhe, 2006). However, despite the importance ascribed to collaborative planning in SCM, existing conceptualizations are far from conclusive. Table 3 outlines some of the definitions of collaborative planning found in the SCM literature.

<table>
<thead>
<tr>
<th>Authors</th>
<th>Definition</th>
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</thead>
<tbody>
<tr>
<td>Barratt (2004a)</td>
<td>A collaborative relationship based on information exchange in support of joint strategic, tactical and operational planning, forecasting and demand fulfilment processes.</td>
</tr>
<tr>
<td>Dudek &amp; Stadtler (2005)</td>
<td>The coordination process of autonomous yet inter-connected MP (master planning) activities is referred to as collaborative planning. (Master planning) is described as mid-term planning that serves to “balance supply with demand over the planning horizon and to synchronize operations across the SC.”</td>
</tr>
<tr>
<td>Akkermans, Bogerd, &amp; van Doremolen (2004)</td>
<td>Collaborative planning is an advanced form of such (supply chain) collaboration, which requires seamless joint work flows, “open kimono” attitude (show all the info and knowledge you have attitude) at all parties, tailored IT support and knowledgeable and trusting supply chain professionals.” (...)</td>
</tr>
<tr>
<td>Poundarikapuram &amp; Veeramani (2004)</td>
<td>Collaborative planning addresses supply planning and demand fulfilment decision-making among all the players belonging to a company’s supply network.</td>
</tr>
</tbody>
</table>
Table 3 does not provide a comprehensive review of collaborative planning definitions but rather highlights some of the approaches to collaborative planning found in the SCM literature. These definitions suggest that collaborative planning is a joint activity that involves some form of collaboration and joint decision-making. Furthermore, the definitions suggest that to devise robust plans it is important to understand the needs and demands of all players in the supply network and to strengthen relationships at the strategic, tactical, and operational level.

According to Barratt (2004b), integrative collaborative relationships between two organizations are key to planning, forecasting, and fulfilment of demand. Research by de Kok, Janssen, van Doremalen, van Wachem, Clerkx and Peters (2005) illustrates how this integration of strategic, tactical and operational levels might play out in practice. De Kok and colleagues (2005) developed and implemented a collaborative planning process at Philips Electronics which integrates monthly supply-chain-capacity agreements, weekly local production-planning activities, and daily operational execution. Planners from Philips Semiconductors and Philips Optical Storage meet weekly in virtual conferences to assess jointly current supply chain parameters such as flow of material and forecasts, to exchange information and assess different planning scenarios, and to make binding decisions on the number of products to be assembled or produced, such as integrated circuits or wafers. This planning process builds on automatically generated information of synchronized work order release plans across the supply network. If decisions are to be made, which are out of the control of the involved planning partners, upper management is called before finally decisions are deployed to the organizations involved.

While the collaborative planning process developed by de Kok and colleagues (2005) represents a highly customized solution other planning processes in supply chains were set up on the basis of the so-called Collaborative Planning, Forecasting, and Replenishment (CPFR) program (cf., Danese, 2006). CPFR is a standardized business process model (cf., Chung & Leung, 2005; Danese, 2006; Terwiesch, Ren, Ho, & Cohen, 2005). In the first stage (strategy and planning) manufacturers and retailers define the scope of their collaboration and set up a joint business plan, which also details retail events that generate largest swings in demand and out-of-stocks. The second stage (demand and supply management) entails a joint forecasting process of demand at the point of sales and subsequently an order planning process. The third stage (execution) consists of order generation and order fulfilment. The fourth stage (analysis) includes the active monitoring of planning and the calculation of key performance metrics to assess the achievement of business goals.
CPFR is said to integrate the operational advantages of earlier programs, for example, vendor managed inventory (VMI)\(^6\) and continuous replenishment (CR)\(^7\) programs, and to add collaborative mechanisms to facilitate information exchange in a multi-tiered supply chain (Cassivi, 2006). Figure 5 (Barratt, 2003) depicts the merging of different earlier concepts into the CPFR model and highlights that collaborative planning is seen as a facilitator of supply chain integration.

\(^6\)“VMI is an integrated approach for customer-supplier coordination, by which the supplier decides on the appropriate inventory levels for each product and on the inventory policies to maintain these levels.” (Danese, 2006, p. 3210).

\(^7\)“The key characteristics of CR are the sharing of real-time inventory data by retailers with manufacturers and continuous replenishment of retailer inventory by manufacturers.” (Goodnow, 1997).
Empirical findings lend some support to the general assumption that CPFR might increase supply chain effectiveness. According to Terwiesch et al. (2005), retailers have reaped significant benefits from introducing CPFR into their supply networks. GobalNetExchange, a global trading consortium, has reported a “5%–20% reduction in inventory costs and an increase in off-the-shelf availability of 2%–12% following the launch of their CPFR program” (Terwiesch et al., 2005, p. 208). More general findings in the SCM literature on collaborative planning corroborate these findings. Barratt (2004b) reports on a collaborative planning initiative between a grocery manufacturer and supermarket retailer. He finds that collaborative planning of promotional activities improved forecast accuracy from 30 percent to 95 percent. Moreover, promotions were exited with an average of less than four weeks of inventory instead of roughly thirty weeks. Further important findings on the operational effects of collaborative planning stem from the above mentioned study with Philips Electronics by de Kok and colleagues (2005). Their findings show that collaborative planning can accelerate decision-making processes, increase real-time information, and provide a sound basis for cooperation and mutual understanding. Furthermore, the collaborative planning process at Philips Electronics led to a reduction in stock level and obsolescence and increased the company’s ability to react quickly to emerging market opportunities.

To sum up, CPFR and related planning models have considerably advanced our understanding of collaborative planning in supply networks. However, the notion of collaborative planning set forth in most studies in the SCM literature views planning as a well-ordered process which consists of several stages that build on each other and result in reliable medium-term guides for action. Furthermore, most studies on collaborative planning in the SCM literature have remained largely silent on the behavioural processes underlying the creation and enactment of plans (cf., for a notable exception, Barratt, 2004a, 2004b). To challenge the view of planning as a well organized process and to bring the human side of collaborative planning to the forefront, I will introduce some findings from the organization studies and applied psychology literature on collaborative planning in the coming section. I will start with elaborating on the idea that planning is a flexible mode of coordination.

### 3.5 Collaborative planning in the applied psychology literature

Key to the understanding of planning as a flexible mode of coordination is Grote’s (2004, 2007) concept of management of uncertainty. Grote distinguishes between two different approaches to handling uncertainty referred to as minimizing uncertainty and coping with uncertainty summarized in figure 6. I will address the lower part of figure 6 (Balance through loose coupling) in chapter 4.
Collaborative planning

Minimizing uncertainties*
- Complex, central planning systems
- Reducing operative degrees of freedom through procedures and automation
- Disturbances as symptoms of inefficient system design which should be avoided

Coping with uncertainties*
- Planning as a resource for situated action
- Maximizing operative degrees of freedom through complete tasks and lateral cooperation
- Disturbances as opportunity for use and development of competencies and for system change

Dependence / feed-forward control
- Balance through loose coupling
- Motivation through task orientation
- Higher order autonomy
- Flexible changes between organizational nodes
- Culture as basis for coordination / integration

Autonomy / feedback control

Figure 6: Basic principles of uncertainty management (taken from Grote, 2004)
* Uncertainties may stem from the system environment and/or from the transformation processes within the system

According to the principle of minimizing uncertainties, which is heavily propagated in taylorist organizations, companies must invest mainly in feed-forward control mechanisms. No or little discretion is left to frontline employees. The principle of coping with uncertainties in contrast, builds on feedback control and strives to enable each employee to handle disturbances locally. According to the coping with uncertainties view, it is imperative to manage disturbances in a flexible and competent manner to prevent them from spreading across the organization. Thus, actors need to be "given as many degrees of freedom as possible" (Grote, 2004, p. 268). While the minimizing uncertainties approach is based on the principles of scientific management (Taylor, 1911), the later is grounded in humanistic system design approaches (Grote, 2004). Both approaches towards uncertainty, and this is the crucial point here, have far-reaching consequences for the role of planning within and across organizations. According to the principles of scientific management (Taylor, 1911) uncertainties can be minimized if detailed and hierarchical preplanning of production processes takes place. The main focus is on centralized planning and the continuous monitoring of plan execution (Windischer et al., in press). The coping with uncertainties approach, in contrast, argues that actors should be enabled to participate in the planning process and highlights the importance of flexible planning given high uncertainties (Grote, 2004; 2007). Instead of preplanning work tasks in miniscule detail plans must be conceived
of as resources for situated action, that is, “actions taken in the context of particular, concrete circumstances” (Suchman, 1987, p.viii):

One should not try to optimize planning based on the assumption that through planning it might become possible to prevent deviations and disturbances from occurring. Instead, one has to accept the fact that individual actions and organizational processes are situated which affords a kind of situated planning (translated from Grote, 1997, p. 99).  

The different notions of planning inherent to the coping with uncertainties (plans as resources for situated action) and minimizing uncertainties (plans as blueprints for action) approaches are further detailed in textbox 3.

Textbox 3: Comparison of perspectives on planning

Cognitive versus situated account towards planning

In a nutshell, cognitive planning theories see plans as linear and hierarchical mental representations of future realities that precede actions and strictly determine their course; plans are “blueprints for action”. Miller, Galanter, and Pribram (1960) suggested that any human behaviour is controlled by hierarchically organized plans that prescribe sequences of operations on different levels of abstractions. Central to their thinking about planning was the usage of a computer program as an analogy to a plan. Intelligent behaviour in cognitive models of planning is mostly localised in the development of the plan. The implementation of the plan is described to a greater or lesser extent as a mechanical performance (cf., Hacker, 1998; Leudar & Costall, 1996; Schank & Abelson, 1977).

The situated planning perspective, in contrast, argue that plans and actions are not directly linked, because actions must be adjusted to suite the concrete demands of any given situation (cf., Clegg, 1994; Das, Kar, & Parrila, 1996; Hayes-Roth & Hayes-Roth, 1979;
Collaborative planning

Leudar & Costall, 1996; Rogoff, Baker-Sennett, & Matusov, 1994; Suchman, 1987; Weick, 1998). Planning is at best a weak resource for acting. Suchman (1987) argues that “however planned, purposeful actions are inevitably situated actions.” As such, planning itself is conceptualized as a situated activity (Suchman, 2007):

\[
\text{…while the course of action can always be projected or reconstructed in terms of prior intentions and typical situations, the prescriptive significance of intentions for situated action is inherently vague (…). The coherence of situated action is tied in essential ways (…)}
\]
\[
\text{to local interactions contingent on the actor’s particular circumstances (Suchman, 1987, p. 28).}
\]

Plans are not seen as controlling structures determining activities in a strong sense but “as an orienting device for action” (Suchman, 2007, p. 19), thereby helping actors to deal with emerging opportunities and constraints in an ad-hoc manner:

\[
\text{The function of abstract representations is not to serve as specifications for the local interactions, but rather to orient or position us in a way that will allow us, through local interactions, to exploit some contingencies of our environment, and to avoid others (Suchman, 1987, p. 188).}
\]

It becomes clear that planning seen from a cognitive standpoint looks quite different, when compared to planning seen from a situated perspective. Both approaches – situated and cognitive – have been criticised on different grounds, mainly from members of the opposing scientific community. The cognitive approach has been criticised for being overly deterministic and for overestimating the importance of setting up detailed plans. In similar vein, scholars from the cognitive school judged the situated account to underestimate the importance of planning by situating intelligence more in ad-hoc decision making and local adaptations.\(^9\)

Based on the coping with uncertainties perspective, a model of collaborative planning has been developed by Windischer (2003) and Windischer and Grote (2003) which is outlined in some detail in the following section.

\(^9\) Readers interested in further detail on this scientific dispute are referred to the thought-provoking debate between Lucy Suchman (2001b, p. 210) and Alonso Vera and Herbert Simon (1993), published in a special issue of Cognitive Science (Vol. 17).
Collaborative planning

3.5.1 Collaborative planning model by Windischer and Grote (2003)

Most organizational activity is planned and carried out, not by individuals in isolation, but jointly by several actors, such as suppliers and customers, project teams, or management boards. Despite the apparent importance of collaborative planning in organizational settings the majority of research in the organization studies and applied psychology literature has examined the processes and outcomes of de-contextualized individuals creating and carrying out plans (cf., Buehler, Messervey, & Griffin, 2005). This pertinent gap in the literature has been discussed more recently by Windischer and Grote (2003) and Windischer (2003). On the basis of an extensive review, Windischer (2003) derived constituent activities of cooperative planning integrating a broad range of theories and insights from work psychology and organization studies (cf., Cranach, Ochsenbein, Tschan, & Kohler, 1987; Frese & Zapf, 1994; Funke & Glodowski, 1990; Hacker, 1998; Hayes-Roth & Hayes-Roth, 1979; Suchman, 1987). The model of collaborative planning (Windischer & Grote, 2003; Windischer et al., in press) derived from the literature distinguishes two sub-processes in the planning process, that is, the establishment of plans and the execution of plans. These sub-processes are not to be thought of as separate entities but as overlapping and recursively interrelated processes. In total, eight constituent activities are found to be at the core of collaborative planning. Figure 7 outlines the model.

![Collaborative Planning Diagram](image)

Figure 7: Model of collaborative planning (taken from Windischer and Grote, 2003).
In the first stage of the planning process, that is, the creation of plans, five activities are important. Firstly, to establish cooperative plans it is necessary to exchange information constantly. This includes not only information that is confirmed but also preliminary knowledge (e.g., an anticipated increase in demand). The importance of preliminary knowledge for coordinating activities has been investigated in the SCM and operations management (Loch & Terwiesch, 2005), the concurrent design (Frank & Mitschang, 2002; Terwiesch, Loch, & Meyer, 2002), and the work psychology (Windischer, 2003) literature. The framework of preliminary knowledge developed by Terwiesch and colleagues (2002) distinguishes information precision and information stability and makes visible trade-offs in the communication of preliminary knowledge. Preliminary knowledge is generally assumed to help to predict likely disturbances in the production process and to initiate counteractive measures earlier (Windischer & Grote, 2003; Windischer et al., in press).10 Secondly, the creation of a plan in a collaborative manner necessitates that actors know about the planning conditions which the cooperation partner acts upon. It is essential to know about the working conditions (for example, time constraints, material requirements, and available infrastructure) and personal resources (for example, knowledge, experience, and individual dispositions) of the cooperation partner. Furthermore, it is imperative to anticipate how the cooperation partner uses resources given existing alternatives (Windischer, 2003). Thirdly, lateral agreements between cooperation partners are to be made. This involves the explicit definition of goals and a commitment from both cooperation partners to ensure that these goals are met. Fourthly, cooperation partners have to devise alternative plans in case the master plan fails and jointly agree upon these. Fifthly, individuals have to examine their common plan and bring to mind how their own planning impacts on the planning and decision making freedom of cooperation partners (Windischer, 2003). An adequate plan needs adequate temporal stability and should give cooperation partners enough time to prepare efficiently for activities. Furthermore, individuals’ possibilities to handle disturbances locally must be sustained in face of the joint plan. Individuals who suspect they will lose too much local control from adopting a joint plan are likely to not enact the plan.

10 Following example from the semiconductors industry illustrates the value of preliminary knowledge (Loch and Terwiesch, 2005). A chip producer informed its equipment suppliers of an order with a lead time of three months exactly three months before the order fulfilment was due. This situation was dramatically improved when the suppliers got access to the chip producer’s planning process for the next seven (!) quarters. This made it possible for the suppliers to prepare for possible large orders.
In the second process stage, the execution of plans, three criteria are relevant. Firstly, it is necessary to monitor planned actions in order to diagnose errors in the common planning. Secondly, it might be inevitable that the original plan comes to be altered in case unforeseen opportunities or constraints arise. Hayes-Roth and Hayes-Roth (1979) coined the term opportunistic planning to refer to ad-hoc and situated changes in planning:

However, we assume that people’s planning activity is largely opportunistic. That is, at each point in the process, the planner’s current decisions and observations suggest various opportunities for plan development (p. 276). 

While changing plans is unavoidable in uncertain environments the challenge in collaborative planning lies in the communication and coordination of these changes. In order to ensure that cooperation partners act upon the same joint plan, it is necessary to agree to such changes upfront or if this is not possible, to communicate such changes in real-time. Thirdly, individuals have to reflect continuously upon the functioning of the plan. In certain cases it might be necessary to abandon a plan. To summarize; Windischer and Grote (2003) distinguish eight constituents of collaborative planning; these can be summarized as representing three facets of collaborative planning: establishment of plans; lateral agreements; and monitoring and revising of the plan (cf., Windischer & Grote, 2003).

Before discussing commonalities and differences across and within disciplines I wish to introduce another planning model from the applied psychology literature, that is, Marks, Mathieu, and Zaccaro’s (2001) process model on team planning. As this study primarily builds on the model by Windischer and Grote (2003) I introduce the model by Marks and colleagues’ (2001) mainly as means for comparison. I wish to compare Windischer and Grote’s model with Marks and colleagues’ model primarily to elucidate key assumptions of Windischer and Grote’s (2003) model as they are of particular importance for understanding planning processes in heterarchic supply networks.

3.5.2 Team planning model by Marks, Mathieu and Zaccaro (2001)

According to Marks, Mathieu, and Zaccaro (2001) and Mathieu and Schulze (2006) planning constitutes of three sub-dimensions and these are deliberate planning, contingency planning, and reactive planning. Deliberate planning leads to formal plans that outline the broad course of action and establish a framework within which short-term planning, that is, contingency and reactive planning, takes place. As an example, Marks and colleagues (2001) refer to hotel catering teams who meet in the afternoon to develop a plan that details how the next
day's events are to be handled. Contingency plans are formulated a priori to be enacted if environmental conditions change in an anticipated way. Marks et al. (2001) point out that the need to have a B-plan or a contingency plan increases in dynamic and unpredictable situations. Catering teams, for example, might develop contingency plans only if orders for an event are to be changed in the last minute. If unforeseen and unanticipated events occur team members often have to devise new plans in an ad-hoc manner. Thus, reactive planning is the "alteration of existing strategy or plans in response to unanticipated changes in the performance environment" (p. 366). If team members only realize as an event unfolds that they miscalculated the amount of food, then reactive planning must take place. Often abrupt and unexpected environmental changes force team members to engage in reactive planning processes. Mathieu and Schulze (2006) go on to suggest that dynamic planning, that is, contingency and reactive planning, takes place within the framework set by more formal, deliberate planning.

### 3.5.3 Comparison of Windischer and Grote and Marks and colleagues

If one compares the collaborative planning model by Windischer and Grote (2003) and the team planning model by Marks and colleagues (2001), the following assumptions of Windischer and Grote’s (2003) model become evident. Firstly, the team model by Marks, Mathieu, and Zaccaro’s (2001) focuses on intra-unit coordination, whereas the planning model by Windischer and Grote (2003) was developed and tested primarily with regard to inter-unit coordination such as inter-departmental coordination. Secondly, the team model defines planning mostly in terms of plan development thereby excluding some characteristics of the plan fulfilment (cf., Marks et al., 2001). The collaborative planning model, in contrast, conceptualizes planning as the development and enactment of plans. In other words, planning in the collaborative planning model partly forgoes the analytical distinction between planning and acting. Thirdly, the team model assumes that contingency and reactive planning takes place within the framework defined through deliberate planning processes. The collaborative planning model, in contrast, conceptualizes planning as a resource for situated action and implicitly accepts that activities can go beyond the scope of the deliberately planned framework. In other words, while the team planning model seems to draw more heavily on assumptions grounded in cognitive planning theories, the collaborative planning model seems to be more strongly inspired from the situated planning account (cf., textbox 3). Despite these differences, both models share a common understanding
concerning the value of plans as vehicles to create “prepared minds”, a term borrowed by Kaplan and Beinhocker (2003) from Louis Pasteur. Furthermore, both approaches reject the notion of planning as a lock step implementation of pre-specified actions (cf., Mumford, Schultz, & Osburn, 2002). Both models of planning locate intelligent behaviour in the development as well as in the execution of plans. To conclude; this study, in line with Windischer and Grote (2003), emphasizes following characteristics of collaborative planning: firstly, it is an inter-unit process; secondly, it transcends action; thirdly, it is a process deliberately designed as well as enacted; fourthly, situated activities can go beyond deliberately designed plans. Building on this view, I will define collaborative planning more formally in the following section.

3.6 Integration of findings

While SCM models of collaborative planning (e.g., CPFR model) tend to describe planning as a linear, multi-stage process, applied psychology models view planning as a dynamic and iterative process. Furthermore, SCM models tend to differentiate between several types of planning, such as the planning of procurement processes, production planning, and the planning of distribution processes. In contrast, planning models in the applied psychology literature forgo such differentiations as they strive to expound the generic characteristics of collaborative planning from a human point of view. Despite these differences there are some commonalities across disciplines, such as the view that collaborative planning is a joint activity that involves joint decision-making and builds upon cooperative relationships. Furthermore, the models outlined commonly stress that to devise robust plans it is important to understand needs and demands of cooperation partners in the supply network. Based on these commonalities and in line with earlier work by Windischer and Grote (2003), this study proposes the following understanding of collaborative planning:

Collaborative planning necessitates that multiple actors orient their plans towards each other in order to reach joint optimization of their planning. Planning is to be seen as an iterative process of deliberate planning and ad-hoc, situated practices.

11 Louis Pasteur (1822-1895), biologist and chemist, is quoted with “Chance favours the prepared mind”.
In stressing the importance of situated activities, this definition highlights the fact that collaborative planning consists of feed-forward and reactive planning activities. While this chapter has elaborated the mechanisms of collaborative planning, I will now go on to introduce the key enablers and barriers of collaborative planning, that is, cognitive processes and relational structures.
Chapter 4

Collaborative planning: its outcome and antecedents

The new organizational forms are heterarchical not only because they have flattened hierarchy, but also because they are the sites of competing and coexisting value systems.

Girard and Stark (2002, p. 1936)

4.1 Introduction

This chapter is structured as follows. By building on cognitive network theory I will highlight the effectiveness of collaborative planning before introducing antecedents of collaborative planning in length. I will investigate two key domains of enablers and barriers of collaborative planning: cognitive processes, such as perspective taking and relational structures, such as interdependence and autonomy. On the basis of existing findings a research model has been developed and hypotheses derived. Figure 8 depicts the model to be tested in a quantitative manner in this study.

Figure 8: Quantitative research model on collaborative planning
Note: Figures indicate the order in which hypotheses are introduced in this chapter.

Whereas this quantitative approach is in line with a functionalist perspective it excludes qualitative, interpretive questions. Therefore, in order to adopt a more balanced approach, I
will secondly build on enactment theory to investigate a qualitative research question on the preconceptions of collaborative planning held by actors. For exploring this qualitative question I follow an inductive approach (in contrast to the deductive approach of the quantitative part of this study). To address both perspectives, quantitative and qualitative, on collaborative planning, I present functionalist and social constructionist theoretical concepts and empirical findings throughout this chapter. I will firstly derive five hypotheses (cf., fig. 8) before introducing the qualitative research question of this study.

### 4.2 Collaborative planning and perceived effectiveness

A number of studies have examined the relationship between planning and effectiveness in inter-unit contexts. In line with Ellinger (2000) and similar to Beugelsdijk, Koen, and Noorderhaven (2006), I define effectiveness of inter-unit relationships as the “perceptions of personnel who interact with people in another functional area, that their relationship is worthwhile, equitable, productive, and satisfying” (Ellinger, 2000, p. 87). Ellinger (2000) finds that cross-functional collaboration increases effectiveness of interdepartmental relations (measured via perceived effectiveness of managers from marketing and logistics department). Windischer (2003) in her study on planning in three organizations finds that interdepartmental planning, for example between purchasing and sales, positively relates to perceived cooperation quality. Studies by Barratt (2004b), Kok and colleagues (2005), and Terwiesch et al. (2005) further support the assumption that planning has a pervasive, perhaps fundamental influence on cooperation and performance in supply networks. Referring to Windischer (2003) I hypothesize that collaborative planning in network dyads enhances performance and effectiveness of interorganizational relationships.

**Hypothesis 1:** The relationship between collaborative planning and perceived relationship effectiveness will be positive for actors in heterarchic supply networks.

Having highlighted the effectiveness of collaborative planning I will now discuss its antecedents in some length.

### 4.3 Interdependence: its bright and dark sides

Interdependence, that is the extent to which individuals are dependent on each other in fulfilling their tasks and reaching set goals (cf., Van De Ven et al., 1976), is often described
as the essence of SCM (cf., Lejeune & Yakova, 2005). Given its high relevance one would expect research on interdependence in supply networks to be bourgeoning. However, interdependence has only recently attracted increasing attention from supply chain researchers. By drawing on the wider management and applied psychology literature, I develop some testable propositions on how interdependence might affect collaborative planning in a supply network context.

One central insight from the extensive literature review conducted in the realm of this study, is that interdependence seems to have a bright and dark side. While some scholars address interdependence as mainly a liability or constraint that needs to be reduced or avoided other researchers treat interdependence as a valuable asset or resource (cf., Gulati & Sytch, 2007). Gulati and Sytch (2007) build the compelling argument that research on interdependence has been conducted based on two different logics. Some of the existing research on interdependence has been conducted based on a logic of power emphasizing the potentially negative effects of interdependence, such as the use of power and punitive actions or feelings of conflict (e.g., Kumar, Scheer, & Steenkamp, 1995; Pfeffer & Salancik, 1978). According to this logic of power, interdependence might have some negative effects on relationships as (especially asymmetrical) interdependences give rise to power plays and opportunism and can cause coordination losses (cf., Gulati & Sytch, 2007; Rubin, Pruitt, & Kim, 1994; Steiner, 1972). The opposing view has been based on the logic of embeddedness (Gulati and Sytch, 2007); the term embeddedness denotes that any economic action is embedded in and constrained by social structures (Granovetter, 1985; Uzzi, 1997). This logic of embeddedness treats interdependence as an asset because higher levels of joint dependence might strengthen economic interactions and might therefore help to jumpstart a “stronger relational orientation” which facilitates joint actions (Gulati & Sytch, 2007, p. 33). Dyer and Singh (1998) argue in a similar vein by pointing out that productivity gains in the supply chain are possible “when trading partners are willing to make relation-specific investments and combine resources in unique ways” (p. 661). In their empirical study on procurement relationships of US automotive manufacturers, Gulati and Sytch (2007), for example, provide ample evidence for the hypothesis that joint dependence with suppliers enhances manufacturers’ performance. Gulati and Sytch’s (2007) empirical findings indicate that joint dependence facilitates performance by increasing the overall robustness of the exchange relationship. To summarize: Instead of thinking of interdependence as a source of uncertainties the logic of embeddedness suggests viewing interdependence as a means to cope with environmental uncertainties. In the following, I will explore both logics of interdependence in more detail by drawing on findings from organization studies and applied psychology literature.
4.4 Interdependence and collaborative planning

Research shows that coordinated behaviour and joint planning is more likely to emerge in interorganizational relationships if actors’ activities, goals, and rewards are interdependent (Boland, Maheshwari, Te’eni, Schwartz, & Tenkasi, 1992). Bachrach, Powell, Bendoly, and Richey (2006), for example, find task interdependence increases communication and information sharing and influences norms of cooperation. Task interdependence refers to the degree to which actors rely on the resources and information of others to perform effectively (Campion, Medsker, & Higgs, 1993; Kumar et al., 1995; Ramamoorthy & Flood, 2004; Van der Vegt & Janssen, 2003). Similarly, Hoegl, Weinkauf, and Gemuenden (2004) find interteam coordination to be particularly important for overall performance when task interdependence between teams is high. Another study on inter-unit coordination finds the degree of task interdependence facilitates joint problem solving between marketing and manufacturing departments (Nauta & Sanders, 2001). Nauta and Sanders (2001) conclude from their study that people who are highly interdependent are more likely to show “constructive negotiation styles because they realize that they need each other now and in the future” (p.152). This finding is particularly interesting as system induced conflicts between marketing and manufacturing rank among the most stubborn ones in organizations.

Furthermore, Tjosvold, Dann and Wong (1992) show goal and reward interdependence to stimulate cooperative behavior. While goal interdependence describes the extent to which goals of an actor are dependent on his or her coworkers’ goals (e.g., Van der Vegt & Janssen, 2003), reward interdependence is defined as the “extent to which the rewards that accrue to an individual depend upon the performance of coworkers” (Wageman & Baker, 1997, p. 142). The more individual goals within teams overlap, the more individuals will invest in relationships and the less likely it becomes that individuals act solely with their own goals in mind (Saavedra, Earley, & Van Dyne, 1993; Van der Vegt, Emans, & Van de Vliert, 2001). Hertel, Konradt, and Orlikowski (2004) in their empirical study on 31 virtual teams find that management practices related to task, goal, and outcome interdependence influence team effectiveness. They conclude that motivational challenges due to low physical connectedness in virtual teams can be overcome by introducing management practices that maintain a sense of interdependence among employees. Making use of goal setting processes, for example, is seen as a viable means to increase perceived goal interdependence among virtual team members. Suchan and Hayzak (2001) conclude similarly that by rewarding team outcomes perceived interdependence in virtual teams can be increased thus enhancing cooperation. These findings on virtual teams are of particular relevance to supply networks as actors in both contexts work at geographically dispersed
locations aggravating collaboration. Taken together, these arguments highlight interdependence’s bright side by suggesting that interdependent parties are more committed to the success of a relationship and that interdependence gives them a reason to cooperate (Chen & Paulraj, 2004; Smith, 1997). Given that “actors’ behaviors in the context of power-dependence relations are ultimately driven by their definitions of the situation” (Gulati & Sytch, 2007, p. 45) it seems reasonable to specifically assess actors’ perceptions of interdependence. Building on these findings the following hypothesis is derived:

Hypothesis 2: The relationship between perceived interdependence and collaborative planning will be positive for actors in heterarchic supply networks.

While research findings support the relationship between interdependence and collaborative planning they remain largely mute on the mechanisms through which interdependence affects collaborative planning. Cognitive network theory finds that cooperative behaviour is threatened by differences in the perceptions actors hold of network structures and relationships (Krackhardt & Kilduff, 1999). In other words, cooperative behaviour is easier to maintain if actors know how to read their environments correctly, an example being their co-actors’ behaviours. An important mechanism which prevents misperceptions and helps actors to read their coactors’ behaviour correctly is perspective taking. As will be shown in some detail in the following sections, there is good reason to assume that interdependence provides means for actors to engage in perspective taking and this then facilitates cooperative behaviour, such as collaborative planning. Thus, it is suggested that perspective taking partially mediates the relationship between perceived interdependence and collaborative planning. Following Baron and Kenny’s (1986) recommendations for testing for mediation, I firstly establish the relationship between interdependence and perspective taking and secondly explain how perspective taking influences collaborative planning. Baron and Kenny’s framework for testing mediation also helps to establish a relationship between interdependence and collaborative planning. My development of hypothesis 2 forms, in fact, the theoretical basis of establishing this relationship empirically.

4.5 The mediating role of perspective taking

By drawing on conceptualizations by Parker and Axtell (2001) perspective taking can be defined as follows:
Perspective taking is an inferential process requiring effort that enables actors to consider the world from another's point of view. Perspective taking makes it more likely that actors understand the intentions, feelings, and actions of co-actors.

The fact that perspective taking is of eminent importance in interorganizational relationships becomes most clearly visible when adopting a social constructionist stance. Difficulties in thinking, perceiving, and acting across organizational boundaries, if seen through an enactment lens, appear to be mainly due to differences in actors' thought-worlds (Dougherty, 1992), interpretive conventions (Mohrman et al., 2001) and frames of reference (e.g., Kickert & Koppenjan, 1997; Vlaar et al., 2006). Due to these differences actors might interpret situations in incompatible ways and this can hamper cooperation. If actors do not find ways to align their preconceptions and interpretations to some workable extent, conflicts, coordination breakdowns and other dysfunctional outcomes may result. To prevent such coordination breakdowns, it is crucial that meanings and individually held interpretations are exchanged; according to Tenkasi and Boland (1996) this means that actors make their interpretations available for others to "incorporate in a perspective taking process" (p. 86). Gibson (2001) further argues that perspective taking requires actors not only to open their interpretive schemes to mutual inquiry but also to comprehend other's processes of interpretation. Perspective taking, therefore, can be reframed in terms of enactment theory, as a process of sensemaking of others' sensemaking. To reiterate, by communicating individual, unique interpretations it becomes possible to construct mutually accepted and new interpretations (Tenkasi & Boland, 1996). Thus, by "sharing meaning systems and interpretive schemes", that is, through mutual perspective taking (Habermas, 1979; cited from Gibson, 2001, p. 125), differences in preconceptions and worldviews can be mitigated.

4.5.1 Perceived interdependence and perspective taking

Interdependence is a key organization design variable in interorganizational relationships. There is good reason to assume that perceived interdependence has a decisive influence on perspective taking. Indeed, perceived interdependence has been found to give a reason to actors to carefully assess and predict precisely another person's behaviour (Rusbult & Van Lange, 2003). As the cost of nonveridical perception in highly interdependent relationships might be quite high, actors engage more strongly in perspective taking (Axtell, Parker, Holman, & Totterdell, 2007; Galinsky et al., 2005). In other words, actors become more motivated to engage in perspective taking if their success or well-being depends on the target person's behaviour (Galinsky, Magee, Ena Inesi, & Gruenfeld, 2008; Johnson, 1975; Menna & Cohen, 1997; Neuberg & Fiske, 1987). If actors perceive high interdependencies,
they will pay more attention to target information and will rely less on stereotypic information so that a more nuanced picture of the co-actor can arise (Neuberg & Fiske, 1987; Parker & Axtell, 2006; Van der Vegt, Van de Vliert, & Oosterhof, 2003). By paying more attention to their actors’ environment they are more likely to correctly infer co-actors’ intentions, motives, and actions (Bromme & Nueckles, 1999). While I have deliberately focused on the perceived side of interdependence so far it is important to note that this is not the only possible view on interdependence. Indeed, more recently there has been quite some debate on the notion of interdependence. This debate is summarized in textbox 4. I will refer back to the different methodological assumptions underpinning the notion of interdependence in the discussion section of this thesis.

Textbox 4: Comparison of perspectives on interdependence

<table>
<thead>
<tr>
<th>Functionalist versus social constructionist accounts on interdependence</th>
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<tbody>
<tr>
<td>The most important insight flowing from the organization studies and work psychology literature is that interdependence seen from a functionalist perspective looks quite different when compared to interdependence seen from a social constructionist perspective (Campion et al., 1993; Kiggundu, 1983; Rusbult, Kumashiro, Coolsen, &amp; Kirchner, 2004; Shea &amp; Guzzo, 1987; Thompson, 1967; Van De Ven et al., 1976; Wageman, 1995, 2001; Wageman &amp; Gordon, 2005). Seen from a functionalist perspective, interdependence appears as a technological property that strongly determines working practices (Thompson, 1967). Interdependence is perceived as a product of technological requirements rather than a context factor that can be manipulated (Sprigg, Jackson, &amp; Parker, 2000; Van De Ven et al., 1976). Proponents of this perspective of task interdependence argue that coordination mechanisms are to be adapted to technological interdependencies. Depending on the strength and quality of interdependence, actors have to coordinate their workflows differently in order to contribute effectively to overall integration (Griffin &amp; Hauser, 1996; Grote &amp; Boy, 2005; Lawrence &amp; Lorsch, 1967; Procter &amp; Currie, 2004). This functionalist account stands in sharp contrast to more recent social constructionist accounts on interdependence (Wageman</td>
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12 Experiments by Galinsky, Magee, Inesi, and Gruenfeld (2006) show that power and perspective taking are negatively correlated. Thus, the more power an individual possesses the less likely this person is to adopt another person’s perspective (Schwarz, 1998). Galinsky et al. (2006) conclude that high power is an impediment to perspective-taking. An explanation for their finding is that those in power have control over valuable resources and are therefore less dependent on others. If power is defined through the absence of dependence, these results indirectly confirm the assumed positive correlation between interdependence and perspective taking.
& Gordon, 2005). The social constructionist account explores how actors interpret and enact interdependencies and assumes only a weak interrelation between technological interdependencies and working practices (Brass & Burkhardt, 1993; Sprigg et al., 2000; Wageman, 1995, 2001; Wageman & Gordon, 2005). This more recent shift in literature from deterministic to social constructionist thinking has been triggered by findings showing that organizational units with similar technological structures enact different working structures with different degrees of interdependence (Campion, Papper, & Medsker, 1996; Shea & Guzzo, 1987; Wageman, 1995; Wageman & Gordon, 2005). This variation shows that technologies do not strongly determine interdependencies. In their excellent longitudinal field study, Wageman and Gordon (2005) find that in teams with ambiguous task structures, group values shape task interdependencies. Given identical tasks, teams with members who value equal rewards tend to enact reciprocal task structures and high task interdependence. In teams with members who value performance based rewards, by contrast, low levels of task interdependence are enacted. In other words, actors’ preconceptions (cooperative vs. competitive social orientation) seem to shape their actions (enactment of egalitarian vs. meritocratic group structures).

4.5.2 Perspective taking and collaborative planning

It is suggested that perspective taking is related positively to collaborative planning. Parker and Axtell (2001) demonstrate this assumed relationship between perspective taking and cooperative behaviour in the context of a glass-manufacturing company empirically. Results from 57 production employees show that perspective taking is related to cooperative behaviour towards external personnel, that is, personnel from other departments. While this finding stems from an intra-firm context, Parker and Axtell (2006) propose that perspective taking can also boost inter-departmental co-operation. Findings from a recent study by Axtell and colleagues (2007) lend some support to this proposition. Their study on the behaviour of call centre agents towards customers finds significant relationships between perspective taking, empathy, and helpful behaviour. These results are further supported by research on prosocial behaviour (Penner, Dovidio, Piliavin, & Schroeder, 2005), that is, “behaviour performed with the intention of promoting the welfare of individuals or groups to whom that behaviour is directed” (Borman & Motowidlo, 1997, p. 100). Experimental research confirms that perspective taking precedes prosocial behaviour, for example, providing help to those in need (Galinsky & Moskowitz, 2000). Interestingly, the literature on perspective taking suggests a variety of reasons why actors who try to infer co-actors motives and behaviours tend to engage more strongly in collaborative planning activities.
Firstly, because perspective taking reduces attribution errors such as the self-serving bias\textsuperscript{13} actors’ tend to evaluate co-actors’ contributions in a more positive light which might in turn facilitate collaborative behaviour (Batson et al., 1995; Bernstein, Stephan, & Davis, 1979). Individuals who actively try to adopt another perspective make more positive or other-serving attributions about a target’s behaviour and are less vulnerable to attribution errors (Galinsky & Moskowitz, 2000; Parker & Axtell, 2001; Regan & Totten, 1975). Research finds that such attribution errors are likely to undermine cooperative behaviour (cf., Akkermans et al., 2004) and that by correcting misattributions actors are in a better position to overcome the dysfunctional “us versus them” mentality (Galinsky et al., 2005; Hewstone, Rubin, & Willis, 2002; Hogg & Terry, 2000).

Secondly, individuals who adopt another person’s perspective tend to engage more heavily in collaborative planning as perspective taking can enhance empathy with the target, this having been found to be an important precursor to collaborative behaviour (Galinsky & Moskowitz, 2000; Parker & Axtell, 2001). Empathy or empathic concern, that is, the ability to “make emotional attributions, or to understand the feelings of another person” (Hynes, Baird, & Grafton, 2006, p. 374),\textsuperscript{14} is presumed to result from “imaging how another person is uniquely affected by the situation confronting that person” (Galinsky & Moskowitz, 2000, p. 709). Experimental studies find impressive evidence for the positive influence empathy has on collaborative behaviour. Batson and Ahmad (2001), for example, show that participants in a prisoner-dilemma game, purposefully induced to experience empathic concern were likely to cooperate even when they knew that their cooperation partner would pursue a competitive strategy. This finding is in line with the empathy-altruism theory (Batson, 1998; Batson et al., 1995), according to which empathy evokes altruistic motivation.

\textsuperscript{13} Individuals often make self-serving attributions. They more often attribute failures of others’ to their individual disposition while explaining their success as resulting from situational conditions. When explaining their own failures or success the reverse is true, that is, success is attributed internally and failure externally (Boland & Tenkasi, 1995). Another attribution error of particular relevance to perspective taking is the false-consensus effect (Raghunathan & Yeh, 2001). People often tend to perceive a false consensus for their own motives, beliefs, and behaviours. This false assumption misleads individuals to overestimate the degree to which their own knowledge is shared by others (Marks & Miller, 1987). To put oneself into another person’s shoes is suggested to be an effective countermeasure to this misperception.

\textsuperscript{14} Empathy is different from sympathy which refers to feeling for the other and not feeling as the other feels (Parker & Axtell, 2001).
Despite some more recent findings on the potentially detrimental effects of perspective taking such as selfish behaviour (Caruso, Epley, & Bazerman, 2006), there is therefore strong empirical evidence for the hypothesis that perspective taking promotes collaborative planning. Perceived interdependence gives a reason for actors to engage in perspective taking which reduces attribution errors and intergroup bias and enhances empathic concerns. Hence, on the basis of perspective taking, perceived interdependence should increase collaborative planning.

Hypothesis 3: The relationship between perceived interdependence and collaborative planning is partly mediated by perspective taking such that greater perceived interdependence leads to higher collaborative planning by increasing perspective taking.

So far this thesis has highlighted the bright side of interdependence providing evidence for the proposition that interdependence facilitates collaborative behaviour. I will now explain why interdependence might also undermine collaborative behaviour.

4.6 The moderating effect of autonomy

There is some theoretical and empirical reason to assume that interdependence also has a dark side. Indeed, high levels of interdependence can limit actors' flexibility and innovation potential, can create dysfunctional lock-ins, and might eventually impair actor's performance (cf., Gulati & Sytch, 2007). This study proposes that such dysfunctional outcomes are due to the fact that interdependence can corrupt organizational autonomy (cf., Oliver, 1991). While it is suggested that interdependence facilitates collaborative planning, it might offset the collaborative planning increase associated with high autonomy and self-discretion (cf., Axtell et al., 2007; Gellatly & Irving, 2001). I will explore the logic behind this interdependence-autonomy paradox more thoroughly shortly. Before doing so, I will present evidence for the hypothesis that autonomy facilitates collaborative planning.

15 Perspective taking's potentially ugly or detrimental effects are described in full length in Caruso, Epley, and Bazerman (2006) and in Epley and Caruso (2006).
4.7 Autonomy and collaborative planning

Autonomy can be understood as the capacity to rule oneself, or in short, as self-determination; this implies that actors are able to choose their goals and the rules they adhere to in a self-determined manner free from external control (cf., Grote, 1997). Autonomy thus provides the basis for situated and improvised activities, behaviours, and solutions and thereby facilitates individual learning and self-development. For the purpose of this work, autonomy is operationally defined as a multidimensional construct, consisting of three facets: work criteria autonomy, work schedule autonomy, and work method autonomy (Breaugh, 1985, 1998). Breaugh (1985) defined work method autonomy as the “degree of discretion individuals have regarding the procedures they utilize in going about their work” (p. 556). Work scheduling autonomy describes the degree of perceived control on scheduling and timing work activities. Criteria autonomy relates to the influence employees have in defining the types of tasks they work on and the goals they are supposed to accomplish. This three factor structure has been replicated in the literature by means of exploratory and confirmatory factor analysis (e.g., Breaugh, 1998; Sadler-Smith, El-Kot, & Leat, 2003).

While autonomy is probably one of the most widely researched working conditions (Breaugh, 1985; Grote, 1997, 2004; Hackman & Oldham, 1976), it has been investigated primarily in within-firm contexts (Cohen & Ledford Jr, 1994; Cordery, Mueller, & Smith, 1991; Hackman & Oldham, 1976; Langfred & Moye, 2004; Sadler-Smith et al., 2003). In contrast, little research exists on the role of autonomy in inter-unit contexts such as interorganizational networks. Similarly, researchers have been interested mainly in understanding autonomy’s effects on person-centric behaviour (in contrast to relational behaviour), such as self responsibility (Grote, 1997), personal initiative (Frese & Fay, 2001), work motivation (Hackman & Oldham, 1976; Janz, Colquitt, & Noe, 1997; Wageman, 1995), work satisfaction (Breaugh, 1999), mental health (Parker, 2003), or performance (Langfred, 2004; Langfred & Moye, 2004). In contrast, little research exists on autonomy’s effects on collaborative behaviour. However, the very few existing empirical studies on the relationship between autonomy and collaborative behaviour give reason enough to assume that autonomy relates positively to collaborative planning.

Gellatly and Irving (2001) for example, in their study on 79 public-sector managers find that perceived autonomy has a positive effect on contextual performance. Contextual performance involves, for example, cooperating with others or carrying out tasks that are not part of one’s official work role description (e.g., Borman & Motowidlo, 1997; Gellatly & Irving, 2001). The interpretation given for this finding is that individuals with high autonomy adopt
broader role definitions, thus seeing job-specific and extra-role behaviour as part of their managerial jobs. This conclusion is consistent with findings from Parker, Wall and Jackson (1997) and Parker and Axtell (2001) who show that job autonomy supports production ownership and integrated understanding which then enhances perspective taking, and therefore collaborative behaviour.

Axtell et al. (2007) investigated the relationship between job enrichment and helping behaviour towards customers in the above mentioned call centre study. To assess job enrichment, call centre agents were asked about their autonomy in making work-related decisions, for example, "allocating jobs among team members" or "investigating and implementing new ideas". Axtell et al. (2007) found that job enrichment is related to helping behaviour via integrated understanding. Integrated understanding is defined as "knowing the units involved in the manufacturing of a product or knowing how disturbances in the own unit affect subsequent work units" (p.6). Thus, autonomous tasks may enable a better understanding of work processes across organizational boundaries making it easier to adequately support cooperation partners. Based on these findings the following hypothesis has been derived:

Hypothesis 4: The relationship between autonomy and collaborative planning will be positive for actors in heterarchic supply networks.

4.8 Untangling the interdependence-autonomy paradox

The interdependence-autonomy paradox is pervasive in supply networks: most efforts to integrate supply chain practices increase interdependencies. This finding can be explained by the means through which supply chain integration is often achieved, such as eliminating excess stock, intensifying collaboration (Yusuf et al., 2004) or reducing order cycle times (Gunasekaran, Patel, & Tirtiroglu, 2001). As an increase in interdependencies can impair actors' autonomy, they might refrain from engaging in collaborative relationships (cf., Christopher & Jüttner, 2000; Dubois et al., 2004; Oliver, 1991; Van de Ven & Walker, 1984). Indeed, this proposition has been sufficiently approved by resource dependence theorists (Pfeffer & Salancik, 1978) and system theorists (Gouldner, 1959). While actors tend to safeguard their autonomy they must often engage in interdependent relationships in order to enhance their competitiveness and to secure their organizational survival (cf., Galaskiewicz, 1985). Two main streams of research have dealt with this intriguing paradoxical situation; organization theory and team research. Unfortunately, no empirical research has yet been
conducted on the interdependence-autonomy paradox in organizational networks. This is why I am including findings from team research in this thesis; nevertheless, due to the significant differences in contexts (between teams and networks) these findings are to be treated cautiously.

Organizational theorists have invested considerable effort in devising organizational design solutions that simultaneously ensure autonomy and interdependence (Gouldner, 1959; Grote, 2004; Weick, 1979). One organizational design solution that is expected to facilitate the autonomy of actors and to provide “sufficient binding forces for all actors to use their autonomy to promote the organization’s objectives” (Grote, 2004, p. 269) simultaneously is loose coupling (Orton & Weick, 1990; Weick, 1976). Loose coupling, that is, the simultaneity of coupling and decoupling (Czarniawska, 2005), is given in situations in which “elements are responsive but retain evidence of separateness and identity” (Orton & Weick, 1990). In terms of Grote’s (2004) concept of uncertainty management, it is through simultaneously managing and coping with uncertainties, that loose coupling emerges (cf., fig. 6 in chapter 3). Different means have been suggested for designing loosely coupled systems. Weick (1987), for example, argues that culture provides the means to simultaneously achieve centralization (i.e., coupling) and decentralization (i.e., decoupling) as culture creates a “homogeneous set of assumptions and decision premises” (p. 124), which preserve coordination and centralization given decentralized operations. Grote (1997, 2004; 2007) suggests, for example, “higher order autonomy” to provide the means to simultaneously ensure integration and autonomy (cf., fig. 6 in chapter 3). To sketch over things somewhat, one can say that higher order autonomy enables individuals to decide about their degree of autonomy. Integration therefore, might depend in some situations on the willingness of actors not to use their autonomy fully, in other words, to impose restrictions of their autonomy upon themselves in order to facilitate others’ autonomy, thereby stabilizing a system.

Team researchers have investigated how different combinations of interdependence and autonomy affect team performance.\textsuperscript{16} In general terms, their findings show that high

\textsuperscript{16} It is important to note that from an analytical standpoint no reason exists as to why a particular combination of autonomy and interdependence should not be possible (Langfred, 2005). Interdependence between actors in interorganizational relationships might be low but this does not necessarily imply that their individual autonomy is high. It might be that due to market regulations, fierce competition, or financial issues actors cannot autonomously choose their strategic or operational path of action. By the same token, if interdependence between actors is high, individual autonomy does not automatically have to be low. It certainly might be the case that actors who enter
individual autonomy can be at odds with high interdependence (e.g., Langfred, 2005; Liden, Wayne, & Bradway, 1997). Langfred and Moye (2004) argue that by granting individual autonomy to actors who are highly interdependent, performance is likely to decrease due to process losses and an unnecessary need for coordinating activities. They speculate that autonomous actors might deviate significantly from prescribed working paths thereby increasing coordination costs and decreasing the performance of other actors. On the other hand, actors who naturally work autonomously might find it frustrating to coordinate their tasks and engage in collective decision-making. Sprigg, Jackson and Parker (2000) find that manufacturing employees working under high task interdependence do not benefit from individual autonomy. More specifically, no relationship is found between autonomy and strain under high task interdependence. Similarly, and more closely linked to my research, Langfred (2005) finds that teams with high task interdependence performed worse when given high levels of individual autonomy in comparison to teams with low individual autonomy. Teams operating under low task interdependence on the contrary, performed better when given high individual autonomy. It seems that under certain conditions individual autonomy might actually do more harm than good. However, it is important to recapitulate that these findings only hold for individual autonomy. Research on collective autonomy or team self-leadership (Stewart & Barrick, 2000) finds positive linkages between collective self-discretion and team performance given high interdependencies among team members (Langfred, 2005).

To summarize: Organization theory has convincingly shown the virtues of loose coupling, virtues which enable systems to cope with ambiguous environments in a coordinated but flexible manner. However, findings by team researchers seem to indicate that in some situations this simultaneity might actually be counterproductive. Team researchers warn that given high task interdependence individual autonomy might decrease team performance (e.g., Langfred, 2005). Two explanations might be given for these seemingly contradictory findings: firstly, loose coupling is a system-level concept whereas team researchers investigate the tensions between interdependence and autonomy at an individual or group level; secondly, in measuring performance, team researchers have limited their attention to short-term adaptations of teams whereas organization scholars also explore the impact of loose coupling on long-term adaptability, that is the capacity to adapt to changes in the long run (cf., Jahre & Fabbe-Costes, 2005; Weick, 1982). Despite these incompatibilities there is interorganizational relationships become less flexible. Still, these are not predetermined consequences of collaborative relationships but often the results of inadequate relationship design.
ample evidence to propose that interdependence can undermine collaborative behaviour through compromising actors’ autonomy thereby highlighting interdependence’ dark side. In other words, there is reason to suggest that autonomy moderates the relationship between interdependence and collaborative planning. However, due to the apparently inconclusive findings from organization and team research I wish to refrain from formulating a directed moderation hypothesis and instead state:

Hypothesis 5: Individual autonomy moderates the relationship between perceived interdependence and collaborative planning in supply networks such that the relationship between perceived interdependence and collaborative planning is significantly different for actors with low individual autonomy in comparison to actors with high individual autonomy.

After having derived the hypotheses of this study I will now go on to introduce the qualitative research question of this study.

4.9 Dynamics in supply networks from an enactment perspective

I repeat and summarize. Enactment theory (cf., chapter 2.5.2) proposes that organizations emerge through individuals’ actions. Individuals’ actions are constrained and influenced by past experiences that manifest in preconceptions held by actors: Preconceptions consist of cause-effect relationships which reflect actors understanding of organizations. If one accepts the core proposition of enactment theory, that is, that individually held preconceptions shape organizations, new insights into the functioning of heterarchic supply networks become possible. Firstly, differences in principles of management, styles of doing business, and cultures that exist within heterarchic supply networks emerge from local enactment processes. As actors in heterarchic supply networks are relatively free of organizational constraints (due to the low degree of formalization and standardization), these differences are likely to be more pronounced in heterarchic supply networks in comparison to strategic networks. Secondly and related to this first insight, as differences in cultures, professions, and frames of reference are particularly pronounced in heterarchic networks, actors will find it especially bothersome to align their preconceptions in order to establish some congruent understanding. Thirdly, it is only on the basis of such congruent understanding, that interlocking of behaviours and synchronizing of processes across the supply network becomes possible. Despite enactment theory’s intriguing appeal, no empirical research has yet been conducted on heterarchic supply networks from an enactment perspective. In order
to address this research void this study seeks to investigate preconceptions actors collectively hold towards supply network processes. Despite the fact that cause maps are individual constructions, actors’ maps are to be interrelated in processes of communication and coordination (Boland & Tenkasi, 1995; Wetzel, 2005), which is why I focus on collectively held assumptions.

More specifically, I seek to focus on preconceptions actors collectively hold towards collaborative planning, its mechanisms, and antecedents in order to allow for comparisons with quantitative findings and to develop a more nuanced and complex understanding of heterarchic supply network processes. Therefore, on the basis of enactment theory, this study seeks to investigate the following question in an inductive manner:

**Research question 1:** What preconceptions do actors collectively hold concerning collaborative planning, its effectiveness, and its antecedents?

This research question ends the theoretical part of this thesis. In the following chapter I will outline the methods with which I want to address the hypotheses and research question presented in this chapter.
Chapter 5

Methods

5.1 Introduction

In this chapter, the research site – two heterarchic supply networks in forestry and timber industry – is described before detailing quantitative (self-responder questionnaire) and qualitative (primarily interviews) measures. Subsequently, data analyses are outlined. I will start by describing quantitative approaches such as mediation and moderation analysis, before expounding the qualitative analyses used in this study such as cause mapping and process analysis. Figure 9 is thought to serve as an orientation device as it depicts how the different approaches described in this chapter interrelate and build upon each other.

Figure 9: Structure of empirical approach
Note: Rectangles denote empirical approaches. Sinuous forms denote data gathering instruments or products of analysis.
Methods

5.2 The organizational context

Data was collected from two forestry supply networks in Switzerland. These networks are referred to throughout the following as the Fagus network and the Picea network. Fagus is derived from the Latin, meaning beech and is used here to indicate that an exceptionally high degree of trees grown and harvested in the Fagus network are beeches. Picea translates into spruce and indicates that the majority of trees harvested in the Picea network are spruces. To understand the idiosyncrasies of the Fagus and the Picea network, both cases are analyzed separately before outlining differences and commonalities (Miles & Huberman, 1994). Important characteristics of both networks are presented in table 4 and figure 10.

Table 4: Fagus network versus Picea network

<table>
<thead>
<tr>
<th>Organizational profile</th>
<th>Fagus network</th>
<th>Picea network</th>
</tr>
</thead>
<tbody>
<tr>
<td>Market coverage</td>
<td>National with particular focus on two Swiss cantons</td>
<td>National with focus on one Swiss canton</td>
</tr>
<tr>
<td>Products</td>
<td>Log wood, round timber, exotic wood</td>
<td>Log wood, round timber (rarely: exotic wood)</td>
</tr>
<tr>
<td>Services</td>
<td>Production of timber (includes biological and technical production), transportation and delivery, further logistics services, for example, sales and purchasing</td>
<td>Production of timber (includes biological and technical production), transportation and delivery, further logistics services, for example, sales and purchasing</td>
</tr>
<tr>
<td>Sales volume (of timber)</td>
<td>2003: 40,000 m³ 2008: 70,000 m³ (forecast)</td>
<td>2003: 60,000 m³ 2005: 136,000 m³</td>
</tr>
<tr>
<td>Network actors in total</td>
<td>~200</td>
<td>~2100</td>
</tr>
<tr>
<td>Forest owners</td>
<td>100</td>
<td>~2000</td>
</tr>
<tr>
<td>Forest rangers</td>
<td>24</td>
<td>23-40</td>
</tr>
<tr>
<td>Service providers</td>
<td>15</td>
<td>30-40</td>
</tr>
<tr>
<td>Customers</td>
<td>50</td>
<td>40-60</td>
</tr>
<tr>
<td>3PL</td>
<td>3</td>
<td>~6</td>
</tr>
</tbody>
</table>

As shown in table 4, the Fagus network consists of organizational actors mainly operating in two cantons in comparison to actors in the Picea network who mainly stem from one Swiss canton. Both networks harvest and deliver wood in various forms and qualities, for example, log wood as well as exotic wood. They both offer full-range services to customers, such as agreement of contracts with suppliers, technical production (harvesting and hauling) and transportation and delivery services. While in 2003 both networks still had comparable trading volumes (40,000 m³ versus 60,000 m³), figures from 2005 and forecasts for 2008,
indicate that the Picea network seems to pursue a more aggressive growth strategy in comparison to the Fagus network. In terms of the number of members one finds that the Fagus network consists of approximately 200 network actors whereas the Picea network consists of 2100 actors. This difference, as can be seen in table 4, results mainly from differences in numbers of forest owners. Figure 10 outlines the organization structure of both supply networks in more detail. While nodes represent actors, lines represent relationships between actors.

**Fagus network**

![Fagus network diagram](image)

**Picea network**

![Picea network diagram](image)

Figure 10: Organization structure of supply networks

*Note: 3PL = Third party logistics (provider); thick lines = operational relationships (arrows indicate the direction of the material flow), thin lines = informational relationships, dashed lines = administrative relationships.

As shown in figure 10, seven (in the Fagus network), respectively eight (in the Picea network) professional groups can be distinguished. These are the association of forest owners, forest owners, forest administration, forest rangers, sub-contractors, service providers, customers, and third party logistics (3PL) providers. Before describing these groups in more detail relationships between groups (indicated in figure 10 by different lines) are demonstrated. Groups are linked through operational (thick lines), informational (thin
lines) and administrative (dashed lines) relationships. Operational relationships exist where material, i.e. timber, is produced and transported; the direction of the flow of material is indicated in figure 10 by arrows. Information relationships exist between actors who exchange information and knowledge to coordinate the flow of material (thin lines); information is exchanged for example to set up delivery agreements, to coordinate supply and demand, and to monitor the unfolding of the order fulfilment process. Administrative links (dashed lines) have regulative and political functions; forest administration for example defines maximum harvesting volumes per year and defines guidelines for harvesting processes in line with the multifunctional nature of forests. In the following paragraphs, the different groups of actors are described in more detail.

While forest owners in the Fagus network are predominantly municipalities, hence having public owners, forests in the Picea network are mainly privately owned. Ownership by private organizations is relatively rare, thus most owners are individuals. The main difference between public and private forest owners is the harvesting volume per owner. This is significantly larger for public forest owners. Therefore, it is likely to be more complex and resource intensive to coordinate timber supply in the Picea network than in the Fagus network.

In the Fagus network, the management of forests and law enforcement is in the hands of forest rangers. Managing forests includes the coordination of harvesting processes and the closing of sales with customers. Law enforcement entails the responsibility of ensuring forest regulations are adhered to, authorizing harvesting, and consulting forest owners on issues such as forest sustainment. While forest rangers in the Fagus network act as managers and officers of forest laws, forest rangers in the Picea network act solely as officers of forest law. Forest management tasks in the Picea network are partly fulfilled by private forest rangers who are employed by forest owners or municipalities or by self-employed forest experts. Thus, in more general terms, law enforcing functions and the management of forests are

17 A large percentage of forest owners in the Fagus network stems from one canton, where the average harvesting volume for public owners is 4460 m$^3$ and for private owners 3.6 m$^3$. In this canton 196,265 m$^3$ of timber were harvested in 2004 by 44 public forest owners and as little as 18,574 m$^3$ by 5149 private forest owners. In the Picea canton the opposite is true; 95,510 m$^3$ of timber were harvested by 330 public forest owners and 308,968 m$^3$ by the impressive number of 11,599 private forest owners. All figures taken from the Report on Swiss forests 2005 (Waldbericht 2005, BUWAL-WSL, 2005) edited by the Federal Office for the Environment FOEN and the Swiss Federal Institute for Forest, Snow and Landscape Research (WSL).
personally integrated in the Fagus network and disintegrated in the Picea network. This has some impact on the organizational structure of logistics providers.

*Service providers* include actors responsible for timber harvesting, hauling, and transportation of timber. Actors are mainly self-employed entrepreneurs who own one or a few harvesters and haulers for mechanical harvesting and employ on average a handful of truck drivers. Depending on their local knowledge, hauling and transportation contractors plan their routing independently. Information on dimensions, quality and storage location of the harvested timber is submitted to transportation contractors either via phone or in electronic format, or summarized in an electronic map supported by a geographic information system (GIS).

*Customers* vary significantly in size and span a wide range of organizational forms. Located on the one end of the continuum are small scale sawmills which use as little as 4,000 m³ timber per year. Among their customers are local carpentries and tilers. On the other end of the continuum are global players in the paper and pulp industry who have annual capacities of up to 1,800,000 m³ timber and a diverse array of products. These global players are amongst the most powerful actors in the network as their policies can have a significant impact on hundreds of suppliers further down the line. Traders of wood who act as customers were subsumed in this group, too.

The organizational structure of *logistics providers* in the Fagus and Picea network follows a similar logic; however differences do exist. Logistics providers can be thought of as impartial brokers (Fernandez & Gould, 1994; Mintzberg, 1979; Schultze & Orlikowski, 2004), who try to coordinate supply and demand in each network. However, 3PL providers in this study are in a difficult position as they lack the authority to issue demands to other network actors which significantly aggravates brokering activities. 3PL providers offer a wide array of customized services – including mediating supply and demand, organizing harvesting, hauling and transportation, and improving means of cooperation in the supply network. 3PL providers investigated in this work, act as incorporations (“Aktiengesellschaft”) consisting of one CEO and one or two employees controlled by a board of directors. Despite their small size, 3PL providers try to coordinate the flow of timber across a network of widely dispersed

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18 Companies in the pulp mill industry use the different components of wood – cellulose fibre substances, hemicellulose, and lignin – for producing speciality cellulose, lignin-based binding and dispersing agents, yeast and yeast extracts, ethanol, and aroma chemical vanillin, among others.
actors. Often, this coordination necessitates face-to-face contacts at sites where harvesting takes place; therefore, 3PL providers cooperate with regional sub-contractors. The 3PL provider in the Fagus network cooperates mainly with three forest rangers all of whom have strong local relationships with forest owners and customers. The 3PL provider in the Picea network, in contrast, cooperates with five self-employed sub-contractors, all of them former forest rangers who also profit from their longstanding local networks. Furthermore, forest rangers and sub-contractors have extensive knowledge of local silvicultural conditions, which is of eminent importance in forestry. Indeed, site production in forestry (Schönsleben, 2004) affords local knowledge to reliably predict the potential effects of management decisions, as for example the use of specific harvesting techniques (cf., Pudack & Franck, 2006).

5.3 Quantitative measures, procedures and sample

A self-report survey was used to assess the data for testing the hypotheses. 3PL providers from both networks provided the author with 335 addresses on active network members. Questionnaires were mailed directly to all members by the author. Each questionnaire was prefaced by an introductory letter that outlined the objective of the study and assured confidentiality and anonymity of respondents. Completed questionnaires were returned to the author in stamped envelopes by each respondent per mail. 107 questionnaires which were filled in correctly were returned, which equals a response rate of 31.9 percent. 59 respondents were members of the Fagus network and 48 respondents belonged to the Picea network (cf., tab. 5). 29 percent of individuals of the full sample were younger than 40 years old, 61.7 percent were aged between 41 and 60, and 10.3 percent older than 61 years old. Respondents, 99.1 percent of whom were men, were asked to answer the questions of the survey in reference to one given group of actors determined on the basis of a process analysis (the rational behind this approach will be fully delineated in chapter 5.6.3). For example; customers were asked to rate their collaborative behaviour towards 3PL providers while forest rangers, in contrast, were asked to rate their collaborative behaviour towards forest owners. Due to statistical reasons and to ease comparison with existing research findings I used, where possible, validated instruments. If necessary, scales were translated from English into German. If not stated otherwise respondents rated whether they agreed or disagreed with a series of statements on a Likert-type scale ranging from 1 ("strongly disagree") to 5 ("strongly agree"). Cronbach’s alpha reliability was calculated for all scales.
Table 5: Respondents per group of actors

<table>
<thead>
<tr>
<th>Group of actors</th>
<th>Fagus network</th>
<th>Picea network</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Forest owners</td>
<td>22</td>
<td>15</td>
<td>37</td>
</tr>
<tr>
<td>Forest rangers</td>
<td>20</td>
<td>12</td>
<td>32</td>
</tr>
<tr>
<td>Service providers</td>
<td>4</td>
<td>8</td>
<td>12</td>
</tr>
<tr>
<td>Customers</td>
<td>11</td>
<td>9</td>
<td>20</td>
</tr>
<tr>
<td>3PL providers*</td>
<td>2</td>
<td>4</td>
<td>6</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>59</strong></td>
<td><strong>48</strong></td>
<td><strong>107</strong></td>
</tr>
</tbody>
</table>

*Note: 3PL providers are supported by a few specific forest rangers (respectively sub-contractors) in coordinating the flow of material and information across the supply network, which is why they were grouped together into the category 3PL providers (cf., chapter 5.2).

5.3.1 Collaborative planning

As no scales on collaborative planning existed, an indication that empirical measurement has not kept pace with the theoretical importance of the concept, new items were developed in the realm of this study. Items on collaborative planning were derived from the theoretical model introduced into the literature by Windischer and Grote (2003) and Windischer et al. (in press). Items were developed to assess the eight behavioural planning facets described in the model on collaborative planning. Windischer (2003), in her study on inter-departmental planning processes, also used an interview guideline to elicit detailed descriptions of critical incidents in planning processes. This interview guideline helped to draft the items used in this study. Items were iteratively discussed with professional colleagues, which led to the final wording of the items. Principal component factor analysis of the twelve collaborative planning items was carried out (cf., tab. 6). Exploratory factor analysis instead of confirmatory factor analysis was deemed to be appropriate due to the “little theoretical or empirical basis to make strong assumptions about how many common factors exist or what specific measured variables these common factors are likely to influence” (Fabrigar, Wegener, MacCallum, & Strahan, 1999, p. 277). Preconditions of exploratory factor analysis were satisfactorily tested as shown in the following. Kaiser–Meyer–Olkin (KMO) measure of Sampling Adequacy was $KMO = .86^{19}$ suggesting the sample to be adequate for factor analysis. Likewise, the

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19 The range 0.80–0.89 indicates a high degree of common variance amongst variables.
Bartlett’s Test of Sphericity rejected the null hypothesis of an identity matrix ($\chi^2 = 789.01$, df = 66, $p = .00$). After the initial factor extractions, the common factors were rotated by VARIMAX rotation, the most common orthogonal transformation (Fabrigar et al., 1999). Three principal factors with eigenvalues greater than 1 were extracted (cf., tab. 6).

**Table 6: Exploratory factors analysis on collaborative planning**

<table>
<thead>
<tr>
<th>Survey item</th>
<th>Factor 1</th>
<th>Factor 2</th>
<th>Factor 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. I provide (the co-actor)(^{21}) with timely and detailed information about upcoming work orders.</td>
<td>.825</td>
<td>-.014</td>
<td>.050</td>
</tr>
<tr>
<td>2. I inform (the co-actor) about events that are still uncertain.</td>
<td>.795</td>
<td>.126</td>
<td>.125</td>
</tr>
<tr>
<td>3. I try to provide (the co-actor) with an insight into my own working conditions (for example on common disturbances or variances).</td>
<td>.734</td>
<td>.184</td>
<td>.299</td>
</tr>
<tr>
<td>4. We laterally set common goals which we are committed to fulfil.</td>
<td>.193</td>
<td>.176</td>
<td>.879</td>
</tr>
<tr>
<td>5. I commit myself to keeping set goals.</td>
<td>.160</td>
<td>.251</td>
<td>.843</td>
</tr>
<tr>
<td>6. I devise alternative plans in case that the joint master plan fails.</td>
<td>.679</td>
<td>.433</td>
<td>.155</td>
</tr>
<tr>
<td>7. When setting up a plan I assess how the plan might possibly impact my cooperation partner.</td>
<td>.622</td>
<td>.441</td>
<td>.149</td>
</tr>
<tr>
<td>8. I continuously assess whether we are on target.</td>
<td>.584</td>
<td>.514</td>
<td>.080</td>
</tr>
<tr>
<td>9. I inform my cooperation partner about any plan deviation.</td>
<td>.618</td>
<td>.593</td>
<td>.044</td>
</tr>
<tr>
<td>10. Before making changes to our common plan I consult with (the co-actor).</td>
<td>.255</td>
<td>.837</td>
<td>.182</td>
</tr>
<tr>
<td>11. Before abandoning a common plan, I ensure that (the co-actor) agrees upfront with this decision.</td>
<td>.188</td>
<td>.845</td>
<td>.219</td>
</tr>
<tr>
<td>12. If a joint plan fails, I reflect upon possible improvements on joint planning in the future.</td>
<td>.028</td>
<td>.718</td>
<td>.477</td>
</tr>
</tbody>
</table>

| Eigenvalue | 3.59 | 3.07 | 1.95 |
| Proportion of variance explained by eigenvector (in %) | 29.9 | 25.6 | 16.3 |

* All measures are standardized; varimax orthogonal rotation procedure is used for reported results.

\(^{20}\) For a critical review on advantages and disadvantages of orthogonal and oblique rotation, see for example Conway and Huffcutt (2003).

\(^{21}\) The term “co-actor” was substituted in the questionnaires by the predetermined group of actors, respondents were asked to refer their answers to.
The factor loadings show a pattern similar to the three facets suggested by Windischer and Grote (2003): establishment of plans, lateral agreements, and monitoring and revising of the plan. Following Windischer and Grote (2003) the three resulting factors were termed attentive exchange of preliminary knowledge (Factor 1), goal agreement (Factor 3), and coordinated, opportunistic planning (Factor 2). Attentively exchanging preliminary knowledge means that individuals take co-actors’ working conditions into account when exchanging (preliminary) knowledge. Co-actors are thereby empowered to prepare themselves for eventualities. Goal agreement increases actors’ goal commitment and might strengthen actors’ sense of control. And individual opportunistic planning refers to the need for coordinating ad-hoc changes with the planning to ensure synchronized actions. As shown in table 6 four items (numbered 6, 7, 8 and 9) could not differentiate between the three constructs which is why I dropped them from consideration in the scale construction (cf., Gulati & Sytch, 2007). Cronbach’s alpha for the resulting three sub-scales is $\alpha = .82$ for exchange of preliminary knowledge, $\alpha = .81$ for goal agreement, and $\alpha = .88$ for opportunistic planning. It is important to note that this study only uses information on sub-scales for exploratory analysis and descriptive statistics. Inferential statistics for this study are not based on sub-scales but on the eight-item collaborative planning scale. Two reasons can be given for this. Firstly, internal reliability of the eight-item scale is $\alpha = .85$ indicating good internal consistency thereby lending support to a one-dimensional interpretation (cf., George & Mallery, 2003; Peterson, 1994). Secondly, existing conceptual and empirical evidence does not allow for a theoretically grounded analysis of antecedents of collaborative planning sub-scales.

### 5.3.2 Perspective taking

Perspective taking was measured by a six-item scale developed by Parker and Axtell (2001). The items address two key constituents of perspective taking, that is, making positive attributions about co-actors’ behaviours and showing empathic concern. Sample items are "(The co-actor) is doing the best he can, given the circumstances" and "I feel concerned for (the co-actor) if he is under pressure". Internal reliability of the six-item scale is $\alpha = .86$ indicating good internal consistency (cf., George & Mallery, 2003).

### 5.3.3 Perceived interdependence

To assess perceived interdependence I used Campion’s (1993) widely used nine-item scale. Sample items are "I cannot accomplish my tasks without information, material or support from (the co-actor)", "My work goals come directly from the goals of (the cooperation
partner)" and "Feedback about how well I am doing my job comes primarily from information about how (the co-actor) is doing". This nine-item scale has a Cronbach alpha of $\alpha = .86$ indicating good internal consistency.

### 5.3.4 Autonomy

To assess autonomy I used the work autonomy scale by Breaugh (Breaugh, 1985, 1989, 1998, 1999; Breaugh & Becker, 1987) which has been consistently proven to be a valid and reliable instrument (cf., Evans & Fischer, 1992). Sample items read “I am allowed to decide how to go about getting my job done (the methods to use)”, “I have control over the scheduling of my work” and “My job allows me to emphasize some aspects of my job and play down others”. This nine-item scale on work autonomy has a Cronbach alpha of $\alpha = .94$ indicating excellent internal consistency.

### 5.3.5 Perceived effectiveness

Perceived effectiveness was assessed using the four-item scale developed and validated by Ellinger (2000). Respondents indicated the perceived effectiveness of the respective relationship during the past six months of the cooperation. Wording of items was slightly changed, substituting the terms logistics and marketing with the respective cooperation partner, for example, service provider. Sample items read “Has the time and effort spent in developing and maintaining the relationship with (the co-actor) been worthwhile?” and “Have you been satisfied with the overall relationship?”. The internal reliability of the four-item scale is $\alpha = .92$ indicating excellent internal consistency.

### 5.3.6 Control variables

In addition to the measures used to test the research model, length of relationship and degree of interaction were controlled for in the research model.

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22 To reflect the particular working context in heterarchic supply networks adequately wording of this item was changed slightly. The original item reads "My job allows me to modify the normal way we are evaluated so that I can emphasize some aspects of my job and play down others".
5.3.6.1 Length of relationship

Length of relationship is a necessary control variable, for the longer the relationship lasts, the more familiar cooperation partners become. Familiarity allows cooperation partners to exchange information and knowledge more easily (e.g., Krauss & Fussell, 1991). Furthermore, actors in long-term network relationships will have less uncertainty about reciprocation which provides motives for actors to cooperate (Blau, 1974; Parker & Axtell, 2006). To assess length of relationship (measured in years) respondents were asked to indicate the year and month of the beginning of their cooperation with the co-actor.

5.3.6.2 Degree of interaction

Schultze and Orlikowski (2004) state that the “frequency of social interaction among organizational members is one of the key drivers in building and maintaining interfirm linkages” (p. 88). According to Dhanaraj and Pharke (2006), organizations that interact more broadly and deeply with each other learn more about each other’s idiosyncrasies. Such knowledge of the working conditions of co-actors is an important resource if one is to understand each other’s behaviour, thus making it easier to enact plans jointly. I used two items to control for the degree of interaction (cf., Parker & Axtell, 2001). First, respondents indicated how often they usually had contact with the co-actor on a scale from 1 (“less than once per month”) to 6 (“several times a day”). Second, respondents were asked to indicate how much they know about the working conditions of the co-actor on a scale ranging from 1 (indicating no knowledge) to 6 (indicating extensive knowledge). To ensure that both items were equally weighted, scores on the two items were standardized and then averaged.

While this sub-chapter has described the quantitative methods of this study the coming subchapter describes the qualitative data gathering methods.

5.4 Qualitative measures, procedure and sample

Answers on the qualitative research question on the preconceptions of collaborative planning held by actors, are based on fieldwork consisting of interviews, observations, and workshops. As further detailed in the coming sections, qualitative methods were used for two reasons primarily. Firstly, the data from the interviews was analyzed to produce cause maps (cf., 5.6.1), that is, networks of preconceptions held by the actors. Secondly, qualitative methods were used to investigate the processing of a customer order in detail (cf., 5.6.2); this was important not only because it helped to develop a deep understanding of the flow of material
and information throughout the supply network, but more so because it provided a sound basis for deciding which dyad-based network relationships to analyze in more detail (cf., 5.6.3). In the following, I start by outlining the interviews in more detail before going on to describing the workshops.

### 5.4.1 Semi-structured and structured interviews

I conducted a total of 52 interviews of which 36 were semi-structured and 16 structured. I conducted the interviews on the basis of interview guidelines which detailed the issues to be explored (cf., McCracken, 1988). As shown in table 7, I ensured that all groups of actors were represented in the interview sample. However, table 7 also indicates that some groups of actors were rather underrepresented (e.g., service providers), while others were rather overrepresented (e.g., 3PL providers). It is important to keep this in mind when interpreting qualitative findings.

**Table 7: Number of interviews (structured / semi-structured) per group of actors**

<table>
<thead>
<tr>
<th>Group of actors</th>
<th>Picea network</th>
<th>Fagus network</th>
</tr>
</thead>
<tbody>
<tr>
<td>Forest owners</td>
<td>1 / 3</td>
<td>1 / 4</td>
</tr>
<tr>
<td>(Including representatives of the association of forest owners)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Forest ranger</td>
<td>1 / 3</td>
<td>2 / 1</td>
</tr>
<tr>
<td>(Including representatives of the forest administration)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Service providers</td>
<td>0 / 3</td>
<td>0 / 3</td>
</tr>
<tr>
<td>Customers</td>
<td>1 / 5&lt;sup&gt;a&lt;/sup&gt;</td>
<td>1 / 5&lt;sup&gt;a&lt;/sup&gt;</td>
</tr>
<tr>
<td>(Including traders of wood who act as customers)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3PL providers</td>
<td>5 / 6&lt;sup&gt;β&lt;/sup&gt;</td>
<td>4 / 3&lt;sup&gt;γ&lt;/sup&gt;</td>
</tr>
<tr>
<td>(Including sub-contractors)</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>8 / 20</strong></td>
<td><strong>8 / 16</strong></td>
</tr>
</tbody>
</table>

Notes:

* The first figure denotes the number of structured, the second the number of semi-structured interviews.

<sup>a</sup> One person was interviewed twice (structured and semi-structured)
<sup>β</sup> Two persons were interviewed twice (structured and semi-structured)
<sup>γ</sup> Four persons were forest rangers who acted as sub-contractors of the 3PL provider.

The 36 semi-structured interviews were conducted over a seven-month period (December 2003 to July 2004). I conducted 16 interviews with members of the Fagus network and 20 interviews with actors from the Picea network. Interviews lasted one to three hours and
provided background information about working practices, day-to-day issues, as well as an understanding of cooperation processes. I asked interviewees to describe in detail their coordination and cooperation with other actors in the network. Questions asked included “With whom in the network do you coordinate your activities?” “How closely do you collaborate?” “Please describe your coordination when processing a customer order in detail” and “Can you give a recent example of coordination processes?” (Interview guidelines are depicted in appendix B). Because interviews were originally conducted to explore the site of research and to establish relationships with industry partners it was felt it might be off-putting to participants if they were tape recorded. However, I took shorthand interview notes of verbatim talk and wrote electronic transcripts shortly afterwards. Interviewees were chosen on the basis of expert advice from 3PL providers and forest officers because they held extensive knowledge of actors in the supply networks. Interviews were combined partly with unstructured on-site observations. On-site observations provided rich information on business processes and routines in the forestry and timber industry. This information helped me to develop a contextualized understanding of the working processes and facilitated the interviewing process.

The 16 structured interviews were conducted over a two-month period (January 2005 to March 2005). I interviewed 8 members of the Fagus and 8 members of the Picea network. These interviews provided detailed insights into the evolution of both networks and their modes of organization. Interviewees were asked to describe the process of change, to identify change agents, and to describe modes of organizing and governance used in the network. Questions asked included “How is the cooperation within the supply network organized?”, “In how much detail have the tasks and responsibilities of network actors been specified?” or “What do you do if rules or agreements are not kept?” (Interview guidelines are depicted in appendix C). In contrast to the semi-structured interviews, these 16 structured interviews were tape recorded as relationships with industry participants were deemed to be sufficiently strong at this point of time in the research project. Interviews were transcribed in an edited form. Statements clearly not related to the topic of this research were not transcribed. Quotes used for this study were retrospectively transcribed in an intelligent verbatim manner.

5.4.2 Workshops

Finally, one half-day workshop organized by the author was conducted in each network, in order to facilitate discussions on coordination processes among network actors. The
workshop held in the Picea network was attended by 13 actors, the workshop in the Fagus network by 14 actors (cf., tab. 8).

Table 8: Workshop participants per group of actors

<table>
<thead>
<tr>
<th>Group of actors</th>
<th>Picea Network</th>
<th>Fagus network</th>
</tr>
</thead>
<tbody>
<tr>
<td>Forest owners</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>(Including representatives of the association of forest owners)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Forest rangers</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>(Including representatives of the forest administration)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Service providers</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>Customers</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>(Including traders of wood who act as customers)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3PL providers</td>
<td>4</td>
<td>3*</td>
</tr>
<tr>
<td>(Including sub-contractors)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>13</td>
<td>14</td>
</tr>
</tbody>
</table>

* Note: Two persons were forest rangers who acted as sub-contractors of the 3PL provider.

I ensured that all groups of network actors were represented in these workshops. This was particularly important as workshops were used to validate process diagrams depicting the flow of material through the Fagus and the Picea network (cf., chapter 5.6.2, for details).

From a practitioner’s view, this workshop was held to provide a platform to discuss current issues between network actors and to develop some action plans for the future. Indeed, this workshop was one of the very rare occasions on which all groups of network actors met; this highlights how dispersed and disintegrated networks under study were.

This brings me to the analysis section. In order to make it as comprehensive as possible, I sub-divided this section; I start by describing the quantitative analyses before delineating the qualitative analyses.

5.5 Quantitative analysis

5.5.1 Analysis of intraclass correlation coefficient (ICC)

The statistical analyses were conducted at the individual level, irrespective of whether individuals were members of the Fagus or the Picea network. To assess the appropriateness of this procedure and to test for independence of observations, I computed the intraclass
correlation coefficient (ICC) on the basis of recommendations given by Cohen et al. (2003). The ICC measures "the proportion of the total variance of a variable that is accounted for by the clustering of cases" (Cohen et al., 2003, p. 537). In other words, the ICC provides a measure to quantify to what extent individual results depend on group membership. An ICC of 0 indicates complete independence whereas a value of 1 indicates complete dependence. The ICCs for collaborative planning, interdependence, autonomy, perspective taking, and effectiveness were -.0185, -.0441, -.0074, -.0124, and -.0103 respectively. In short, the variance accounted for by the clustering of cases is smaller than or equal to +/- .04 which suggests that it is appropriate to analyze the data at the individual level irrespective of individuals’ network membership.

5.5.2 Missing data analysis

Missing data analysis on the variables used in the self-respondent questionnaire revealed that from the 43 single items of the scales perceived interdependence, autonomy, perspective taking, collaborative planning, perceived effectiveness, length of relationship, and degree of interaction, between 1.9 and 8.3 percent of data was missing. In accordance with recent research findings I used maximum likelihood (ML) estimation to substitute this missing data. This technique has been shown to be superior to ad-hoc missing data techniques like listwise or pairwise deletion (Enders, 2003; Schafer & Graham, 2002).23

5.5.3 Analysis of common-method bias

Because data used for testing the research model outlined in figure 8 was collected from one source, that is, self-respondent questionnaires, I conducted Harmon’s (1967) one factor test as recommended by Conway and Huffcutt (2003) to evaluate the possibility of same-method bias. This necessitates conducting a factor analysis using all items from all scales. If a single factor emerges from this analysis, common method poses a serious problem. The results of this analysis for autonomy, perceived interdependence, perspective taking, collaborative planning, and perceived effectiveness did not identify a single factor, explaining a major proportion of the total variance in the set of items. Thus, it seems that common method variance did not significantly influence results of this study.

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23 Schafer and Graham (2002) urge researchers not to use listwise or pairwise deletion as these techniques "may do more harm than good, producing answers that are biased, inefficient (lacking in power), and unreliable" (p. 147).
5.5.4 Mediation analysis

A mediator is defined as a variable or mechanism that explains the relationship between a predictor and an outcome (Frazier, Tix, & Barron, 2004). To test for mediation effects I used the three-equation approach recommended by Kenny and colleagues (Baron & Kenny, 1986; Judd & Kenny, 1981; Kenny, Kashy, & Bolger, 1998). To establish that a variable mediates the relationship between a predictor and an outcome variable, four conditions must hold (tested in three sequential equations). Firstly, the outcome variable is regressed on the predictor; secondly, the mediator is regressed on the predictor variable; and thirdly the outcome variable is simultaneously regressed on the predictor and the mediator. This third equation provides a test of whether the mediator is related to the outcome controlling for the treatment as well as an estimation of the relation between the predictor and the outcome controlling for the mediator. If the relation between predictor and outcome is zero when controlling for the mediator, full or complete mediation is given (James & Brett, 1984). If the relation between predictor and outcome is significantly diminished when controlling for the mediator, the data suggest partial mediation (Frazier et al., 2004). Frazier et al. (2004) recommend also including variables that might influence both the mediator and the outcome directly in the mediation model (in this case the control variables). Furthermore, it is suggested that unstandardized regression coefficients in mediation analysis be interpreted (Frazier et al., 2004).

5.5.5 Moderation analysis

Moderated regression analysis was used to test the interactions predicted in hypothesis 5. In general terms, a moderator is a qualitative or quantitative variable that influences the strength and the direction of a relationship between an independent variable and a dependent variable (Baron & Kenny, 1986; Frazier et al., 2004). Moderation hypotheses are tested by means of hierarchical multiple regression. As a first step, control variables are entered into the equation; the main effects are entered in step 2; and the interaction effects in

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24 I did not use Structural Equation Modelling (SEM) due to sample size. According to Frazier et al. (2004) SEM requires a sample size of at least 200.

25 There is some debate in the literature as to whether a significant relationship between the independent and dependent variable is a necessary condition for a mediation effect to hold. I follow Preacher and Hayes (2004) and Mathieu and Taylor (2006) who, by distinguishing between indirect and mediation effects, make clear that a direct relationship must be given for any mediation hypothesis to hold. "Mediator variables are explanatory mechanisms that shed light on the nature of the relationship that exists between two variables. If no such relationship exists, then there is nothing to be mediated." (Mathieu & Taylor, 2006, p. 1038)
step 3. Finally, interactions between control variables and all other variables as well as product terms are included in a fourth step (Frazier et al., 2004). A significant interaction is indicated by a significant R-square change ($\Delta R^2$) in step 3.

To explore the particular form of interaction and to test statistical significance of simple slopes (i.e., functions that detail the relationship between predictor and outcome for different values of the moderator), I used a computational tool for probing interaction effects provided by Preacher, Curran, and Bauer (in press). To illustrate interaction effects further, interactions were plotted by deriving separate equations for the high (one standard deviation above the sample mean) and low (one standard deviation below the sample mean) conditions of independent variables as recommended by Frazier et al. (2004). As widely recommended (Cohen et al., 2003) independent continuous variables were centred before being entered into the regression model. If variables are not centred, interpretation of moderation analysis becomes unstable and error-prone due to the fact that main effects and interaction terms are correlated. Furthermore, unstandardized regression coefficients (B) are reported instead of standardized regression coefficients ($\beta$), because the coefficients for the interaction terms are not standardized properly in equations including interaction terms and are thus not interpretable (cf., Cohen et al., 2003; Frazier et al., 2004). It is important to note that despite these precautions, moderator effects remain notoriously difficult to detect in non-experimental social studies (McClelland & Judd, 1993) explaining rarely more than one to three percent of variance (Redman & Snape, 2005). As can be seen in the results section, this was also true for this study.

5.6 Qualitative analysis

5.6.1 Cause mapping

Enactment theory (Weick, 1979) argues that preconceptions actors hold shape their actions and organizational processes (cf., chapter 2.4.2). Therefore, from an enactment perspective, an understanding of preconceptions is key to understanding organizations. According to Weick (1979) preconceptions are best thought of as networks of concepts tied together by causal relationships, or in short, as cause maps (cf., fig. 2). In consequence, this study seeks to explore preconceptions held by actors through the approach of cause mapping (cf., Bougon et al., 1977; Maruyama, 1963; Pitt, 2005; Weick, 1979; Weick & Bougon, 1986). Cause maps were derived from the interview data (cf., 5.4.1). Throughout the following I will describe the process by which I analyzed the interview material in order to identify cause maps. Analysis was conducted for each network separately.
Instead of analyzing individually held maps I searched for collectively held understandings, that is, concepts and causal relationships that are touched upon by a sufficiently large number of interviewees in order for me to be convinced that they did not just represent individual idiosyncrasies (cf., chapter 4.3). To gather “thick descriptions” (Geertz, 1973) of key concepts and causal relationships held by actors I relied on the 52 interviews detailed above as primary data source (cf., chapter 5.4.1). All 52 interview transcripts were coded in Atlas.ti 5.0 (cf., Gibson & Gibbs, 2006). Atlas.ti is a software program for content analysis which allowed me to use flexible qualitative coding as well as to take inventories of specific categories in a text. To code the interview data I created a “start list” of codes (Miles & Huberman, 1984), which contained all concepts of my quantitative research model, that is, interdependence, autonomy, perspective taking, collaborative planning, and effectiveness. The rationale behind this decision, as described in detail in chapter 4.3, was two-fold. Firstly, the chosen approach allows answering the qualitative research question of this study, that is, what preconceptions do actors hold concerning collaborative planning, its effectiveness, and its antecedents? Secondly, I expected this approach to enable comparisons between qualitative and quantitative results on the mechanisms and antecedents of collaborative planning. As a unit of analysis, I used any interviewees’ statement sufficiently long and precise enough for me to understand them as being related to the concepts of my quantitative research model. However, I quickly realized that these categories were insufficient as other concepts were intrinsically tied to my model concepts, that is, perceived uncertainty and integration. Thus, these variables were included in the category scheme as well. The final categorization scheme contained the following concepts: interdependence, autonomy, perspective taking, integration, common understanding, perceived uncertainty, and collaborative planning. Definitions of these concepts depicted in table 9 were used as guidelines for coding.

*Table 9: Definitions of concepts*

<table>
<thead>
<tr>
<th>Concept</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Interdependence</td>
<td>Extent to which individuals are dependent on each other in fulfilling their tasks and reaching set goals (definition based on Van de Ven et al., 1976)</td>
</tr>
<tr>
<td>Autonomy</td>
<td>Capacity to rule oneself, or in short, self-determination; this implies that actors are able to choose their goals and the rules they adhere to in a self-determined manner free from external control (definition based on Grote, 1997).</td>
</tr>
<tr>
<td>Perspective taking</td>
<td>Inferential process requiring effort that enables actors to consider the world from another’s point of view (definition based on Parker &amp; Axtell, 2001).</td>
</tr>
<tr>
<td><strong>Integration</strong></td>
<td>The extent to which business processes, organizational activities, and technologies are streamlined and synchronized across organizational boundaries (definition based on Elbanna, 2007).</td>
</tr>
<tr>
<td>-----------------</td>
<td>--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td><strong>Common understanding</strong></td>
<td>Set of congruent expectations on norms, work roles, the nature of the work itself, or social relationships (definition based on Ring &amp; Van de Ven, 1994).</td>
</tr>
<tr>
<td><strong>Perceived uncertainty</strong></td>
<td>Perceived ability either to predict events with sufficient accuracy or to sufficiently cope with their effects (e.g., state of environment, behaviour of co-actor); what is sufficient depends on the context, person, and task (definition developed in dependence on Grote, 2004; Milliken, 1987).</td>
</tr>
<tr>
<td><strong>Perceived effectiveness</strong></td>
<td>The extent to which individuals think of an interorganizational relationship as worthwhile, equitable, productive, and satisfying (definition based on Ellinger, 2000).</td>
</tr>
<tr>
<td><strong>Collaborative planning</strong></td>
<td>Necessitates multiple actors orienting their plans towards each other to reach a joint optimization of their planning. Planning is to be seen as an iterative process of formalized planning and ad-hoc, situated practices (definition based on Windischer &amp; Grote, 2003).</td>
</tr>
</tbody>
</table>

As the coding of the interview transcripts followed an exploratory logic, insights were iteratively compared with existing theory on enactment processes often resulting in rereading interview transcripts and recoding data. After having coded all interviews, I went through the coded material again in order to identify relationships between concepts indicated by interviewees. Links between any possible pair of concepts, such as, uncertainty and planning or interdependence and common understanding, were counted in order to identify key relationships. It occurred that some concepts did not clearly relate to other concepts. In order to avoid misinterpretations, this study only reports those relationships that were conclusive and mentioned by a sufficient number of interviewees for me to be convinced that relationships did not only represent individual idiosyncrasies. To evaluate dynamics of the resulting cause maps I referred to the evaluation method suggested by Weick (1979) and described in detail in chapter 2.4.2.2. To recapitulate; cause maps are evaluated by assessing their causal relationships. Firstly, the quality of single loops in cause maps is evaluated on the basis of the number of negative signs. If there is an even number of negative signs, then the loop is deviation-amplifying; loops with an odd number of negative signs, in contrast, are deviation-counteracting. Secondly, on the basis of the number of deviation-counteracting loops, cause maps are evaluated. If there is an even number of deviation-counteracting loops, the system is instable; an odd number of deviation-counteracting loops, in contrast, indicates that the system is stable (cf., chapter 2.4.2.2, for details).
5.6.2 Analysis of the ordering process

The 52 interviews also produced a substantial body of information on the flow of material and information throughout the supply networks. However, interviewees' accounts focused on different sequences of the flow of material and information, that is, mainly those sequences actors were directly affected by. Thus, to generate a more complete picture of the material and information flow, actors' accounts were systematically collated, ordered across time, and pieced together. The unit of analysis was any interviewees' statement referring to an individual or collective action that directly related to the ordering process, that is, the processing of a customer order. Furthermore, the focus was clearly on inter-unit actions that involved organizational actors from at least two different groups. Actions within organizational units that merely involved one actor were only depicted in a highly aggregated form. As an example, consider the harvesting process, which consists of several steps such as mechanical harvesting, manual harvesting, repositioning of the harvester, or ad-hoc site preparation. However, these steps were summarized in the process diagram under the one label of harvesting. In contrast to this, inter-unit actions such as coordination processes between forest rangers and forest owners are depicted in much greater detail.

Focus on the ordering process was deemed to be in line with the SCM literature according to which the order is the main analytical instrument of logistics (Schönsleben, 2004).26 After having been pieced together, the verbal reports of interviewees on coordination processes were transferred into a visual representation of the ordering process most commonly referred to in the business literature as process diagram (cf., Langley, 1999; Meyer, 1991). Process diagrams are to be understood to be standardized graphical representations of an ordered course of processes (Schönsleben, 2004, p. 131).27 I used a particular type of process diagrams, that is, the organization-oriented process diagram. Organization-oriented process diagrams are among the most widely used methods of analysis in logistics and process engineering and can be defined as follows:

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26 The order contains the necessary information to plan and control the flow of material and information in supply networks by defining business partners (customers and suppliers), the date the order is issued, the due date, and various order positions, for example, products that are to be manufactured (for a more detailed description, cf. Schönsleben, 2004).

27 Processes are defined in line with Specker (2005) as related and self-contained units of operations taking place at different system levels.
The organization-oriented process diagram shows a process with its part processes, tasks, or functions through the course of time (horizontal axis), and in its embeddedness in the structural organization (vertical axis) (Schönsleben, 2004, p. 146).

The fact that organization-oriented process diagrams contain information on processes and functions (Specker, 2005) makes it possible to match actors and sub-processes, thereby ascribing responsibilities to different process owners. The advantage of allowing the simultaneous representation of various dimensions is highlighted particularly in the literature (cf., Langley, 1999). Also, precedence of events and parallel processes can be depicted simultaneously. In contrast to flow charts, even large numbers of sub-processes can be delineated in a concise and structured manner (Schönsleben, 2004). And in contrast to other kinds of process diagrams, such as the value-added network diagram, it is possible to depict sub-processes running in parallel in an organization-oriented process diagram. Due to the large amount of information to be depicted in the diagram, the usage of more detailed modelling techniques, such as MEDILS (Method for description of integrated logistic systems, Schönsleben, 2000; 2001a; 2004) was deemed not to be applicable here.

Displaying verbal information on the ordering process in a visual manner certainly has several advantages, such as allowing the presentation of large quantities of information in a way which is intriguingly easy to understand (Langley, 1999) or providing common ground for discussions among network actors. However, as I had taken the lead in creating the organization-oriented process diagrams it was crucial to ensure social validation (cf., Schönsleben, 2004). To provide room for such social validation half-day workshops (described above in detail, cf., chapter 5.4.2) were organized. Process diagrams were presented to the participants who then spent between two and four hours discussing, validating, refining, and extending processes to ensure that resulting diagrams correctly represented the order processing. The final process diagrams depict the prototypical steps of the order processing but omit some of the process variations as this would have increased...

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26 Popular press falsely treats the terms flow chart and organization-oriented process diagram as synonyms. For a detailed description of flow charts, see Schönsleben (2000).
29 According to Schönsleben (2004) the term value-added network is a high-level concept encompassing different sub-types of networks, for example, a logistics network or a production network (p. 13). The technical German term is Wertschöpfungskettendiagramm.
30 MEDILS goes beyond other process diagrams by integrating information on different kinds of flow (that is, goods flow, data flow, and control flow) and information on stores (for example, good stores or data stores). Flow of goods and information is interrupted whenever goods or information are stored. If not managed adequately stores can cause delivery delays and long lead time.
complexity of the diagrams inappropriately because each of the organization-oriented process diagrams specifies around 100 process steps.

5.6.3 Interface analysis

Collaborative planning is a dyad-level construct which is why the unit of analysis of this study is the interorganizational relationship in heterarchic supply networks. As heterarchic supply networks consist of multiple dyadic relationships, I had to decide which network dyads to investigate in detail. In line with conventions in the SCM literature, I based this decision on the number of organizational interfaces among network actors in the ordering process (Yan & Louis, 1999). As outlined above in full detail (cf., chapter 2.3.2), any interface provides means to increase or decrease the efficiency and effectiveness of supply networks: if well structured, interfaces can be sources of joint learning processes; if badly structured, interfaces may corrupt order processing. The more interfaces two actors have the more likely it is that the order processing quality in the supply network depends on this particular dyad. Thus, I used the quantity of interfaces as an indicator for the relative influence dyads have on order processing. Amount of interfaces can be read out directly from organization oriented process diagrams. For each group of actors their most important cooperation partner – measured in number of interfaces – was identified resulting in ten network relationships which were further assessed in detail via self-respondent questionnaires (cf., chapter 5.3). This concludes the method part of this thesis and brings me to the results section.
Chapter 6

Results

6.1 Introduction

In this chapter, I present the findings of this study. I start by describing the ordering process in each network before going on to outline the quantitative findings of the study which provide support for my mediation and moderation hypotheses. Finally, qualitative findings are detailed; cause maps that emerged from the coding of interviews are described at length.

6.2 Order processing

Order processing within the Fagus and the Picea network are portrayed in the form of organization-oriented process diagrams. Each order processing consists of five, respectively six sub-processes, these are, medium-term planning, bid processing, harvesting and hauling, transporting timber, measuring and billing of timber. Due to their size process diagrams are only depicted in the appendix (cf., appendix D and E).

6.2.1 Order processing in the Picea network

Order processing in the Picea network starts with the forest ranger developing an operating plan (cf., appendix D). Operating plans must be in line with medium-term plans developed by the forest administration. Forest rangers mark out trees to be felled within 36 months. Customers, for example from the paper or pulp mill industry, forecast their requirements for the coming year and signal their demands to the 3PL provider. The 3PL provider eventually requests annual delivery volumes from private forest owners before reporting back about possible delivery volumes to the 3PL provider who then integrates this data and informs customers. If the proposed supply conditions meet the customers’ demands, a contract is set up (which can either be a written or take the form of an oral agreement). Large customers often specify their demands further on a monthly basis. On the basis of this contract, sub-contractors engage in mid-term planning of harvesting and hauling operations. If customers signal demand on short-term notice, sub-contractors get into contact with forest owners directly in order to assess whether short term harvesting is possible. It can also happen that forest owners harvest timber without making arrangements with sub-contractors upfront. Such
short-term coordination happens parallel to mid-term planning. Sub-contractors eventually invite and compare offers from different service providers before giving information to service providers on harvesting sites, delivery deadlines, and customer requests. Eventually sub-contractors and service providers visit harvesting sites together to decide on the site preparation eventually necessary for mechanical harvesting. Harvesting takes place and timber is stored in the forests according to customer orders. Information on storage locations, timber volume, and quality is exchanged with sub-contractors, who forward this information to independent transportation contractors (either in paper format or in an electronic form supported by a geographic information system). The more familiar truck drivers are with harvesting sites the less information sub-contractors provide them with. If customers who own trucks wish to coordinate the transportation process independently, sub-contractors provide them with information on harvesting sites. Based on detailed routing and scheduling, truck drivers pick up the wood from the storage locations in the forests and deliver it to the customers where it is measured. Finally, a transaction report is submitted to sub-contractors for accounting and invoicing. The 3PL provider manages payments for goods and services to all actors in the Picea supply network through electronic fund transfers.

6.2.2 Order processing in the Fagus network

As depicted in the appendix (cf., appendix E), order processing in the Fagus network starts with forest rangers developing a medium-term operating plan and an annual operating plan which is then approved by public forest owners, such as municipalities. Customers, for example from the paper or pulp mill industry, forecast their requirements for the coming year. On the basis of this forecast, customers’ purchasing agents approach the third party logistics provider with an annual delivery request. In some instances it is the 3PL provider who contacts customers to learn about annual delivery demands. The 3PL provider informs forest rangers about the delivery request. Forest rangers report back to the 3PL provider who then assesses whether the aggregated delivery volume meets the delivery request. Finally, the 3PL provider reports the maximum delivery volume to customers and eventually, a contractual agreement for delivery is reached. As soon as this happens the 3PL provider engages in medium-term planning of harvesting and hauling processes. Service providers and forest rangers jointly evaluate harvesting sites by sight. Short term planning for the coming month takes place and a maximum monthly delivery volume is agreed upon with customers. This information is exchanged with forest rangers and service providers, including transportation contractors. Forest rangers and service providers jointly prepare the harvesting site. As soon as the harvesting and hauling operations are finished, service providers exchange information on volume, quality, and storage locations of the stacked round wood with forest rangers and the 3PL provider. Forest rangers then provide
transportation contractors with information on storage location. The more familiar truck drivers are with harvesting sites the less information sub-contractors provide them with. Routing and scheduling is either done by customers (who own trucks for transporting wood) or by independent transportation contractors. Scheduling of truck drivers takes place; they then pick up the wood from the forests. Transportation contractors deliver the timber to customers, whereupon the delivery is compared with the contracted supply. Finally, a transaction report is submitted to the 3PL provider for accounting and invoicing. The 3PL provider manages payments for goods and services for all actors in the Fagus network by means of electronic fund transfers.

6.2.3 Comparison of order processing across networks

After comparison of both networks, one finds some differences in the ordering process. The 3PL provider in the Fagus network seems to be more directly involved in the bid processing (i.e., the second process stage) in comparison to the Picea network. Furthermore, it seems to be more time-consuming to gather information on the potential maximum delivery volume in the Picea network in comparison to the Fagus network. A possible reason for this is the fact that 3PL providers in the Picea network must gather information from a larger number of (private) forest owners, whereas in the Fagus network 3PL providers receive information from a smaller sample of public forest owners, often pre-structured by forest rangers. In short, more contingencies are to be taken into account in the bidding process in the Picea network in comparison to that in the Fagus network; this is especially true for short-term bidding which is why this process is separately depicted in the Picea network but not in the Fagus network (cf., appendix D and E). In the harvesting and hauling stage (i.e., the third stage) it seems that accountability for local coordination is distributed among forest rangers and 3PL providers in the Fagus network, whereas in the Picea network, responsibility for coordination mainly remains with 3PL providers. In the fourth stage, that is, the transportation of timber, information on harvesting sites is given to transportation contractors and / or customers by forest rangers in the Fagus network, whereas in the Picea network transportation contractors are informed by sub-contractors. Differences found in the third and fourth stages reflect the differences in the tasks of forest rangers described above: while law enforcing functions and the management of forests are personally integrated in the Fagus network, they are disintegrated in the Picea network (cf., chapter 5.2). In sum, some differences exist in the ordering process between both heterarchic supply networks. Nevertheless, commonalities in terms of structure of the ordering process, network structure, and modes of coordination seem to prevail in the ordering process.
6.2.4 Organizational interfaces

Table 10 presents the number of organizational interfaces between all actors in the Fagus and Picea network respectively. Data above the diagonal indicates the number of interfaces in the Picea network. Data below the diagonal indicates the number of interfaces in the Fagus network. The number of interfaces was read out from the organization-oriented process diagrams directly. Interfaces were identified on the basis of the definition given above, according to which an interface is established whenever materials or information cross organizational boundaries (Yan & Louis, 1999).

<table>
<thead>
<tr>
<th></th>
<th>Forest owner</th>
<th>Forest ranger</th>
<th>Service provider</th>
<th>Customer</th>
<th>3PL provider</th>
</tr>
</thead>
<tbody>
<tr>
<td>Forest owner</td>
<td></td>
<td>5</td>
<td>1</td>
<td>0</td>
<td>6</td>
</tr>
<tr>
<td>Forest ranger</td>
<td>3</td>
<td>2</td>
<td>0</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>Service provider</td>
<td>0</td>
<td>12</td>
<td>3</td>
<td>8</td>
<td></td>
</tr>
<tr>
<td>Customer</td>
<td>0</td>
<td>2</td>
<td>3</td>
<td>8</td>
<td></td>
</tr>
<tr>
<td>3PL provider</td>
<td>0</td>
<td>11</td>
<td>6-7</td>
<td>7-9</td>
<td></td>
</tr>
</tbody>
</table>

*Note: Data above (below) the diagonal indicate the number of interfaces in the Picea (Fagus) network.

As outlined above (cf., chapter 5.6.3), the more interfaces two actors have, the more likely it is that order processing quality depends on the respective dyad. Hence, the number of interfaces indicates the relative influence dyads have on order processing. In the Picea network, results of the interface analysis are unambiguous for four out of five groups of actors. Forest owners, service providers, and customers have most interfaces with 3PL providers; hence these groups were asked to rate their relationship with the particular 3PL provider they have most often contact with. Forest rangers were asked to respond in reference to forest owners as they “meet” most often. 3PL providers have as many interfaces with customers as with service providers. Due to the higher strategic importance of the relationship, 3PL providers were asked to assess their relationship with customers. Results for the Fagus network indicate that forest owners and service providers have most interfaces with forest rangers. Hence, these groups were asked to assess their relationships with the particular forest ranger they most often have contact with. As customers interact most often with 3PL providers in the realm of order processing, they assessed their relationship with the respective 3PL provider. However, for two out of the five groups of actors in the Fagus network results from the interface analysis were not that straightforward. Forest rangers are interacting with 3PL providers (11 interfaces) as intensely as with service providers (12 interfaces). Forest rangers were asked to assess their relationship with 3PL providers.
because this relationship is judged more critical for the functioning of the network. And while 3PL providers have more interfaces with forest rangers (11) than with customers (7-9) I decided to ask 3PL providers to assess their relationship with customers because of the high strategic importance of this relationship. After having explored the ordering process, I will now report the quantitative findings on collaborative planning, its effectiveness, and antecedents. Data stems from those key dyadic interorganizational relationships identified by means of interface analysis. Therefore, it is suggested that findings reflect the quality of collaborative planning and its antecedents at the network level.

6.3 Quantitative results

6.3.1 Descriptive statistics and zero-order correlations

Analysis of the intraclass correlation coefficients (cf., chapter 5.5.1) has shown that it is appropriate to analyze data at the individual level irrespective of individuals' network membership. Thus, statistical results presented in the following are based on analyses of the full sample of individuals \(N = 107\). Table 11 summarizes the descriptive statistics and zero-order correlations across both networks. Coefficient alphas are also presented.

Descriptive statistics on collaborative planning reveal exchange of preliminary knowledge poses most difficulties to network actors \((\text{Mean} = 3.47)\), whereas goal agreement \((\text{Mean} = 4.28)\) and opportunistic planning \((\text{Mean} = 4.07)\) seem to be in line with actors' needs. Levels of perspective taking \((\text{Mean} = 3.97, \text{S.D.} = .87)\), and perceived effectiveness \((\text{Mean} = 3.99, \text{S.D.} = .83)\) are similarly pronounced indicating high quality relationships. While the mean level of perceived interdependence is comparably low \((\text{Mean} = 2.72, \text{S.D.} = .96)\) actors seem to feel autonomous in their decision making \((\text{Mean} = 3.94, \text{S.D.} = 1.13)\). Correlation analysis finds support for hypothesis 1 showing collaborative planning and relationship effectiveness to be positively correlated \((r = .39, p < .01)\). However, Hypothesis 4 (autonomy and collaborative planning is positively related) seems not to be supported \((r = .14, \text{ns.})\).
Table 11: Means (M), Standard Deviation (SD), and Inter-Correlations

<table>
<thead>
<tr>
<th></th>
<th>M</th>
<th>SD</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
<th>9</th>
<th>10</th>
</tr>
</thead>
<tbody>
<tr>
<td>(1) Autonomy</td>
<td>3.94</td>
<td>1.13</td>
<td>(.94)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(2) Perceived interdependence</td>
<td>2.72</td>
<td>0.96</td>
<td>-0.18</td>
<td>(.86)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(3) Perspective taking</td>
<td>3.97</td>
<td>0.87</td>
<td>0.19</td>
<td>0.37**</td>
<td>(.86)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(4) Collaborative planning</td>
<td>3.90</td>
<td>0.91</td>
<td>0.14</td>
<td>0.46**</td>
<td>0.54**</td>
<td>(.85)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(5) Exchange of preliminary knowledge</td>
<td>3.47</td>
<td>1.21</td>
<td>0.03</td>
<td>0.34**</td>
<td>0.36**</td>
<td>0.79**</td>
<td>(.82)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(6) Goal agreement</td>
<td>4.28</td>
<td>1.00</td>
<td>0.27**</td>
<td>0.32**</td>
<td>0.41**</td>
<td>0.69**</td>
<td>0.33**</td>
<td>(.81)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(7) Opportunistic planning</td>
<td>4.07</td>
<td>1.21</td>
<td>0.10</td>
<td>0.41**</td>
<td>0.49**</td>
<td>0.84**</td>
<td>0.40**</td>
<td>0.51**</td>
<td>(.88)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(8) Perceived effectiveness</td>
<td>3.99</td>
<td>0.83</td>
<td>0.03</td>
<td>0.35**</td>
<td>0.61**</td>
<td>0.39**</td>
<td>0.31**</td>
<td>0.21*</td>
<td>0.36**</td>
<td>(.91)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(9) Length of relationship</td>
<td>6.52</td>
<td>5.85</td>
<td>0.00</td>
<td>0.15</td>
<td>0.29**</td>
<td>0.13</td>
<td>0.12</td>
<td>0.01</td>
<td>0.14</td>
<td>0.30**</td>
<td>(n.a)</td>
<td></td>
</tr>
<tr>
<td>(10) Interaction with co-actor</td>
<td>0</td>
<td>0.85</td>
<td>-0.01</td>
<td>0.33**</td>
<td>0.53**</td>
<td>0.49**</td>
<td>0.43**</td>
<td>0.19*</td>
<td>0.44**</td>
<td>0.52**</td>
<td>0.19</td>
<td>(n.a)</td>
</tr>
</tbody>
</table>

Note: Cronbach’s alpha in parantheses.

**p<0.01, *p<0.05; n = 107.
6.3.2 Mediation analysis

Table 12 shows the results of the mediation analysis. Mediation analysis was performed in order to test hypothesis 3 (i.e., perspective taking partially mediates the relationship between interdependence and collaborative planning).

Table 12: Mediation analysis

<table>
<thead>
<tr>
<th>Testing the four conditions that must hold to establish mediation</th>
<th>B</th>
<th>SE B</th>
<th>β</th>
<th>R²</th>
</tr>
</thead>
<tbody>
<tr>
<td>Testing condition 1</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Control variables: Length of relationship, Interaction with co-actor</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Outcome: Collaborative planning</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Predictor: Perceived interdependence</td>
<td>.318</td>
<td>.081</td>
<td>.337**</td>
<td>.319**</td>
</tr>
<tr>
<td>Testing condition 2</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Control variables: Length of relationship, Interaction with co-actor</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Outcome: Perspective taking</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Predictor: Perceived interdependence</td>
<td>.187</td>
<td>.077</td>
<td>.206*</td>
<td>.334**</td>
</tr>
<tr>
<td>Testing conditions 3 and 4</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Control variables: Length of relationship, Interaction with co-actor</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Outcome: Collaborative planning</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mediator: Perspective taking</td>
<td>.341</td>
<td>.099</td>
<td>.328**</td>
<td></td>
</tr>
<tr>
<td>Predictor: Perceived interdependence</td>
<td>.254</td>
<td>.078</td>
<td>.269**</td>
<td>.385**</td>
</tr>
</tbody>
</table>

Note: B = unstandardized multiple regression coefficient; β = standardized multiple regression coefficient; R² = adjusted portion of variance; *p<.05, **p<.01; n=107

Table 12 reveals that 38.5 percent of the total variance is explained by length of relationship, interaction with co-actors, perceived interdependence, and perspective taking (adjusted R² = .35, p < .001). Length of relationship and interaction with co-actors were both included in the equation to control for their influence. Both variables, that is, perceived interdependence (B = .25, p < .01) and perspective taking (B = .34, p < .01) significantly predict collaborative planning. Furthermore, perceived interdependence significantly predicts perspective taking (B = .19, p < .01). To assess whether the relation between predictor and outcome diminishes significantly when controlling for the mediator (that is, condition 4), the drop from 0.32 (in
condition 1) to 0.25 (in condition 4) must be assessed for significance (Frazier et al., 2004). In order to do this, I used the Sobel test (Preacher & Hayes, 2004).\textsuperscript{31} Calculation of the mediation effect yielded a z score greater than 1.96 (1.98, p < .05). Thus, the proposed causal model, which assumes that perspective taking partially mediates the relationship between perceived interdependence and collaborative planning, is consistent with the data providing support for hypothesis 3.

### 6.3.3 Moderation analysis

Table 13 shows the results from the moderation analysis. Moderation analysis was performed to test hypothesis 5 (i.e., autonomy moderates the relationship between perceived interdependence and collaborative planning).

<table>
<thead>
<tr>
<th>Step and variable</th>
<th>B</th>
<th>SE B</th>
<th>ß</th>
<th>ΔR²</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Step 1</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Length of relationship</td>
<td>.007</td>
<td>.014</td>
<td>.042</td>
<td></td>
</tr>
<tr>
<td>Interaction</td>
<td>.511</td>
<td>.093</td>
<td>.478*</td>
<td>.238**</td>
</tr>
<tr>
<td><strong>Step 2</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Perceived interdependence (centred)</td>
<td>.357</td>
<td>.080</td>
<td>.378**</td>
<td></td>
</tr>
<tr>
<td>Autonomy (centred)</td>
<td>.210</td>
<td>.079</td>
<td>.210**</td>
<td>.143**</td>
</tr>
<tr>
<td><strong>Step 3</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Perceived interdependence * Autonomy</td>
<td>-.147</td>
<td>.060</td>
<td>-.195*</td>
<td>.035*</td>
</tr>
</tbody>
</table>

Note. B = unstandardized regression coefficient; ß = standardized regression coefficient; ΔR² = change in explained variance; *p<.05, **p<.01; n=107

The omnibus F test representing step 4 was not significant, thus the step was dropped from the model (Frazier et al., 2004). Control variables in step 1 explain a significant portion of the variance (ΔR² = .238, p < .01). In step 2, autonomy and perceived interdependence added 14.3 percent of unique variance (ΔR² = .143, p < .01) pushing the total amount of variance explained to 38.1 percent (R² = .381). Step 3, finally, shows that the R² change associated with the interaction term was ΔR² = .035. In other words, the interaction between autonomy

\textsuperscript{31} I used an interactive calculation tool for mediation tests, provided online by Preacher and Leonardelli (2001).
and perceived interdependence explained an additional 3.5 percent of the variance in collaborative planning above and beyond the 14.3 percent explained by the first-order effects of autonomy and perceived interdependence. In total, the variables included in the model explain 41.6 percent of total variance ($R^2 = .416$). As moderator effects are notoriously difficult to detect in field studies (McClelland & Judd, 1993) and rarely explain more than 1 to 3 percent of variance (Redman & Snape, 2005) my findings seem to be worth discussing.

Simple slope analysis (Preacher, Curran et al., in press) reveals a significant positive relationship between perceived interdependence ($x$) and collaborative planning ($y$) for actors with low and medium autonomy$^{32}$:

Low autonomy: \[ y = 3.717 + .4426x \; (t = 5.0917, \; p = .0000) \]

Medium autonomy: \[ y = 3.876 + .3909x \; (t = 3.8625, \; p = .0002) \]

For actors with high autonomy$^{33}$ no significant relationship between interdependence and collaborative planning was found:

High autonomy: \[ y = 4.035 + .1754x \; (t = 1.6586, \; p = .1003) \]

As illustrated in Figure 11, perceived interdependence relates positively to collaborative planning. If I had not included autonomy as a moderator, I would have concluded that perceived interdependence had a small to medium-sized relation to collaborative planning ($B = .36$). This would have masked the fact that the relation was much stronger in actors with low autonomy ($B = .44, \; p = 0$) than in actors with high autonomy ($B = .18, \; p > .05$)$^{34}$. This finding provides support for hypothesis 5. Furthermore, the ordinal interaction reveals that autonomy somehow offsets the collaborative planning decrements associated with low perceived interdependence. In other words, a high level of perceived interdependence facilitates collaborative planning irrespective of the level of individual autonomy. A high level of individual autonomy serves to reduce the collaborative planning decline associated with low perceived interdependence.

---

$^{32}$ Low autonomy = mean level of autonomy minus one standard deviation

$^{33}$ High autonomy = mean level of autonomy plus one standard deviation

$^{34}$ The final equation regressing collaborative planning ($y$) on perceived interdependence ($x$), autonomy ($z$), and the interaction of interdependence and autonomy ($xz$) is: \[ y = 3.876 + .309x + .175z - .147xz. \]
To recapitulate, figure 11 illustrates how the relationship between perceived interdependence and collaborative planning shifts from relatively flat among actors with high autonomy to positive among actors with low autonomy. In order to enrich and complement these quantitative findings, I will now introduce the qualitative findings from the cause mapping analysis.

6.4 Qualitative results

Variables and cause-effects relationships identified from the coding of the interviews are presented for each network separately. Coding results are outlined before presenting cause maps and discussing their underlying logics of organizing. Answers are provided with the main qualitative research question of this study. That is: What preconceptions do actors hold concerning collaborative planning, its effectiveness, and its antecedents (cf., chapter 4.3)? I will start with presenting findings from the Picea network before describing causal relations found in the Fagus network.

6.4.1 Causal relationships in the Picea network

Appendix F presents the results from the qualitative coding process. The 28 interviews conducted with actors of the Picea network resulted in 132 statements relating to one of the
pre-defined concepts (cf., tab. 9 in chapter 5), out of which 64 described a causal relationship between two concepts. 20.3 percent (13 statements) out of the 64 statements referred to the relationship between integration and autonomy. 25.0 percent (16 statements) of the coded material addressed the relationship between uncertainty and planning. No other relationships emerged in sufficient clarity and strength to be interpretable (cf., appendix F). I will describe the quality of these two causal relationships (integration-autonomy and uncertainty-planning) in the following in detail. As will be shown, these seemingly simple causal relationships might have important consequences for processes of organizing.

### 6.4.1.1 Integration and autonomy

According to interviewees, integration of business processes and organizational activities, which was often addressed in terms of centralization, mainly became an issue in 2002 with the foundation of the 3PL provider. Interview findings indicate that efforts to tighten network processes, partly initiated by the 3PL provider, while responded to differently by network actors were often perceived as undermining organizational autonomy. Some interviewees (e.g., 3PL providers) stressed the following positive effects of integration: integration would make it more difficult for actors to undermine change processes in the network; it would facilitate synchronized action; it would increase process transparency; and it would foster supply network’s efficiency. Other actors, in contrast, such as forest owners, forest rangers, or service providers were often concerned with the possible negative side-effects of integration. They addressed integration issues mainly in terms of interdependence: Actors expected to become more interdependent if business processes were streamlined across organizational boundaries. Their main concern seemed to be that tighter integration with suppliers, 3PL providers or customers, would reduce their process control and their degrees of freedom in decision-making. It was clearly stated that while actors in general seemed to be in favour of reinforcing integration, they seemed not to be willing to give up autonomy in return. As indicated by one interviewee, an increase in integration could indeed influence actors’ level of autonomy:

So that forest cultivation can actually be carried out for larger entities, forest owners must cede competencies. The final decision stays with the forest owner as to whether he wants to cultivate the forest or not. But he has to give up (decision-making authority) concerning the details. These are the most significant changes (...). That forest owners have to cede some competencies concerning the details. (...) Strategic (decision-making) is still his responsibility, but he has to give up operational (decision-making).
While this interviewee clearly distinguishes between strategic and operational decision-making this distinction was often not made by forest owners themselves. Instead, integration processes were thought to threaten autonomy in general. Service providers, similarly, were concerned that if 3PL providers coordinated processes, their brokerage position linking forest owners and customers might come under threat. In sum, it is probably safe to say that an influential number of interviewees held the preconception that efforts to integrate processes would restrict their decision-making autonomy.

6.4.1.2 Uncertainty and planning

While uncertainty was pervasive in both supply networks, for example, in the form of disruptive weather changes or catastrophes like hurricanes or indeterminate oral agreements among actors, the relationship between perceived uncertainty and planning was particularly highlighted in the Picea network. While interviewees in general agreed that uncertainties aggravate planning, their perceptions of uncertainties differed. Some actors highlighted planning’s virtues, such as the saving of costs from long-term transport planning, as these help to avoid running trucks which are empty. These interviewees reported various means of coping with uncertainties in planning, for example, by taking account of likely disturbances when scheduling delivery dates. Or by setting up interim storage facilities at the outskirts of the forests from where truck drivers could pick up the wood, irrespective of weather conditions.

However, it was found that other actors were rather suspicious of the value of planning given the high degree of uncertainties in forestry. This is exemplified in the following statement of one sub-contractor:

One could plan for the next 100 years, in principle. But then you got environmental influences crop up you cannot account for; it is pointless to plan for the years ahead or to pursue detailed plans.

Detailed preplanning of processes was argued to be ineffective in the face of an unpredictable environment, which according to interviewees would favour ad-hoc decision-making. A customer stressed the fact that not only was the environment in forestry highly unpredictable, but also the material to be processed, that is, timber itself. In the eyes of this respondent it was because of these uncertainties that planning often was not possible. Another interviewee made the interesting comment that the high degree of uncertainty might have served, in some instances, as an excuse for not tackling existing difficulties more
proactively. By treating uncertainties as unchangeable, it would become less likely that actors would initiate counteractive measures. This mindset can, obviously, undermine coping capabilities. Therefore, in building on these latter statements, it seems warranted to say that an influential number held the preconception that uncertainty and planning were negatively related. The more uncertain the environment appeared, the more actors doubted the value of planning; this preconception decreases the amount of planning, and perceived uncertainty is therefore likely to increase further.

6.4.1.3 Cause mapping

In sum, preconceptions held by actors in the Picea network with regard to planning, its effectiveness and antecedents were described. Two causal relationships were laid bare: an integration-autonomy relationship and a causal loop linking (perceived) uncertainty and planning. Both relationships are depicted in the form of a cause map in figure 12. While it would be possible to suggest theoretically robust and meaningful linkages among both causal relationships I refrain from doing so as this would inadequately compound empirical and subjective realities. However, I will explore some possible linkages in exemplary form in the discussion section.

![Figure 12: Cause map in the Picea network](image)

If one examines figure 12, one finds one deviation-amplifying causal loop (cf., Weick, 1979) linking (perceived) uncertainty and planning. Suppose planning increases. This reduces (perceived) uncertainty which encourages actors to invest further in (collaborative) planning. However, in contrast, if (perceived) uncertainty increases, actors are more likely to reduce investments in collaborative planning as planning is perceived to be less effective in the face
of high uncertainty. The fewer actors invest in collaborative planning though, the less controllable the environment appears, that is, perceived uncertainty increases. Therefore, as no regulation mechanism is built into this loop deviations will increase, creating either a regenerative or a vicious circle. In addition to this loop one also finds one unidirectional relationship: Actors seem to hold the preconception that supply network integration reduces their individual autonomy. While actors’ assumptions on how these two relationships (uncertainty-planning and integration-autonomy) are intertwined remained obscure, it is possible to assess the stability of this scarcely linked cause map. As there is an even number of deviation-counteracting loops, namely zero, the cause map is instable (cf., chapter 2.5.2). I will return to this finding in the discussion section when proposing some suggestions on how to increase cause maps’ stability.

6.4.2 Causal relationships in the Fagus network

Appendix F presents the results from the qualitative coding process. 24 interviews were conducted with members from the Fagus network. From these, 113 statements were identified as making reference to one of the concepts defined above (cf., tab. 9). 73 of these highlighted a causal relationship between two concepts. 19.2 percent (14 statements) of the 73 statements specified the relationship between integration and autonomy. 12.3 percent (9 statements) of the statements referred to the relationship between perspective taking and common understanding. 10 statements referred to the relationship between perspective taking and collaborative planning (cf., 6.4.1.2). However, these statements on uncertainty and planning were either inconclusive or described individually held assumptions, which is why I refrained from interpreting them. Nevertheless, it is important to keep this finding in mind when interpreting the results (cf., chapter 7).

6.4.2.1 Integration and autonomy

Interview data indicated integration to have a bright side as integration constitutes a competitive advantage as indicated by one 3PL provider:

One is aware of the need for an end-to-end organization (and) for aligning this (timber) chain with demand. This consciousness was non-existent in the past.

Furthermore, there seems to exist a reciprocal relationship between integration and cultural changes conducive to integration as highlighted by one customer:
We talk to each other more often and more openly nowadays; customers and suppliers; in the past we experienced some distrust (from the suppliers who appeared to think) they (the customers) only wanted to exploit us; and by in the past I mean ten years ago. So this is something we have worked on quite intensively, so that we consider each other partners and treat each other accordingly. This culture, to describe it one way, has considerably improved in past years.

To paraphrase, a change in cultural climate favoured a shift from traditional arms-length approaches towards more collaborative approaches. However, similar to observations made in the Picea network, actors in the Fagus network expressed their concern that if supply and demand were centrally coordinated their autonomy would come under threat. The intention of the 3PL provider, for example, to coordinate supply and demand in a more integrated manner caused resistance from some actors, such as public forest owners, as they feared loosing some power and influence on determining timber prices. The latter also applies to forest rangers, who in some regions are responsible for the bidding and sales process. In sum, it seems warranted to say that actors withdraw from cooperative relationships if they expect their autonomy to come under attack.

6.4.2.2 Perspective taking and common understanding

It has been argued that perspective taking is of particular importance in heterarchic supply networks as actors with different professional and cultural backgrounds must synchronize their activities. Interviewees' intuitive appreciation of perspective taking and its significance is best reflected in the phrase "our purpose is to sensitize co-actors to our own working conditions". Another rich and insightful description of how perspective taking plays out in practice is found in the following statement by one 3PL provider:

More customers expect deliveries just in time; expectations for quality are also on the rise. This is (...) quite important, otherwise such customers might not exist any more in the future. Forestry has realized that if a customer from industry demands ten trucks of fresh wood daily - timber that is not to be older than two weeks - this is really the case (there is a real need for these deliveries) and it has nothing to do with purposefully adding unnecessary pressure (...). (It is important) to understand the needs of the next echelon in the supply chain, (to have an understanding) that goes beyond your own job; there is a good reason for them (customers) to demand the same amount of timber in summer as in winter time, and it is not just a case of
bullying suppliers. This understanding is currently being propagated by the canton as well: support the processing industry otherwise the timber will be exported.

This perspicuous account of perspective taking highlights one of its most important manifestations, that is, making positive attributions. Instead of feeling bullied by customers’ strict delivery requirements, suppliers attribute requirements to the market pressures customers obviously have to react to. In other words, suppliers seem to make customer-favouring attributions. This style of attribution clearly facilitates cooperative relationships. Furthermore, this statement indicates that perspective taking might bring competitive advantages to supply chain partners, for example by facilitating just-in-time solutions. Interviewees also described means which are referred to in the literature as important enablers of perspective taking (cf., Parker & Axtell, 2001), such as mutual site visits:

....so, for example, if I go to the paper mill to negotiate timber prices, I take along a forest ranger so that he gets a bigger picture (of the situation). If, for example, we sell timber to (a sawmill) I bring along four or five forest rangers.

This statement of one 3PL provider highlights the importance ascribed to site visits as a means of facilitating perspective taking. In sum, it seems safe to say that network actors’ implicit understanding of perspective taking had some influence on their day-to-day work practices. A second issue closely related to perspective taking was recurrently touched upon by interviewees, and that is common understanding. The following two statements of one customer and one forest ranger give insights into actors’ interpretations of this common understanding:

There has been this relationship (with a representative of suppliers) for years and one knows what to expect from each other; through discussions this relationship was strengthened even further (...) so they (representatives of a supplier) know our expectations very well.

We have regularly met with forest rangers, and then slowly, very slowly, an understanding for the whole (system) has been awakening, through experience, and through customer orders, which we’ve fulfilled jointly. And lots of people participated in these early talks who then later backed out of (the system) again, (people) who haven’t looked for cooperation.
Drawing on interviewees' accounts, common understanding seems to consist of the following constituents: a deep understanding of each others' expectations; an understanding of the bigger picture; and confidence in each others' abilities. Such common or congruent understanding (cf., Vlaar, Van den Bosch, & Volberda, 2006) seems to develop through a history of organizing episodes in which actors learn about each others' expectations. To reiterate, the common understanding among suppliers and customers seems not to stem from suppliers' adopting customers' pre-existing understanding or from customers adopting suppliers pre-existing understanding. Instead, suppliers and customers seem to create new meaningful interpretations of events and situations that both parties can then rely on. It appears that actors think of perspective taking and congruent understanding as two highly intertwined processes. Thus, it seems safe to assume, that perspective taking and common understanding are thought to influence each other reciprocally.

6.4.2.3 Cause mapping

In sum, analysis of preconceptions held by actors in the Fagus network revealed two causal relationships: an integration-autonomy relationship and a causal loop linking perspective taking and common understanding. Both relationships are depicted in the form of a cause map in figure 13.

![Figure 13: Cause map in the Fagus network](image)

If one examines figure 13, one finds one deviation-amplifying causal cycle (cf., Weick, 1979) linking perspective taking and common understanding. An increase in perspective taking increases common understanding which further increases perspective taking. And if one of both variables starts decreasing, the other variable will decrease too. As no counteracting force exists, deviations will increase either triggering a regenerative or a vicious circle. As
there is an even number of deviation-counteracting loops, namely zero, the cause map is
instable which means that deviations are continuously amplified.

Before discussing the implications of my results I want to stress the following point; it should
be obvious that cause maps delineated in this chapter capture only a small extent of all
possible system variables and relationships. Therefore, it should also be obvious that cause
maps are not equivalent to the networks as systems. However, as I will discuss shortly,
cause maps enhance not only our understanding of the dynamics of collaborative planning
mechanisms and antecedents, but also provide a basis for engaging in systems thinking.
Chapter 7

Discussion

We suggest that organizational network research could move forward by incorporating actors' memories and desires, their bounded rationality and structural biases, and their creation and re-creation of structures of dynamic stability that they may only partially understand.

(Kilduff, Tsai, & Hanke, 2006, p. 1037)

7.1 Introduction

In this final chapter, I not only present a resume of the key quantitative and qualitative findings, but I also integrate these findings and discuss how a pluralistic account contributes to our understanding of collaborative planning processes in heterarchic supply networks. After summarizing the main findings of this study, I outline its theoretical and practical implications. Finally, I address the limitations of this thesis and outline future research opportunities.

7.2 Theoretical motivation

Since Daft and Lewin's (1993) seminal call for theories for the new organizational forms, organization theory has advanced our understanding of postbureaucratic organizations and networks considerably. However, decentralized, heterarchic supply networks have not yet received adequate attention and further theoretical and empirical grounding seems imperative. Thus, this thesis has attempted to address this void by several means: Firstly, by providing a definition of heterarchic supply networks that integrates findings from the organization studies and applied psychology literature. Secondly, by analyzing process integration in heterarchic supply networks through two theoretical lenses, that is cognitive network theory and enactment theory. Thirdly, by developing and testing a framework of collaborative planning mechanisms and antecedents; this was done in order to enhance our understanding of this key enabler of supply network integration. And fourthly, by exploring
Discussion

preconceptions actors held concerning collaborative planning, its effectiveness, and its antecedents.

While both theoretical accounts that were used in this study - cognitive network theory (Ibarra et al., 2005; Krackhardt & Kilduff, 2002) and enactment theory (Weick, 1979; 2001) - share certain premises, such as their cognitive orientation and their focus on local processes, they differ significantly in terms of methodology. While cognitive network theory has a largely functionalist theoretical underpinning and adopts a variance theory methodology, enactment theory is a social constructionist account and favours a process methodology. While the larger part of this study has been quantitative in nature (based on variance methodology) it has also entertained a qualitative perspective (based on process methodology) that complements and enriches quantitative findings. In line with arguments provided by Hodgkinson (2003) this study has been grounded in the belief that it needs both perspectives to develop satisfactory accounts of the new organizational forms, such as, heterarchic supply networks. On the basis of this belief this thesis has empirically addressed the following research question: how can collaborative planning contribute to integration in decentralized, heterarchic supply networks? Quantitative and qualitative findings responding to this question are summarized in the following.

7.3 Resume of quantitative findings

7.3.1 Collaborative planning and effectiveness

Exploratory factor analysis revealed collaborative planning in forestry supply networks to rely mainly on attentive exchange of (preliminary) knowledge, joint goal agreement, and opportunistic planning. In other words, collaborative planning combines feed-forward strategies with situated action and thereby parallels and extends research on coordination (Faraj & Xiao, 2006), organizational routines (Feldman & Pentland, 2003), and work practices (Orlikowski, 2000, 2002). Collaborative planning has been found to be significantly and positively linked with relationship effectiveness. This finding is in line with earlier findings showing collaborative planning leading to a reduction of stock level and obsolescence and to increasing companies' ability to react quickly to emerging market opportunities (de Kok et al., 2005).
7.3.2 Antecedents of collaborative planning

Mediation analysis has revealed perspective taking as acting as a (partial) mediator between perceived interdependence and collaborative planning, which explains approximately 20 percent of the total effect of perceived interdependence on collaborative planning. This result is in line with earlier research that finds relationships between perspective taking and cooperative behaviour (Parker & Axtell, 2001), helping behaviour (Axtell et al., 2007), and prosocial behaviour (Batson & Ahmad, 2001). On the basis of these findings it could be suggested that difficulties in collaborative planning due to physical and cultural distances might be overcome, firstly by enabling actors to tap into their co-actors’ perspectives (cf., Parker & Axtell, 2001) and, secondly, by increasing actors’ interdependencies (cf., Hertel et al., 2004).

However, moderation analysis shows that interdependence does not facilitate collaborative planning in general. It has been found that interdependence does not provide motives for collaborative behaviour in general, but in dependence on the given degree of actors’ autonomy. Perceived interdependence relates positively to collaborative planning only for actors with little or medium autonomy but not for actors with high autonomy. These findings underline the key role of autonomy as a relational structure. Interestingly, correlation analysis (cf., tab. 11) has not found any direct relationship between autonomy and collaborative planning. However, moderation analysis (cf., tab. 13) revealed a significant relationship between autonomy and collaborative planning when controlling for the influence of interdependence. This finding indicates that interdependence acts as a suppressor variable hiding the real relationship between autonomy and collaborative planning (cf., Cohen et al., 2003; McClelland & Judd, 1993). On the one hand, this ad-hoc hypothesis certainly needs further empirical testing. On the other hand, it lends some support to the assumption that autonomy influences collaborative planning not only indirectly (as shown in this study) but also directly.

One further finding seems to be worth reporting here, that is, the relatively high quality of collaborative planning under the high autonomy × low interdependence condition (cf., fig. 11 in chapter 6). While this finding parallels empirical results from team research (Langfred, 2005) the interesting question is why network actors show collaborative behaviour under arguably un-cooperative conditions. In other words, why is it that network actors make efforts to optimize joint planning if they feel, at the same time, little interdependent (indicative of the availability of alternative business partners and control of resources) and highly autonomous (indicative of strategic discretion and competitive advantages)? Depending on the theoretical
standpoint, different answers can be given to this question. Interactive theorists have suggested that actors with a joint history care about their partners and show collaborative behaviour even if no exogenous reasons exist for them to do so (Deutsch, 1962). Others have convincingly argued that anticipated future interactions (Heide & Miner, 1992) and expectations of reciprocity (Yamagishi & Kiyonari, 2000) facilitate collaborative behaviour. Empathy-altruism theorists (Batson & Ahmad, 2001) find actors behave collaboratively in the absence of any joint past or anticipated joint future if induced to feel empathy; this later explanation underlines the key role of perspective taking as a precursor to empathy, in facilitating collaborative behaviour. Another possible explanation, derived from cognitive network theory, may be that actors behave collaboratively to strengthen their overall position in the network (Håkansson & Snehota, 1995; Jahre & Fabbe-Costes, 2005). Indeed, Lomi and Pattisson (2006) argue that actors might maintain certain direct ties because they help to safeguard and improve other indirect types of resource flows (cf., chapter 2.5.1). As an illustration, consider an example where a forest owner is not dependent on a 3PL provider due to multiple direct customer ties. In this instance, the forest owner might still behave collaboratively towards the logistics provider as this might strengthen his or her position towards customers in the bidding process. Hence even in the absence of direct interdependencies, the forest owner might find that behaving collaboratively towards third party logistics providers is in his or her own best interests.

7.4 Resume of qualitative findings

This study has not only been based on quantitative analyses; I have also explored enactment processes in networks through a more qualitative, social constructionist approach, that is, cause mapping. This approach gave rise to some interesting answers to the qualitative research question as to which preconceptions actors held concerning collaborative planning, its effectiveness, and its antecedents. While often used to represent individual means-end relationships, in this study cause maps were used to convey a picture of preconceptions held by a sufficiently large number of interviewees for me to be convinced that topics and relationships did not only represent individual idiosyncrasies. Four findings that emerged from this qualitative analysis seem to be of particular relevance.

Firstly, the ambivalence of network integration and interdependence, respectively, became evident in both networks. According to interviewees, integration is assumed to have a bright side in terms of its potential contribution to synchronized action in networks. However, interviewees from both networks accentuated its dark side. Actors raised the concern that
network integration might impair their autonomy and process control. However, while some actors referred to autonomy as an inseparable entity, others highlighted different facets of autonomy, such as strategic and operational autonomy. This latter conception of autonomy allowed actors to accept some means of integration while opposing others. Means of integration that constrained strategic autonomy were deemed to be unacceptable while those constraining operational autonomy were perceived as tolerable. One might conclude that actors who held more nuanced preconceptions of autonomy seemed to be in a better position to accept (operational) integration while safeguarding their (strategic) autonomy simultaneously.

Secondly, planning and uncertainty were found to be intertwined. While actors from both networks indicated relationships between uncertainties and planning, there was only sufficient evidence in the Picea network to report findings. There seemed to be a consensus among interviewees from the Picea network that the high degrees of uncertainties in the forestry and timber industry made planning troublesome. However, actors’ strategies to cope with uncertainties differed largely. While some actors engaged in developing robust plans that address uncertainties, others questioned planning’s usefulness given an apparently uncontrollable environment. While the former mindset is likely to give rise to coping strategies actors can rely on in face of uncertainty, the latter is more likely to increase the need for ad-hoc coordination which can be difficult, costly, and troublesome. This line of argumentation is supported by enactment theory, according to which differences in preconceptions give rise, over time, to different environments, which then leave individuals differently prepared for coping with uncertainties (cf., Weick, 1979). To say that planning would help to manage uncertainties is not to advocate blueprints for action (Miller et al., 1960) but to embrace planning in a form that creates prepared minds (Kaplan & Beinhocker, 2003; Grote, 2004; Windischer, 2003). It seems plausible to assume that actors will be in a better position to cope with uncertainties if they expand and diversify their understanding of uncertainty and planning. This contextual rationality (cf., Weick, 1993) might help actors to come up with more sensible counteractive measures in the face of uncertainty.35

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35 The reader will have noticed that these suggestions are not new; indeed, they are very old as they rest on Ashby’s (1957) law of requisite variety (the variety in inputs to a system is to be matched by equal variation among processes within the system) and corresponds to Weick (1979) who challenges managers to complicate themselves.
Thirdly, findings from the Fagus network highlight the relevance of perspective taking and common understanding in interorganizational logistics relationships. Perspective taking helps actors (e.g., suppliers) to infer reasons behind co-actors’ (e.g., customers) demands and enables parties to read situations correctly. To make sense of others’ sensemaking is perceived as a means of jointly creating new meaningful interpretations of unequivocal inputs. Thus, perspective taking might be seen as a means to prevent against adversarial thinking. Congruent understanding, at the same time, eases a change in perspectives as it provides some common ground for parties from which to explore each others’ motives and rationales.

Fourthly, both cause maps – in the Fagus and the Picea network – have been found to be instable as the only closed loop existent in both networks had an even number of negative loops (cf., chapter 2.5.2.2). Any deviation in the cause map, thus, keeps growing until some significant changes occur; for example, environmental changes, such as rapidly falling product prices, which force actors to question their preconceptions. If no changes take place, deviations keep increasing either creating a regenerative or a vicious circle. I will touch upon this finding again in the section on applied implications to proffer some suggestions for stabilizing both cause maps. Before doing so, I want to highlight the key theoretical implications of this study.

### 7.5 Theoretical implications

This study has several theoretical implications. Firstly, this study has emphasized the active role individuals play in shaping heterarchic supply networks: Individuals enact plans to synchronize processes; they try to make sense of larger contexts they only partly apprehend; and they enact network structures guided by their presumptions. This, among other reasons, is why human agency seems to be so important for understanding the functioning of postbureaucratic organizations.

The second theoretical implication concerns “researchers’ allegiance to single research paradigms” (Vlaar, 2006, p. 216). While some incompatibilities exist between cognitive network theory (Ibarra et al., 2005; Krackhardt & Kilduff, 2002) and enactment theory (Weick, 1979; 2001), this study has found both approaches to be complementary in important ways. By moving back and forth between both theoretical accounts, it became possible to extend the theoretically derived framework on collaborative planning mechanisms and antecedents.
Figure 14: Antecedents of collaborative planning

Figure 14 seems to reflect the complexity of heterarchic coordination more adequately than any of the single paradigm depictions of this study did (cf., fig. 8, 12 and 13). Only through adopting both perspectives has it become possible to deduce the theoretical implications presented in this study. Furthermore, figure 14 indicates that antecedents might operate on different organizational levels; while perceived uncertainty and integration primarily play out on the network level, perspective taking, for example, is relevant mainly at the dyad level. This finding is particularly important in light of Weick's (1979) assertion that it is the relations among variables (e.g., reciprocal relationship between interdependence and autonomy), organizational actors and scholars have to cope with and not the isolated variables (e.g., interdependence). In conclusion, to cope with the complexity of heterarchic supply networks, actors must clearly understand the interrelations of cause-effect relationships at the different levels of networks.

Thirdly, a core tenet of the quantitative part of this thesis has been the assumption that to cope with high degrees of environmental uncertainty there needs to be some kind of flexible mode of coordination, such as collaborative planning (cf., van Fenema et al., 2004). This
contingency logic is challenged in the qualitative part of this thesis with the argument that environments are individually and socially constructed (Weick, 1979). Thus, instead of thinking of environmental uncertainty as an external structure to which coordination mechanisms are to be adapted, enactment theory suggests reorienting attention away from the unchangeable occurrence of environmental shocks, such as hurricanes, towards actors’ interpretations and reactions to these shocks (cf., Mills & Weatherbee, 2006). To think of planning and uncertainty as reciprocally interrelated constructs, emphasizes this agency perspective.

Fourthly, by testing the combinatory effects of autonomy and interdependence on collaborative planning, this study contributes to the literature in some important ways. While research has found that collaborative behaviour is not only related to interdependence (Gulati & Sytch, 2007; Hoegl et al., 2004) but also to autonomy (Axtell et al., 2007), no study has yet tested the interactive effects of interdependence and autonomy on collaborative behaviour in an interorganizational setting. Hence, the finding that the relationship between interdependence and collaborative planning is contingent upon the level of individual autonomy is parallel to and extends findings by Gulati and Sytch (2007). While the quantitative findings of this study seem to support the assumption that interdependence is an asset and not a liability, this study also indicates the limits of interdependence-based approaches towards SCM. If autonomy is high, actors’ relational orientation cannot be increased by enhancing interdependencies. In this particular situation there might be a chance to enhance relational orientation by facilitating cognitive processes, such as perspective taking and sensemaking (cf., Weick, 1987; Grote, 1997; 2004; 2007).

7.6 Applied implications

The results of this study have several applied implications for coordination in heterarchic supply networks. While these implications might hold for other industries as well, implications can only be legitimized for the forestry and timber industry sector. In the following, I will firstly explore in some detail how systems thinking might help actors to realise more stable network processes. Secondly, I will make some more specific suggestions on how to facilitate collaborative planning.

7.6.1 Systems thinking

Senge (1990) has urged managers to engage in systems thinking and to explore the webs of interdependence they are part of. Weick (1979; 2001), more generally, has suggested that by
mapping relationships and feedback loops among organizational variables actors might be able to make sense of the complexity and hidden influences in their organizational environments. Building on Senge’s and Weick’s ideas, I argue that by adopting a systems lens influential actors in heterarchic supply networks might be able to ease collaboration in networks. To exemplify this approach I present possible means of increasing the stability of the cause maps delineated for the Fagus and Picea network. As findings are exploratory in nature they need to be treated cautiously. I start with findings from the Picea network before moving on to make some suggestions for system changes in the Fagus network.

As detailed above (cf., 2.5.2.2) deviation-amplifying systems undermine human control and prevent social structures from stabilizing. In order to increase human control, systems therefore, need to be stabilized. System thinking provides different means of increasing stability, such as altering the quality of existing relationships, changing the direction of causality, or integrating a new variable. As found in interviews, preconceptions held by network actors appeared to be reasonably robust which indicates that they might be difficult to change. On the basis of this proposition, I therefore suggest altering the cause maps by enacting new relationships that help creating stable social structures on the basis of existing preconceptions (cf., Weick, 1979). Figure 15 depicts a cause map for the Picea network resulting from the enactment of two new linkages. It is important to note that this is only one of various possible solutions. However, this cause map meets some criteria other cause maps do not meet. First, this map integrates all variables identified; secondly, the proposed solution is parsimonious (cf., Runkel & McGrath, 1972); and thirdly, the causal relationships found empirically have been retained, thereby reducing the danger of putting false words into actors’ mouths.
Figure 15: A stable cause map in the Picea network

Note: A positive (negative) sign indicates that that the two connected variables move in the same (opposite) direction (cf., Weick, 1979, p. 71).

The two changes necessary to transform the deviation-amplifying map (cf., fig. 12) into a deviation-counteracting map (cf., fig. 15) are one positive linkage leading from (collaborative) planning to integration and one negative linkage leading from autonomy to perceived uncertainty. The resulting stable map consists of two closed loops; the first loop goes from U to P to I to A to U; the second loop goes from U to P to U. Suppose perceived uncertainty (U) increases (for example, as a consequence of a series of natural disasters); this will reduce actors’ planning (P). This will reduce integration (I) but increase an individuals’ autonomy (A). The more autonomous individuals become, and this is the crucial point here, the less uncertain the environment appears to them (U). However, the uncertainty perceived by actors does not only depend on the degree of autonomy (A-U), but also on the amount and quality of planning (P-U). As no further information is available on the relative importance of the two cycles depicted in figure 15, it seems reasonable to assume that both cycles are of equal importance (cf., Weick, 1979). Thus, while perceived uncertainty increases if planning decreases (P-U), an increase in autonomy (which results from a decrease in planning) simultaneously decreases perceived uncertainty (A-U). Integrating both effects (P-U and A-U) leads to a degree of perceived uncertainty below the “starting value” thereby increasing the propensity towards collaborative planning. If these cycles repeat over time, variables will continuously change, however they will fluctuate around some middle value thereby stabilizing the system and increasing human control.

Let’s now turn to the Fagus network. What would be necessary to integrate the causal relations between perspective taking and common understanding and autonomy and integration into a stable cause map? Drawing again on the three criteria of parsimony,
comprehensiveness and integrity, this would be a cause map consisting of at least one closed loop integrating the two empirically found causal relations. Figure 16 presents one possible solution.

![Figure 16: A stable cause map in the Fagus network](image)

Note: A plus (negative) sign indicates that that the two connected variables move in the same (opposite) direction (cf., Weick, 1979, p. 71).

The two changes necessary to transform the unstable cause map (cf., fig. 13) into a stable cause map (cf., fig. 16) are two positive linkages leading from common understanding to integration (C-I) and from autonomy to perspective taking (A-P). This new cause map consists of two closed loops; as there is an odd number of deviation-counteracting loops, i.e. one, the map is stable. Suppose the degree of mutual perspective taking (P) between a supplier and customer increases; this produces a higher common understanding (C) among both actors, which leads to a higher integration of business processes (I)\(^{36}\). This tighter integration reduces both actors’ autonomy (A), which reduces partners’ ability and motivation to see each others perspective (P). While this reduces common understanding and integration, autonomy increases which increases perspective taking and so forth. Any deviation in the cause map can be counterbalanced which is why the cause map will tend to stabilize over time thereby enhancing predictability of cause-effect relationships and human control.

\(^{36}\) While different mediators linking common understanding and integration can be considered, such as, perceived effectiveness of the relationship, ease of cooperation, or trust, it seems obvious that this relationship would need further empirical underpinning.
While these practical examples of how to create stable maps (cf., fig. 15 and 16) might be found helpful by some actors in the Picea and Fagus network, what is more important about this exercise is that it demonstrates that system changes can be realized by enacting new cause-effect relationships. I do not suggest that practitioners should adopt the depicted solutions (cf., fig. 15 and fig. 16) but I hope that some practitioners might find these examples sensible enough to investigate preconceptions they and other network actors currently hold and to engage in means of systems thinking jointly.

7.6.2 Collaborative planning and its antecedents

With regard to collaborative planning this study finds that the attentive exchange of knowledge poses more difficulties to actors compared to joint goal agreement and opportunistic planning. Some recommendations can be given on how to facilitate the exchange of preliminary knowledge (Loch & Terwiesch, 2005; Terwiesch et al., 2002): Firstly, make the preliminary character of information explicit, for example, by communicating ranges instead of precise numbers (on products the customer may wish to buy in the medium future for example); secondly, engage in trust-building means; and thirdly, design communication and coordination technologies in such ways that preliminary knowledge can actually be exchanged electronically (Günther, Grote, & Thees, 2006).

Furthermore, some suggestions can be given on how to deal with the intricate relations of the two relational structures analyzed in this study, that is, interdependence and autonomy. It appears to be crucial that actors understand the importance of the fit between interdependence and autonomy, as a lack of attention to this paradox can harm collaborative planning processes in network dyads and decrease performance of the whole network (cf., Langfred, 2005). Actors in network dyads may carefully consider what type of relationship, for example, purely trust based relationships versus formal contract based relationships, suits them best in terms of autonomy and interdependence. Furthermore, findings from this study suggest that contingent on actor’s autonomy, different interventions might be suitable. Collaborative planning might benefit most from increasing interdependencies among actors with little or medium autonomy. However, as indicated above, this interdependence-based approach is unlikely to work for actors with high autonomy. It might be more effective to support perspective taking, sensemaking, and system thinking. These cognitive resources are thought to enable actors to consider cause-effect relationships at local and network levels. In short, given high autonomy, this study advocates an old but underused formula of organizing for ensuring process integration: Enact local processes on the basis of complex, global cause maps (cf., Grote, 1997, 2004; 2007; Weick, 1987).
Finally and in relation to the latter, this study shows that the role of perspective taking in heterarchic networks can hardly be overestimated. Therefore, to facilitate perspective taking various approaches have been suggested in the literature, such as having regular meetings between actors (Parker & Axtell, 2001), enriching jobs (Axtell et al., 2007), using advanced communication and cooperation technologies (Boland & Tenkasi, 1995), creating joint working spaces and reducing spatial communication barriers (Allen & Henn, 2007), and establishing mutual site visits and facilitating joint learning processes (Endres & Wehner, 1996). Findings from this study, which shows interdependence facilitating perspective taking, indicate another intervention: Enhancing perceived interdependence either by creating new interdependencies or by increasing the visibility of already existing interdependencies. While the overall sequential nature of the order processing might be difficult to change, much room remains for restructuring processes at the local level, thereby increasing perceived interdependence. The following measures seem especially important: Create multidisciplinary task forces including forest rangers, service providers, and customers; introduce cooperative goal agreements; adapt Management by Objectives practices (cf., Antoni, 2005); and redesign reward structures towards supply chain based rewards (cf., Hertel et al., 2004). To make interdependencies more readily visible, I suggest an approach not yet clearly articulated in the literature, that is, to reflect jointly upon past critical events in order processing. It is suggested that existing interdependencies become more clearly visible in a joint analysis of past critical events. An anecdote from this research project illustrates how a joint analysis of critical events provides a means to tap existing interdependencies. Actors who participated in the workshops were asked to refine the process diagrams jointly. When recapitulating working steps forest rangers found that by involving service providers in the medium-term planning of the harvesting process the need for short-term and costly ad-hoc planning processes could be reduced. Obviously forest rangers had not been fully aware of service providers’ needs to be involved in the planning process at an early stage. Hence by co-constructing critical events from the past, existing interdependencies were made transparent. In short, practitioners may find the joint analysis of past critical events to be helpful in making existing interdependencies visible. Influential actors who want to make use of the recommendations given in this section on implied applications could proceed along the lines suggested in textbox 5.
Textbox 5: Practical recommendations

Step-by-step suggestions for practitioners

Firstly, assess existing uncertainties (e.g., environmental uncertainties) and means of collaborative planning used in the network. Engage as many network actors as possible in this assessment. Secondly, jointly reconstruct past success stories or failures of collaborative planning with a particular focus on where the success or failure originated, where it was undone, and whom it affected. Thirdly, explore and display relationships between uncertainties and collaborative planning. Examine individually held assumptions about these relationships; use the resulting individual cause maps not only as a basis to openly discuss the usefulness, reasonableness, and validity of cause-effect assumptions (cf., Boland et al., 1992; Boland & Tenkasi, 1995) but also to jointly construct networks of relationships which are of concern to a larger number of actors. Fourthly, determine how to change collaborative planning to enact stable systems. Make use of the various concrete recommendations. Fifthly, put changes into practice and continuously monitor their reciprocal effects across actors; evaluate, adopt, and redesign changes. Monitor how perspective taking, interdependence, autonomy, integration, and common understanding affect and are affected by changes.

I will outline limitations of this study in the coming sub-chapter and present some suggestions which could help overcome these limitations in further research.

7.7 Limitations and suggestions for further research

While making important theoretical and empirical contributions to the literature on heterarchic supply networks, there are several important limitations to this study including causal inference and generalizability. Firstly, the fact that all quantitative and qualitative data was collected at one point in time strictly limits the ability to make causal inferences. However, considerable effort has been invested into developing a sound theoretical framework which increases the internal validity of the findings. Indeed, according to Mathieu and Taylor (2006) it is “first and foremost a theoretical exercise” (p. 1036) to specify the causal order of variables and to make inferences about, in their case, mediational relationships. Secondly, and related to the first limitation, variables were treated in a mainly static manner. While this study has made some suggestions on how to assess network dynamics through an enactment lens, the dynamics and the evolution of heterarchic coordination and organizing
have not been thoroughly investigated. Thirdly, the fact that findings of this study are based on a relatively small number of respondents and interviewees limits the generalizability of findings and calls for further large-scale studies. Nevertheless, the fact that quantitative analysis has shown a number of significant effects is encouraging. Fourthly, while firmly grounded in enactment theory (Weick, 1979), the qualitative part of this study has some key limitations. Notwithstanding the efforts made in this study to refrain from putting words into actors’ mouths, this study has limited actors’ control in the cause mapping process. While it is not unusual in research to assess cause maps via interviews (cf., Markóczy & Goldberg, 1995; Roos & Hall, 1980) it would have been more appropriate to ask participants to design cause maps themselves, that is, to ask actors to identify crucial variables and to specify connections (cf., Weick & Bougon, 1986). To overcome some of these limitations and to further expand our understanding of heterarchic coordination, the following avenues for future research seem promising.

Firstly, not only to enhance confidence in the causal sequence of variables but also to explore the dynamics of network coordination, a longitudinal approach seems appropriate. This would not only allow for the assessment of how the three dimensions of collaborative planning—exchange of preliminary knowledge, goal agreement, and opportunistic planning—interrelate and co-evolve over time, but would also provide the basis for a better understanding of the dynamics of the interdependence-autonomy paradox. Organizational research (and this study is not an exception) has investigated mainly the co-existence of autonomy and interdependence by treating both concepts as static variables (Langfred, 2005). However, Adler (1995) and Lazzarini and Senger (2002) highlight the dynamic nature of interdependence—respectively cooperation—and autonomy. Lazzarini and Zenger’s (2002) dynamic theory on coordination underpins how formal governance mechanisms can be used to temporarily enhance autonomy and constrain interdependence and vice versa. By adopting a longitudinal perspective, it seems possible to shed new light on the temporal and dynamic dimensions of network coordination. This perspective seems to be especially timely and relevant, given the recent shift in perspectives on interdependence highlighting interdependence’s malleable nature (cf., textbox 4 in chapter 4).

Secondly, to strengthen the external validity of results further, it seems imperative to replicate results on the basis of a larger sample. This would allow for adopting structural equation modelling techniques to test assumed hypotheses in an integrative model and for robustly testing more complex hypotheses, for example, moderated mediation models (e.g., Preacher, Rucker, & Hayes, in press). While exploratory factor analysis and item statistics on collaborative planning scales were satisfactory, further testing of these newly developed
scales is recommended, for example, by means of confirmatory factor analysis. This is especially important as the three scales do not encompass all planning characteristics theoretically derived by Windischer (2003) and Windischer and Grote (2003). Furthermore, while it was found that the usage of common methods did not significantly influence results, self-reports might suffer from social desirability bias (Moorman & Podsakoff, 1992). Hence, follow-up studies should use alternative measures to replicate findings from this study.

Thirdly, there clearly is a chance to explore more thoroughly processes of organizing in interorganizational contexts (cf., Vlaar, Van den Bosch, & Volberda, 2006). Researchers could, for example, explore actors’ interpretations of interdependencies and network integration. Why is it that some actors seem to think of interdependence and integration as assets while others mainly regard them as liabilities? This question could be addressed from two different angles; firstly, by examining actors’ interpretations of existing relationships, and secondly, by exploring actors’ expectations and presumptions of possible future relationships. While the former perspective highlights retrospective sensemaking processes, the latter focuses on prospective sensemaking. When engaging in prospective sensemaking, actors reflect about future consequences of possible actions in order to develop a better understanding of their current situation (Gioia, Corley, & Fabbri, 2002; Gioia, Thomas, Clark, & Chittipeddi, 1994). Investigating prospective sensemaking might not only be helpful for understanding actors’ actions but even more importantly for understanding their nonactions (Gioia et al., 1994). Why is it, for example, that some actors avoid engaging in strong relationships? Or why do actors tend to refrain from any long term or formalized agreements? As these questions have been addressed mainly from a rational decision-making point of view so far (cf., Tallman & Shenkar, 1994), new answers may arise by adopting an enactment perspective.

Fourthly, while this study shows collaborative planning and relational effectiveness to be related, it is recommended that further careful analysis is conducted on how collaborative planning influences supply chain performance. It is necessary to establish empirical linkages between collaborative planning at the dyad-level and performance at the supply network level. The key, presumably, is to choose performance metrics indicative of the specific value of a single network relationship (Provan & Sydow, in press). Instead of relying on one performance metric, for example, order cycle time or efficiency, it might be beneficial to triangulate measures to reflect the different facets of supply network performance accurately. To assess supply network performance in an integrative manner, researchers may want to combine metrics on cost, time, quality, flexibility, and innovativeness. However, whilst financial metrics on supply chain performance are abundant in the literature, there is a
paucity of qualitative metrics and non-financial measures of innovativeness and customer satisfaction (Shepherd & Günter, 2006). Innovativeness and customer satisfaction appear as two key areas, work and organizational psychologists can significantly contribute to and hence help advancing the field of SCM.

Fifthly, scholars could extend the framework of coordination proposed in this monograph (cf., fig. 14) by integrating findings of power and trust. Researchers might want to assess how power imbalances and information asymmetries between actors impact on the creation of meaning within and across dyads (cf., Vlaar et al., 2006). A possible path of inquiry might be to collect data on dependencies from both sides of the dyad (Gulati & Sytch, 2007). Additionally, it seems promising to investigate the role of trust in network coordination by building on some existing research findings. Trust has not only been found to play a pivotal role in the building and maintaining of high quality supply chain relationships (Fynes, Voss, & de Burca, 2005; Günter et al., 2007), but also to mitigate supply chain dynamics (Croson, Donohue, Katok, & Sterman, 2004). However, further research efforts are necessary to investigate whether trust, interdependence, autonomy, and perspective taking are complements or substitutes or both (cf., Woolthuis, Hillebrand, & Nootenboom, 2005). Additionally, researchers might want to explore whether these variables facilitate collaborative planning in general or whether they might indeed have a negative influence on collaborative planning given certain circumstances (cf., Anderson & Jap, 2005).

A final research priority of this research is to develop approaches and methods that go beyond the level of dyads (Garcia-Canal, Valdes-Llaneza, & Ariño, 2003). This would allow, for example, the investigation of how third parties influence the building and maintaining of network dyads or how power relations and interdependencies play out in triads or cliques (Lomi & Pattison, 2006; Madhavan, Gnyawali, & He, 2004; Watts, 1999). New insights are likely to emerge from studying network triads (Casciaro et al., 1999), such as, for example, a better understanding of the difficulties actors experience in navigating multi-actor landscapes (cf., Galinsky et al., 2005).

7.8 Concluding remarks

Organizational networks are thought to balance the “flexibility of markets with the predictability of traditional hierarchies” (Borgatti & Foster, 2003). While in strategic supply networks powerful actors manage this balancing act on the basis of hierarchy, in heterarchic supply networks responsibility and accountability for balancing is scattered, contended, and
shifting. Thus, integration of processes across heterarchic networks cannot be delegated vertically, but must emerge laterally, for example, by facilitating and integrating collaborative planning processes within and across network dyads. The following four propositions that emerged from this study are suggested as being at the core of heterarchic integration:

- Continuously inquire and question individually and collectively held preconceptions (e.g., concerning the controllability of uncertainties).
- Make full use of the potential of collaborative planning to cope with uncertainties and to recreate and alter system structures.
- Make sense of own actions but also explore others’ sensemaking processes.
- Ensure process integration between autonomous actors through enacting process interdependencies and through instigating perspective taking, cognitive integration, and systems thinking.

Implications proposed in this thesis emerged through a multi-perspective approach integrating insights from different disciplines (SCM, organization studies, and applied psychology literature), theoretical backgrounds (cognitive network and enactment theory) and empirical approaches (quantitative and qualitative approaches). It is hoped that this pluralistic approach has resulted in some insights sufficiently interesting and thought-provoking for other scholars to benefit from.
References


References


APPENDIX A: Self-respondent questionnaire

1. Persönlicher Code

Für den Fall, dass wir diese Befragung zu einem späteren Zeitpunkt wiederholen möchten, brauchen wir von Ihnen einen persönlichen Code. Dieser individuelle Code ist nur für den internen Gebrauch bestimmt und kann nicht dazu verwendet werden, den Absender zu ermitteln. Bitte geben Sie uns dazu folgende Angaben:

Anfangsbuchstabe des ersten Vornamens Ihrer Mutter: __
Endbuchstabe des ersten Vornamens Ihres Vaters: __
Geburtsmonat Ihrer Mutter: __
Geburtsmonat Ihres Vaters: __

2. Informationen zum Arbeitsumfeld

Was machen Sie hauptberuflich?

________________________________________


________________________________________

Wie viele Tage pro Jahr arbeiten Sie (ungefähr) in der Forstwirtschaft?

__________________ Tage

Wie gross ist das Waldgebiet, für das Sie verantwortlich sind? (Angaben in ha)

________________________________________

Wie gross ist die jährliche Hiebsmenge in diesem Waldgebiet? (Angaben in m³)

________________________________________
3. Zusammenarbeit mit (Ko-Akteur)

3.1 Im Folgenden interessiert uns, wie Sie die Zusammenarbeit mit (Ko-Akteur) einschätzen. Überlegen Sie bitte, mit welchem (Ko-Akteur) Sie am häufigsten (!) zusammenarbeiten. Beziehen Sie Ihre folgenden Antworten bitte auf diese eine (!) Person!


Seit: _____________________

<table>
<thead>
<tr>
<th>Wie häufig haben Sie Kontakt mit dem (Ko-Akteur) (z.B. am Telefon, persönlich oder per e-mail)?</th>
<th>seltener als einmal pro Monat</th>
<th>einmal pro Monat</th>
<th>einmal wöchentlich</th>
<th>mehrmals wöchentlich</th>
<th>einmal täglich</th>
<th>mehrmals täglich</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
</tbody>
</table>

Wie gut kennen Sie die Arbeitsbedingungen des (Ko-Akteur)?

<table>
<thead>
<tr>
<th></th>
<th>gar nicht</th>
<th>kaum</th>
<th>mittelmässig</th>
<th>ziemlich gut</th>
<th>ausserordentlich gut</th>
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</tbody>
</table>

3.2 Im Folgenden wollen wir wissen, wie stark dieser (Ko-Akteur) Ihre Entscheidungen beeinflusst. Beziehen Sie Ihre Antworten auf die Zusammenarbeit mit dem (Ko-Akteur), mit dem Sie am häufigsten zusammenarbeiten.

In der Zusammenarbeit mit dem (Ko-Akteur) ...

<table>
<thead>
<tr>
<th>...kann ich selber entscheiden, wie ich meine Arbeit erledige.</th>
<th>trifft nicht zu</th>
<th>trifft eher nicht zu</th>
<th>teils-teils</th>
<th>trifft eher zu</th>
<th>trifft zu</th>
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<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>...kann ich wählen, wie ich meine Arbeit mache (in welcher Art und Weise).</th>
<th>trifft nicht zu</th>
<th>trifft eher nicht zu</th>
<th>teils-teils</th>
<th>trifft eher zu</th>
<th>trifft zu</th>
</tr>
</thead>
<tbody>
<tr>
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<td>☐</td>
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<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>...kann ich meine Arbeitsmittel frei wählen.</th>
<th>trifft nicht zu</th>
<th>trifft eher nicht zu</th>
<th>teils-teils</th>
<th>trifft eher zu</th>
<th>trifft zu</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>...bestimme ich den zeitlichen Ablauf meiner Arbeit.</th>
<th>trifft nicht zu</th>
<th>trifft eher nicht zu</th>
<th>teils-teils</th>
<th>trifft eher zu</th>
<th>trifft zu</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>...lege ich selber fest, in welcher Reihenfolge ich was tue.</th>
<th>trifft nicht zu</th>
<th>trifft eher nicht zu</th>
<th>teils-teils</th>
<th>trifft eher zu</th>
<th>trifft zu</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
</tbody>
</table>
In der Zusammenarbeit mit dem (Ko-Akteur) ...

<table>
<thead>
<tr>
<th></th>
<th>trifft nicht zu</th>
<th>trifft eher nicht zu</th>
<th>teils-teils</th>
<th>trifft eher zu</th>
<th>trifft zu</th>
</tr>
</thead>
<tbody>
<tr>
<td>...kann ich entscheiden, wann ich bestimmte Arbeiten mache.</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>...entscheide ich, welche Arbeitsaufgaben ich besonders berücksichtige oder vernachlässige.</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>...kann ich meine Arbeitsziele verändern.</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>...kann ich beeinflussen, was ich – aus Sicht des (Ko-Akteurs) erreichen sollte.</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
</tbody>
</table>

3.3 Die folgenden Fragen erfassen, wie stark Sie auf die Zusammenarbeit mit dem (Ko-Akteur) angewiesen sind.

<table>
<thead>
<tr>
<th></th>
<th>trifft nicht zu</th>
<th>trifft eher nicht zu</th>
<th>teils-teils</th>
<th>trifft eher zu</th>
<th>trifft zu</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ich kann meine Arbeit nicht erledigen, wenn mir Informationen, Waren oder Unterstützung von dem (Ko-Akteur) fehlen.</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>Er braucht von mir Informationen, Waren oder Unterstützung um seine Aufgaben erfüllen zu können.</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>Meine Arbeitsaufgaben hängen mit den Aufgaben des (Ko-Akteur) zusammen.</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>Meine Arbeitsziele sind unmittelbar von seinen Zielen abhängig.</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>Meine täglichen Arbeitsaufgaben leiten sich davon ab, welche Ziele der (Ko-Akteur) festlegt.</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>Ich arbeite meistens an Aufgaben, die einen Bezug zu seinen Zielen haben.</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>An seiner Leistung kann ich ablesen, wie gut ich meine eigenen Arbeitsaufgaben erfüllt habe.</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>Seine Leistung hat grossen Einfluss darauf, wie andere meine eigene Leistung bewerten.</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>Viele Belohnungen in meiner Arbeit (z.B. Bezahlung, bessere Marktposition) hängen davon ab, wie viel ich zu seinem Erfolg beitrage.</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
</tbody>
</table>
3.4 Bitte geben Sie an, wie stark Sie den folgenden Aussagen in Bezug auf den (Ko-Akteur) zustimmen. Beziehen Sie Ihre Antworten auf den (Ko-Akteur), mit dem Sie am häufigsten zusammenarbeiten.

<table>
<thead>
<tr>
<th>Aussage</th>
<th>trifft nicht zu</th>
<th>trifft eher nicht zu</th>
<th>teils-teils</th>
<th>trifft eher zu</th>
<th>trifft zu</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ich kann nachvollziehen, wie es dem (Ko-Akteur) geht, wenn er (zeitlich) unter Druck steht.</td>
<td>☐</td>
<td>☐</td>
<td>☑</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>Es freut mich, wenn ich sehe, dass seine Arbeit gut läuft.</td>
<td>☐</td>
<td>☐</td>
<td>☑</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>Ich kann seine Schwierigkeiten nachvollziehen.</td>
<td>☐</td>
<td>☐</td>
<td>☑</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>Er arbeitet so gut wie es unter den gegebenen Umständen möglich ist.</td>
<td>☐</td>
<td>☐</td>
<td>☑</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>Wenn ihm eine Panne unterläuft, ist es in der Regel nicht seine Schuld.</td>
<td>☐</td>
<td>☐</td>
<td>☑</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>Er arbeitet genauso hart wie ich auch.</td>
<td>☐</td>
<td>☐</td>
<td>☑</td>
<td>☐</td>
<td>☐</td>
</tr>
</tbody>
</table>

3.5 Die folgenden Aussagen beziehen sich auf die Abstimmung und die gemeinsame Planung zwischen Ihnen und dem (Ko-Akteur). Beziehen Sie Ihre Antworten auf den (Ko-Akteur), mit dem Sie am häufigsten zusammenarbeiten.

<table>
<thead>
<tr>
<th>Aussage</th>
<th>trifft nicht zu</th>
<th>trifft eher nicht zu</th>
<th>teils-teils</th>
<th>trifft eher zu</th>
<th>trifft zu</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ich informiere den (Ko-Akteur) frühzeitig und detailliert über anstehende Arbeitsaufträge.</td>
<td>☐</td>
<td>☐</td>
<td>☑</td>
<td>☐</td>
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</tr>
<tr>
<td>Ich informiere ihn über Ereignisse, die noch ungewiss sind.</td>
<td>☐</td>
<td>☐</td>
<td>☑</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>Ich gebe dem (Ko-Akteur) einen guten Einblick in meine eigenen Arbeitsbedingungen. (Bsp.: welche Schwierigkeiten häufig auftreten).</td>
<td>☐</td>
<td>☐</td>
<td>☑</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>Bei der Bearbeitung von Aufträgen vereinbaren wir klare und verbindliche Ziele (bspw. Liefertermine).</td>
<td>☐</td>
<td>☐</td>
<td>☑</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>Ich verpflichte mich gegenüber dem (Ko-Akteur), Vereinbarungen einzuhalten.</td>
<td>☐</td>
<td>☐</td>
<td>☑</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>Ich plane im Voraus, was zu tun wäre, wenn ein gemeinsamer Plan fehlschlagen sollte.</td>
<td>☐</td>
<td>☐</td>
<td>☑</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>Ich berücksichtige bei meiner Planung, welche Auswirkungen mein Plan auf ihn haben könnte.</td>
<td>☐</td>
<td>☐</td>
<td>☑</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>Ich überprüfe regelmässig, ob wir noch im Plan liegen.</td>
<td>☐</td>
<td>☐</td>
<td>☑</td>
<td>☐</td>
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</tr>
<tr>
<td>Sobald ich feststelle, dass wir vom Plan abweichen, informiere ich ihn.</td>
<td>☐</td>
<td>☐</td>
<td>☑</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>Ich spreche mich mit dem (Ko-Akteur) ab, bevor ich unsere gemeinsame Planung verändere.</td>
<td>☐</td>
<td>☐</td>
<td>☑</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>Ehe ich einen gemeinsamen Plan aufgebe, stimme ich mich mit dem (Ko-Akteur) ab.</td>
<td>☐</td>
<td>☐</td>
<td>☑</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>Wenn ein gemeinsamer Plan fehlschlägt, überlege ich, was wir bei der nächsten Planung besser machen könnten.</td>
<td>☐</td>
<td>☐</td>
<td>☑</td>
<td>☐</td>
<td>☐</td>
</tr>
</tbody>
</table>
3.6 Bewerten Sie die folgenden Fragen bitte für die vergangenen 2 Jahre. Beziehen Sie Ihre Antworten auf den (Ko-Akteur), mit dem Sie am häufigsten zusammenarbeiten.

<table>
<thead>
<tr>
<th>Frage</th>
<th>gar nicht</th>
<th>kaum</th>
<th>mittel-mässig</th>
<th>ziemlich</th>
<th>außer-ordentlich</th>
</tr>
</thead>
<tbody>
<tr>
<td>Haben sich die Zeit und der Aufwand gelohnt, die Sie in die Beziehung zum (Ko-Akteur) investiert haben?</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>War diese Geschäftsbeziehung bisher produktiv?</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Wie zufrieden sind Sie im Großen und Ganzen mit dieser Geschäftsbeziehung?</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hat der (Ko-Akteur) seine Verantwortungen und Verpflichtungen in der Geschäftsbeziehung erfüllt?</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

7. Informationen zu Ihrer Person

Wie alt sind Sie?
- < 30
- 31-40
- 41-50
- 51-60
- > 60

Welchen Ausbildungsabschluss haben Sie? (Es reicht, wenn Sie Ihren höchsten Ausbildungsabschluss ankreuzen)
- Anlehre, bzw. Grundbildung mit Berufsattest
- Berufsfahrt
- Berufsmaturität, Maturitätsschule, Gymnasium, Lehrerseminar, Schule für Unterrichtsberufe
- Höhere Berufsausbildung mit (Meister-) Diplom, Eidgenössischer Fachausweis, Technikeroder Fachschule
- Höhere Fachschule, HTL, HWV, Fachhochschule, Höhere Forstliche Fachschule
- Universitäts- bzw. ETH-Abschluss

Welche forstliche Ausbildung (Ausbildungsabschluss) haben Sie?

8. Anmerkungen und Kommentare

Dieser Platz ist für Ihre Kommentare und Anregungen gedacht (sowohl zur Zusammenarbeit in der Holzkette als auch zum Fragebogen):

Vielen herzlichen Dank für Ihre Mitarbeit!
APPENDIX B: Guidelines for semi-structured interviews

1. Allgemein Fragen:
   - Was für berufliche Positionen haben Sie?
   - Wie viel Zeit verbringen Sie prozentual in diesen beruflichen Positionen?
   - Welche Aufgaben haben Sie als (...)?

2. Zusammenarbeit in der Logistikkette:
   - Mit welchen Akteuren arbeiten Sie zusammen? Wie viele verschiedene Akteure pro Gruppe? Wie eng arbeiten Sie zusammen? (Liste der möglichen Akteure vorlegen)
   - Wie läuft die Zusammenarbeit bei der Erfüllung eines Kundenauftrages im Detail ab? Da mich diese Frage besonders interessiert, bitte ich Sie den Ablauf so genau als möglich zu schildern. Dies gelingt am besten anhand eines konkreten Beispiels: schildern Sie mir doch den Ablauf vom letzten Mal.

3. Bewertung der Zusammenarbeit:
   - Was sind die Ziele, die Sie in der Logistikkette erreichen wollen?
   - Was für Vor- und Nachteile hat aus Ihrer Sicht die Organisationsform „Logistikdienstleister“?
   - Welche zukünftigen Herausforderungen sehen Sie für den „Logistikdienstleister“?
   - Welche Akteursgruppen mussten ihr Arbeitsverhalten durch die Gründung des „Logistikdienstleisters“ am stärksten umstellen, welche müssen sich noch umstellen?

4. Kooperative Planung:
   - Wie sieht ihre Kooperative Planung mit anderen Akteuren aus (Elemente der kooperativen Planung nennen; evtl. anhand konkreter Situationen erfragen, welche Schwierigkeiten dabei aufgetreten sind)?

5. Allgemeine Schwierigkeiten:
   - Wo treten in Ihrem Arbeitsalltag Schwankungen und Störungen auf?
   - Welche Schwierigkeiten generell belasten sie im Arbeitsalltag am stärksten? Wo würden Sie sich dabei Unterstützung durch die Forschung wünschen?

(Eventuell:) 6. Zuliefererstruktur:
   - Zuliefererstruktur? Nach welchen Kriterien suchen sie ihre Zulieferer aus?
- Wie bewerten Sie Ihre Zulieferer (Kennzahlen)? Wie schneidet dabei der „Logistikdienstleiter“ ab?

(Eventuell:) 7. Koordination der Zulieferer:
- Wie läuft die Koordination mit den Zulieferern ab?
- Wie laufen Verhandlungen mit den Zulieferern ab (Preisverhandlungen, Terminvorgaben)? Wie viel Handlungsspielraum hat die Forstwirtschaft?
- Wie viel Prozent ihres Holzes liefert der Logistikdienstleister

(Eventuell:) 7. Entwicklung des Netzwerks:
- Ist es Ihnen möglich, die wichtigsten Meilensteine seit der Gründung des „Logistikdienstleisters“ zu nennen?
- Was ist dabei gut gelaufen, was schlecht?
APPENDIX C: Guidelines for structured interviews

1. Träger des Veränderungsprozesses

1.1 Sind Schlüsselführer aufgetreten, die starke Befürworter des Veränderungsprozesses waren?


<table>
<thead>
<tr>
<th>Person (Name)</th>
<th>Akteursgruppe</th>
<th>Dauer der Zugehörigkeit zum Netzwerk</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

1.2 Wie stark trifft die folgende Aussage auf Person A, B, C zu?

„Die Person hat den Veränderungsprozess intensiv und häufig gefördert (=starke positive Einflussnahme).“

<table>
<thead>
<tr>
<th>Person</th>
<th>trifft nicht zu</th>
<th>trifft eher nicht zu</th>
<th>teils</th>
<th>trifft eher zu</th>
<th>trifft zu</th>
</tr>
</thead>
<tbody>
<tr>
<td>Person A</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Person B</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Person C</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

1.3. Wie stark stimmen Sie den folgenden Aussagen zu Person A, B, C zu?

<table>
<thead>
<tr>
<th>Person</th>
<th>nie</th>
<th>selten</th>
<th>gelegentlich</th>
<th>oft</th>
<th>immer</th>
</tr>
</thead>
<tbody>
<tr>
<td>Die Person löst sachliche und technologische Probleme, die im Veränderungsprozess auftreten.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Die Person erkennt Möglichkeiten zur Steigerung der Leistungsfähigkeit des Netzwerkes.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Die Person verfügt über spezifisches, technologisches Wissen, das wichtig für die Gestaltung des Veränderungsprozesses ist.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Person A:</td>
<td>nie</td>
<td>selten</td>
<td>gelegentlich</td>
<td>oft</td>
<td>immer</td>
</tr>
<tr>
<td>-----------</td>
<td>-----</td>
<td>--------</td>
<td>--------------</td>
<td>-----</td>
<td>-------</td>
</tr>
<tr>
<td>Die Person stellt materielle und finanzielle Mittel für den Veränderungsprozess bereit.</td>
<td>☐</td>
<td>☑</td>
<td>☐</td>
<td>☑</td>
<td>☑</td>
</tr>
<tr>
<td>Die Person stellt gezielt Kontakte her zwischen den Netzwerkpartnern, die den Veränderungsprozess aktiv fördern.</td>
<td>☐</td>
<td>☑</td>
<td>☐</td>
<td>☑</td>
<td>☑</td>
</tr>
<tr>
<td>Die Person wirbt geschickt für die Veränderungen bei den anderen Netzwerkpartnern.</td>
<td>☐</td>
<td>☑</td>
<td>☐</td>
<td>☑</td>
<td>☑</td>
</tr>
<tr>
<td>Die Person steuert den Veränderungsprozess.</td>
<td>☐</td>
<td>☑</td>
<td>☐</td>
<td>☑</td>
<td>☑</td>
</tr>
<tr>
<td>Die Person hat eine zentrale Position in den informellen Netzwerken der Netzwerkpartner.</td>
<td>☐</td>
<td>☑</td>
<td>☐</td>
<td>☑</td>
<td>☑</td>
</tr>
<tr>
<td>Die Person fördert die Geschäftsbeziehungen zu Personen, die nicht im Netzwerk sind.</td>
<td>☐</td>
<td>☑</td>
<td>☐</td>
<td>☑</td>
<td>☑</td>
</tr>
<tr>
<td>Die Person verfügt über gute Beziehungen zu einflussreichen Personen im und ausserhalb des Netzwerkes.</td>
<td>☐</td>
<td>☑</td>
<td>☐</td>
<td>☑</td>
<td>☑</td>
</tr>
<tr>
<td>Wie häufig schaltet sich Person A in den Veränderungsprozess ein?</td>
<td>☐</td>
<td>☑</td>
<td>☐</td>
<td>☑</td>
<td>☑</td>
</tr>
</tbody>
</table>
2. Managementaufgaben

2.1 Finden und Auswählen von Netzwerkpartnern

- Wurde festgelegt, mit welchen Personengruppen aktiv im Netzwerk zusammengearbeitet werden soll?
- Wurde festgelegt, welche Personen aus diesen Gruppen in der Holzkette mitarbeiten sollen?
- Wurden langfristige und/oder kurzfristige Ziele der Holzkette definiert? Wer hat diese definiert?
- Wurden Kriterien entwickelt, um beurteilen zu können, welche Personen Netzwerkpartner werden sollen (um die Ziele des Netzwerkes zu erreichen)?
- Was waren dies für Kriterien? (Bsp.: Qualitätsstandards, Liefermöglichkeiten, Grösse, persönliche Beziehungen etc.). Wer hat diese Kriterien festgelegt?
- Wurden langfristige und/oder kurzfristige Ziele der Holzkette definiert? Wer hat diese Ziele definiert?

- Wurden die gewünschten Personen auf das zu gründende Netzwerk aufmerksam geworden? (bspw. vor allem über persönliche Kontakte, Informationsveranstaltungen etc.)
- Haben Sie selber für die Idee des Netzwerkes Werbung gemacht? Auf welchem Weg haben Sie versucht, die Idee des Netzwerkes bekannt zu machen? (bspw. über informelle Kontakte, Informationsveranstaltungen, Zeitungsartikel etc.). Wie erfolgreich waren diese einzelnen Massnahmen?
- Wurden die Erwartungen der Akteure an die Zusammenarbeit im Netzwerk erfasst?
- Sind Personen auch auf das Netzwerk zugekommen (mit dem Anliegen, im Netzwerk mitarbeiten zu wollen)?
- Wurde in diesen Fällen entschieden, ob die Person als Netzwerkpartner geeignet oder ungeeignet ist?

Bezug zu Promotoren:

Diese Fragen bezogen sich alle auf den Aufgabenbereich „Finden und Auswählen von Netzwerkpartnern“. Wenn Sie diesen Bereich gesamthaft betrachten:

- Welche Rolle (d.h.) hatten dann die bereits genannten Schlüsselpersonen (A, B, C) beim „Finden und Auswählen von Netzwerkpartnern“? Waren die Personen treibende Kräfte, neutral (wenig aktiv) oder sogar hemmende Kräfte?
  - Schlüsselperson A:
2.2 Zusammenbringen der Akteure
- Haben sich die verschiedenen Akteure gemeinsam getroffen, um die Zusammenarbeit im Netzwerk zu planen? Was wurde dabei vereinbart?
- Gab es so etwas wie Konsens zwischen den verschiedenen Akteuren darüber, was die wichtigsten Aufgaben im Netzwerk sind?
- Wurde gemeinsam erarbeitet, welches Ziel man im Netzwerk verfolgt?
- Wurden gemeinsam Lösungsvorschläge erarbeitet, wie die Ziele zu erreichen sind?

Bezug zu Promotooren:
Diese Fragen bezogen sich alle auf den Aufgabenbereich „Zusammenbringen der Akteure“. Wenn Sie diesen Bereich gesamthaft betrachten:
- Welche Rolle hatten die bereits genannten Schlüsselpersonen (A, B, C) beim Zusammenbringen der Akteure? Waren die Personen treibende Kräfte, neutral (wenig aktiv) oder sogar hemmende Kräfte?
  o Schlüsselperson A:
  o Schlüsselperson B:
  o Schlüsselperson C:

2.3 Festlegen von Aufgaben und Verantwortlichkeiten
- Wurden die Aufgaben und Verantwortlichkeiten im Netzwerk festgelegt? Wie detailliert wurde dies getan? Wer hat die Aufgabenverteilung festgelegt?
- Gab es Kriterien, nach denen über die Aufgabenverteilung entschieden wurde? Wer hat diese Kriterien festgelegt?

Bezug zu Promotooren:
- Diese Fragen bezogen sich alle auf den Aufgabenbereich „Festlegung der Aufgaben und Verantwortlichkeiten“. Wenn Sie diesen Bereich gesamthaft betrachten:
- Welche Rolle hatten die bereits genannten Schlüsselpersonen (A, B, C) bei der Festlegung der Aufgaben und Verantwortlichkeiten? Waren die Personen treibende Kräfte, neutral (wenig aktiv) oder sogar hemmende Kräfte?
  o Schlüsselperson A:
  o Schlüsselperson B:
  o Schlüsselperson C:

2.4 Aufbau von Prozessen und Strukturen
- Wie ist die Zusammenarbeit im Netzwerk geregelt?
Welche Regeln und Vereinbarungen (formell oder informell) gelten für die Zusammenarbeit? (Bsp.: Regeln zum Umgang mit Konflikten oder zur Nutzung von wichtigen Unternehmensinformationen)

Wer hat diese Regeln oder Vereinbarungen festgelegt?

Wurden Regeln schriftlich festgehalten? Wurden vertragliche Vereinbarungen geschlossen?

Wie wird damit umgegangen, wenn Regeln oder Vereinbarungen nicht eingehalten werden?

Welche Anreize gibt es für die Netzwerkpartner, sich gemäß den Regeln und Vereinbarungen zu verhalten?

Welche Anreize gibt es für die Netzwerkpartner, gegen die Regeln und Vereinbarungen zu verstossen?

Bezug zu Promotoren:

Diese Fragen bezogen sich alle auf den Aufgabenbereich „Aufbau von Prozessen und Strukturen“. Wenn Sie diesen Bereich gesamthaft betrachten:

Welche Rolle hatten die bereits genannten Schlüsselpersonen (A, B, C) beim Aufbau von Prozessen und Strukturen? Waren die Personen treibende Kräfte, neutral (wenig aktiv) oder sogar hemmende Kräfte?

- Schlüsselperson A:
- Schlüsselperson B:
- Schlüsselperson C:

2.5 Bewertung

Wird die Leistung des Netzwerkes überprüft und bewertet?

- Wenn ja: Von wem? Welche Kriterien werden dabei bewertet? Welche Konsequenzen haben diese Bewertungen?
- Wenn nein: Wie würden Sie die Leistung bewerten? Was für Informationen bräuchten Sie dazu?

Wird die Leistung der einzelnen Akteure überprüft und bewertet?

- Wenn ja: Von wem? Welche Kriterien werden dabei bewertet? Welche Konsequenzen haben diese Bewertungen?
- Wenn nein: Wie würden Sie die Leistung der Akteure bewerten? Was für Informationen bräuchten Sie dazu?

Wird die Qualität der Zusammenarbeit der Akteure überprüft und bewertet?

- Wenn ja: Von wem? Welche Kriterien werden dabei bewertet? Welche Konsequenzen haben diese Bewertungen?
- Wenn nein: Wie würden Sie die Qualität der Zusammenarbeit bewerten? Was für Informationen bräuchten Sie dazu?
Wir haben bisher über folgende vier verschiedene Managementaufgaben gesprochen: das Finden von Netzwerkpartnern, das Zusammenbringen der Netzwerkpartner, die Festlegen von Aufgaben und Verantwortlichkeiten und den Aufbau von Prozessen und Strukturen. Werden diese einzelnen Managementaufgaben selber wieder überprüft und bewertet?

- Wenn ja: Von wem? Welche Kriterien werden dabei bewertet? Welche Konsequenzen haben diese Bewertungen?
- Wenn nein: Wie würden Sie diese Managementaufgaben bewerten? Was für Informationen bräuchten Sie dazu?

Bezug zu Promotoren:

- Diese Fragen bezogen sich alle auf den Aufgabenbereich „Bewertung“. Wenn Sie diesen Bereich gesamthaft betrachten:
- Welche Rolle hatten die bereits genannten Schlüsselpersonen (A, B, C) bei der Bewertung?
  Waren die Personen treibende Kräfte, neutral (wenig aktiv) oder sogar hemmende Kräfte?
    - Schlüsselperson A:
    - Schlüsselperson B:
    - Schlüsselperson C:
3. Soziotechnische Geschichte

Gesamtanalyse der Entwicklung

3.1 Meilensteine
- Welches waren die wichtigsten Meilensteine in der organisatorischen (politischen) und technischen Entwicklung seit Beginn des Projektes (...)
- Geben Sie bitte kurz an, was Gegenstand dieser verschiedenen Veränderungen war. Beginnen wir mit der Veränderung (...)
- Zu jedem Meilenstein:
  - Was waren die Ziele dieser Veränderung (betriebswirtschaftlich, ökologisch, technisch, organisatorisch, Mitarbeiter-bezogen, sonstiges)?
  - Was wurde mit dieser Veränderung erreicht?
  - Was wurde nicht erreicht?

3.2. Art der Entwicklung
- War die technisch-organisatorische Entwicklung des Netzwerkes eher durch „radikal, grosse Schritte“ oder durch ein „schrittweises Vorgehen“ im Sinne vieler, kleiner Veränderungsschritte gekennzeichnet?
- Erfolgten die Veränderungen auf der Basis einer langfristigen Strategie? Wenn ja, was waren die Inhalte dieser Strategie?
- Gab es Veränderungen, die abgebrochen werden mussten und / oder Projekte, die Sie als Flops bezeichnen würden?
  - Wenn nicht bereits unter Meilensteinen (3.1) genannt:
  - Was waren die Ziele dieser Veränderung (betriebswirtschaftlich, ökologisch, technisch, organisatorisch, Mitarbeiter-bezogen, sonstiges)?
  - Wie endeten die Projekte?
  - Was für Konsequenzen wurden aus diesen Erfahrungen gezogen? Wie sind diese Erfahrungen in die folgenden Projekte eingeflossen?

3.3. Ausblick auf anstehende Veränderungen
- Welche technisch-organisatorischen Veränderungen stehen an?
- Wie ist der momentane Stand dieser Vorhaben?
- Warum sind diese Veränderungen gerade jetzt notwendig?
- Was soll mit diesen Veränderungen erreicht werden? (betriebswirtschaftlich, ökologisch, technisch, organisatorisch, Mitarbeiter-bezogen, sonstiges)
- Was soll beim Vorgehen aus den bisherigen Erfahrungen im Sinne von „das muss wieder so gemacht werden“ berücksichtigt werden?
- Was soll beim Vorgehen aus den bisherigen Erfahrungen im Sinne von „das darf nicht wiederholt werden“ berücksichtigt werden?
Detailanalyse einzelner Meilensteine

3.4 Auswahl von einem / zwei Meilensteinen:
Bitte wählen Sie einen wichtigen Meilenstein aus, zu dem ich Sie dann detailliert befragen möchte. Wählen Sie bitte ein Veränderungsprojekt aus, das möglichst das gesamte Netzwerk betrifft. Zudem sollte diese Veränderung ein relativ typisches Beispiel für die vergangenen Veränderungen sein (und nicht zu lange zurückliegen).

(Bei 2 Projekten: Versuchen Sie ein Projekt auszuwählen, das sehr erfolgreich verlaufen ist und ein zweites Projekt, das weniger erfolgreich verlaufen ist.)

3.5 Grundlagen
- Was war Gegenstand des Veränderungsprojektes?
- Welche Ziele wurden mit der Veränderung angestrebt? (betriebswirtschaftlich, ökologisch, technisch, organisatorisch, Mitarbeiter-bezogen, sonstiges)
- Was war der entscheidende Grund für diese Veränderung?

3.6 Projektorganisation
- In welcher Rolle waren Sie an der Veränderung beteiligt?
- Welche anderen Personen waren an der Durchführung des Veränderungsprojektes beteiligt?
- Was für Rollen hatten diese Personen?
- Welche Akteursgruppen (bzw. Akteure) waren von der Veränderung betroffen?

3.7 Projektablauf
- Wie wurde die Veränderung geplant?
- In welchem Zeitraum wurde diese Veränderung umgesetzt?
- Wie wurden Entscheidungen im Rahmen der Veränderung getroffen?
- Wie wurden die beteiligten Akteure und die betroffenen Akteure über diese Entscheidungen informiert?

3.8 Bewertung der Projektorganisation - Projektablauf:
- Was waren die grössten Vorteile der Projektorganisation und des Projektablaufes?
- Was waren die grössten Nachteile der Projektorganisation und des Projektablaufes?
- Was wurde mit dem Projekt erreicht?
- Was wurde nicht erreicht?
- Was waren bei dieser Veränderung die grössten Probleme?
- Was wurde aus diesem Veränderungsprojekt gelernt?
- In welcher Form flossen die Erfahrungen in die nächsten Vorhaben ein?

3.9 Mitarbeiterbeteiligung
von wem wurden diese Akteure für die Projektarbeit ausgewählt? Nach welchen Kriterien erfolgte die Auswahl?
- Welche Aufgaben haben diese Akteure ausgeführt?
- Auf welche Aspekte des Projektes konnten diese aktiven Akteure Einfluss nehmen?
- Auf welche Aspekte des Projektes konnten diese aktiven Akteure Einfluss nehmen?
- Wie konnten die nicht-aktiven Netzwerkpartner das Projekt beeinflussen?
- In welcher Form wurden die nicht beteiligten Akteure über die laufende Veränderung informiert?
- Was waren die grössten Vorteile dieser Form der Beteiligung der Akteure?
- Was waren die grössten Nachteile dieser Form der Beteiligung?

3.10 Qualifizierung der Mitarbeiter
- Waren die Akteure für die aktive Gestaltung des Veränderungsprojektes ausreichend qualifiziert und ausgebildet?
- Wurden die Akteure für die Projektarbeit gezielt ausgebildet?
- Was wurde an Wissen, Fertigkeiten vermittelt?

3.10. Widerstand
- Kam es zu Widerstand gegen die Veränderung?
- Wenn ja, welche Akteursgruppen leisteten diesen Widerstand?
- Wie kam dieser Widerstand zum Ausdruck?
- Wie wurde mit diesem Widerstand umgegangen?
- Welche konkreten Konflikte entstanden im Rahmen der Veränderung zwischen verschiedenen Akteursgruppen?
- Wie wurden diese Konflikte gelöst?
- Was waren die „Highlights“ im Rahmen der Veränderung?
- Was waren die Tiefpunkte (grössten Probleme)?
- Wie kam man wieder aus dieser Talsohle?

3.11 Abschliessende Bewertung
- Die vorhin von Ihnen genannten Ziele des Projektes waren (Ziele noch einmal aufzählen). Zu wie viel Prozent wurde jedes dieser Ziele erreicht (dabei unterscheiden bezüglich betriebswirtschaftlichen, ökologischen, technologischen, arbeitsorganisatorischen und mitarbeiter-Innenbezogen Aspekten)?
- Wie würden Sie das Projekt insgesamt bewerten, auf einer Skala von 1-10: 1 = Projekt war ein absoluter Misserfolg, 10 = Projekt war ein absoluter Erfolg.
- Was waren die Ursachen für den Erfolg, Misserfolg der Veränderung?
- Was würden Sie bei einem zukünftigen und ähnlichen Vorhaben gleich machen?
- Was würden Sie bei einem zukünftigen und ähnlichen Vorhaben anders machen?
APPENDIX D: Process diagram: Picea network

Symbols used in the organization oriented process diagram meet existing standards (DIN 66001, cf., Schönsleben, 2004). The form of the boxes indicates whether the event described represents a process step (rectangles), a decision (diamonds), or a document or information carrier (sinuous rectangles). Rectangles contain either information on the processing of material or on the exchange of information. Sinuous rectangles represent any kind of physical or electronic entity that carries information on the order processing or related to the order processing. The location of the boxes in one of the ten bands indicates the actor carrying out the particular process step. The arrows leading from each box indicate subsequent process steps. Lines without arrows linking two boxes indicate parallel activities.
Picea network

Main process stages

First stage: Medium term planning

Forest administration (Canton / district)

- Medium-term planning
- Medium-term plan

Association of forest owners

Private forest owner

- Medium-term planning
- Informing forest ranger about harvesting intention
- Accompanying forest ranger with marking out trees

Third party logistics provider (3PL)

Sub-contractor

Forest ranger

- Medium-term planning
- Developing operating plan based on medium-term plan
- Operating plan
- Requesting information from subcontractor on medium-term wood demand
- Marking out trees for harvesting in forest district (within coming 36 months)

Service provider (Harvesting and hauling)

Service provider (Freight carrier)

Regional customer (Saw mills)

Industry customer (Paper and pulp mills)

- Demand planning (12 months demand)
- Demand plan
Second stage: Bid processing (aripanying forest district, planning)

1. Second stage: Bid processing (aripanying forest district, planning)
   1.1 Requesting customer's annual demand
   1.2 Exchanging information on customers' demand with sub-contractors
   1.3 Requesting customer's annual demand
   1.4 Sub-contractor knows from experience (of former years) that supply opportunities exceed demand
   1.5 Requesting annual delivery volume from forest owners (+/-10-20%)
   1.6 Rigging out trees in forest district (smiling 35 months)
   1.7 Informing 3PL about maximum delivery volume
   1.8 Notifying customers about maximum delivery volume (> demand)
   1.9 Notifying sub-contractor about annual demand (partly detailed on a monthly basis)
   1.10 Notifying 3PL about annual demand (partly detailed on a monthly basis)
   1.11 Requesting for quotations
   1.12 Formulating blanket order
Third stage: Bid processing (short-term level)

- Harvesting of wood, eventually in cooperation with other forest owners
- Sorting wood according to customers' demand
- Information on timber stores
- Information service provider on volume of timber marked out (= rough harvesting volume)
- Taking direct offers from service providers
- Exchanging information via ad-hoc manner
- Providing service providers information for their medium-term planning
- Providing information on how to sort wood according to customers' demand
- Medium-term planning of harvesting and hauling processes
- Inviting and comparing offers from different service providers with subsequent decision
- Providing service providers (harvesting, hauling, transportation) with detailed written information
- Informing forest owner on service providers in district
- Forest ranger informs service providers about harvesting dates and volume
- Forest ranger informs service providers about harvesting dates and volume
- Providing information on due dates and harvesting volumes in their forest district
- Making offers to forest owners directly
- Forest ranger and service provider jointly check the harvesting site
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Exchanging information in an ad-hoc manner via phone

Providing service providers information for their medium-term planning

Evaluating harvesting sites by sight

Evaluating take-over readiness by asking subcontractor

Detailed delivery agreement with customers

Reconfirming take-over security with customer

Confirming take-over security towards service provider

Evaluating harvesting sites by sight

Ensuring harvesting sites by sight

Ensuring take-over readiness by asking subcontractor

Scheduling resource availability and attendance

Attendance and resource availability information

Harvesting takes place in the mountains

Setting up machinery for mechanical harvesting at site

Setting up ropeway for harvesting

Parking
Fourth stage: Harvesting and Invoicing from different forest districts

Information in SCM5

Bneting machine operator on harvesting site

Entering information in SCM5

Information on harvesting site, volume, and quality

Truck driver is familiar with harvesting site

Information on harvesting site, volume, and quality

Marking out timber

Information in SCM5

Documenting information on harvesting

Information on harvesting site, volume, and quality

Formulating transport order

Storage wood according to customer orders (pattern)
Fifth stage: Transporting wood

Legend

- Process step
- Document, information center
- Decision

Flow of materials or information (one way or both way)

- Detailed routing and scheduling
- Scheduling truck drivers
- Transportation orders
- Picking up wood from forest storage locations
- Delivering wood to customers
- Unloading wood

- Customer order
- Scheduling truck drivers
- Transportation orders

Truck driver is familiar with harvesting site

Information on harvesting site - volume and quality
Sixth stage: Measuring wood and billing

- Measuring wood
- invoicing (supplier specific)
- bank transfer for wood delivery to 3PL provider
- controlling contract matters
- invoicing (supplier specific)
- bank transfer for wood delivery to 3PL provider
- sending delivery confirmation to sub-contractor
- controlling measurement results
- bank transfer

3PL transfers money to contributing actors (credit memo procedure)
APPENDIX E: Process diagram: Fagus network

Symbols used in the organization oriented process diagram meet existing standards (DIN 66001, cf., Schönsleben, 2004). The form of the boxes indicates whether the event described represents a process step (rectangles), a decision (diamonds), or a document or information carrier (sinuous rectangles). Rectangles contain either information on the processing of material or on the exchange of information. Sinuous rectangles represent any kind of physical or electronic entity that carries information on the order processing or related to the order processing. The location of the boxes in one of the ten bands indicates the actor carrying out the particular process step. The arrows leading from each box indicate subsequent process steps. Lines without arrows linking two boxes indicate parallel activities.
Fagus network

Main process stages

First stage: Medium term

- Forest administration (Canton / district) - Medium-term planning, i.e., plan development based on physical inventory data, information on tree population etc.
  - Operating plan defines maximum harvesting volume for coming ten years
  - Operating plan: Medium-term planning of plantation, maintenance, and harvesting

- Association of forest owners
- Private forest owner
- Public forest owner
- Third party logistics provider (3PL)
- Forest ranger
  - Developing operating plan based on guidelines given by forest administration
  - Operating plan
  - Medium-term planning of plantation, maintenance, and harvesting
  - Developing annual plan (financial budgeting)

- Service provider (Harvesting)
- Service provider (Hauling)
- Service provider (Freight carrier)
- Regional customer (Sawmills)
- Industry customer (Paper and pulp mills)

- Demand planning (12 months demand)
  - Demand plan

- Approving

Industry customer (Paper and pulp mills)

Service provider (Freight carrier)

Service provider (Hauling)

Service provider (Harvesting)

Third party logistics provider (3PL)

Public forest owner

Private forest owner

Association of forest owners

Forest administration (Canton / district)
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Second stage: Bid process

- Approving annual plan
- Requesting customer’s annual need
- Requesting maximum delivery volume (for one year)
- Developing annual plan (financial budgeting)

Medium-term planning of resources

- Ad-hoc decision-making with forest owners and 3PL
- Notifying about annual delivery volume
- Notifying about maximum volume
- Decision-making with forest owners and 3PL

Demand plan

- Formulating blanket order
- Customer blanket order (for one year)
Medium-term planning of harvesting and hauling processes

Evaluating harvesting sites by sight

Marking out trees to be felled at harvesting sites

Assessing what additional site preparation is needed for mechanical harvesting

Short-term planning (monthly basis): Information on timber supply is gathered from forest rangers

Providing customers from timber industry with information on maximum delivery volume in the coming month

Sending delivery permits to forest rangers

Short-term scheduling of service providers based on delivery permit

Order releasing for the coming month

Delivery permit (fixed volume per supplier)

Annual planning (yearly basis)
Informing about delivery volume

Informing about delivery volume

Cross-banding harvesting sites

Informing about delivery volume

Scheduling resource availability and attendance

Scheduling resource availability and attendance

Setting up machinery (for mechanical harvesting) at sites

Requesting information on transport volume for the coming two weeks

Requesting information on transport volume for the coming two weeks

Routing and scheduling

Routing information

Routing information

Information on harvesting site, volume and quality

Information on harvesting site, volume and quality

Documenting information on harvesting

Documenting information on harvesting

Invoicing

Invoicing

Enquiring take-over reality

Enquiring take-over reality

Reconfirming take-over reality with customer

Reconfirming take-over reality with customer

Short-term scheduling of service providers based on delivery permit

Short-term scheduling of service providers based on delivery permit

Briefing machine operator on harvesting site

Briefing machine operator on harvesting site

Appendix
Third stage: Harvesting and hauling

- Short-term planning of hauling process
- Hauling information (site, volume, assortments)
- Invoices from different forest districts
- Collating information on stacked roundwood
- Information on timber stores in forests

- Communicating information on stacked roundwood (site, volume, quality, assortments) to 3PL
- Wood/transportation organized by customer.
- Collating identification numbers of timber for each forest district
- Collating information on forest districts, storage locations, and identification numbers

- Short-term planning, reservation, and setting up machinery (for mechanical haulings at sites)
- Storing wood according to customer/forest district
- Invoicing

- Truck driver is familiar with harvesting sites
- Collating information on storage locations, quality, and volume of timber

- Yes
- Collected identification numbers of timber for each forest district
- Collating information on forest districts, storage locations, and identification numbers

- No
- Communicating information on stacked roundwood (site, volume, quality, assortments) to 3PL
- Wood/transportation organized by customer.
- Collating identification numbers of timber for each forest district

- Yes
- Invoicing

- No
- Communicating information on stacked roundwood (site, volume, quality, assortments) to 3PL
- Wood/transportation organized by customer.
- Collating identification numbers of timber for each forest district

- Invoicing
and hauling

Fourth stage: Transporting wood

Collating identification numbers of timber from each forest district

Collating information on forest districts, storage locations, and identification numbers

Information on forest districts, storage locations, and identification numbers

Detailed routing and scheduling

Transfer order (delivery due date)

Formulating transfer order

Routing and scheduling

Transportation order

Delivering wood to customers

Picking up wood from forest storage locations

Scheduling (truck drivers)

Invoice

Invoices from different forest districts.
Fifth stage: Measuring wood and billing

Legend

- Process step
- Document, information carrier
- Decision
- Flow of materials or information (one-way or both-way)

- Sending credit notes to forest owners and service providers
- Invoicing
- Information on volume, quality, and resulting price
- Transfer of sums of money to 3PL

- Picking up wood from forest storage locations
- Delivering wood to customers
- Unloading wood
- Measuring wood
- Invoice
- Payment receipt
APPENDIX F: Coding of concepts and their relationships*

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*Note: Data above (below) the diagonal indicate the number of statements on relationships between concepts in the Fagus (Picea) network. Number of statements in parantheses.
Curriculum Vitae

Name: Hannes Günter
Date of birth: 20/04/1977
Place of birth: Villingen, Germany
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Education

2003 – 2007 ETH Zurich
Ph.D. in work and organizational psychology
2001 University of Melbourne
Study Abroad Program in psychology
1999 – 2003 Dresden University of Technology
Master of Arts with a major in psychology
1997 - 1999 University of Freiburg i.Br.
Bachelor of Arts with a major in psychology
1987 - 1996 Gymnasium am Romäusring, Villingen
A-level, Secondary school

Work experience

2003 – 2007 ETH Zurich, Organization Work and Technology Group
Research associate
2000 – 2003 PAUL Consultants
Project work
2001 Institute of Arbitrators and Mediators
Internship
2001 International Conflict Resolution Centre
Internship
2000 Bickmann & Collegen
Internship
Publications

Parts of the conceptualizations and ideas in this thesis emerged through the writing of following journal and conference papers:


