Implementing Sustainability into Supply Chain Operations

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IMPLEMENTING SUSTAINABILITY INTO SUPPLY CHAIN OPERATIONS

by

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Dissertation submitted
ENGLISH SUMMARY

Sustainability is acknowledged as a top strategic agenda by many global companies. As increasing globalization and outsourcing trends shift competition from single company affairs to competition among supply chains, the implementation of sustainability within companies’ supply chain operations becomes even more crucial. Professional literature acknowledges that complex and dispersed supply chain structures present organizational challenges when companies strive to translate their strategic sustainability intentions into ongoing supply chain operations.

Despite the recognized challenges, few empirical studies have investigated in detail how sustainability agendas are implemented or how they affect supply chain operations. These studies have mostly investigated the impact of implementation, explored the relationship between strategy formulation and performance, or provided descriptions of drivers of sustainable behavior. However, a process perspective on what happens when sustainability is implemented in ongoing supply chain operations remains underrepresented in the research. In particular, research on how top-down sustainability strategy is translated into, aligned with, and affected by bottom-up, day-to-day experiences of supply chain operations is scarce.

The contingency approach, which includes the contextual conditions under which the implementation occurs, is also scarce. Moreover, there is a lack of theoretical frameworks based on empirical studies that can support the application of sustainable supply chain management SSCM in practice.

This study aims to explore in detail the implementation of sustainability in ongoing supply chain operations. Specifically, it investigates how a company approaches the implementation of sustainability in different areas of its supply chain operations, exploring interactions on both cross-functional and cross-organizational levels.

The thesis builds on an exploratory, in-depth, single case study, which examines how a Danish company leading in sustainability has implemented a strategic sustainability agenda within its supply chain operations. In order to understand and
explain why the implementation of sustainability occurs as it does, the following research questions were developed:

Research Question 1. What are the current organizational barriers to sustainability and how do they impede companies in implementing and anchoring sustainability in their supply chain practices?

Research Question 2. How does a new agenda of sustainability affect supplier-buyer relationships?

Research Question 3. How does operational coordination between suppliers and customers change with the introduction of a sustainability agenda?

To answer these specific research questions and achieve the aims of the study, the logic of theory-building through a qualitative case study approach was applied. Secondly, a multi-theoretical lens was adopted to explain the revealed aspects of the phenomenon. Thirdly, systems theory was used as an epistemological meta-theory to unfold the complexity of sustainability implementation in supply chain operations.

The study findings point to the need for adequate cross-functional and cross-organizational coordination, as well as the need to develop sustainability performance metrics that are tangible and coherent within the operational logic of supply chain functions. The findings also show that the co-generated value-seeking approach (vs. a trade-off approach) is one of the factors affecting the deployment of sustainability in supply chain operations, as well as that a company’s purchasing strategy changes when sustainability is set as a strategic target. The study’s examination of operational coordination suggests the appearance of multiple value-offering and order-decoupling points that occur when sustainability is practiced as a buyer-supplier collaborative initiative. Finally, the study highlights the need for an “integrator” function—both across company functions and across the organizations involved in the supply chain—to achieve sustainability deployment.

The outcomes of the study are as follows: (1) Conceptual frameworks are developed based on empirical data from the case study. These frameworks cover three different levels of the business system and present a simplified model to
explore the complexity of the phenomenon. (2) Means for the deployment (i.e., successful implementation) of a sustainability agenda in supply chain practices are identified. The discussion of means provides some explanations for relationships among frameworks components. More specifically, these means begin to explain why sustainability is being implemented the way it is. (3) Research propositions are suggested for validation in future research. These propositions are developed based on the discussion of means.

This study contributes to both industry practice and academia. The study contributes to industry practice through knowledge of more efficient sustainability implementation by (1) providing rich insights into the process of sustainability implementation and (2) discussing the means for sustainability deployment. The study enhances SSCM theory development by: (1) adding in-depth knowledge and unfolding the complexity of the cross-functional and cross-organizational aspects of the implementation of sustainability in ongoing supply chain operations, (2) suggesting frameworks that fit into the business system, and (3) providing an explanation for the phenomenon through a discussion of the means for implementing sustainability.
Bæredygtighed er anerkendt som en af de top-prioriterede strategiske dagsordener hos mange globale virksomheder. Den stigende globalisering og trenden i outsourcing flytter konkurrencen fra enkeltvirksomheder til konkurrence mellem supply chains, hvilket gør implementering af bæredygtighed i supply chains essentiel. Litteraturen anerkender, at komplekse og geografisk spredte forsyningskæder udgør organisatoriske udfordringer, når virksomhederne forsøger at transformere deres bæredygtighedsintentioner i forhold til deres løbende supply chain operationer.

Trods denne udfordring, er der få empiriske studier, der i detaljer undersøger, hvordan bæredygtighed sættes på dagsordenen og implementeres, samt hvordan det påvirker SCM. De eksisterende undersøgelser undersøger primært virkningen af bæredygtighedsinitiativer, forholdet mellem strategiformulering og præstation, eller beskriver det, som fører til bæredygtig adfærd. Forskning i implementering af bæredygtighed i supply chains, og som studerer fænomenet fra et procesperspektiv, herunder faktorer relateret til den organisatoriske kontekst, er imidlertid underrepræsenteret. Desuden er der mangel på teoretiske frameworks baseret på empiriske studier, der kan understøtte anvendelsen af SSCM i praksis. Især er forskning i, hvordan top-down initierte bæredygtighedsstrategier transformeres og medieres af bottom-up tiltag, begrænset.

Dette studie har til formål at undersøge processen med implementering af bæredygtighed i SCM på detailniveau. Mere specifikt undersøges, hvordan en virksomhed implementerer bæredygtighed i forskellige aspekter af SCM og undersøger udfordringerne på såvel tværfunktionelle som tværorganisatoriske niveauer.

Afhandling bygger på et eksplorativt og mangefacetteret casestudie baseret på en case, hvor det undersøges, hvordan en dansk virksomhed, der er frontløber i bæredygtighed, har gennemført sin strategiske agenda om bæredygtighed i virksomhedens forsyningskæder. For at forstå og forklare, hvorfor implementeringen af bæredygtighed skete som observeret i casen, stilles følgende forskningsspørgsmål:
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Forskning Spørgsmål 1. Hvad er de nuværende organisatoriske barrierer for bæredygtighed, og hvordan begrænser de virksomhederne i at gennemføre og forankre bæredygtighed i deres forsyningskæde i praksis?

Forskning Spørgsmål 2. Hvordan påvirker en ny dagsorden for bæredygtighed leverandør- og kundeforhold?

Forskning Spørgsmål 3. Hvordan ændrer operationel koordinering mellem leverandører og kunder sig, når en dagsorden for bæredygtighed kommer i spil?

For at besvare disse forskningsspørgsmål og opnå de i studiet opstillede mål, benyttes det for det første et kvalitativt casestudie baseret på ”teori oparbejdning”. For det andet benyttes flere teoretiske tilgange for at forklare fleste mulige aspekter af fænomenet. For det tredje anvendes systemteori som epistemologisk metateori for at indfange kompleksiteten i implementeringsprocessen for bæredygtighed i SCM.

Resultaterne af undersøgelsen viser nødvendigheden af tilstrækkelig tværfunktionel integration og tværorganisatorisk koordinering, samt behovet for at udvikle håndgribelige og sammenhængende effektivitetsmålninger, der måler den operationelle funktionsspecifikke logik i de bæredygtige supply chains. Resultaterne viser også, at den i fællesskab genererede værdisøgende tilgang (i modsætning til trade-off) er en af de positive faktorer for udrulning af bæredygtighed i SCM, og at indkøbsstrategien i et selskab ændrer sig, når bæredygtighed er prioriteret som strategisk målsætning. Resultaterne af studiet om diffusion af både værditilførsel og ordre-dekoblingspunkter, når bæredygtighed praktilseres som et køber-leverandør samarbejdsinitiativ. Endelig viser undersøgelsen af den operationelle koordinering, at der er behov for at have en integrator-funktion til implementering af bæredygtighed.

Resultaterne af undersøgelsen er: (1) Konstruktion af konceptuelle rammer, baseret på empiriske data fra et casestudie. Disse konceptuelle rammer dækker tre forskellige niveauer af forretningsystemet og viser den forenklede model til udforskning af fænomenets kompleksitet. (2) Et middel til udrulning (vellykket gennemførelse) af en strategisk bæredygtighedsdagsorden i SCM. Midlerne giver nogle forklaringer mellem komponenterne i frameworket. Mere konkret begynder de at forklare, hvorfor gennemførelsen af bæredygtighed sker, som den gør. (3) Der
er angivet hypoteser (propositions), som kræver validering i fremtidig forskning. Disse hypoteser er udviklet på baggrund af en diskussion af midler.

Afhandlingen indeholder bidrag både til industriel praksis og til den akademiske verden. Til industriel praksis bidrager den med viden om mere effektiv implementering gennem (1) at give en mangesidet indsigt i processen omkring implementering af bæredygtighed og (2) gennem at diskutere midlerne til bæredygtighedsimplementering. Studiet bidrager til den akademiske verden gennem teoriudvikling indenfor SSCM: (1) Ved at udfolde og forklare kompleksiteten i tværfunktionelle og tværorganisatoriske aspekter i bæredygtighedsimplementeringen i eksisterende supply chains, (2) gennem at opbygge konceptuelle rammer, som indpasses i forretningsystemet, og (3) gennem at forklare midlerne i indførelse af bæredygtighed.
ACKNOWLEDGEMENTS

The PhD study has been a fascinating journey. During this time I have experienced both the joy of accomplishments and despair of losing the sense of direction. Despite that the process sometimes felt as impossible to accomplish, I have learned to appreciate challenges and obstacles as highly beneficial experiences. This allowed me to grow as a researcher and has contributed to my personal development.

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Notwithstanding all the above support for this research, I am the only person, who is responsible for errors in this thesis.
Throughout the thesis, various acronyms are applied. To assist the reader, the most important/common is listed.

SCM – Supply chain management

SSCM – Sustainable supply chain management

GSCM or Gr SCM – Green supply chain management

CSR – Corporate social responsibility

NGOs – Non-governmental organizations

TBL – Triple Bottom Line

LCA – Life cycle assessment

KPI – Key performance indicator

VOP – Value offering point

OPP – Order decoupling point

PT – Production technology management [department]

EVSM – Energy value stream mapping

TC – Technology center

3PL – Third party logistics

GHGs – greenhouse gases emissions
Thesis title: Implementing Sustainability into Supply Chain Operations

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Name and title of supervisor and any other supervisors:

Professor Brian Vejrøm Wæhrens and Professor Poul Israelsen

List of published papers: Paper are included, see page XXI

"This thesis has been submitted for assessment in partial fulfillment of the PhD degree. The thesis is based on the submitted or published scientific papers which are listed above. Parts of the papers are used directly or indirectly in the extended summary of the thesis. As part of the assessment, co-author statements have been made available to the assessment committee and are also available at the Faculty. The thesis is not in its present form acceptable for open publication but only in limited and closed circulation as copyright may not be ensured."
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Paper One

Jørsfeldt, Liliyana Makarova; Jensen, Peter Meulengracht; Waehrens, Brian Vejrum. 
Barriers to the Implementation of Sustainability in Supply Chain Operations.

An earlier version was published in Proceedings for Advances in Production Management Systems conference:


The current version was submitted and was given full consideration for publication in the Special Issue of Supply Chain Forum—An International Journal (SCFIJ) in November 2013.

Paper Two


Paper Three


Submitted to the Strategic Outsourcing: an International Journal, Sept. 2015. The paper is presently being given full consideration for publication.
PART I
CHAPTER 1. INTRODUCTION

The sustainability phenomenon has long been discussed and debated in both the academic world and the professional world. The most generally accepted and used definition of sustainability, or sustainable development, is that proposed by the Bruntland Report (World Commission on Environment and Development, 1987). This states that sustainable development is development that "meets the needs of the present without compromising the ability of future generations to meet their needs" (World Commission on Environment and Development, 1987, p. 8). This definition also highlights a dilemma central to this thesis. In organizational practice, sustainable development is operationalized through the concept of the triple bottom line (TBL), developed by Elkington (1998), which promotes the simultaneous consideration of economic, social and environmental criteria (e.g. Carter and Rogers, 2008; Carter and Easton, 2011; Pagell and Wu, 2009).

Since gaining interest in academic literature more than 25 years ago, sustainability has been integrated into various disciplines (Carter and Rogers, 2008; Linton et al., 2007; Winter and Knemeyer, 2013). In industry, an increasing number of companies have begun to categorize sustainability as a top strategic priority (Lacy et al., 2010), and sustainability has been identified as an emerging megatrend (Lubin and Esty, 2010). For example, according to a 2010 CEO study on sustainability, in which data were gathered from CEOs from over 100 countries and 25 industries, the sustainability agenda was acknowledged by CEOs as “more important than ever to the future success of their business and identified as one of the “key strategic challenges” (Lacy et al., 2012, pp. 346, 347).

The adoption and incorporation of sustainable practices as a key strategic priority by companies has been triggered by many factors. One of these factors is pressure from stakeholders, such as government regulators, non-governmental organizations (NGOs), community activists, and socially conscious customers (Hassini et al., 2012; Linton et al., 2007; Seuring and Müller, 2008a; Seuring and Müller, 2008b). These stakeholders have expressed growing concerns over the diminishing availability of raw materials, the scarcity of energy sources, greenhouse gas emissions (GHGs), and the threat of global warming (Dey et al., 2011; Gupta and
Palsule-Desai, 2011; Kleindorfer et al., 2005; Lee et al., 2014; Srivastava, 2007). Legal demands and regulations introduced by policy makers in response to environmental protection have led to rising supply chain costs, resulting in pressures for organizations to accomplish goals in a cost-effective manner (Kleindorfer et al., 2005). Market factors, such as global competition for resources and the escalating deterioration of the environment, also create pressure for companies (Pagell and Wu, 2009). In particular, a growing awareness of sustainability issues creates new markets for sustainable products and also increases consumer demands for whole supply chain sustainability (Kleindorfer et al., 2005; Lacy et al., 2010; Walker et al., 2008).

The next step for the broader incorporation of sustainability is the incorporation of sustainability at the level of the supply chain. This means that the goal of sustainability implementation is not limited to the silo of the individual company; instead, it needs to occur throughout the supply chain, from raw material extraction to customer use and disposal (Guiffrida et al., 2011; Linton et al., 2007; Seuring and Müller, 2008a; Seuring and Müller, 2008b). If global companies are to take the next step in developing sustainable supply chains, they must shift from simply making sustainability a strategic priority to actually implementing it in ongoing supply chain operations. Implementing sustainability in the supply chain has become especially important as a consequence of increased globalization and outsourcing trends. In connection with these trends, a new approach to competitiveness has appeared—one that recognizes that it is not single companies that compete, but the supply chain as a whole (Christopher, 2011; Dyer, 2000; Goldsby and Stank, 2000; Pagell and Wu, 2009). The intensification of the globalization phenomenon has also led to the supply chains of many companies becoming increasingly complex and dispersed. Moreover, many global companies, with suppliers and customers all over the world, face the challenge of how to respond to simultaneous and sometimes non-coherent strategic priorities. When implementing sustainability in supply chain operations, the issue of how to balance the sustainability agenda with other diverse strategic demands in dispersed and complex supply chains comes to the forefront (Mollenkopf et al., 2010; Seuring and Müller, 2008a; Seuring and Müller, 2008b). Moreover, the sustainability agenda has increased the complexity of supply chain management and has highlighted the need for an integrated approach, emphasizing
issues related to cross-functional and inter-organizational coordination and integration (Christopher, 2011; Elhedhli and Merrick, 2012).

There already exists a body of research addressing various issues within the sustainable supply chain management domain related to implementing sustainability practices in organizations and supply chains. Literature from the field of Green Supply Chain Management (GSCM) addresses many sustainability issues in supply chain operations. In particular, it examines the importance of working with both customers and suppliers across supply chains on environmental initiatives and the relationship between sustainability and supply chain management, while also identifying drivers for and barriers to green supply (Carter and Rogers, 2008; Seuring and Müller, 2008a; Vachon and Klassen, 2006; Walker et al., 2008). The economic effect of sustainability implementation has been discussed within the research, with some studies reporting that the implementation of sustainability could increase organizational profitability (Christmann, 2004; Mefford, 2011; Melnyk et al., 2003), while other research has documented that some environmental initiatives may come at significant economic costs (Margolis et al., 2007; Walley and Whitehead, 1994)). The literature argues for a positive effect for both suppliers and customers when collaborating on environmental and social issues (Gold et al., 2010; Rao and Holt, 2005; Vachon and Klassen, 2008).

Since sustainability has been recognized as one of the key strategic competitive priorities in supply chain management, research in the field has resulted in the development of tools for integrating sustainability into operational strategy (Gupta and Palsule-Desai, 2011). For example, to implement sustainability at the supply chain operations level, effective tools and techniques, such as lifecycle assessments, reverse logistics, closed-loop supply chains, and design for disassembly, have been developed over the last 25 years (Kleindorfer et al., 2005; Seuring and Müller, 2008b). Despite the existence of these and other tools, numerous empirical studies highlight the managerial problems that occur when sustainability is applied in the supply chain context (Lacy et al., 2010; Seuring and Müller, 2008a; Vachon and Klassen, 2008; Walker et al., 2008). Some of these studies document problems in the implementation of a strategic sustainability agenda (Lieb and Lieb, 2010) and identify that operational practices in companies and their supply chains remain
mostly unaffected, despite the presence of sustainability agendas (Kiron et al., 2013; Wolf and Seuring, 2010).

When adhering to the definition of implementation as “the system-wide action taken by firm members aimed at accomplishing formulated strategies” (Hahn and Powers, 2010, p. 66), only a few studies have empirically investigated this problem on an operational level in the context of operations strategy (Bowen et al., 2001a; Holt and Ghobadian, 2009; Porter and Kramer, 2006). These studies mostly investigate the impact of implementation, strategy formulation, and the relationship between strategy and performance, investigate the drivers of environmental behavior and describe the existing practice. To my knowledge, they do not study implementation in detail and do not include factors related to the organizational context when implementing sustainability in ongoing supply chain operations. This could be explained by the predominant thinking of strategy implementation as the planning of organizational arrangements (Hill et al., 2014) at the stage of strategy formulation, followed by a review of whether or not performance targets were achieved. For example, Slack and Lewis (2008, p. 300) state that implementation “means the organizing of all the activities involved in making the strategy work as intended.” This shows that, when implementation is discussed by the authors from the point of view of formulating and planning, the discussion of actions in the organizational context remains underrepresented. In this way, implementation remains a “black box” for strategic managers. Only a few empirical studies investigate in detail how the sustainability agenda is implemented and how this affects supply chain operations (Marchet et al., 2014; see examples: Schneider et al., 2014).

Given the limited amount of research in the context of implementing sustainability in supply chain operations with the process perspective, I consider the topic to be currently underrepresented in the literature. This perspective is supported by the calls that have been made to bridge this research gap (Hald, 2011; Linton et al., 2007; see in: Pagell and Wu, 2009; Porter and Kramer, 2006; Winter and Knemeyer, 2013).

The above discussion of the extant literature have allowed for the formulation of the overall objective of this study. This objective is based on three main points of the above discussion: (1) the significance of embedding sustainability into the supply
chain as a strategic, competitive priority; (2) the indicated managerial problem inherent to the implementation of sustainability in practice; and (3) the call for further research to investigate in detail the practice of implementing sustainability in sustainable supply chains. Together, these lead to the overall objective of this study, as follows:

The overall objective of this study is to explore in detail the implementation of sustainability in ongoing supply chain operations from an organizational perspective. The focus is on cross-organizational and cross-functional aspects of the practice of implementing sustainability.

To achieve this overall objective, I aim to explore how companies are implementing the strategic agenda of sustainability in supply chain operations, with sustainability as one of the top strategic priorities. I investigate what occurs when a sustainability strategy is translated to the operational level. With the aim of understanding what is occurring in the translation of strategy to the operational level, I go beyond the strategic and corporate realms and investigate how organizational practice (i.e., current organizational set-up, coordination, and integration) change in response to new strategic agendas of sustainability. I examine how the sustainability agenda has been approached in different parts of the supply chain; I investigate how decision-making changes when new sustainability performance indicators are introduced in different departments; I explore how new performance indicators for sustainability compare to traditional performance indicators; I map the interfaces and connections between functions within an organization, and between organizations, when the processes of sustainability are implemented into the supply chain; I explore how the relationships on the operational level unfold and change in response to more sustainable practices. Through exploring these interactions, I provide insights into what is happening when sustainability strategic agendas are absorbed into organizations’ supply chain operations.

The potential significance of this study lies, first, in the advantages that the study of sustainability implementation can bring. This study not only answers the question of what is actually going on, but also provides an explanation of why the implementation of sustainability may be more or less successful (Werner, 2004). As such, this study aims to provide rich knowledge and insights into the topic. By providing explanations of the implementation of sustainability and identifying the
challenges that occur during implementation and the ways and means for deploying sustainability, the study offers knowledge that can lead to the more efficient deployment of a sustainability strategy.

From an academic point of view, this research is one of the first studies to address cross-functional and cross-organizational issues, taking the perspective of how such issues are approached from the company side in order to implement sustainability in ongoing supply chain operations. Moreover, by aiming to understand and explain why the implementation of sustainability in supply chains occurs the way it does, this study develops the relevant frameworks, and explanations of the phenomenon related to these frameworks, as aspects of theory development, thus enhancing the theory of sustainable supply chain management.

The thesis is structured as follows: Chapter 2 and Chapter 3 provide a literature review; Chapter 4 defines the scope of the study and specifies research questions; Chapter 5 describes the methodological approach; Chapter 6 provides the theoretical background; Chapter 7 describes the case; Chapter 8 presents the papers; Chapter 9 discusses findings; and Chapter 10 concludes and suggests further research.
CHAPTER 2. SUSTAINABLE SUPPLY CHAIN MANAGEMENT—OVERVIEW OF A RESEARCH FIELD

The research in sustainable supply chain management has been growing for the last 25 years. Many research investigations in sustainability are interdisciplinary, spanning the boundaries between operations and supply chain management with other disciplines and resulting in the application of sustainability in different fields. The scope of the literature is very broad, and it includes, among others, such topical areas as decision making, organizational studies, logistics, supply chain management, environmental management, etc.; moreover, multiple methodologies are applied (Ashby et al., 2012; Srivastava, 2007). Thus, it is recognized that SSCM is an evolving concept, involving multidisciplinary research and lacking a well-defined structure as a result of the concept’s early stages.

This landscape creates a situation in which research relevant to this study and useful for exploring the phenomenon may be published elsewhere than operations management and supply chain management journals. Therefore, it is necessary to gain an understanding of the overall scope and evolitional development of the SSCM domain. This will provide a solid background for research and ensure the rigor needed for a further and more focused literature review.

The other reason for conducting such a review is to define the position this research takes within the broader field of SSCM. This is accomplished by defining the scope and delimitation of this research and by ensuring that the research is novel and addresses aspects that have not yet been analyzed. This also allows for the identification of research gaps suggested by other scholars.

In order to gain the required understanding of the overall field of SSCM, an examination of 15 existing literature reviews was conducted (see Appendix B). These reviews were identified through the literature search methodology, which is described in Chapter 3. Each of them was written from a different angle, adopts a different perspective, and investigates particular aspects of the SSCM domain.
The reasons for conducting such an analysis of a set of secondary data included both saving time and embracing the multifaceted nature of the existing research, which includes a tremendous number of articles.

Since the topic of SSCM has experienced growing interest from the academic world, there have been numerous attempts to review the existing literature. It is generally recognized that the topic of SSCM has been developing for more than 25 years. Research on sustainable supply chains began in the early 1980s, and the research stream can be seen as the next step after the examination of sustainability in operations (Ashby et al., 2012; Linton et al., 2007). However, it is only since 2001 and 2003 that the research has shown steady growth, currently attracting interest both from academics and practitioners (Seuring and Müller, 2008b). For example, the International Journal of Operations and Production Management (IJOPM) has recently published a special issue entitled Sustainable Operations Management that includes research on sustainable supply chains (Walker et al., 2014).

The 15 identified review articles were analyzed in the following way. Firstly, they were read from the perspective of understanding the general tendencies and evolitional development of the field of SSCM. The identified research gaps and suggestions for future research in this study are highlighted in a table in Appendix B. Further, five distinct themes are identified, presented in Figure 2-1, and described. This demonstrates how the field’s main focus and approaches have changed over time. Finally, the results of analysis are summarized, and preliminary suggestions and prospective directions for further research are suggested.

Five key themes in the research domain of sustainable supply chain shows the evolution of the field and the new trends added to the research.

FIRST THEME: RESPONSE TO ENVIRONMENTAL REGULATIONS AND RISK MANAGEMENT

Legal demands and regulations are most commonly mentioned as factors in supply chain pressures and incentives—and, therefore, as triggers for sustainable supply chain management at the normative level (Linton et al., 2007; Seuring and Müller, 2008b).
Seuring and Müller, (2008b) stress that, while customers are generally the main stakeholders triggering changes in company strategy, in the case of sustainability development it is the government that sets the pressures and incentives that are of the greatest relevance when discussing SSCM triggers. Linton et al. (2007) notes that sustainability is not only business, but also a political mainstream increasingly discussed by policy makers, with many countries introducing legislation to address issues of sustainability. Compliance with environmental regulations and demands, such as the implementation of environmental management systems like the ISO 14001 and the SA 8000, often occur not only to meet legal requirements, but also because companies want to reduce the risks associated with reputational losses. There is a risk that customers will boycott products and services whose company’s environmental or social problems are reported (Kleindorfer et al., 2005; Seuring and Müller, 2008b).

The pressures from public and political institutions to improve performance related to environmental and social issues have led to a situation in which “the question to the companies has become not whether to commit to a strong environmental, health
and safety record, but how to do this in a cost effective manner” (Kleindorfer et al., 2005, p.484). This has led to further development in the field.

SECOND THEME: GREEN SCM, ENVIRONMENTAL MANAGEMENT, GREEN PRODUCT MANAGEMENT, MANAGEMENT FOR EFFICIENCY, AND WASTE MINIMIZATION

The foundation for this line of research was drawn from environmental issues and the environmental imperative, and it is primarily devoted to technical and operational considerations (Gupta and Palsule-Desai, 2011; Sarkis, 2003; Sarkis et al., 2011; Srivastava, 2007). The extensive body of research in reverse logistics, remanufacturing, and waste management has both acknowledge and responded to such facts as the diminishment of raw materials and the overflow of waste (Srivastava, 2007). The concepts of Supply Chain Management (SCM) and Life Cycle Assessment (LCA) in the context of operations found their application in this domain.

Sustainable SCM is considered to be an extension of GSCM (Ahi and Searcy, 2013). The authors argue that SSCM research takes a more broad approach to SCM than GSCM—which, in turn, has “an emphasis on the characteristics of environmental, flow, and coordination focuses” (p. 329). Thus, the research under the GSCM domain needs to be considered in the further focused literature review of this study.

According to Carter and Easton (2011), SSCM research began with research on stand-alone environmental and social initiatives under the Corporate Social Responsibility (CSR) concept and continued with the Triple Bottom Line (TBL) approach. The research using the TBL approach is very rich and can be classified into literature for SCM processes, SC network structures and SCM components (Winter and Knemeyer, 2013). Seuring and Müller (2008b) noted the existence of two strategies for sustainability: “supplier management for risk and performance” and “supply chain management for sustainable products.”

Given the development of the research in sustainability and supply chains, academics have called to integrate the issues and flows that extend beyond the core of supply chain management: that is, product design, the manufacturing of by-
products, by-products produced during product use, product life extension, product end-of-life, and the recovery processes at end-of-life (Linton et al., 2007; Srivastava, 2007).

**Third Theme: Adaptation of Operation Tools and Techniques with Sustainability Dimensions, as Well as Performance Measures**

The research in this domain is more focused on the tactical and operational aspects of supply chains. Lean production, as the process for detecting and eliminating waste, was originally focused on time and quality defects and could be used to reduce environmental waste. This subject attracted the attention of academics, and several studies have been conducted to determine whether the lean and green approach is evident in practice and how best to achieve lean and green synergies (Kleindorfer et al., 2005). Kleindorfer et al. (2005) also mentioned that the source of synergies can be found between quality and environmental management systems.

Practitioners’ need to measure sustainability triggered a research domain around the following questions: “How can we find relationships between financial and green performance?” “What are the measures for sustainable performance?” and “What are the sustainable supply chain metrics?” In this regard, Hassini et al. (2012) analyzed the literature covering the operational and tactical issues of sustainable supply chains. According to the authors, despite the existence of many environmental indicators, there are hurdles for the development of reliable performance measures. Thus, the authors encouraged further investigation in a number of areas.

**Fourth Theme: Integration of Sustainability into Supply Chain Operations**

The development of this theme was forecasted by Kleindorfer et al. (2005). In covering supply chain issues in their review of sustainable operations management, the authors stated that operations management practitioners faced challenges integrating sustainability with their traditional areas of interest. They observed a growing recognition for aligning strategy and operations and noted that operations management has moved from “a narrow focus on costs to an appreciation of the customers” (Kleindorfer et al., 2005, p. 483).
Support for a direct connection between a company’s operational decisions and its environmental performance, despite environmental considerations often imposing costs and constraints on production systems, is discussed by Gupta and Pausule-Desai (2011). The authors provided an understanding of the issues and trade-offs involved in making decisions related to SSCM. Their integrative framework for SSCM summarizes the literature into four categories: strategic considerations, decisions at functional interfaces, regulations and government policies, and integrative models and decision support tools.

The other trend that developed at this stage is based on the notion of inter-organizational resources and the extension of sustainability to suppliers. It has been argued that collaborations with suppliers offer benefits, with investigations taking the perspective of collaborative paradigms and/or the resource-based view (Gimenez and Tachizawa, 2012; Gold et al., 2010). Gold et al. (2010) emphasized that supply-chain-wide collaboration, while is a source for inter-firm resources and capabilities, also is essential to sustainability performance, while Gimenez and Tachizawa (2012) concluded that both assessment and collaboration have positive impacts on environmental performance and corporate social responsibility.

Currently, researchers have noted that the majority of research on SCM and SSCM is practice driven: “about 55 percent of articles over the full-time period failed to employ any sort of theory” (Carter and Easton, 2011, p. 55). For this reason, various authors have called for more theory-building research. To respond this call, Sarkis et al. (2010) categorized the literature on GSCM using such organizational theories as complexity theory, ecological modernization, information theory, institutional theory, Resource-based View (RBV), resource dependency theory, social network theory, stakeholder theory, and transaction cost economics. They concluded with suggestions for additional organizational theories for future research.

**Fifth Theme: Adding the Social Dimension to Supply Chain Management Research**

Currently, interest is growing in the social dimension of the TBL approach and in social sustainability in developing countries. While interest environmental research is still strong, there are more studies exploring social sustainability. For example,
one stream of research investigates social issues in the clothing industry (Fahian et al., 2014). Ashby et al. (2012) conducted a systematic review of current SCM literature conducted specifically in relation to the social and environmental dimensions of sustainability. The authors concluded that SSCM is a significant but evolving field and suggested that its social dimension and integration of environmental and social dimensions would be dominant topics for future research.

SUMMARY

The analysis of the contemporary overall state of SSCM research was conducted in order to provide a solid background for the focused literature review in the following chapter, as well as in the study in general. This analysis achieved three major outcomes that will facilitate higher quality in later stages of the study.

First, the framework developed for the evolution of SSCM facilitates an understanding of the scope and characteristics of the current stage of research in SSCM in a more clear and structured way. This knowledge serves as a platform for a better sampling of the literature for the focused review and ensures that the developments connected to the main purpose of my study will be taken into consideration. The focused review takes into account that there have been developments in other disciplines and across disciplines, beyond the major stream. Thus, it is necessary to look for the literature supplementing standard literature procedure.

Second, based on the suggestions for future research in the 15 sampled articles, potential future areas of research interest in relation to problem formulation are identified. This step also provides information and a platform to develop and describe our research scope and delimitations, as well as to promote an awareness of possible developments in the field. The analysis of the literature showed that scholars call for more theory development, highlight the need to apply a more integrative approach to SSCM, propose further study of the organizational aspects of SSCM, and emphasize the need to understand the practices of SSCM.

Third, by studying these articles, I ensured that my focused literature review is novel and provides new knowledge.
Another interesting finding of this review involves the current discussion of “conventional” versus “sustainable” supply chain management. Throughout the development of SSCM research, there have been continuous discussions on whether SSCM is a completely new subject that requires new theory or whether sustainability is just one of the new parameters of supply chain management. A recently published article by Beske and Seuring (2014) was driven by the question of whether there is a difference between “conventional” and “sustainable” supply chain management. The conclusion followed the idea that sustainability is an additional driver of supply chain management (Svensson, 2007), since practices have been adapted and are positioned as being developed specifically for SSCM—and, in reality, have initially been proposed by researchers within SCM. In Beske and Seuring’s (2014) opinion, SSCM differs from “conventional” SCM in the way in which sustainability is integrated: SSCM “leads to different practices for setting up and implementing dedicated SCM,” while “SSCM and SCM align more and more closely” (Beske and Seuring, 2014, pp. 328,329). This subject is addressed in the discussion of the theoretical underpinnings of this study.
CHAPTER 3. LITERATURE REVIEW AND RESEARCH GAP

This literature review is conducted in order to provide a sound, state-of-the-art foundation for the empirical research. It aims to address the following objectives (Hart, 1998):

1) To understand the contemporary state of research in the area of interest, which reflects the overall objective of the study; to acquire knowledge about existing theories to establish sound empirical research; to identify the conceptual context of the field and contribute to theory development; to find a foundation in the related literature; and to summarize existing research by identifying patterns, themes, and issues.

2) To identify research gaps and potential interests for further research; to identify a research agenda for future research, including considerations of what will facilitate the advancement of knowledge and practice in the area and which can be coherently linked with the problem statement.

3) To point to novel research domains or domains that have not yet been researched that have a similar purpose or answer similar research questions (Hart, 1998).

The structure of the chapter is as follows: Firstly, the methodology that is applied to the literature analyses is presented and explained. Secondly, content analyses of the articles selected to cover the problem statement are conducted using categories. Finally, conclusions are drawn.

3.1. METHODOLOGY FOR LITERATURE REVIEW

From a methodological point of view, the literature review is a process of content analysis. It has been conducted in the following sequence (Hart, 1998):
1) Collection: The search for related publications was mainly conducted as a structured keyword search: TS = ((sustainable supply chain management) AND ((implementation) OR (practice*))) in the database “Web of Science.” The returned results were then refined to only include article document types and English-language publications. The results were further refined by limiting the category to “management or operations research management science.” Following an initial content check, identified articles were selected for or excluded from the analysis. As a secondary source, additional relevant articles were identified from the references of the primary articles. Major databases, such as ProQuest, Web of Science, and Google Scholar, were used to search for related articles.

2) Delimitation: Articles in languages other than English were excluded. Articles that focused only on ethical demand or that were purely natural science articles were excluded. Articles that focused only on regulations and government policies were also excluded. Through these delimitations, relevant articles focused on specific processes of how to implement strategic incentives in ongoing supply chain operations were identified. Thereafter, literature reviews were also excluded.

3) The resulting collection of 38 articles includes material addressing the implementation and practice of strategic incentives within ongoing supply chain operations.

4) Category selection: Analytic categories were inductively derived following an initial reading of the collection of papers. The identification of categories was accomplished through pattern recognition and was described using existing literature. It involved two dimensions: research roots (supply chain or operations management) and type of research (content-oriented or process-oriented research).

5) Material evaluation: Analytic categories were applied to the collected material. The sample of 38 articles (see appendix C) was analyzed. Each article was assessed for positive mental associations between pairs of categories within
3.2. LITERATURE ANALYSIS

In this chapter, the 38 selected articles are analyzed. These articles represent state-of-the-art research on implementing sustainability within ongoing supply chain operations.

3.2.1. ANALYTIC CATEGORIES

In reviewing these articles, two dimensions were inductively identified: research roots and type of research. The term “research roots” refers to the presumptions or points of departure adopted by scholars. With regard to the “research roots”, two categories were defined: “operations management” and “supply chain management.” It is presumed in this focused literature review that the research rooted in the cross-functional aspects of sustainable supply chains belongs to “operations management.” The research that is rooted in cross-organizational aspects and that discusses, for example, relationships with suppliers, belongs to “supply chain management.” With regard to the “type of research” dimension, two categories were defined: “content-oriented” and “process-oriented.” This categorization can be seen as a matrix in the figure below, which is followed by an explanation of categories. This structure is used to classify and analyze the 38 articles.
First dimension: Research roots

In this dimension, I have identified two categories: operations management research and supply chain management research. The research that covers the topic of sustainability in supply chains can be approached from these two different angles. The operationalization and explanations of these two categories are inspired by the study by Rudberg and Olhager (2003). The category of “operations management” in the framework for the literature analysis corresponds with the description of “manufacturing network research” in this study; similarly, the category “supply chain management” corresponds with the description of “supply chain research.” Below, the main differences among the categories are described and then operationalized in Table 3-1. Later, the operationalization is used for analysis and to attribute articles to the clusters.

Rudberg and Olhager (2003) stated that, “as a result of globalization, the vast majority of manufacturing in large companies is carried out in value networks” (p. 29). They argued that there are two research tracks: manufacturing network
research and supply chain research. Both of these research tracks focus on the value network, but they use different approaches.

Research on manufacturing networks has its roots in the manufacturing management of a single factory. In contrast, research on supply chains from a logistics perspective tends to analyze networks as external networks, in which facilities are owned by different organizations. Logistics research takes its point of departure from physical distribution and material management and focuses on the links among nodes, while manufacturing network research tends to focus on these manufacturing nodes themselves (Rudberg and Olhager, 2003). The research on manufacturing networks began in the 1970s and was dominated by the issues of “the focused factory” and “economies of scale.” Later, with the globalization of markets in the late 1980s and 1990s, the research “was extended from multi-plant to network issues” (Rudberg and Olhager, 2003, p. 30). Rudberg and Olhager (2003) also identified two dominating areas in the research on manufacturing networks: research on configuration issues and research on coordination issues.

The research on supply chains has its origins in logistics management, with a predominant interest in the management of material flows and goods storage of. The historical evolution presented by Rudberg and Olhager (2003) divides the evolution of business logistics into three phases: functional management (divided into two functions: material management, and physical distribution; 1960s to 1970s); the internal integration of the two functions into logistics management, which involved an increased customer focus (1980s); and external integration (1990s), which was the extension of focus to first-tier suppliers, downstream customers, and third-party agencies. This historical account shows that supply chain management research—which, due to globalization currently includes aspects of external coordination—has its roots in logistics and may give rise to insights regarding the role of logistics function in SSCM. Moreover, when analyzing literature for this category, it is valuable to consider this historical account in order to enable better matching.

To help identify differences between these two approaches in the process of literature analysis, Table 3-1 below has been developed. This table summarizes the above discussion.
**Table 3-1 Operationalization of the operations management and supply chain management categories for the literature analysis (inspired by Rudberg and Olhager, 2003)**

<table>
<thead>
<tr>
<th>Operations management</th>
<th>Supply chain management</th>
</tr>
</thead>
<tbody>
<tr>
<td>Investigation of value networks from the perspective of the operations management of a single factory; global value networks of large manufacturing company are seen as resulting from globalization</td>
<td>Investigation of value networks as external networks (chains) in which facilities are owned by different organizations</td>
</tr>
<tr>
<td>Single factory perspective; operations management</td>
<td>Logistics perspective</td>
</tr>
<tr>
<td>Originated from “the focused factory;” extended to network issues in the manufacturing efforts of large companies</td>
<td>Originated from logistics management, with an interest in the management of material flows and the storage of goods; extended to the external integration of the supplier focus</td>
</tr>
<tr>
<td>Focuses on manufacturing nodes</td>
<td>Focuses on the links between nodes.</td>
</tr>
<tr>
<td>Includes research on configuration issues and coordination issues</td>
<td>Takes its point of departure from physical distribution and material management</td>
</tr>
<tr>
<td>Emphasizes corporate decision-making that covers supply chain operations</td>
<td>Focuses on the decision of which suppliers to include in a network</td>
</tr>
<tr>
<td>Mainly takes an intra-firm perspective</td>
<td>Focuses mainly on coordinating supplier relationships</td>
</tr>
<tr>
<td>External interfaces with first-tier suppliers and customers</td>
<td>Interfaces between sets of suppliers or customers</td>
</tr>
</tbody>
</table>
SECOND DIMENSION: TYPE OF RESEARCH

Here, the existing SSCM research is evaluated in terms of the distinction between process-oriented and content-oriented. To help distinguish whether the literature material belongs to process research or content research, as well as to discuss the differences between process and content, I refer to Leong et al. (1990) and their content and process models. The subject of process vs. content has been addressed in strategic management research (Ketchen et al., 1996) and in manufacturing strategy (Leong et al., 1990) with the purposes of analysis.

Leong et al. (1990) suggested the need to separate the research on process and content in manufacturing strategy, since these research topics must be approached with different types of questions. Thus, approaching them both in one study may result in the inappropriate application of methodology to either process or content. The authors conclude that more research is required on process models, which adequately map the process of manufacturing strategy.

The distinction between content and process is also described by Fahey and Christensen (1986) in their review of content research on competitive strategy, as follows:

Content focuses on the specifics of what was decided, whereas process addresses how such decisions are reached in an organizational setting. This distinction is useful, in spite of the obvious interactions between the two in organizational life. (Fahey and Christensen, 1986, p. 186)

Although Leong et al. (1990) stated that the process-content distinction is useful, they also mentioned that this distinction has not been applied explicitly to manufacturing and that most empirical studies on manufacturing strategy do not distinguish between the notions of content and process (Lambert and Cooper, 2000).

In order to operationalize the categorization of process-oriented research and content-oriented research, the extant literature has been examined with a focus on distinguishing between these two categories. The findings are described below and then summarized in Table 3-2.
The recent research regarding strategy implementation emphasizes the need for insights into the process of strategy implementation as the process of execution, rather than research on strategy formulation and the impacts of strategy implementation on performance (Naidoo and Wu, 2011; Schneider et al., 2014; Thorpe and Morgan, 2007).

The other distinction between process and content was described by De Wit and Meyer (2010) as follows: A strategy process is defined as a flow of activities, or throughput, while strategy content refers to the results of strategy process, or output.

Alan Werner (2004), in his guide to implementation research when evaluating program execution, distinguishes between impact studies and implementation research focused on the question “What is happening?” The core mission of implementation research is to describe, assess, and explain what is happening and why. In organization theory, implementation involves a firm’s structure, systems, operating procedures, and social processes. Implementation has been overlooked by strategy scholars (Parmigiani and Holloway, 2011). This may be because processes like implementation are challenging to study, unless one engages in a deep case study (often within a single firm). The links between strategy and operational daily practice are considered factors of implementation (Serdar Asan and Tanyaş, 2007). Therefore, the logic and approach of the strategic management tool “Hoshin Kanri” (Akao, 1991) have also been used to delineate between process and content.

The process perspective on strategy implementation was also presented by Mintzberg et al. (1998). The authors emphasize that strategy implementation does not only involve the one-way, top-down perspective. Instead, the intended strategy is continuously enacted through a bottom-up emergent strategy based on day-to-day experiences at the operations level (Mintzberg et al., 1998).

In order to evaluate the selected literature with regard to the categories of process vs. content, the following table has been developed. This table refers to literature that presents information for dividing process-oriented and content-oriented research, as used for the given study.
### Table 3-2 Operationalization of the process and content categories for the literature analysis

<table>
<thead>
<tr>
<th>Process-oriented research</th>
<th>Content-oriented research</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sequence of steps in implementation</td>
<td>Results, impacts</td>
</tr>
<tr>
<td>Flow of activities—throughput (De Wit and Meyer, 2010)</td>
<td>Results of strategy implementation—output (De Wit and Meyer, 2010)</td>
</tr>
<tr>
<td>Process-oriented research studies; strategy implementation with dynamic change</td>
<td>Content research studies; phenomenon in its static position; evaluating results and impact</td>
</tr>
<tr>
<td>Actions, flow</td>
<td>Strategy formulation and performance measures</td>
</tr>
<tr>
<td>Process addresses how decisions are reached in an organizational setting (Fahey and Christensen, 1986, p. 168)</td>
<td>Content focuses on the specifics of what was decided (Fahey and Christensen, 1986, p. 168)</td>
</tr>
<tr>
<td>Means and ways of deployment; means for successful implementation</td>
<td>Tools, components, structures, products, results of strategy implementation; methods</td>
</tr>
<tr>
<td>Hoshin Kanri (Akao, 1991)—continuous improvement; ongoing activities; what are the means of achieving?</td>
<td>Balanced scorecard (measure of impact); have targets been achieved?</td>
</tr>
</tbody>
</table>

### 3.2.2. RESULTS AND DISCUSSION

The results of the analysis are presented in Figure 3-2, and each cluster is described further on.
Cluster 1: Supply Chain and Content-Oriented Research

The articles gathered under this cluster are characterized, first, by the content type of the research. The articles (the research) in these cluster identifies which patterns
exist in SSCM practices (Bowen et al., 2001b) and studies their characteristics, components, and elements (Büyüközkan and Çifçi, 2012). It also identifies constructs (Shi et al., 2012), investigates impacts related to the alignment between supply chain strategy and corporate environmental strategy (Wu et al., 2014), and explores the role of the purchasing function in green supply chains (Bowen et al., 2001a).

Secondly, most articles have supply chain roots, along with a predominant interest in the management of material flows. Bowen et al. (2001a) discusses the liaison between purchasing and other functions and the role of cross-functional management in green supply. MacCarthy and Jayarathne (2012) and Vachon and Klassen (2006) study SSCM empirically from the collaborative paradigm perspective and confirm a positive link between collaborative practices in the supply chain and the enhancement of the sustainability agenda.

Under this group, there are several studies that investigate the components and elements of SSCM, develop prescriptive models of SSCM, and use empirical or conceptualizing methods (or both) (Ageron et al., 2012; Beamon, 1999; Büyüközkan and Çifçi, 2012; Pagell and Wu, 2009; Sarkis, 2003; Shi et al., 2012). Some of these articles suggest solutions for decision making and develop tools and methodologies for evaluation (Bai et al., 2012; Beamon, 1999; Pagell and Wu, 2009; Sarkis, 2003).

Closer attention is now given to the three articles that focus on the intersection between supply chains and operations management. These represent a key recent trend in SSCM research.

Shi et al. (2012) proposed and confirmed the link between intra-organizational practices and inter-organizational environmental practices. In developing a structural model for “natural, resource-based, green supply chain management,” the domain was explored in more depth at the theoretical level through the integration of a natural resource-based view and institutional theories and by addressing both the internal and external perspectives of the firm (Shi et al., 2012, p. 64).

Wu et al. (2014) took an alignment perspective to empirically examine the links among four supply chain (SC) strategies and four corporate environmental (CE)
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strategies. They found that an SC strategy, when properly aligned with a CE strategy, improves a firm’s overall performance. The study also offered guidelines for firms to align goals related to both operational efficiency and pollution reduction, suggesting that this approach is more useful than a traditional view of negotiating trade-offs.

Research by Bai et al. (2012) introduced a methodology for joint ecological and business performance measurement management, using the supply chain operations reference (SCOR) model to help evaluate, select, and monitor sustainable supply chain performance measurements integrated into a performance measurement system.

Identification of aspects for further research in relation to the overall purpose of the present study.

Bowen et al. (2001a) suggested extending “the general manager-purchasing manager approach” to make observations across several functions in green supply (p. 187). Wu et al. (2014) studied the impact of aligning supply chain strategies with corporate environmental strategies and suggested that the focus of future research may shift from investigating the specific features of supply chains (e.g., purchasing or logistics) to examining integrated business models.

**Cluster 2: Supply Chain and Process-Oriented Research**

Research in this cluster takes the process perspective and investigates the relationships among a company’s attitude toward ethical and environmental responsibility, its supplier policies and practices, and its supply chain partnership strategy (Gallear et al., 2012). It also analyses the practices of sustainability in the supply chain (Kogg and Mont, 2012) and examines the concurrent implementation of green, lean, and global supply chain strategies.

Within this perspective, most research takes an initial supply chain management perspective and proposes a contingency approach when dealing with sustainability in the supply chain. Depending on the degree of expected SCM change and the prevailing attitude toward the role of SCM in the sustainability agenda, Halldórsson et al. (2009) suggested three different strategies: integrated, alignment, and replacement. Pagell et al. (2010) explained observed changes in the purchasing
portfolio and suggested a modified, sustainable purchasing portfolio model as a strategic tool. Walker and Jones (2012) developed a typology of approaches to SSCM based on internal and external enablers and barriers. The positive relationship between sustainability and supply chains was suggested in the findings of Gallear et al. (2012), Vachon (2007), and Mefford (2011).

Gallea et al. (2012) examined the relationship between a firm’s supply chain partnership strategy and its corporate (i.e., ethical and environmental) responsibility attitudes, policies and practices towards suppliers. Findings indicate that corporate responsibility does influence the functional level of the firm, including the supply chain.

Three articles are positioned at the intersection of the perspectives of operations management and supply chain research. In their conceptual article, Halldórsson et al. (2009) suggested, based on their findings and depending on the degree of expected SCM change and the attitude toward the role of SCM in the sustainability agenda, three different strategies for addressing sustainability from a supply chain perspective: integrated, alignment and replacement. They proposed a contingency approach as an appropriate way to address sustainability agendas in supply chains. Finally, they call for future research to determine the contextual factors for sustainable supply chains.

Identification of aspects for further research in relation to the overall purpose of the present study.

Gallea et al. (2012) called for more in-depth case studies to expose further factors in the relationship between corporate responsibility and its influence at the functional level of the supply chain (p. 80), as well as for further research on the “influence of corporate responsibility in other functional areas of the firm” (p. 90).

Mollenkopf et al. (2010, pp. 20-31) conducted an extensive literature review to examine the concurrent implementation of green, lean and global supply chain strategies. Research agendas were proposed for (1) the need for theoretical application, including cross-functional and inter-organizational involvement; (2) need to strategically integrate functional knowledge and a call for managers to “move beyond their siloes, considering the entire supply chain and all of its
participants;” (3) the need to develop a systems approach to “encapsulate the complexity of the supply chain;” and (4) the need for applied metrics and measurement methods.

**Cluster 3: Operations Management and Content-Oriented Research**

The articles gathered under this cluster are characterized, first, by their adoption of the content type of research. These studies aim to demonstrate the use of diagnostic tools to determine which activities create value for consumers at every stage of the supply chain stage and then to compare this value to the greenhouse gas emissions attributed to these activities (Soosay et al., 2012). They address the intersection of environmental logistics measurements and performance measurements (Björklund et al., 2012); propose a “sustainable scanning model” with a scope and targets (Fabbe-Costes et al., 2011); examine the drivers and essentialities of SSCM (Gopalakrishnan et al., 2012); examine the factors influencing the greening of supply chains (Holt and Ghobadian, 2009); develop a supply chain model using a discrete event simulation (Jaegler and Burlat, 2012); aim to empirically evaluate the effects of firm-specific resources and capabilities on SSM and sustainability performance (Paulraj, 2011); empirically test the relationships between a country’s supply chain strength and its dimensions of sustainable development; and examine the impact of environmental collaborative activities on manufacturing performance using regression analyses (Vachon and Klassen, 2008).

The studies focus on the directions of corporate decisions made within a network. For example, the approach of Soosay et al. (2012) made it possible to identify priority areas and bottlenecks, thus facilitating a more effective resource allocation that takes into account tradeoffs between customer value and CO₂ emissions. Fabbe-Costes (2011) based the research in environmental scanning and added a supply chain perspective. Gopalakrishnan et al. (2012) explored the company level and worked from systems, processes, and structural elements. Holt and Ghobadian (2009) distributed questionnaires to 60 manufacturing companies in order to identify the companies’ GSCM operational activities and pressures. Jaegler and Burlat (2012) studies nodes and provided variables for discrete event simulation, such as manufacturing capability, locations, modes of transportation, and types of products. Paulraj’s (2011) findings supported the significance of internal resources and capabilities in managing SSC and organizational sustainability.
There are two articles that cover the intersection of the supply chain and operations management perspectives:

In their framework, Björklund et al. (2012) attempted to combine measurements of managerial levels in a logistics management system (which is considered to be vertically integrated) and to measure across the supply chain (horizontally integrated performance measurements).

The Vachon and Klassen’s (2008) article examined the impact of environmental collaborative activities on manufacturing performance. The authors assessed the upstream (towards suppliers) and downstream (towards customers) influences of environmental collaborative practices. They included such aspects as joint environmental goal setting, shared environmental planning, and working together to reduce pollution or other environmental impacts.

Identification of aspects for further research in relation to the overall purpose of the present study

The results of Paulraj (2011) suggested that the “strategic purchasing function alone cannot help in achieving the lofty goals of sustainability” (p. 19)—and, as one of the directions for future research suggests, “also include internal (firm-level) sustainability competency to understand its broader importance in promoting Sustainable supply management” (p. 31). Fabbe-Costes et al. (2011) took their point of departure from environmental scanning and added a supply chain perspective. The authors suggested viewing SSCM in its highest degree of complexity, where it comprises “many traditional business function areas, including purchasing, logistics, operations, and marketing” (p. 229).

**Cluster 4: Operations Management and Process-oriented Research**

Research under this cluster takes a process perspective and investigates sustainability from the operations management perspective. Alvarez et al. (2010) responded to the call to study the dynamic aspects of collaboration in inter-organizational networks. In particular, they studied the creation and evolution of governance mechanisms in a multi-stakeholder supply chain sustainability initiative. The study found that, in contrast to existing literature starting from the sustainability initiative, governance mechanisms relied mostly on informal
mechanisms that were often not explicit and that could be identified through self-regulation, such as norms, conventions, standards, informal cultures, and social bonds. Formal governance mechanisms, such as control and reporting systems, incentive systems, and standard operating procedures, were incorporated into relationships from the latter stages of the sustainability initiative (Alvarez et al., 2010). This article took the perspective of operations management to study the multi-stakeholder supply chain sustainability of Nestle’s Nespresso division.

Corbet and Klassen’s (2006) research article presented a review and synthesis of previous research, in which the authors extrapolated from the developmental paths of total quality management SCM to suggest future directions for environmental research. Certain aspects of their investigation were devoted to the analysis of how environmental management was expanding to the horizons of supply chain management.

Identification of aspects for further research in relation to the overall purpose of the present study

This cluster includes only two articles and is, thus, underrepresented in the field of SSCM research. Since there exists a managerial need to gain deeper insights into what is happening in the implementation of sustainability strategies, as well as calls from researchers in SSCM (identified in the other clusters of analysis), the cluster is suggested as a focused area for achieving the overall purpose of the study. Therefore, the present study takes the strategy process-oriented and operations management perspectives in order to fill the identified research gap and enrich our understanding of SSCM.

3.2.3. LITERATURE ANALYSIS IMPLICATIONS

This section summarizes and concludes the results and findings of the literature review and proposes directions for further research, considering the overall purpose of this study (as defined in the introduction).

Firstly, the literature analysis results reveal that sustainable supply chain management research is currently thriving and encompasses a myriad of research trends. In this literature review, four clusters with specific characteristics were delineated: (1) supply chain management/content-oriented research; (2) supply
chain management/process-oriented research; (3) operations management/content-oriented research; and (4) operations management/process-oriented research. A research gap was found in cluster (4).

The focused analysis of the extant literature shows that, with regard to sustainability practices in supply chains, the existing research primarily covers the technological aspects, developed tools, and content of sustainability strategies; studies the impacts, drivers, motives and triggers for sustainable intent; develops tools and methodologies for sustainability evaluations in supply chains; estimates the impact of the use of operational procedures; identifies different types of context factors that trigger sustainability implementation; and investigates behavioral issues. Few studies are dedicated to investigating sustainable practices in supply chain operations from an organizational perspective, examining the cross-functional and cross-organizational interactions with a process perspective on sustainability strategy implementation.

Though some studies partly take organizational issues into account (for example, Bowen et al., 2001b; Gallear et al., 2012; Shi et al., 2012), they do not investigate the supply chain functional level from an integrated, holistic perspective, and they do not study cross-functional issues at the supply chain operational level when sustainability is implemented.

To address this research gap and respond to the calls to add a holistic perspective and view the supply chain in its complexity (Fabbe-Costes et al., 2011), to develop a systems approach to study the complexity of supply chains (Gallear et al., 2012), and to examine the integrated business model of supply chains (Wu et al., 2014), I suggest taking into consideration the integration and coordination that occurs both across company functions and across companies when investigating the implementation of sustainability in supply chain operations. These must be seen as factors in overcoming the complexity of supply chain management, which is caused, in conjunction with other factors, by the new strategic agenda of sustainability.

To investigate these issues and address the gap concerning the lack of cross-functional integration and coordination, I propose adding an operations management (i.e., cross-functional aspects) manufacturing network perspective as a
point of departure for studying the complexity of sustainable supply chain management (Rudberg and Olhager, 2003). Thus, I investigate how a company’s formulated sustainability strategic intent is translated into supply chain operations and what is going on in this translation on both a cross-functional and a cross-organizational level. In this way, I study sustainable supply chains not only from the logistics and operations management perspectives separately, but also from a combination of these two perspectives.

Secondly, the focused literature analysis reveals that there is a lack of empirical studies that investigate, in detail, the process of how sustainability is translated into supply chain operations and how this process affects supply chain operations (Marchet et al., 2014; Schneider et al., 2014). Though some empirical studies investigate practices of sustainable supply chain management (for example, Alvarez et al., 2010; Bowen et al., 2001a; Colicchia et al., 2011; Gopalakrishnan et al., 2012; Walker and Jones, 2012), these studies mostly investigate the impacts of implementation, strategy formulation, and the relationship between strategy and performance; investigate the drivers of environmental behavior; and describe existing practice. They do not study implementation in detail, and nor do they incorporate cross-functional organizational factors when implementing sustainability in ongoing supply chain operations. Calls have been made to address this gap in the literature (Hald, 2011; Linton et al., 2007; in Pagell and Wu, 2009; Winter and Knemeyer, 2013).

Therefore, I suggest that research should take the process perspective when studying the implementation of sustainability in supply chains and explore in detail the implementation of sustainability by taking the organizational, managerial perspective and examining both cross-organizational and cross-functional issues. That is, in order to study the phenomenon, I seek to investigate what is going on and why when a sustainability strategic agenda is implemented. To be more specific, I suggest investigating, for instance, how companies in the supply chain (i.e., buyers and suppliers) and different functions change their operational practices and interactions.

Finally, the results of our literature analysis show that there is paucity of theory usage and that current research is predominantly practice-driven. This finding is also supported by calls in the literature for more theory-building research (Carter
and Rogers, 2008; Carter and Easton, 2011; Hassini et al., 2012). Theory development is considered to be imperative for the maturity of any scientific field (Burgess et al., 2006; Kuhn, 1970; Wacker, 1998). Therefore, for future research, I suggest taking steps towards theory building. For this study, this means that, while exploring the implementation of sustainability in supply chain operations, I place emphasis on understanding why sustainability implementation occurs the way it does, what the main factors are, what prevents implementation, and what the means and ways to implement sustainability are. In this way, the present research provides rich insights into what is happening in sustainability implementation, while also providing some explanations for these occurrences. In so doing, it advances current theory and has implications for managerial practice.
Due to increasing interest among organizations and academia, the research field of sustainable supply chain management is currently prospering (Beske and Seuring, 2014; Walker et al., 2014). This stream of research includes many topics, perspectives, trends, and directions (Sarkis, 2012; Wilkinson et al., 2001). Despite the widespread acknowledgment of SSCM as a separate research field with a multifaceted and multidimensional research domain, many researchers have pointed to various field shortcomings in empirical research, such as a lack of theory advancements or a scarcity of managerial implications in terms of explanatory power and practical relevance for supply chain managers (Carter and Easton, 2011)—both in the theory-building and the theory-testing arenas (Carter and Rogers, 2008; Seuring and Müller, 2008a; Walker et al., 2014).

To answer this call, this study adds to the development of the SSCM research field by providing a deeper understanding and explanation of what is going on when sustainability is translated from a corporate strategy level to the level of the ongoing supply chain. I study sustainability initiatives and the process of how they are implemented in a company, discussing these topics from an organizational perspective. The aim of the study is to explore what is occurring in an organization and how sustainability initiatives are implemented. In order to acquire in-depth knowledge about the process, the investigation was conducted in iterative steps until the point of saturation was achieved.

4.1. BOUNDARY OF THE RESEARCH

Given the many research trends and directions in the SSCM research domain, it is useful to identify boundaries, narrow down the research arena, and show exactly where contributions will be. A comprehensive multidimensional framework (Sarkis, 2012) is used to explain the boundaries of this research.

To answer the research questions and to cover the problem formulation context, I have narrowed down and defined the research boundaries, as shown in Figure 4-1.
In the research, I investigate how relationships among the different components of a system (i.e., organization, supply chain, and functions) change and identify which relations have the greatest impact on the system when a sustainability agenda is to be implemented.

4.2. SUPPLY CHAIN MANAGEMENT

As several different approaches to supply chain management exist, for the purposes of this study, I define SCM as follows:

…the systemic, strategic coordination of the traditional business functions and the tactics across these business functions within a particular company and across businesses within the supply chain, for the purposes of improving the long-term performance of the individual companies and the supply chain as whole. (Mentzer et al., 2001, p.18)

In other words, SCM is concerned with the orchestration of diverse business functions involving incongruent priorities within a company and across a number of companies, all of which are engaged in the mutual pursuit of serving the performance objectives of the overall supply chain.

Cross-functional and cross-organizational nature of SCM.

A supply chain is seen as a network of connected and interdependent companies, or business units, from suppliers to end users (Christopher, 2011; Lambert et al., 2005). I support the view that, in order to achieve cross-functional and cross-
organizational integration, a company must adopt a process perspective and implement cross-functional business processes (Cooper et al., 1997; Lambert et al., 2008; Lambert et al., 2005). However, the process approach should not exclude functional division within the company, since functional departments possess expert knowledge of specific operations (Lambert et al., 2008). In this research, I aim to provide some clarity regarding the role of logistics in cross-functional integrations that occur within and between companies in a supply chain when sustainability is implemented as a strategic agenda in ongoing supply chain operations.

4.3. ORGANIZATIONAL INTEGRATION AND COORDINATION

The foundation for this research is the organizational perspective, through which I view supply chain management as the management of complex networks of inter- and intra-organizational relationships in a cost-effective, value-adding chain (Bartlett and Ghoshal, 1993; Christopher, 2011).

The greater need for integration that occurs when an organization becomes more complex and differentiated has already been established (Child, 2005; Galbraith, 1977; Oliva and Watson, 2011). Child (2005) defines integration as “a condition in which there is adequate coordination between the different, but complementary activities that collectively create value” (p. 139) and discusses some of the areas in which integration problems can arise. In this study, the alignment of sustainable corporate and operational strategies takes place when a sustainability agenda is pursued; therefore, integration problems may occur between functions that support the implementation of sustainability initiatives and functions that actually implement these initiatives in practice.

Need for coordination.

Several authors view supply chain management from a cross-functional and cross-organizational perspective. These authors conclude that the cross-functional and cross-organizational nature of supply chain management raises the challenge of integrating and coordinating processes and functions (Cooper et al., 1997; Ellram and Cooper, 1993; Kahn and Mentzer, 1998; Lambert et al., 2005; Mentzer et al., 2001; Oliva and Watson, 2011). The integration, alignment, cooperation, and coordination of functions and process within a company and across companies
describe the various ways of overcoming functional silos, minimizing mismatches between functions’ different strategic priorities (performance indicators), and achieving effective SCM (Christopher, 2011; Cooper et al., 1997; Lambert et al., 2008; Lambert et al., 2005; Oliva and Watson, 2011; Schneider et al., 2014; Simatupang et al., 2002). I take the process perspective to study the activities aimed at implementing sustainability in SC; thus, I find it relevant to consider the term “coordination.” Coordination is defined, in the supply chain context, as the act of managing interdependencies both among business function activities within a single company and among companies in a supply chain for the achievement of overall supply chain goals (Malone and Crowston, 1994; Simatupang et al., 2002).

4.4. RESEARCH QUESTIONS

Given the overall research purpose and the scope and frame of the research, the following research questions were developed:

*Research Question 1. What are the current organizational barriers to sustainability and how do they impede companies in implementing and anchoring sustainability in their supply chain practices?*

*Research Question 2. How does a new agenda of sustainability affect supplier-buyer relationships?*

*Research Question 3. How does operational coordination between suppliers and customers change with the introduction of a sustainability agenda?*

To answer research question 1, this study seeks to examine the current organizational set-up and traditional key performance indicators, as well as to discuss how sustainable initiatives were approached and motivated in the different parts of the supply chain operations. Moreover, the study attempts to identify challenges in embedding sustainable development in ongoing supply chain operations; establish patterns of organizational changes in response to the need for more sustainable manufacturing practices; and, finally, suggest a solution. This question is addressed in PAPER 1, presented in Chapter 8.
To answer research question 2, this study maps the interface and connections between suppliers and buyers, examining how far suppliers and customers penetrate one another’s processes when sustainability targets are introduced. Then, the study establishes the patterns of change in relationships that occur in response to the need for more sustainable practices. Finally, the research identifies contingencies in buyer-supplier relationships and presents a model that will help companies make the right choice concerning the types of relationships to establish with suppliers when sustainability is on the agenda. This question is addressed in PAPER 2, presented in Chapter 8.

To answer research question 3, the study examines operational coordination as one of the characteristics of buyer-supplier relationships. It maps the interface and connections between the supplier and buyer and examines how far suppliers and customers can penetrate into one another’s processes. Further, the decoupling points concept is used to discuss and explain how buyers’ new sustainability targets change the locations of decoupling points and how these changes affect supplier-buyer relationships. This question is addressed in PAPER 3, presented in Chapter 8.
CHAPTER 5. METHODOLOGY

This chapter describes the research strategy used to study the implementation of sustainability in ongoing supply chain operations. Building on the defined research scope and the research questions in Chapter 4, this chapter provides further methodological considerations. Namely, it describes the case study research design, the case selection, the data collection, the data analyses, and the applied research criteria.

5.1. CASE STUDY RESEARCH DESIGN

The case study approach has been chosen as the most appropriate methodology for answering the research questions. The case study research methodology has been widely applied in SSCM and SCM research in recent years (Seuring, 2008). The strength of this qualitative empirical research is its ability to use a flexible research strategy to investigate a phenomena in their real-life contexts (Eisenhardt, 1989; Seuring, 2008; Yin, 2004). The argument for this choice is that the study focuses on exploring the sustainability phenomenon in the context of ongoing supply chain operations, which is a relatively new area in scientific research in which there has been little progress in theory building (Carter and Rogers, 2008).

This study aims to understand what is happening in ongoing supply chain operations and to create new knowledge for the implementation of sustainability within supply chain operations. Hence, the approach of this study is theory building.

On a methodological note, this research can be considered a step in a theory building process; at this stage of a normal research cycle, the outcome is a conceptual framework (see Figure 5-1) (Meredith, 1993).

As a methodological approach to theory building through case study, I applied the “conceptual induction” method (Meredith, 1993). In so doing, I analyzed a number of occurrences of the phenomenon (i.e., several sub-cases of successful and unsuccessful initiatives of sustainability strategies) to find an explanation of the
phenomenon through the relationships observed among system elements. Further on, I describe the phenomenon and explain how it occurs.

5.2. SELECTION OF CASES AND UNIT OF ANALYSES

When choosing a company for the study, I initially looked for information in public sources (e.g., newspapers, websites) to select companies that showed an interest in sustainability and CSR areas. The list of companies was then reduced based on the criterion of a global presence of production facilities and suppliers. At the end of this process, I identified only one company that had showed engagement with sustainability activities over the last 15 years, that could be considered a frontrunner in its industry in terms of social and environmental performance, and that was also willing to provide access and data to support the study. In the Danish context, the case company represents an extreme case not only with regard to its focused efforts and ambitious goals to establish sustainable operations, but also with regard to the complexity of implementing the new agenda in the supply chain. The extremity of the case context enables me to study the phenomenon at its edge—and, thus, makes it likely that the study will reveal more information (Yin, 2004).
5.3. DATA COLLECTION

The data collection process was carried out in three phases.

In phase one (see Table 5-1), interviews with the manager responsible for supporting the implementation of sustainability in the company were conducted. The interview-based data collection was supplemented by additional data through e-mail correspondence. Empirical data were acquired in relation to the processes of formulating sustainability strategies, supporting the implementation of sustainability initiatives, and reporting to corporate strategic functions. During phase one, necessary knowledge about sustainability initiatives was obtained, and process stakeholders were defined. Moreover, a semi-structured interview protocol (see Appendix A) was developed to conduct further focused interviews.

Table 5-1 Data collection, single in-depth case-study: Phase one

<table>
<thead>
<tr>
<th>Department</th>
<th>Interviewed position</th>
<th>Sustainability focus</th>
<th>Data</th>
</tr>
</thead>
<tbody>
<tr>
<td>Global environment and safety</td>
<td>Manager</td>
<td>Support for processes of implementation of sustainability initiatives</td>
<td>Correspondence Preliminary interviews</td>
</tr>
</tbody>
</table>

In phase two (see Table 5-2), semi-structured interviews were conducted according to the seven sustainability initiatives (projects) in the case company. These interviews were supplemented with additional internal documentation and quantitative data.
### PHASE TWO

<table>
<thead>
<tr>
<th>Department</th>
<th>Interviewed position</th>
<th>Sustainability focus</th>
<th>Data</th>
</tr>
</thead>
<tbody>
<tr>
<td>Global logistics</td>
<td>Logistics manager</td>
<td>Global reduction of CO₂ emissions through transportation</td>
<td>Semi-structured interviews Documentation</td>
</tr>
<tr>
<td>Global environment, health and safety</td>
<td>Manager</td>
<td>Global motor and pump replacement</td>
<td>Semi-structured interviews Documentation</td>
</tr>
<tr>
<td>Global purchasing, head office</td>
<td>Purchasing manager</td>
<td>Embedding CSR requirements into supplier relationships management</td>
<td>Semi-structured interviews Documentation</td>
</tr>
<tr>
<td>Production technology management</td>
<td>Process consultant</td>
<td>Meeting environmental requirements for machinery</td>
<td>Semi-structured interviews Documentation</td>
</tr>
<tr>
<td>Production of pumps</td>
<td>Production manager, environmental manager</td>
<td>Energy stream value mapping, using lean tools for lean production</td>
<td>Semi-structured interviews Documentation</td>
</tr>
<tr>
<td>Global technology center</td>
<td>Environmental engineer</td>
<td>Developing technology projects focusing on sustainability</td>
<td>Semi-structured interviews Documentation</td>
</tr>
<tr>
<td>Global production improvement; group lean production</td>
<td>Process manager</td>
<td>Implementing sustainability in production improvement</td>
<td>Semi-structured interviews Documentation</td>
</tr>
</tbody>
</table>
Following the analysis and triangulation of existing data, additional interviews were needed to gain more information to ensure data quality. Thus, additional data were collected in phase three (see Table 5-3), during which clarifying and additional information was obtained.

Table 5-3 Data collection, single in-depth case-study: Phase three

<table>
<thead>
<tr>
<th>PHASE THREE</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Department</strong></td>
</tr>
<tr>
<td>----------------</td>
</tr>
<tr>
<td>September 2012 – April 2013</td>
</tr>
<tr>
<td>30.04.2013</td>
</tr>
</tbody>
</table>

A semi-structured protocol offers the flexibility to focus on what is unique within each department (Kvale, 2008). This played an important role in understanding how sustainability issues were addressed in different parts of the supply chain and facilitated a deep view into the unique conditions of each department in order to reveal the specific and unique barriers of each subcase. The in-depth interviews were conducted mostly as “group” interviews; the data were recorded through audio-recordings, and written notes were taken. Internal corporate documentation
and qualitative data were also collected to support the information acquired in the interviews and to analyze the case. A certain amount of knowledge, including valuable case information, was acquired through e-mail correspondence; these data were also documented and archived. Together, all of the data formed a dataset for the case, consisting of both digital and printed material.

5.4. DATA ANALYSES

The case study consisted of six subcases, mirroring the different stages of supply chain management and their key support functions: the product development department; the purchase department; two production companies (one recently established and, therefore, more likely to be up-to-date with technology, and one with a long history that less likely to have undergone a technological upgrade); the process technology department; and, finally, the environmental department. These sub-cases differ both in terms of the approaches they apply to sustainability and in terms of their interactions with other parties in the supply chain. In practice, the data analyses followed the steps described by Creswell (2009), which can be seen in Figure 5-2.

First, individual case analyses were conducted to structure, define, reduce, and understand the information in each case. Secondly, cross-case analyses were conducted in order to identify patterns and common themes regarding the organizational aspects of implementation sustainability in ongoing supply chain operations. Finally, the key findings were presented and discussed.
CHAPTER 5. METHODOLOGY

5.5. RESEARCH QUALITY CRITERIA

The case study research methodology has been widely applied in SSCM and SCM research in recent years (Seuring, 2008). While the strength of this qualitative empirical research approach is its ability to use a flexible research strategy to investigate a phenomenon in its real-life context (Seuring, 2008; Yin, 2004), case studies have faced criticisms related to their potential lack of rigor (Ellram, 1996; Mentzer, 2008; Seuring, 2008). To ensure the rigor and quality of case study research, Yin (Yin, 2014) proposed four criteria: construct validity, internal validity, external validity, and reliability. Each of these are discussed in turn.

Construct validity tests are used to ensure that correct and sufficient operational measures are chosen for the research. This helps to overcome researcher subjectivity (Yin, 2014). In this study, to increase construct validity, several steps were conducted. First, the composition of the study was identified by presenting the definition of SCM and describing the research scope. These topics were discussed
IMPLEMENTING SUSTAINABILITY INTO SUPPLY CHAIN OPERATIONS

using existing concepts followed by this study. The focus of this study is the implementation of sustainability in supply chain operations from an organizational perspective. Secondly, I use multiple sources of evidence: semi-structured interviews; publicly available information from company websites; and specific documents, which provide evidence of initiatives implemented by the company (e.g., a report on CO₂ emission reduction). Thirdly, the chain of evidence is established during data collection and when reporting the case study. This is done to allow the findings of the research to be traced back to the data. Specifically, research questions are coherently provided; a research protocol for the interviews is developed; the source, time, and place of data are documented, and sources of information in the reported case study are cited.

Internal validity is applied to test whether conclusions (inferences) related to causal relationships are true (Yin, 2014). Generally, in a case study, the conclusion drawn by the researcher is based on data collected in interviews, which present information on particular situations that result from earlier actions and conditions. The correctness of such conclusions may be questioned; thus, explanatory and causal studies often use internal validity tests. Since frameworks in this study include some explanatory elements (e.g., I explain why certain sustainability initiatives were either implemented successfully or ultimate failures), I consider it relevant to use an internal validity test. To test internal validity and the logic of my reasoning, I have applied pattern-matching logic when conducting the cross-case analyses of the subcases in the study. Similarly, I have implemented explanation-building when trying to explain why some of the sustainability initiatives occur, and—presuming a set of causal links—reflect critical insights.

External validity questions the generalizability of a study’s findings (Yin, 2014). It can be the target of major critiques with regard to poor bases for generalization, especially from scholars who use statistical generalizations in their empirical studies (e.g., surveys). Here, it is necessary to emphasize that this case study uses analytical generalization, in which the researcher aims to generalize from a specific case to a higher conceptual level, thus encompassing a broader theoretical domain or frame of reference (McCutcheon and Meredith, 1993; Mentzer, 2008). To enhance the external validity of my case study, I apply certain tactics. First, I chose the boundaries of the research scope and the perspectives of the study at the
beginning of the investigation and established the theoretical frameworks that were used as a canvas for the case study inquiry. Second, my empirical findings were continuously compared with other findings in the literature. These comparisons are provided in Chapter 9. Thirdly, I engaged in ongoing discussions with the participants of the interviews and with academics during conferences in order to provide a sound grounding for my findings and generalizations.

A reliability test aims to ensure that, if other researchers conduct the same case study using the same research design and procedures, the findings will be the same (Yin, 2014). The general recommendation for ensuring case study reliability is to document the procedures followed in the stage of data collection in detail (e.g., through a case study protocol) and to create a case study database. These requirements are fulfilled in the present research through the creation of a protocol (see Appendix A) and database with audiotaped interviews, summaries for every interview, specific documents, and minutes for meetings.
CHAPTER 6. THEORETICAL FRAMEWORK

Although research in supply chain management is considered to be practice-driven (Voss et al., 2002), there is a general understanding that theory development is essential for the development and maturity of any research domain (Burgess et al., 2006; Defee et al., 2010; Kuhn, 1970; Wacker, 1998). Moreover, a theoretical frame of reference is useful in case study research to facilitate improved generalizations of findings (Yin, 2014).

In the given research, I hold the view that the SSCM domain does not require “original” theories, but can, instead, draw on theories from SCM and other fields. Moreover, I believe that a single theory cannot fully explain SCM (Burgess et al., 2006) or SSCM. Thus, I suggest the application of a multi-theoretical lens, in which a combination of existing theoretical approaches is applied to my research to explain all aspects of the phenomenon and to generate new knowledge in the field.

6.1. THEORETICAL LENSES IN RESEARCHING SUSTAINABILITY

The results of recent literature reviews in SSCM show that research in the field is mainly practice-driven and that there is insufficient use of theories and limited theoretical groundings. Several calls have been made for more theory-building research (Carter and Rogers, 2008; Carter and Easton, 2011; Hassini et al., 2012). In the search for theoretical underpinnings, one can refer to Sarkis et al.’s (2011) comprehensive analysis of the GSCM literature. According to this study, there are only a handful of studies that engage in the application of theories: Carter and Rogers (2008) apply the resource dependency theory, transaction cost economics, and the resource-based view; Seuring and Müller (2008b) apply a combination of stakeholder theory, competitive advantage, performance management, and risk management; and Gold et al. (2010) apply a relational view and approach collaboration as a source of competitive advantage.
Beyond the lack of theoretical underpinnings, another issue under discussion is whether SSCM is a completely new subject in need of a new theory or whether sustainability is simply a new parameter for SCM (Beske and Seuring, 2014). Because I adhere to the latter view, I support the approach that sustainability is an additional driver of SCM (Svensson, 2007). However, because sustainability leads to new practices that differ from those of conventional supply chains in SCM (Beske and Seuring, 2014), further theory development is needed to explain the phenomenon. I assume that SSCM draws on general supply chain management literature by adding environmental and social externalities. Therefore, when researching SSCM, I suggest considering theories from the SCM research domain. Nevertheless, the literature in SCM also highlights the relative lack of theoretical work and calls for the future development of theory (Chicksand et al., 2012; Giannakis et al., 2004). Furthermore, Chicksand et al. (2012) conclude that SCM is not yet a scientific discipline and that there is no emergent paradigm in research for the field.

In my research, I have examined theoretical underpinnings and attempted to delineate existing theories because theory development is one of the necessary conditions for the development of a scientific field (Burgess et al., 2006; Kuhn, 1970; Wacker, 1998). I considered SSCM to be an applied field; thus, I adopt the approach that there is no need for “original” theories. My research emphasizes the main factors in play and identifies what prevents the translation of sustainability into supply chain operations. I use existing theoretical approaches to construct the framework for my study. This framework draws on a systems view of the supply chain management process, involving Porter’s value chain perspective and the concept of collaborative advantage based on the relative view of the firm (Duschek, 2004; Dyer, 2000), which is an extension of the resource-based view (Barney, 1991). As I have used several theories, my approach can be defined as a multi-theoretical one. The use of multiple theories is needed when a single existing theory cannot explain all aspects of what is happening in the phenomenon.

Though I hold the view that SSCM as a body of knowledge does not require new, original theories, I also acknowledge that, in order to conduct solid research incorporating of various perspectives in the SSCM field, there is a need for a theoretical tool. This theoretical tool should include some set of epistemological
principles that clarify how knowledge in the field can be constructed. In this way, the theoretical tool provides research guidelines, outlining a model of how to gain knowledge in a logically consistent manner.

A suggested solution for this may lie in the fact that the theoretical background for SSCM can be described through meta-theory, or the “theory of theories” (Tsoukas, 1994, p. 290). Since I was unable to find any attempts to draw on meta-theory in SSCM, I would suggest that, in future research, systems theory should be employed as the meta-theory for the field. In the research on SSCM, systems theory can be applied as a process of meta-synthesis—that is, a process involving multiple theories that can be combined to describe and explain different aspects of the research theme (Denyer et al., 2008). In this case, systems theory is used as an epistemological approach to provide a guideline of how to view aspects of the field (Checkland, 1983).

6.2. VALUE CHAIN PERSPECTIVE AND COLLABORATION

The value chain concept (Porter, 1985) rests on a view of the organization as a linked chain of value-added discrete activities (e.g., developing, producing, delivering, and supporting products). It “disaggregates a firm into its strategically relevant activities in order to understand the behavior of costs and the existing and potential sources of differentiation” (Porter, 1985, p.33).

Christopher (2011) argued that the supply chain becomes the value chain and that value (and cost) is created by all the companies that are connected to one another through a network. The logic of this statement lies in the idea that, when a company makes a decision to outsource some of the activities in its value chain to suppliers, the decision does not give the company itself any real competitive advantages in these outsourced activities. Instead, the value chain of the company becomes a supply chain with the aim of providing superior value to customers.

Later, researchers recognized that real competition does not occur as external threats against single companies, but, rather, occurs in the context of supply chains against supply chains (Christopher, 2011; Gold et al., 2010). Following this insight, consideration was given to the process of value creation through collaborations in supply chains—both in practice and in research. For example, Vachon (2007)
IMPLEMENTING SUSTAINABILITY INTO SUPPLY CHAIN OPERATIONS

mentioned collaboration with customers as having key importance among the “green” initiatives available for companies involved in logistics and transportation activities. Marchet et al. (2014), in a recent literature review, highlighted the cooperation between a third-party logistics company and its customers as one of the key themes for implementing environmental initiatives in logistics and transportation. Therefore, in this study, the concept of value is considered relevant as a theoretical underpinning for investigation.

6.3. RELATIONAL VIEW AND CONTINGENCY

Since this study investigates the buyer-supplier relationship as it derives from the definition of the supply chain, the relational view was chosen to support the research. The framework’s background was based on the concept of collaborative advantage, which is found in the relational view of the firm (Duschek, 2004; Dyer, 2000). This concept holds that competitive advantages derive from a “…network of independent relationships developed and fostered through strategic collaboration with the goal of deriving mutual benefits” (Chen and Paulraj, 2004, p.121).

While support can be found for the idea that collaboration and partnerships are superior to other kinds of relationships, there are other approaches that suggest that multiple kinds of relationships exist that are suited to each of the specific conditions of purchasing (Dyer, 1996). I subscribe to the latter view—and, therefore, apply a contingency approach that holds that there is no single best way to manage relationships or to make decisions about design. Instead good decisions must fit the particular situation in question.

6.4. IMPLEMENTATION OF SUSTAINABILITY IN SUPPLY CHAIN OPERATIONS: PROCESS PERSPECTIVE

If companies aim to develop sustainable supply chains, they must implement strategic sustainability agendas formulated on a corporate level and integrate this implementation down to their supply chain practices. To explicitly show the approach of this study, a discussion of how sustainability strategy and operational practices in supply chain is presented in this section. Finally, the framework (Figure 6.2) that serves as canvas for the research, which investigates the problem and identifies the factors related to the organizational context, is presented. This
framework provides a simplified view of the implementation of sustainability and presents lenses through which I investigate the problem and identify the factors related to the organizational context. The implementation of strategy is illustrated in Figure 6-1 and Figure 6-2.

The framework in Figure 6-1 presents the traditional hierarchical planning approach to strategy implementation. The implementation of sustainability involves a new strategic agenda—and therefore, involves horizontal, cross-functional, and cross-organizational coordination during implementation. As a result, companies face the challenge of how to translate from the “top” corporate level (where strategy is formulated and long-term objectives are stated) “down” to the level of supply chain operations (Schneider et al., 2014; Wu et al., 2014). Therefore, in the framework, an “alignment” link is drawn from “corporate strategy long-term objectives,” where top management sets overall guidelines and strategies, to “supply chain operations midterm and short-term objectives.” This shows that overall organizational goals are aligned with the goals of each department or supplier in terms of the stakeholders’ primary processes or activities (Evans and Lindsay, 2012). This framework indicates that strategy drives processes and that much emphasis is attributed to the feedback mechanism, which is depicted as a “review” in the figure.

An alternative view of strategy implementation can be found in Mintzberg et al. (1998). The authors highlight that, in the process of translating intended strategy into realized strategy, the strategy is influenced by experiences learned from day-to-day practices (Figure 6-2.) In other words, intended strategies are influenced by emergent strategies on a continuous basis.

Linking strategy with operational daily practice is considered a factor of implementation (Serdar Asan and Tanyaş, 2007). I also use the approach of the strategic management tool Hoshin Kanri to develop the framework. Hoshin Kanri (Akao, 1991) is a systematic approach to organizing the deployment of organizational strategies down to the daily working level (Witcher and Butterworth, 1999), and it is considered to be valuable in aligning objectives on a functional level with overall company goals. It is a process-based approach that supports the development, communication and implementation of strategies, and it is means-oriented (Evans and Lindsay, 2012; Serdar Asan and Tanyaş, 2007).
IMPLEMENTING SUSTAINABILITY INTO SUPPLY CHAIN OPERATIONS

Figure 6-1 Sustainability implementation in supply chain operations

Figure 6-2 Implementation of sustainability strategy—process perspective
The “cross-functional and cross-organizational alignment and coordination” portion of the diagram presents the ongoing systematic activities in relation to the particular process of translating from strategic goals to operational activities. There are no concrete formulated actions; instead, there is a process of iterative communication with other departments and organizations (Witcher and Butterworth, 1999). The framework mirrors the PDCA (plan-do-check-act) cycle, which prescribes a method of controlling and improving activities (Wood and Munshi, 1991) that correspond to the alignment, integration, review, and formulation of strategic priorities.

In this research, I have applied this framework (Figure 6-2) as a lens through which to examine the details of sustainability implementation. I am particularly interested in understanding and explaining the means (ways) of successful implementation of sustainability in supply chain operations. This framework helps to emphasize detailed research on what is occurring within a supply chain when sustainability strategies are implemented, allowing an understanding beyond that of a traditional planning strategy perspective.
CHAPTER 7. DATA: IMPLEMENTING SUSTAINABILITY IN A GLOBAL SUPPLY CHAIN—THE COMPANY CASE

This case presents a detailed account of the efforts of a large Danish manufacturing company to introduce an ambitious sustainability agenda in its ongoing supply chain operations. The aim is to develop a deeper understanding of cross-functional coordination and integration, governance mechanisms, and operational practices related to the introduction of a highly ambitious sustainability agenda in a company supply chain.

7.1. PROLOGUE

“If we want to be environmentally friendly, we can cut volume transported by airfreight,” said the logistics manager, pointing to the results of the project for mapping CO2 transportation emissions. “There are two benefits here: we reduce our CO2 emissions, but we can also save a lot of money.” The measurements in question found that one-third of the company’s overall CO2 emissions came from transportation. Moreover, airfreight accounted for only 1% of total transportation volume, but contributes 33% of CO2 emissions (see Figure 7-1).

The first diagram on Figure 7-1 shows the share of transportation volume in tons for each type of transportation. The second diagram shows the percentage of CO2 emissions for each type of transportation.

From the perspective of the logistics department, despite clear motives to implement sustainability in ongoing logistics operations, in practice, sustainability efforts faced challenges related to other stakeholders in the transportation process—namely, case company production companies: “Each company has standard lead time. And we cannot change it. If we need to go into [the] reduction of CO2 emissions, and it will mean increasing lead time or cost, then we cannot have this project” (logistics manager).
This example demonstrates some of the issues faced by many different supply chain functions when trying to anchor a sustainability agenda within company operations. First, each department has its own perspective on sustainability; for example, in this case, the logistics department considered sustainability in terms of CO₂ emissions from transportation, the purchasing department demanded that suppliers comply with CSR requirements, and so on. Moreover, each function had other strategic performance objectives that were crucial to achieving and sustaining the company’s competitive advantages, such as cost and delivery time. Thus, when attempting to implement sustainability in its ongoing supply chain operations, the case company faced the challenge of how to align these different perspectives across functions in order to reach the goal of a sustainable supply chain.

The need to organize adequate coordination between functions was also driven by a situation in which no single particular department in the company was given the mandate of working on sustainability projects. Instead, sustainability was set as an overall value and goal for the company, and all employees were expected to work towards it. Thus, in order to implement sustainability initiatives, each department (function) had to rely upon and collaborate with other functions. Such a situation raised the issue of how to coordinate the different but complementary activities of different functions in the supply chain in order to create overall value.
In this case study, I describe some of the main functions of the supply chain that contributed to the development of sustainability and overall company performance. I then trace how these specific functions engaged with other functions in the process of sustainability implementation.

**Evolution of Sustainability in Case Company**

The company examined in this case study is a Danish manufacturer of a wide range of pumps and systems for water applications (e.g., irrigation, heating, and wastewater treatment) in industry. The company has a global presence in all its value chain functions, employs more than 15,000 people in over 50 countries, and holds a leading position in its industry in terms of both technology and global market share.

The company’s work with a sustainability agenda can be traced back to late 1960s, when the first “flex workshop” was introduced. This workshop enabled the company to employ people with reduced working capacity, disabilities, or long-term unemployment. In those days, the case company’s initiatives rested primarily on the vision of the company’s founder, who established the case company in 1940s based on the values of responsible thinking and “paying back” to the community. These values are still fundamentally important to the company.

Since then, changes in the manufacturing environment have directed the company to see sustainability not only as a social responsibility, but also as a potential business strategy. This shift has sparked many initiatives to improve product designs for effective energy use, as well as to improve conscientiousness regarding working with rare materials at risk of depletion (*Internal documentation: Group Environmental Report, 1998*). At the time, the case company pursued several sustainability projects that were implemented primarily as stand-alone initiatives and that showed excellent results, but with effects limited to individual products or processes (*Internal documentation: Sustainability Report, 2010*).

In its attempt to achieve cross-organizational effects, the company became certified according to the international environmental standard ISO 14001 and completed its European EMAS registration in 1996. In 2006, the company launched its highly efficient A-labeled circulator pump, adding several groundbreaking product
technologies that have slowly been embedded into the overall product program. In the same year, the company’s first sustainability report was released, adding numbers to the company’s stated intentions. Furthermore, the company has supported the UN Global Compact since 2002; the company Code of Conduct was signed by its group of senior executives in 2006; and since 2007, the company has been a member of the World Business Council for Sustainable Development (WBCSD) (Internal documentation: Sustainability report, 2010).

With customer demands for sustainable solutions and practices expected to grow, the company decided to pursue its sustainable agenda even more intently. In 2008, the company’s top management upgraded sustainability to a key strategic goal. The sustainability strategy was formulated and visualized in the commitment noted in corporate strategic intent, which stated: “We will never emit more CO₂ than we did in 2008” (Internal documentation: Sustainability First – our Response to Climate Challenge). This was a very ambitious target, since it came alongside an expected global growth to 75,000 employees by 2025. This also meant that the case company needed to take additional and possibly more difficult steps, particularly in relation to how to embed the sustainability agenda into supply chain operations.

The pursuit of this ambitious agenda has met with several challenges. In addition to the complexity inherent in a globally dispersed supply chain consisting of the company’s own facilities as well as those of numerous partners, the implementation of sustainability has been hindered by turbulent and uncertain market conditions. The contemporary market environment creates a situation in which companies must meet several competing and often conflicting strategic agendas. Every time a new strategic agenda is set by top management, there is a need to readdress supply chain governance. Partners from core supply chain processes and support functions must engage in different ways of carrying out tasks set by different strategic agendas—ultimately finding trade-offs if these strategic agendas are in conflict.

This case study presents cases describing two successful initiatives and several initiatives in which the effects are yet to be observed. The sub-cases differ in terms of both their approaches to sustainability and their interactions with other parties in the supply chain. These cases mirror: the initiative itself, what triggered this initiative, the key business functions involved, and how these functions engaged
with one another. Finally, it discusses the barriers that were faced and how these barriers were addressed.

### 7.2. CASE 1—REDUCING CO₂ EMISSIONS THROUGH TRANSPORTATION

In 2009, the 5th United Nations Climate Change conference took place in Denmark; this event gave momentum to the company’s initiative of mapping CO₂ emissions from transportation, which was headed by the logistics department. In relation to the motives for the CO₂ mapping project, the transportation manager noted: “The initiative was initiated by the logistic department in Denmark, but it was also about the identity of [the company]—it is value for the owners and part of leaving a better world to the future generations.”

The transportation setup of the company can be described as follows: every production company interacts with another production company, all of which interact with distribution centers. Moreover, each company ships to sales companies, which have local warehousing. Geographically, the company is divided into three “super regions:” North America, Western and Central Europe, and Asia and the Pacific. Likewise, transportation is set up on three levels: global, regional, and local.

While existing relationship linkages to transport providers, production sites, distribution centers, and warehouses produced reliable information on the transportation-related CO₂ footprint and were able to create a clear picture of how to change the transportation set-up to reduce CO₂ emissions, the logistics department was not able to put such solutions into effect on its own. Transportation was designed to comply with a primary set of requirements from production sites and other departments related to costs and lead-times. For this reason, any CO₂ emissions-reduction project initiated by the logistics function could only be achieved if it did not compromise the key criteria of costs and lead-times.

The shipping manager in the case company facility in Denmark had reports for each type of freight and could see what types of shipping were used in a given period, who received the freight, and what costs and CO₂ emissions were generated.
Airfreight was a priority issue for the sustainability agenda because just a slight reduction in airfreight volume would hugely reduce CO₂ emissions.

While the logistics department is not in control of spending, it has the responsibility for examining the totality of transport and how it can be achieved more efficiently with existing resources. In the given circumstance, shipping managers could not dictate the ways that stakeholders in the transportation process behave; however, they could try to influence them. As it was expressed:

The customer is always right, but we anyway try to challenge core assumptions in the demand pattern, asking: ‘Do you really need twenty pallets now delivered by air? Could you have only five now and the rest later? And maybe we can find some alternatives to air, some cheaper ones—for example, a combination of air and sea—to deliver the remaining fifteen pallets.’ (logistics manager)

Such a dilemma is occasionally raised by the other main stakeholders of the logistics department: the sales companies and the direct end customers. To solve such problems, it is often necessary to engage in dialogs with other stakeholders, including production companies, sales companies, and end customers. The methods used by the logistics department included: “dialog, changing awareness, involving decision-making people in different processes, being open about asking these questions… It has been a journey over the past two years to get to another mindset, to think differently, but we are getting there” (logistics manager).

The department’s work led to a CO₂ reduction of 27% from 2010 to 2011(Figure 7-2).
7.3. CASE 2—MOTOR AND PUMP REPLACEMENT PROJECT INITIATED BY THE ENVIRONMENTAL DEPARTMENT

The company’s environmental department was established in 2009 with the aim of supporting the case company’s strategy of sustainable development, as well as of facilitating and driving “change projects.” The department’s tasks also included enforcing environmental standards (e.g. ISO 14001) within the organization and initiating environmental reduction projects in cooperation with local sites. The purpose of the environmental department is “to make [the case company] a role-model for environmental considerations by 2020” (global environment and safety manager). In 2009, the department, together with top management, launched a climate strategy, setting ambitious targets with a strong focus on CO₂ emissions from internal operations. The goal was to never emit more CO₂ than the levels emitted in 2008, despite organizational and economic growth. This climate strategy was later adjusted and made part of a wider sustainability strategy, the focus of which was expanded to include significant reductions to total environmental footprints throughout the value chain by 2017.

The environmental department of the company is part of the organizational matrix structure and performs a strictly support function. Even though this department does not possess any power over the resources allocated to environmental projects, it does have the mandate of negotiation and defining yearly environmental targets for
relevant organizational units of the supply chain, hence setting the organization’s environmental performance criteria for the organization.

In translating the corporate sustainability agenda to ongoing supply chain operations, the environmental department works with the following key performance indicators of sustainability:

- CO₂ emissions
- Energy consumption
- Hazardous waste
- Waste
- Injuries

Due to the market situation in the post-recession global economy, top-priority objectives at the company’s operations level in 2012 included cost reductions, on-time delivery, and quality.

When negotiating the environmental objectives of relevant organizational units, the environmental department faces the challenge of how to make decisions that will improve environmental performance to create overall growth for the company, while simultaneously not compromising traditional operational objectives.

When discussing the deployment of the company’s sustainability strategy from a corporate perspective, two approaches should be mentioned: the balanced scorecard approach and the target letter approach. In the balanced scorecard approach, sustainability is one of five strategic themes. The case company’s production companies have the responsibility of reporting on all five themes on a quarterly basis. They must report progress on defined measurements that are evaluated based on predefined targets. There are five sub-categories under the sustainability theme: systematically implement best sustainability practices; build competencies and increase knowledge about development and learning; create showcases for solutions for energy savings and CO₂ reductions in processes; be inspired from a customer perspective; and save energy in production to decrease CO₂ from a financial perspective (Internal documentation: Sustainability in balanced scorecard). Measures, targets, and results are monitored for each.
In addition to the balanced scorecard approach, the strategy of “target letters” is also used. This means that each production site within the case company receives yearly sustainability targets. Each site then reports its progress to corporate management on a monthly basis through an internal performance management system. These targets are typically concrete reduction targets in terms of, for example, water usage, energy consumption, etc.

In 2009, the executive vice president of operations issued a memo calling for the replacement and optimization of all motors and drives in an initiative that would significantly improve the company’s energy performance and reduce CO₂ emissions. The identification, analysis, replacement, and optimization of the company’s entire installed motor base, comprising roughly 40,000 motors and drivers distributed across more than 80 subsidiaries worldwide, would require substantial resources, competencies, and commitment. Initially, the responsibility for the replacement was allocated to the facilities and maintenance staff of individual subsidiaries. However, due to a lack of resources, a fear of disturbing the production flow, and the higher prioritization of other optimization projects and tasks, the implementation of this initiative achieved only insignificant results. It quickly became evident that accomplishing the replacement effort would require a united front from the company.

A project management office (PMO) was established and given the task of configuring and deploying a program that would support subsidiary staff in realizing replacement and post-replacement goals. This program was to ensure that subsidiary staff possessed the competencies required to sustain improved performance. A team of handpicked technical experts who had demonstrated excellent results in past replacement efforts was made responsible for defining and developing a concept for how staff at the subsidiary level should carry out the replacement.

A roadmap and overall implementation plan for the program was crafted and, as the program was deployed, the PMO monitored progress through the establishment of corporate (global) and subsidiary (local) targets and objectives, which were in accordance with resource availability, budgets, capacity, etc. The staff at the subsidiaries were organized into project teams, which were given the specific task of carrying out local replacement. On a monthly basis, the PMO facilitated web
meetings, during which project teams could discuss technicalities, address challenges, share knowledge regarding the replacement, and report on their progress. The PMO served as a “center of excellence,” supporting the subsidiary project teams’ work on the replacement technicalities and monitoring the overall progress of the program. Progress was reported on a quarterly basis to a sponsoring group of senior executives, who ensured that the program received the commitment and top management attention required to realize the replacement tasks.

With the project teams working in accordance with the outlined concept and the PMO supporting and coordinating replacement on a global scale, the case company accelerated its replacement efforts fourfold and realized substantial energy reductions.

The project of pump replacement started as “two sides of the same coin,” as stated by the environmental manager of the department. The company produced energy-efficient pumps; however, in its own production, it used pumps and motors produced by competitors that were not as energy efficient. Pumps produced by the company consisted of two parts: the hydraulic part (i.e., the head of the pump) and the motor. Motors could be used for various applications—not only for pumps. For example, the company used motors for conveyor belts and ventilation systems.

Thus, the company decided to use its own technology instead of buying pumps from competitors. This approach would save energy, since the company’s pumps and motors were more energy efficient than others, while also reducing its environmental footprint. This was not an “either-or” decision; instead, the chosen direction achieved both objectives, creating a synergy between business and environmental objectives.

This initiative, which started in the case company in Denmark, ultimately became a best practice example for how to realize energy reductions on a global scale by working in unity across subsidiaries based on predefined and validated concepts.

In Figure 7-3, the status for the first quarter of 2013 is shown. At this point, seven companies around the globe were involved, and the estimated CO₂ reduction from the replacement was 3250 tons per year. This reduction responds to 36 percent of the potential estimated replacement of the company’s motors and pumps.
CHAPTER 7. DATA: IMPLEMENTING SUSTAINABILITY IN A GLOBAL SUPPLY CHAIN—THE COMPANY CASE

Realized Savings

<table>
<thead>
<tr>
<th></th>
<th>Status Q1 2013</th>
<th>Status Q3 2012</th>
<th>Status Q1 2012</th>
</tr>
</thead>
<tbody>
<tr>
<td>Companies involved</td>
<td>7</td>
<td>6</td>
<td>3</td>
</tr>
<tr>
<td>Motors and Pumps replaced</td>
<td>1887</td>
<td>1451</td>
<td>1288</td>
</tr>
<tr>
<td>Energy savings (kWh/yr.)</td>
<td>5.52M*</td>
<td>2.54M</td>
<td>2.35M</td>
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<td>CO2 savings (T/yr.)</td>
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<td>Cost savings (€/yr.)</td>
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<td>240K</td>
<td>219K</td>
</tr>
<tr>
<td>Estimated time of completion</td>
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<td>2017</td>
<td>2016</td>
</tr>
<tr>
<td>Progress (% of Group potential replaced)</td>
<td>36</td>
<td>17</td>
<td>15</td>
</tr>
</tbody>
</table>

Figure 7-3 Realized savings from the motor replacement initiative (Internal documentation)

7.4. OTHER SUSTAINABILITY INITIATIVES—CHALLENGES AND BARRIERS

The following five subcases present initiatives for sustainability implementation for which the effects are only expected.

7.4.1. CASE 3—PURCHASING DEPARTMENT

The main objective of the case company’s purchase function is to ensure the recruitment of appropriate suppliers to the organization. This is achieved through three main processes: strategic sourcing, supplier relationship management, and operational procurement management.

The first process begins with the identification of potential suppliers. The relevant information is then requested from the potential suppliers, and an internal audit covering various aspects (e.g., quality, environment, CSR management systems, etc.) is conducted. This general audit is a precondition for approval as a group
supplier. After a potential supplier is approved, negotiations begin, and the process is finalized with the signing of a contract.

The requirements for suppliers are defined in collaboration with other departments: production companies, the environmental department, and (more recently) the CSR department. However, the choice of supplier is made according to one central aspect: cost. Only after suppliers prove their ability to meet the goals for indicator do further performance indicators, such as quality, management systems, and punctual delivery, come into play.

The idea of anchoring sustainability in the purchasing process arose within the purchasing department in 2009. As expressed by the purchasing manager, the motives for embedding CSR in supplier relationships were twofold: first, this would allow the value of the company to be defined from the top level (a responsible way of doing business), and second, there was an expectation that customers would increasingly demand evidence of responsible supplies throughout the chain (purchasing manager). In response to this demand, the purchasing department developed and implemented a Supplier Code of Conduct. This is an appendix to contracts signed between the company and suppliers. The purpose of the document is to encourage suppliers to operate in accordance with internationally recognized minimum standards of human rights, labor, and the environment, as well as to make suppliers aware that the case company adheres to the same principles.

Furthermore, CSR requirements were included in a general audit in the process of strategic sourcing. In 2011, the company initiated an audit of certain suppliers according to an extensive checklist of CSR factors. The assessment checklist included comprehensive questions regarding how suppliers comply with standard norms related to:

- Labor standards
- Employment practices
- Anti-corruption and community impact

While the choice of supplier was driven primarily by a cost-benefit analysis, the results of the CSR audit were used as a validation of quality: “if we see that a
company can comply with our demands about CSR (e.g., safety), then we can be more sure about quality...I mean, usually, it goes hand in hand” (purchasing manager). The managers in the purchasing department were absolutely sure that embedding CSR would bring benefits to the company, stating that “there is no doubt we want to work with CSR: we believe it will be beneficial.”

Nevertheless, there were challenges facing the implementation of sustainability (i.e., CSR) in purchases. The first challenge involved the lack of measurements for CSR value: “How do we measure a value of CSR? And I do not have the answer. I wish I had” (purchasing manager). The second challenge discussed involved the integration of CSR into the purchase process: “Why is CSR not visible on this map? Some years back, we defined a support process, and then we removed it because we do not want to see it as a support process. But we want to see it integrated. We want to see it as a mindset” (purchasing manager).

### 7.4.2. CASE 4—PRODUCTION TECHNOLOGY (PT) MANAGEMENT

The main responsibility of PT management is to specify and develop process technologies that enable the company to maintain its competitive lead in the industry. The case company has a long tradition of basing its competitive position on proprietary process technology, and the PT department holds a strong position and reports directly to corporate management. In recent years, the PT department has been focusing to a greater extent on two key priorities: minimizing the cost of investments in production technology and minimizing the cost of operating production technology. Increasingly, PT has been moving the focus of its efforts from supplying whole packages of technology to taking responsibility for systems design. Today, it focuses the development of its own components on certain key technologies that enable the company to differentiate through production technology. As a result, the department now relies much more on external suppliers—often large, multinational suppliers of production equipment.

The primary business objective of the (PT) department is the implementation of new equipment and production systems, maintenance, and process improvements. For some time, the department has experienced growing delays in the maintenance of new equipment and systems. For example, the production department has often had to reject machinery after it had already been delivered to production because it
did not meet environmental requirements. These situations occur because, previously, only managers of production sites specified machinery requirements—and, accordingly, had the mandate to approve it. Then, new demands from other departments (e.g., the environmental department) were introduced, triggered by the sustainability agenda. As a result, managers from other departments became involved in the decision-making process. However, the lack of appropriate coordination among the different functions involved in the process has caused delays and a degree of sub-optimization.

In 2010, with the aim of reducing the implementation time for new equipment, the project was launched with the purpose of aligning all equipment requirements from different departments early in the process, when the requirements are first specified. For this reason, sustainability requirements became relevant for both the environmental department and the department responsible for working conditions. While the idea that “sustainability is a driver” was expressed by the process manager, the main key performance indicators (KPIs) related to the choice of equipment were tied to the traditional performance criteria of cost and time. Therefore, sustainability could not be considered “a goal in itself, but rather a supplement to these higher-ranking criteria” (process consultant). During the project, managers from the production technology department were engaged in interacting and collaborating with managers from other functions: the environmental department, the production company, and the department of working conditions. Given the synergy of their different competencies, the project resulted in the addition of environmental requirements to the specification list of new equipment (see Figure 7-4) (adapted from an “Equipment specification” presentation by a process consultant, personal communication, April 12, 2012).

However, one process engineer stated that defining specific sustainability demands for equipment remained a highly ambiguous issue in comparison with technical demands, arguing: “we have no good measures which specifically describe sustainability demands, whereas there are preexisting standards for other technical demands.”
7.4.3. CASE 5—PUMP PRODUCTION

In the case company, production is a broad concept, and the characteristics related to the sustainability of production facilities differ widely in terms of competencies, process technologies, and production processes. Some sites have been acquired, others have been running for many years and use outdated technologies, and still others have state-of-the-art technologies. This makes the establishment of common standards difficult—and, furthermore, it makes it difficult to propose a common roadmap for implementing sustainable practices. However, each site has a responsibility for achieving sustainability and is charged with assessing, improving, and reporting sustainability issues to the environmental department.

There is not much integration between production and sustainability: We all know the overall perspective as stated in the ‘innovation intent,’ where
sustainability is a key focus. We also know that we should not emit more CO2 than I did in 2008. And some people work on that; however, it is centralized in the environmental department. (production manager)

The above explanation shows that governance of sustainability initiatives is perceived as the responsibility of the environmental department. The main reason for this is the high priority of cost in production. As expressed by the production manager: “Due to the financial situation in Western Europe right now, we are told to reduce cost and comply with the budget as our primary concern.”

One sustainability initiative was the energy value stream mapping (EVSM) project that was implemented within the process of pump production. This project was carried out as a collaboration between the environmental department and the shop floor excellence department. The idea was to understand lean tools and how to operationalize them, with the purpose of reducing energy use. Although energy reduction was achieved through the use of lean tools and the project created an awareness related to using lean tools for energy reduction, the project’s tools are not used in everyday practice, and staff have no key performance indicators (KPIs) to follow. As expressed by the production manager: “The project was there, and now it is gone.” The sustainability agenda is not integrated with the production process because there is no systematic approach to measure day-to-day ongoing operations, and the strategic documents determining the direction of the agenda have not been developed into a sufficiently detailed plan for everyday use that makes sense from the production perspective.

In terms of production, it is acceptable to replace equipment (e.g., motors) as part of a sustainability initiative, but this must be done in such a manner that it does not interfere with the ongoing production flow—and, therefore comes into effect primarily during refurbishments or new installations. If an environmental department manager suggests changing equipment in favor of more energy-efficient solutions, and such a change would entail extra use of resources (e.g., time, people) in the department, the production manager would have to reject the change because the key management priority is efficiency and quick returns on new investments. In other words, “If corporate resources are not allocated for a specific sustainability project, there will be very limited room for it” (production manager).
Cost is the main priority in production, and production sites generally struggle to reduce costs in order to comply with their budgets. This means that there is not much room for experimentation or for taking initiatives that interfere with the production flow. One production manager stated that, because of the high focus on cost, she was forced to focus on production and traditional production KPIs, stating: “This high focus on cost is holding us back.” In order to take the next steps in sustainability, there must be some space to “be able to do some other things than just focus on production. Time and opportunity are very limited, both if you look at resources such as manpower and competence, as well as monetary resources for non-essential investments” (production manager).

If a proposed refurbishment of equipment meets only sustainability targets and does not improve efficiency in other ways, the investment is not made, and the production manager is forced to reject the project. As stated by one production manager:

That is [a] very big issue. If resources are not specifically allocated to sustainability projects, there will be no room for them in the tight budgets we operate under. Therefore, the key to success is to build a solid investment argument, where sustainability is linked to other means of efficiency, such as cost and quality.

7.4.4. CASE 6—TECHNOLOGY DEVELOPMENT: TECHNOLOGY CENTERS

The company has three technology centers (TCs) located in Hungary, China, and Denmark. The TC in Denmark plays the leading role in this network. It consists of several sections and includes the following lines of activity: discovering new technologies, developing prototypes, building specific equipment and tools, and testing equipment. The Denmark TC aims to be the preferred supplier for all production sites for the ten corporate mission-critical components in which it has required expertise; however, it is not the only supplier and is subject to external competition on most projects.

In August 2011, the department employed its first sustainability engineer, who had three main tasks:

- Developing own technology projects focused on sustainability
IMPLEMENTING SUSTAINABILITY INTO SUPPLY CHAIN OPERATIONS

- Embedding sustainability into all projects and the overall work culture
- Supporting evaluations (assessments) of sustainability-related measures

Despite strong strategic intentions towards the development of sustainable technology, sustainability is not well integrated in the development process. The main reason for this, as expressed by the environmental engineer, is that customers of the TC (i.e., the production sites and the business development department) focus on cost, quality, and performance; thus, environmental criteria are not a key priority (environmental engineer). To change this situation, the department had the intention of involving customers and other stakeholders in the early stages of the machinery development process. As a result, the department planned to formalize the procedure of sustainability assessment on an operational level in order to make it more achievable. The results of this work are shown in Figure 7-5. The department also planned to develop sustainability targets for new projects while, or before, the determination of specifications, involving customers in this early stage of development. Finally, when a project was closed, the department planned to reassess environmental targets for new projects.

![Sustainability Assessment of Technologies](image)

**Figure 7-5 Sustainability assessment of technologies (Internal documentation)**

To make this process more effective, it was suggested that the department use a guide of six questions (see Figure 7-6) to enable customers to make informed decisions about their technologies: “If you want to design a machine and want to use less energy then you have to do this and that. Then, it is much more tangible and much clearer to the people. It is about making it more practical.” (environmental engineer).
The main challenges in embedding sustainability involved the issues of how to make sustainability tangible on an operational level and how to raise awareness and sustainability within the department.

### 7.4.5. CASE 7—PRODUCTION IMPROVEMENTS

Since the sustainability agenda is one of the top priorities of the case company’s corporate strategy, the aim is to incorporate sustainability into the company’s lean manufacturing approach, which is applied across production sites to comply with efficiency measures. In this context, sustainability requirements are dealt with as a form of waste. As stated by the process manager, “every customer, internal or external, should be interested in reducing something that creates waste or has a negative impact on the environment” (process manager).

To illustrate how the company’s sustainability strategy would be implemented on the shop floor, the Company Operations Vision 2017 was developed and approved in the summer of 2012.

The challenge in implementing sustainability in production was described by a process manager as follows:

> We see the same problem with sustainability as with lean .... At the top level, we see the picture and we want to do this; but we do not realize how to
implement it in a correct way. We are talking a lot about it, but how much is it practiced? This is a problem.

The company already has a significant number of tools that can be used for both the lean approach and the value stream mapping currently applied in sustainability assessments. To implement a sustainability agenda in company operations, there is a need to formulate and visualize corporate strategy down to operations strategy. It is then important to change the behaviors of operations managers, who will lead the changes in organizational behavior and culture.

### 7.5. EPILOGUE—FURTHER INITIATIVES IN LOGISTICS

The logistics department in Denmark organizes meetings with each supplier within each transportation type at least every three months. In these quality meetings (Q-meetings), the logistics department and forwarder follow up on KPIs and general business according to local standard operational procedures (SOPs). Sustainability is also on the agenda at these meetings. Since 2011, spokespersons for forwarders have been invited to participate and to contribute new ideas for sustainable development, as follows:

> Could you come up with activities that could improve CO₂ footprints within our business? Can you see any possibilities within our frame of business and sustainability which we can put into our cooperation? It could be anything—no limitations regarding our business relationships. If we see that we can gain from this, we are ready to support the project. (shipping manager)

Such discussions with suppliers of transportation services have been fruitful and have given rise to new ideas and possibilities for how to approach sustainability (see Figures 7-7 and 7-8).

In addition to these new suggestions, there are other outcomes of ongoing discussions and cooperations with suppliers regarding sustainability. Specifically, the requirements for suppliers are changing. For upcoming tenders for transportation services suppliers, the logistics department has been invited to act as a supporting stakeholder by the management group, which owns the tender process. The logistic department has a greater knowledge and understanding of activities in the market and has raised a number of new requirements. One of these requirements involves procuring documentation that confirms policies or strategies for driving
behavioral education. The root of this new mandate is the idea that “some studies show that good driving habits lead to fuel economy and therefore less CO₂ emissions” (shipping manager). The other requirement increases the duration of contracts with forwarders up to four years. This is considered necessary because longer relationships facilitate working together on sustainability issues:

We want to have more relationships because then we can ask for cooperation, and if you have only a two-year contract and do not guarantee more to the supplier, then the relationship will be all about the money and delivering short-term performance, and suppliers will not be able [to] give you more in terms of long-term performance. (shipping manager)

Lastly, the demand for CO₂ emissions reporting has been raised. Specifically, monthly reports on CO₂ emissions data, rather than the current quarterly reports, have been requested.

The company is continuously working on sustainability issues. The logistics department has described its hands-on approach to sustainability initiatives as follows: “The whole idea is to pick the low-hanging fruits. Let’s not make things more difficult than they are already; let’s first focus on things that we can easily do.”

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<th>Suggestion 1.</th>
<th>Denmark to Australia (Adelaide)</th>
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<td>• possible significant reductions</td>
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<th>Suggestion 2.</th>
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<td>• change from Sea/Road to Sea</td>
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<th>Suggestion 3.</th>
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<td>• possible significant reductions</td>
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<td>• minor cost reduction</td>
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<td>• change from Air to Rail/Air</td>
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<td>• longer lead time</td>
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*Figure 7-7 Suggestions for 2012 to 2013 CO₂ reductions for company “Logistics 1”*
<table>
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<tr>
<th>Suggestion</th>
<th>Description</th>
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| 1.         | Aerodynamic trailers  
- possible 5% reduction on long haul  
- higher cost (lease & running cost)  
- no use on ro/ro ferry svs |
| 2.         | European consolidation of imp vol.  
- possible 2% reduction  
- increased utilization  
- no financial impact |
| 3.         | ECO road svc to Sweden  
- possible reduction 4%  
- longer lead times (better utilization)  
- no extra cost / reduced cost reachable |
| 4.         | Finland road service  
- possible reduction 10%  
- reduce number of weekly departures to 2  
- emergency orders vs daily groupage dep.  
- no financial impact |
| 5.         | UK road service by ferry  
- possible reduction 60%  
- reduce number of weekly departures to 2  
- emergency orders vs daily groupage dep.  
- no financial impact |
| 6.         | Germany via train  
- line haul reduction of 40%  
- using Hupac trailers Taulov to Düsseldorf  
- longer lead time  
- increased dist cost in Germany |
| 7.         | Import via Rail/Air or Sea/Air  
- possible reduction 10%  
- longer lead time  
- cost? |

*Figure 7-8 Suggestions for 2012 to 2013 CO₂ reductions for company “Logistics 2”*
CHAPTER 8. PRESENTATION OF PAPERS

Each paper is devoted to answering one of the research questions presented in Chapter 4. These papers fulfil the overall objective of the study: namely, to explore in detail the implementation of sustainability in ongoing supply chain operations. This is done in such a way that each paper presents a study on a deeper level. The general outline of these levels can be seen Figure 4-1 in Chapter 4.

The empirical case study contributes to the development of the SSCM research stream by providing a deeper understanding and explanation of what happens when sustainability is translated from a corporate strategy level to the level of ongoing supply chain operations. I have studied what occurs in an organization and how the implementation of sustainability initiatives takes place. This in-depth knowledge about the process has allowed me to develop three conceptual frameworks on a different levels of business systems (Figure 4-1). Through applying these frameworks I explore how the relationships among certain system components (i.e., the organization, the supply chain, and the functions) are developed and which relations have greater impacts on the system when a sustainability agenda is implemented. The frameworks for each level of analysis (each of the articles) are connected through the application of the systems approach as the epistemological approach and presented as a system framework (Figure 8.1).

One practical and managerial implication of this theoretical system framework is its provision of rich contextual information on how the implementation of sustainability is executed in a real-world situation, based on actual practice In this way, this study can encourage and inspire other companies.
Figure 8-1 System framework, showing the three different levels of analysis undertaken
8.1. BARRIERS TO THE IMPLEMENTATION OF SUSTAINABILITY IN SUPPLY CHAIN OPERATIONS

Jørsfeldt, Liliyana Makarova; Jensen, Peter Meulengracht; Waehrens, Brian Vejrøm. Barriers to the Implementation of Sustainability in Supply Chain Operations.

- An earlier version was accepted for the Advances in Production Management Systems Conference in September of 2012. It was published in the Proceedings for Advances in Production Management Systems Conference, as follows:
- The current version was submitted and was given full consideration for publication in the Special Issue of Supply Chain Forum—An International Journal (SCFIJ) in November 2013.
- In March 2014, a recommendation was given to revise the paper according to reviewers’ comments, and to resubmit the article to the regular issue of the journal.
- The critical comments and suggestions of the reviewers have been addressed to improve the research. The responses are incorporated in Chapters 2, Chapter 3, 4 and Chapter 9 of the thesis.

This paper takes the organization as a starting point for analysis and studies the links between the organization and other levels.

The first framework addresses the supply chain management process. It presents a model of a holistic, integrated system of sustainable supply chain management within an organization. The elements of the system are drawn with the approach that SCM is concerned with the orchestration of diverse business functions, which must address incongruent priorities both within the company and across a number of companies and which are engaged in the mutual pursuit of serving the
performance objectives of the overall supply chain. This study incorporates a combination of value chain analyses and functional integration in a methodology to determine organizational barriers.

The discussion is based on the given framework, which applies Kahn’s division of integration in cross-functional work and distinguishes between interaction-based integration and collaboration-based interaction (Kahn, 1996). Finally, the paper concludes with a discussion of how roles and coordination are affected by the emerging agenda.

PAPER 1 is included in PART II of the thesis.

8.2. THE INFLUENCE OF THE SUSTAINABILITY AGENDA ON BUYER-SUPPLIER RELATIONSHIPS


- The paper underwent thorough discussion at the 6th EurOMA Workshop on Journal Publishing in Operations Management (June, 2013). The authors participated in this workshop with the aim of receiving guidelines.
to develop this conference paper into a journal paper. Marie Koulikoff-Souviron, SKEMA Business School, France, and Cristina Gimenez, ESADE, Spain, acted as faculty at the workshop.

- Justified criticism has been addressed in order to improve the research. The responses to critiques are incorporated in this thesis. Specifically, they can be found in Chapter 9.

This paper presents a next level of analysis and investigates the links between the organization and the supply chain in detail, taking the buyer perspective. The buyer-supplier relationship that I discuss in this paper is a subsystem for the previous framework and investigates the phenomenon more deeply.

The elements of these frameworks were identified through the literature review via the results of a previous study on sustainability’s role in supply chain management (PAPER 1). Here, I investigate the buyer-supplier relationship as the unit of analysis. The framework’s background is based on the concept of collaborative advantage, which is found in the relational view of the firm.

This investigation aims to identify the contingencies in buyer-supplier relationships and to establish the patterns of change in such relationships in response to the need for more sustainable practices. Buyer-supplier relationships are subsystems for the previous framework and investigate the phenomenon more deeply.

PAPER 2 is included in PART II of the thesis.
8.3. THE INFLUENCE OF THE SUSTAINABILITY TARGETS ON BUYER-SUPPLIER RELATIONSHIPS: AN EMPIRICAL STUDY OF THE DECOUPLING POINTS IN THE LOGISTICS FUNCTION


- This paper has been submitted (September, 2015) and is presently being given full consideration for publication in Strategic Outsourcing: An International Journal.

Referring to the system model (Figure 4-1), this paper investigates the studied phenomenon on the micro level of the system. It analyses how the introduction of sustainability targets into supplier-buyer relationships change companies’ operational practices. The framework for this step of the research is a sub-system of the previous level, and the paper investigates the different types of operational coordination (i.e., integration or collaboration) with the help of the value offering point/order decoupling point (VOP/OPP) methodology (Holmström et al., 1999).
This case study takes the perspective of a sustainability-conscious Danish company that outsources logistics services to third-party logistics (3PLs) but maintains internal logistics as a boundary function. The research question is, therefore, more specific. It is presented in the paper as:

**RQ:** *How does a new agenda of sustainability affect the operational coordination between a supplier of logistics services (3PLs) and a buyer of logistics services (focal company)?*

The study provides rich insights into how companies manage the implementation of sustainability in supply chain operations, and it exemplifies how the VOP/OPP concept can be applied by 3PLs to develop new, sustainable offerings. I discuss how sustainability agenda changes that have been recently introduced to the supply chain affect the relationships between suppliers and customers. I also explore how moving the VOP changes customer-supplier relationships in such a way that suppliers create added value for customers.

In practice, this tool allows suppliers to decide how to move their VOPs and change supplier-customer relationships in ways that increase value (Holmström et al., 1999). My study is based on this tool, from which I developed my own framework (see Figure 8-5). This allows an explanation of what occurs in the process of sustainability implementation.
Two propositions for future research are presented based on the developed conceptual framework and discussion (PAPER 3). One of the propositions will be elaborated here.

**PROPOSITION.** The existence of a function-integrator in the deployment of sustainability initiatives has a mediating effect on the effective implementation of sustainability in ongoing supply chain operations (both across functions and across organizations).

Through this proposition, I suggest testing the role of function integrators on the successful translation of strategic intent into the actual implementation of sustainability in ongoing supply chain operations. The mediating influence of this system property can be illustrated as shown in Figure 8-6.

Here, the mediator (i.e., the function integrator) presents the properties of a system that, in this case, transforms inputs/independent variables (i.e., the sustainability strategic intent) into outcome variables (i.e., the actual implementation of sustainability in supply chain operations). It therefore seems that the existence of a function-integrator should mediate the relationships between corporate sustainability agendas and the implementation and adoption of sustainable initiatives.
PAPER 3 is included in PART II of the thesis.
CHAPTER 9. DISCUSSION AND FINDINGS

This chapter answers the overall research objective by drawing on the findings of the individual papers and the presented case study (see Chapter 7, 8 and PART II).

This explorative, in-depth case study was initiated in 2011 with the aim of investigating the phenomenon of the implementation of sustainability in ongoing supply chain operations. Initially, I worked from the pre-understanding that the case study research process would be similar to the processes of other empirical research studies. That is, I assumed that it would be linear and sequential, taking departure from the research question; progressing through instrument development, data gathering, and data analysis; and ending with dissemination (Stuart et al., 2002). In reality, though I started with a single research question and the aim of investigating the phenomenon in-depth (while, at the same time, ensuring the appropriate level of rigor in the research process) (Seuring, 2008), the actual process became iterative, with some research stages being repeated. Over time, the theoretical frameworks took form. These included explanatory elements, thus allowing the frameworks to be used to represent and explain what happens when a sustainability agenda is implemented.

During this iterative process, in addition to answering the research questions, I also observed some other aspects related to the critical areas of contemporary SSCM discussions. While these observations are not directly represented in the papers presented in the Chapter 8, they represent some critical and interesting points for discussion by providing us with a deeper understanding and explanation of what occurs when sustainability is translated from a corporate strategy level to an ongoing supply chain level. They also add valuable knowledge to the domain of SSCM.

Therefore, in order to highlight the specifics of the new knowledge that this research contributes to the SSCM domain, the following chapter outlines seven different topics of interest in this study and presents a discussion of each of these points. Each point first briefly describes the topic of the discussion and then
IMPLEMENTING SUSTAINABILITY INTO SUPPLY CHAIN OPERATIONS

presents comparisons and suggestions for further research using analyses, discussions, and observations. In this manner, the results of my research, as presented in the articles (see Chapter 8), are included in the discussions. However, the discussions are structured in such a way as to not answer the research questions directly; instead, they explore and contribute to the domain of SSCM research. This approach is taken in order to show the value of bringing new knowledge to topics contemporarily discussed in SSCM through this case study. The discussion includes observations and presents the knowledge and findings gained over the three years of the research. The aim of the discussions is to present critical new insights obtained through this study and to discuss these insights in relation to similar existing research in extant literature.

In the first subsection, I discuss conceptual frameworks developed in this study. The second subsection presents explanations and insights through discussion of means as factors in the successful implementation of sustainability in ongoing supply chain operations.

9.1. FRAMEWORKS

SSCM is accepted as a multifaceted and multidimensional research domain, informed by contributions from such well-established domains as operations management, supply chain management and environmental management. Nevertheless, there is a lack of theory advancements and managerial implications with explanatory power and practical relevance for supply chain managers in empirical research, as achieved through the theory-building process of the research cycle (Carter and Rogers, 2008; Carter and Easton, 2011; Seuring and Müller, 2008b; Walker et al., 2014).

To the best of my knowledge, in extant literature, there are two existing conceptual frameworks of SSCM. First, Seuring and Müller (2008b) developed a conceptual framework for sustainable supply chain management based on a review of the literature. This framework consists of three parts: triggers for SSCM, supplier management for risks and performance, and supply chain management for sustainable products. Another framework was developed by Carter and Rogers (2008). This framework is similar to the previously used conceptual theory building approach, and it is based on an extensive literature review. The distinctive feature
CHAPTER 9. DISCUSSION AND FINDINGS

of their study is that four complementary theories (i.e., the resource dependence view, transaction cost economics, population ecology, and the resource-based view) were integrated to build the framework. The resulting framework takes its departure from the TBL concept and suggests four supporting factors: risk management, strategy, transparency, and organizational culture. As can be seen, these two frameworks are grounded on literature reviews. In contrast, the frameworks developed in this study are based on in-depth empirical data from a single case study of a Danish company that represents an extreme case. Because extreme cases enable the study of phenomena on their edges, they are valued for contributing contextually rich and nuanced information about a variety of phenomena.

Research outcomes

One of the outcomes of this study is the three conceptual frameworks that responds to three different level of analyses undertaken (macro, meso and micro). The system framework (Figure 8-1) connects these three frameworks into one entire system model. This system framework is a conceptual model that was developed by capturing a picture of actual practice through a case study. One of the key roles of the conceptual model is to provide extended knowledge of how to incorporate sustainability into supply chain operations for real-world application.

The system framework (Figure 8-1) is one step in a theory-building process for the SSCM research domain (see Figure 5-1). While the framework must have more properties in order to fulfill all five requirements of the theory development cycle (Dubin, 1969), and while it needs to be tested and validated before it can be considered a “good” theory (Wacker, 2004; Weick, 1995), the framework can be considered a “pre-theory” because it satisfies the requirements of the “exploratory” research phase (McCutcheon and Meredith, 1993; Yin, 1989). This allows the generation of propositions to test and validate the framework so that it can eventually be developed into a complete theory.

Theory-building through the case study

I have identified the factors that appear to influence sustainability implementation in companies’ supply chains. I have also identified various components of this process and the suspected relationships among them, as well as means by which I can evaluate the practices and processes of the phenomenon. The presented system
framework (Figure 8-1) is a simplified “human interpretation” of the system’s elements and relationships in the system, which aims to describe and explain how the phenomenon occurs.

The system framework includes explanatory elements, by means of which the phenomenon and its manifestation can be evaluated in detail. Based on observations, propositions have been developed. Testing the applicability of the framework is proposed for future studies.

The system framework consists of three conceptual frameworks that describe and explain the investigated phenomenon at three distinct levels. The research process and the formulation of the research questions allowed each of the papers to be dedicated to a single research question—and, thus, to uncover in great depth the essence of the system under investigation. These concepts are used to represent and explain what happens when a sustainability agenda is translated to the supply chain level. Each of the conceptual frameworks and their in-depth analyses are presented in the articles included in this thesis (see PART II).

Because this case study is an explorative, in-depth, single case study, it was possible to develop a nuanced understanding of how organizations implement sustainability within their internal supply chain operations and external supply chain relationships. The study also aimed to explain the set of relationships in our system boundaries (see Figure 4-1). These discussions and explanations enabled the suggestion of propositions for further validation (see the next sub-chapter).

9.2. MEANS FOR THE DEPLOYMENT OF SUSTAINABILITY ON THE OPERATIONAL LEVEL—EXPLANATIONS FOR FRAMEWORKS

This subsection presents a discussion of the critical areas in contemporary SSCM research. The discussion is based on the overall research results, which highlight the means (ways) of sustainability deployment (see Figure 6-2). Hence, the subsection includes a further elaborated discussion of the results presented in the papers, which is supplemented with other aspects of the critical areas of contemporary SSCM research that are not directly represented in the papers. The subsection begins by presenting a sustainable-purchasing portfolio, which takes its point of departure
from the Kraljic frameworks (Kraljic, 1983) and applies a contingency approach. I then discuss how functions and companies are linked in the implementation of sustainability initiatives. The next point emphasizes the measurement and metrics used in SSCM. Afterwards, I consider questions related to different strategic agendas and trade-offs in the decision making process. Finally, I address the theme, “does it pay to be green?”

### 9.2.1. VARIETY OF PURCHASING PORTFOLIOS

Purchasing is generally recognized as a function with a strategic role that enhances a company’s competitive position (Chen and Paulraj, 2004; Gelderman and van Weele, 2005). Many companies in today’s global competitive landscape face the need to respond to new sustainability agendas and to balance several strategic goals, including sustainability. Hence, purchasing function, which primarily carry buyer-supplier relationships, is also challenged to incorporate new strategic agendas of sustainability. In the literature, these practices are reflected in sustainable sourcing, green purchasing, responsible purchasing, and ethical purchasing (for example, in Miemczyk et al., 2012; Pagell et al., 2010).

While long-term collaborations and cooperative relationships with suppliers have empirically proved their positive effects on performance (Carr and Pearson, 2002; Chen and Paulraj, 2004) and environmental and social issue collaborations (Gold et al., 2010; Rao and Holt, 2005; Vachon and Klassen, 2008), there is a view that differentiation is needed to manage supplier relations (Gelderman and Van Weele, 2005). This means that cooperation and collaboration are not the only ways to manage suppliers, and different types of purchases can be addressed in different ways in order to optimize a company’s resources. In practice, this perspective has been realized through the portfolio view and Kraljic’s matrix, which is considered to be a standard in the field of purchasing portfolio models and which is accepted in supply chain management literature (Gelderman and van Weele, 2005; Pagell et al., 2010). Kraljic (1983) suggests that a company will pursue different supply strategy roles with respect to the selection of different purchasing items. The classification of the purchasing items in this model is determined using two factors: profit impact (i.e., the strategic importance of purchasing an item) and supply risk (i.e., the complexity of the supply market).
However, recent research has provided empirical evidence that when a company adopts a sustainability agenda in its strategy, it does not follow Kraljic’s portfolio model. In fact, leading in SSCM companies engage in relationships with commodity suppliers in a way more suitable as for strategic suppliers (Pagell et al., 2010). Based on observations of ten companies with a wide range of expertise in sustainability, Pagell et al. (2010) suggested a modified sustainable purchasing portfolio matrix, in which the “Threat to the Triple Bottom Line” is one factor that can be used to classify the purchasing strategy.

In my study, one of the objectives was to investigate in detail how sustainability agendas affect supplier-buyer relationships, given that few empirical studies investigating the operationalization of sustainability agendas in dyadic relationships exist. Taking a point of departure from the portfolio approach, I set strategic and commodity items as key contingencies for buyer-supplier relationships. In investigating the dynamics of these relationships, I identify certain patterns of change (PAPER 2). This empirical evidence, combined with findings from an analysis of previous literature, facilitates the development of a model that can be used as a tool to make better choices in purchasing responses. The model is presented here as Figure 9-1; an elaborated explanation can be found in PAPER 2.

This contingency model, which I built to describe the choice of mode for supplier-buyer relationships in the presence of sustainability targets, differs from Pagell’s sustainable purchasing portfolio matrix (Pagell et al., 2010) in that it pursued a “value seeking” approach, which was derived inductively, instead of a “threat to the triple bottom line” approach. Lee et al. (2014) studied managerial responses to the “green” bullwhip effect when companies face tightening environmental regulations from the European Union, and their work shows similarities to my research and supports my observations regarding changes to purchasing strategies resulting from the sustainability agenda.
The discussion and explanations above lead to the suggestion of the following proposition:

**PROPOSITION 1. In a purchasing portfolio approach for sustainable companies, the choice of mode for supplier-buyer relationships is contingent upon an item’s “sustainability opportunities.”**

In the case study, the empirical evidence indicates that a buyer with a strategic sustainability agenda not only demands suppliers to be more sustainable, but also changes its own purchasing strategy and its modes of relationships with suppliers depending on which factor is defined as an item’s “sustainability opportunity.” A good example of this situation can be seen in the case of purchasing logistics services. Because transportation has significant potential to contribute to sustainability (since CO2 emissions due to transportation are one of the major sources of companies’ CO2 emissions; see PAPER 3), the suppliers of this item
(services-logistics services) are treated differently following the implementation of a sustainability agenda.

It is suggested that further research refine and test the given proposition.

9.2.2. IMPLEMENTATION OF SUSTAINABILITY IN SUPPLY CHAIN OPERATIONS: LINKING FUNCTIONS

Management practices in supply chain operations are concerned with the coordination and integration of business functions within the company and across companies in the supply chain (Mentzer et al., 2001). The integration of all processes from diverse functions (e.g. from purchasing to distribution) is needed to achieve a supply chain’s performance objectives (Cooper et al., 1997; Lambert et al., 2008; Lambert et al., 2005; Mentzer et al., 2001). These cross-functional processes inevitably play a role when a sustainability initiative or practice is implemented in the supply chain. Several research studies have been devoted to the subject. For example, Oliva and Watson (2011) studied cross-functional alignment in the supply chain planning process; Lambert et al. (2008) investigated the role of logistics in cross-functional business processes; and the relationship between participation in cross-functional teams and the maturity of the purchasing function was explored by Gelderman et al. (2005). However, in the case of sustainability implementation in supply chains, very little research has been done to examine the topic of cross-functional integration and coordination. To my knowledge, only one case study research paper, conducted by Schneider et al. (2014), has addressed the implementation of sustainability on a corporate and functional level. Moreover, a research agenda was proposed by Mollenkopf et al. (2010) and Gallea et al. (2012) to encourage future studies to address this research gap and investigate in detail how the implementation of a strategic sustainability agenda influences cross-functional processes in the supply chain.

My in-depth case study covers this research gap by exploring the implementation of a sustainability strategy. I map the process of sustainability implementation from an organizational view and then analyze seven sub-cases of the implementation of sustainability initiatives from an organizational perspective. The findings and discussions are presented in PAPER 1. The findings show that factors preventing effective implementation include incoherent functional logic and the lack of a clear,
systematic approach to cross-functional coordination. This situation may be explained as follows. Firstly, the sustainability agenda increases the number of functional interests involved in the coordination of supply chain processes. The implementation of sustainability requires the participation of many departments, and it brings at least one more stakeholder into every core supply chain process. In turn, sustainability leads to the need for more intensive coordination. Secondly, sustainability is a new strategic imperative and has not been translated to tactical and operations practices as a tangible performance measure. Moreover, relevant new performance measures must be coherent to a department’s functional area. This raises the need for more intensive communications with the purposes of aligning performance objectives—both vertically to functions (from a corporate agenda) and horizontally between functions—to support overall supply chain performance. Finally, the existing mindset of trade-offs (e.g., cost saving vs. differentiation) presents certain challenges related to the incorporation of a value-seeking approach to sustainability. To change existing mindsets, importance should be placed on achieving a mutual understanding and forming bases for collaboration through communication.

The issue of cross-functional coordination is addressed in the next level of the research in PAPER 3. Here, I discuss the role of the logistics department as an integrator for sustainability initiatives. The findings show that, in order to achieve adequate integration and coordination among companies in a supply chain, there is a need to consider the internal integrations among functions. This demands a leading role to be played by an “integrator” of functions, which possesses expert knowledge about specific operations in the context of sustainable supply chain. The given study examined this phenomenon by exploring the logistics department as an expert function in the context of achieving CO₂ emissions reduction through transportation.

The discussion and explanations above lead to the suggestion of the following proposition:

**PROPOSITION 2.** A clear systematic approach to cross-functional coordination has a moderating effect on the effective implementation of sustainability in supply chains.
Through this proposition, I test how an organization’s ability to systematically evaluate, monitor, and implement adequate change to the mode of coordination (for example, see Simatupang et al., 2002) in response to changing contextual factors in either the company’s organizational life or the industry’s competitive environment influences the company’s implementation of sustainability in supply chains. In other words, I propose that when a company carries out the processes of coordinating supply chain operations through explicit and carefully defined procedures and plans, it enhances its ability to effectively adapt to the introduction of a sustainability agenda. In this case, the focus is on the internal practices of the supply chain and their importance to supply chain management.

Additionally, in this topic, it is recommended to compare this clear, systematic approach factor to other factors that have been highlighted in the literature as being capable of influencing the implementation of strategy, such as leadership, strategic consensus, and control mechanisms. Some examples of such factors can be found in the work by Schneider et al. (2014).

**9.2.3. IMPLEMENTATION OF SUSTAINABILITY IN SUPPLY CHAIN OPERATIONS: LINKING COMPANIES**

This section will add clarity regarding coordination and integration of companies in a supply chain when sustainability is implemented in ongoing supply chain operations. As was explained in the section “linking functions,” supply chain management is concerned with both cross-functional and cross-organizational processes, with the aim of improving the performance of the supply chain as a whole. Therefore, one of the research questions was defined as follows: “How does operational coordination between suppliers and customers change with the introduction of a sustainability agenda?” This portion of the research is addressed in PAPER 3. The study focuses on the activities that take place when sustainability demands for suppliers of logistics services are introduced. The study uses the VOP/OPP tool, which considers buyers and suppliers together as potential co-producers of value.

The logic of the study lies in: (1) addressing external cross-organizational issues in which there is a need to consider internal cross-functional issues and (2) collaborations in supply chain that create value for both buyers and suppliers.
In this concept, the point of order penetration (OPP) and point of value offering (VOP) connect the demand chain and the supply chain. The analyses focused on how these points change positions when sustainability-conscious companies introduce sustainability targets (i.e., CO₂ reduction) to suppliers of logistics services. The findings are illustrated through the dynamic changes of VOP and OPP positions when buyer and supplier are engaged in collaborative actions towards CO₂ emission reduction.

When suppliers of logistics services move VOP further in the demand chain of the buyer, this will largely benefit the buyer. For example, in the studied case, a 3PL provider was working jointly with the buyer towards the consolidation of small shipments in hubs. This value offering included CO₂ emissions reduction, as well as the improved utilization of vehicle capacity. Another example involves moving VOP to the “planning” phase; this was illustrated when the buyer and the 3PL met for cooperative planning to achieve better driver behaviors, the consolidation of goods, and a choice of freight.

Though moving the VOP benefits the customer and requires more work from the supplier (3PL), the supplier also gains benefits: namely, increasing the duration of the contract. This is a benefit because it provides the supplier leverage and power for them. Moreover, it provides more predictability and improves the supplier’s ability to deal with order variability.

The results of the study show that, to implement a sustainability initiative in a supply chain (in our case, a CO₂ emissions reduction in logistics operations), the logistics function of a sustainability conscious company plays the role of an integrator both across functions within a single company and across organizations. The study also shows that companies in a supply chain begin to overcome the traditional trade-off view when negotiating with their suppliers towards value-seeking activities.

This study supports the findings of Wu et al. (2014) and Shi et al. (2012) by confirming the link between intra- and inter-organizational practices. Since the study highlights the need for the development of cross-functional and cross-organizational coordination mechanisms, further research is suggested to test the
presented framework. In particular, the application of quantitative methodologies is recommended.

The discussion and explanations above lead to the suggestion of the following proposition:

**PROPOSITION 3.** Communication towards achieving a mutual basis for understanding sustainability demands, directions, and perspectives within a company are important both for forming a basis for effective coordination and for ensuring collaboration among the companies in a supply chain.

This case study revealed that sustainability implementation in supply chains increases the number of functional interests involved—and, as a result, increases the complexity of cross-functional coordination. In the case of sustainability implementation, the challenge is that, for each different functional area, sustainability means different things. For instance, in one function, sustainability may refer to the use of rare materials, while, in another function, it may refer to CO2 emissions resulting from transportation. In the second example, sustainability is a new strategic imperative and has not yet been translated to tactical or operational practices through tangible performance measures. Third, the traditional mindset of trade-offs also presents a challenge to the incorporation of sustainability. Communication is the medium through which information and expertise are shared to overcome challenges and enhance the implementation of sustainability. Therefore, I postulate that, to overcome these challenges, communication towards achieving a mutual basis for understanding sustainability demands is a critical success factor. It is recommended that future research test this proposition.

**9.2.4. SUSTAINABLE SUPPLY CHAIN PERFORMANCE MEASUREMENT AND METRICS**

The old expression “You get what you measure” is used frequently by professionals in supply chain management to indicate the importance of measuring performance in operations and supply chains. Performance measures and metrics in supply chains are used to track progress against stated targets (e.g., to estimate the rationality of resource use), to identify areas for improvement, and to make the right decisions with the overall aim of enhancing a company’s competitiveness.
Performance measurement is “the process of quantifying the efficiency and effectiveness of an action” (Gunasekaran and Kobu, 2007, p. 2821). The term “metrics” is, thus, used to include information about the measure itself, the formula for the calculation, the data that are to be used, and who is responsible for the calculation.

Traditionally, at the strategic level, performance measures have been oriented towards financial metrics, such as the return of capital employed or profit. These traditional performance measures have worked in the past; however, due to the globalization of markets and operations, there is a need for new metrics and tools to enable companies to estimate their performance in new environments (Gunasekaran and Kobu, 2007). The mismatch between the known principles of performance measurement and supply chain dynamics is one of the issues inherent in measuring sustainability performance in supply chains. At the operational level, supply chain performance measures have conventionally been oriented around cost, time and accuracy (e.g., order lead time, delivery performance, and customer query time). However, given the trends of sustainable development, the need to comply with governmental requirements for sustainability reporting, and the risks involved in the potential reputational loss resulting from a failure to be sustainable, companies face the challenge of determining how to measure a new, non-financial, non-tangible set of performances, which requires a transition from stand-alone performance measures to more comprehensive methods of measuring supply chain performance (Gunasekaran and Kobu, 2007; Shaw et al., 2010).

Despite the existence of a number of measurements and metrics for sustainable supply chain performance, research on supply chain metrics is scarce. Thus, calls have been made to empirically investigate the actual use of metrics and measures in the field (Gunasekaran et al., 2004; Hassini et al., 2012; Shaw et al., 2010; Zhu and Sarkis, 2004). Extant research has mentioned some specific problem areas, such as: the development and use of reliable and adequate metrics for dynamic markets and operations; the use of the right tools for deciding which measurements to use and when and how to use them; the difficulty of aligning performance measures through supply chain companies; and the dynamic nature of supply chains, in which performance measures change over time and supply chain companies can change their roles (Hassini et al., 2012; Hervani et al., 2005; Zhu and Sarkis, 2004).
Against this background measurements and metrics, the main results of my case study investigating the implementation of sustainability initiatives at an operational level are discussed below. Performance measures of environmental performance (as found in the case) include the following:

1) Overall key performance indicators for sustainability on the strategic level, such as CO₂ emissions, energy consumption, hazardous waste, waste, and injuries.

2) Sustainability in the “balanced scorecard” and “target letter” approaches.

3) On the operational level, a variety of measurements, which differ depending on the unit or department:
   - Supplier Code of Conduct: Extensive checklists of CSR aspects in audits for the purchasing department
   - Sustainability requirements for new equipment specification lists, such as energy classes for electrical motors or the recycling of heat/cold
   - Tables for the sustainability assessment of technologies, which include main criteria and sub-criteria
   - The list of guidance questions for the assessment of technology development within the Technology Center
   - CO₂ emissions for each type of transportation in the logistics department

Contrary to the results of the study by Hervani et al. (2005), I did not find a significant relationship between the environmental management systems (ISO 14001 and EMAS) deployed in the case company and the development of sustainability measures and metrics on the operational level of the supply chain. Therefore, I suggest further research in this area.

Below, I discuss the important aspects of the development of SSC performance measurement and metrics.
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Need for sustainable supply chain performance indicators that are tangible and easy-to-use on the operational level in day-to-day practice

The case company has sufficient knowledge about available sustainable performance measures and metrics, and sustainability key performance indicators are defined on the strategic level. However, in almost all sub-cases, the main issue still involves how to make targets stated at the strategic level tangible and useful on the operational level. Here, I refer to the situation in which the corporate sustainability agenda is presented as general key performance indicators for sustainability, such as CO₂ emissions, energy consumption, hazardous waste, waste, and injuries. No single specific unit in the supply chain is given specific targets from top management, and all members of the company should work toward achieving targets. The environmental department serves a supporting function to align long-term corporate strategy objectives in sustainability with the mid-term and short-term objectives of the different company departments (functions). The issue is how to determine the most reliable and adequate measures and metrics tailored to a given supply chain unit or project. The answer to this question can be traced through the sub-cases.

Cross-functional and cross-organizational issues

The need to develop reliable and adequate measures and metrics raises the questions of the necessity for employees to go outside of their functional siloes and to work together with other departments (such as environmental and safety department), or new stakeholders on defining sustainable performance measures / indicators.

Coordination issues

The results of my study show that extensive coordination is necessary at the definition stage of introducing sustainability criteria. There is a need for intensified coordination to communicate sustainability efforts both internally and externally—both among functions and with suppliers and customers. Due to the dynamics of the supply chain, it is important that the development of the criteria for a sustainable supply chain is not a one-off process. On the contrary, it is important to build agile and responsive coordination mechanisms that allow both customers and suppliers to access the process through which underlying criteria are established. Effective
coordination mechanisms play an important role in effective and ongoing operations to achieve tasks associated with the implementation of sustainability.

For example, in the project for defining sustainability requirements for new technology, managers from the production technology department interacted, shared information, and aligned processes with managers from other functions (i.e., the environmental department, the production company, and a health and safety organization). In the process of defining and implementing the demands of the environmental department, a lack of appropriate coordination caused delays in the maintenance of new machinery, as well as a degree of sub-optimization.

The discussion and explanations above lead to the suggestion of the following proposition:

**PROPOSITION 4.** The development of tangible sustainability performance measures for tactical and operational practices, which are translated from the strategic agenda level, should be coherent with the other operational objectives of a department’s functional area.

This proposition has been developed through an analysis of sustainability implementation in the case company. Sustainability is a rather new strategic imperative, and on a strategic level, sustainability criteria are formulated as general key performance indicators. When the units of a supply chain are not given specific targets tailored to their individual functional areas, employees do not consider the sustainability agenda to be part of their day–to-day operational practice. This impedes the implementation of sustainability in operational practice.

**9.2.5. DIFFERENT STRATEGIC AGENDAS—OVERCOMING TRADE-OFFS**

The contemporary manufacturing environment is characterized by complex and dispersed supply chains that have developed as result of globalization and outsourcing. Moreover, with rapid changes in market demands, global companies face the challenge of addressing different strategic demands and performance objectives. The sustainability agenda is one such new objective, and studies report that it may become a key competitive parameter (Lacy et al., 2012).
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When companies extend a sustainability agenda to their supply chains, there is a question concerning how the new agenda will affect decision making. This is the case whenever companies align corporate strategies with ongoing supply chain operations (Wu et al., 2014). In particular, the discussion in extant literature has emphasized the strategic tensions of the link between the environmental and economic dimensions of sustainability. Positive economic performance results due to the incorporation of sustainability into supply chains have been reported (Christmann, 2004; Mefford, 2011; Melnyk et al., 2003). However, other studies report increasing costs and a negative economic impact when sustainability initiatives are implemented (Margolis et al., 2007; Walley and Whitehead, 1994). In a review, Gupta and Pausule-Desai (2011) analyzed the issues and trade-offs involved in making decisions, summarizing their results under the categories of strategic considerations, decisions at functional interfaces, regulation and government policies, and integrative models and decision support tools. Similarly, Wu and Pagell (2011) researched how organizations balance short-term profitability and long-term environmental sustainability when making supply chain decisions. They found that sustainability-conscious companies have fewer trade-offs then companies for which sustainability is not a top priority. Moreover, there are still long-term trade-offs among TBL line components (Wu and Pagell, 2011).

Debates over whether it is trade-offs or win-win situations that are predominant in sustainable supply chains have also been prevalent in supply chain management research (Kleindorfer et al., 2005; Quariguasi Frota Neto et al., 2010; Seuring and Müller, 2008a). Win-win situations occur when environmental and economic objectives are aligned, while trade-off situations occur when sustainability initiatives have economic costs that may impose constraints on short-term profitability. The debate regarding whether win-win or trade-off situations dominate has not produced a real winner; however, a number of examples show that both trade-offs and win-win situation occur. Moreover, though research documents the occurrence of managerial problems when sustainability is translated to supply chain level (Lacy et al., 2010; Seuring and Müller, 2008a; Vachon and Klassen, 2008; Walker et al., 2008), few studies investigate the strategic decision-making approach (trade-off vs. win-win) on the operational level of supply chains. Because I have chosen to conduct an in-depth case study methodological approach, my
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investigation offers insight into the approach behind sustainability initiatives on the level of supply chain operations.

This study contributes to the discussion within the field by showing that, when a case company has to choose between strategic sustainability objectives and other strategic objectives that conflict, the latter will always take priority. Evidence for this can be seen, for instance, in the sub-case of logistics and purchasing. Take the case of logistics: If CO₂ reductions will increase lead times or costs, a project will be rejected (see Chapter 7). In the context of extending a sustainability agenda to suppliers, I document practices of supplier assessment, such as audits and codes of conduct. In the decision making process of choosing a supplier, cost is the highest-ranking criterion. The case study also provides examples in which more proactive approaches towards sustainability bring positive environmental effects and positive economic effects (i.e., a so-called win-win situation) simultaneously. For example, in the case of the logistics department, collaboration and cooperation with logistics service providers in achieving reduced CO₂ emissions in transportation also brings clear economic benefits.

The results of the study predominantly document “win-win” situations, thus illustrating the value-seeking approach to sustainable initiatives. For example, in the case of logistics, the reduction of CO₂ emissions through the reduction of airfreight volume goes hand-in-hand with reduced transportation costs. Similarly, the replacement of old pumps produces energy savings while also reducing the company’s environmental footprint. I did not find the conflict between sustainability and economic competitiveness to be an important criterion in ongoing supply chain operations, since traditional performance criteria (e.g., cost and time) were higher-ranking. Instead, it was the synergy between business and environmental objectives that proved to be important. Thus, I would challenge the trade-offs view and suggest that I observed what I call “the co-generated value seeking approach.” Sustainability was set as an overall company value towards which employees were expected to work. The success of the sustainable initiatives was the result of value-seeking activities designed to develop the synergy between environmental and operational performance objectives in functions.

One interesting finding was that the decision-making process inherent in sustainable supply chains may be characterized by an increase in the involvement of different
departments and cross-functional cooperation (compared to the decision-making found in conventional supply chains). When a decision involves sustainability, it involves a greater number of reciprocal relationships (compared to the sequential relationships seen in conventional supply chains). This can be explained by the structural feature of the sustainability agenda, which involves the setting of sustainability goals as general company objectives, while, in practice, each department has its own sustainability perspective (e.g., CO₂ emission reduction through transportation in the logistic department; suppliers complying with CSR requirements in the purchasing department; the reduction of waste in the production improvement department). The implementation of sustainability initiatives leads to an increasing need to rely on collaboration and cooperation with other functions—and, in other words, to have a dialog and involve decision-making people in different processes. For sustainability, few tangible measures exist, and communication is directed towards the achievement of a mutual understanding and a basis for collaboration. This reality suggested the issue of achieving adequate coordination between the different functions of the supply chain.

The discussion and explanations above lead to the suggestion of the following proposition for further validation:

**PROPOSITION 5.** The companies currently leading in sustainability are overcoming the trade-off approach on the operational level and, instead, using a value-seeking approach. A clear understanding of the links between environmental activities and economic effects will enhance the implementation of sustainability in supply chains.

In this case, I refer to the discussion of when companies on the operational level are “overcoming trade-offs” and moving towards a value-seeking approach (Slack and Lewis, 2008; Van Hoek, 1999). Here, I propose that organizations, in terms of sustainability performance objectives, strive to find ways of overcoming the “intrinsic trade-offs caused by the constraints imposed by the operation’s perspective” (Slack and Lewis, 2008, p. 57).
9.2.6. DOES IT PAY TO BE GREEN? RELATIONSHIPS BETWEEN FINANCIAL PERFORMANCE AND GREEN PERFORMANCE.

The discussion of whether it pays to include sustainability in supply chain operations can be traced to the early 1990s (Kleindorfer et al., 2005). At that time, growing climate change concerns led to the introduction of stringent regulations and governmental policies that pressed companies to address environmental issues (Gupta and Palsule-Desai, 2011; Kleindorfer et al., 2005). Zhu and Sarkis (2004) discussed the possibility that both positive and negative economic performance could result from corporate environmental practices. In their study, they focused, not on aggregate corporate performance indicators, such as share price, market share, return on assets, and return on equity, but instead on more operational-level economic and financial performance measures. These measures included decreased costs of materials purchasing and energy consumption, decreased fees for waste treatment and waste discharge, and decreased fines for environmental accidents as positive economic performance indicators, and increased investment, operational and training costs and costs of purchasing environmentally friendly materials as negative economic performance indicators.

Rao and Holt (2005) posed the question of whether green supply chains lead to competitiveness and economic performance. Their study empirically evaluated the link between supply chain management practices and company competitiveness and economic performance using surveys from 64 companies. To measure competitiveness, they used such variables as improved efficiency, quality improvement, productivity improvement, and cost savings. To measure economic performance, they used the variables of new market opportunities, product price increases, profit margins, sales, and market share. The greening of supply chains was estimated at the levels of the inbound, production and outbound phases of a green supply chain. The greening factors for the outbound phase included six elements, such as informing suppliers about the benefits of cleaner production and technologies. The production phase included eight factors, such as the use of environmentally friendly raw materials. The outbound phase included seven factors, such as the implementation of environment friendly waste management practices. Despite confirming the link between the greening of the supply chain and increased competitiveness and economic performance, the authors warned that their results could not be generalized to all companies.
Extant literature proposes that, by operating a global supply chain while implementing sustainable practices, such as CSR, a company will improve its financial performance. For example, Mefford (2011) developed a conceptual model that suggests linkages between sustainable supply chain practices and financial performance, measured through the effects of sales, decreased costs, reduced financial risks, and increased profits. This model was built on the basis of a literature review and, therefore, requires further validation through empirical data. Gupta and Paule-Desai (2011) noted in their review that even if environmental practices often impose additional production costs and constraints, they can lead to better financial performance if exploited correctly. They suggested that researchers and practitioners develop mathematical tools and models for decision making that can address the trade-offs between environmental and profit-maximizing goals. Kleindorfer et al. (2005) emphasized that companies seeking to invest in sustainable technology will face risks and uncertainties similar to those faced when investing in any other new technology.

The results of this study allow us to relate to some of the findings of Kleindorfer et al. (2005). In the example of the technology center sub-case, the decision to buy equipment was made based on investment costs. Specifically, the environmental engineer suggested using a 10-year perspective and estimating the total cost of ownership, which also included reductions to energy use and environmental effects. Thus, the decision to buy sustainable technology may be dependent on the KPIs set by management: that is, investment cost vs. total cost of ownership. This raises further questions concerning performance criteria in traditional supply chains and new requirements for measuring performance in sustainable supply chains.

Some linkages between operational performance environmental performance found in the study show that environmental initiatives lead to both environmental and economic benefits. In the sub-case of logistics, reduced airfreight volume led to both reduced CO2 emissions and reduced costs. Similarly, in the sub-case of the motor replacement initiative, CO2 savings, energy savings, and cost savings were achieved simultaneously (see Chapter 7).

In my study of the implementation of sustainability agendas in supply chain operations, the linkages between sustainable initiatives and economic effects like new market opportunities, product price increases, profit margins, sales, and market
shares have not been traced. This gap represents a limitation of the research and a recommendation for future investigation.

In comparison to Gupta and Paule-Desai (2011), I do not find significant conflicts or trade-off issues when sustainability is implemented, since operational efficiency and economic performance were always priorities in the studied organization. However, the case company managed to address its sustainability agenda by applying, as seen in practice, a “win-win” principle. Thus, as a direction for future research, I suggest that the development of integrated models and tools for decision making that involve a co-value-seeking approaches instead trade-off approaches. A co-generated, value-seeking approach refers to a situation in which companies in a supply chain collaborate with the aim of providing value while simultaneously introducing sustainability practices.
I conclude with an evaluation of the relevance of the research to the problem identified, including an evaluation of how the research questions have been answered and a discussion of the relevance of the findings and their contribution to the research domain. I then discuss managerial implications and propose future research directions. The aim of the research is to investigate the implementation of sustainability in supply chain operations. Through the literature review, the qualitative case study approach was identified as particularly useful for exploring and grasping current operational practices. I have taken the process perspective to investigate the implementation of sustainability initiatives, aiming to explore what occurs when a sustainability strategic agenda is translated to the operational level. According to the identified managerial problem and the identified research gap, the research questions were stated as follows:

Research Question 1. What are the current organizational barriers to sustainability and how do they impede companies in implementing and anchoring sustainability in their supply chain practices?

Research Question 2. How does a new agenda of sustainability affect supplier-buyer relationships?

Research Question 3. How does operational coordination between suppliers and customers change with the introduction of a sustainability agenda?

To answer the first research question, I examined how sustainable initiatives were approached and motivated in the different parts of a supply chain operation. I identified challenges related to embedding sustainable development in ongoing supply chain operations and recognized patterns and means related to organizational changes in response to the need for more sustainable manufacturing practices. More specifically, I found a lack of tangible sustainable performance measurements and an incoherent logic for cross-functional coordination to be the main factors preventing the effective implementation of sustainability initiatives. There is a need for a formalized integration of sustainability into operations, as well as a clear,
systematic approach to cross-functional coordination. A discussion of these findings can be found in PAPER 1 and Chapter 9.

To answer the second research question, I studied the interface and connections between suppliers and buyers. Specifically, I examined how far suppliers and customers penetrate one another’s processes when sustainability targets are introduced. The patterns of change in relationships in response to the need for more sustainable practices were identified, and a contingent model for buyer-supplier relationships was developed. In my investigation of buyer-supplier relationships, I found that organizations attempt to increase data sharing and to penetrate deeper into operational processes to achieve common environmental solutions. The need to systematically develop solutions, along with new requirements, raises the demand for better cross-functional teamwork. The results of the study show that environmental solutions are only implemented if they can support operational performance in terms of cost and efficiency. Sustainability will not influence supplier-buyer relationships in isolation from other key performance criteria pursued in the supply chain. In order for a sustainability agenda to be implemented, it needs the support of other strategic requirements. Based on the data, a contingency model for making a choice among the types of relationships available when sustainability is a strategic target (see Section 9.2.1) was developed.

To answer the third research question, I studied how the operational coordination between suppliers of logistics services (3PL) and buyers of logistics services (the focal company) are affected by sustainability agendas using the VOP/OPP methodology (Holmström et al., 1999).

The investigation of the operational coordination between sustainability conscious buyers and suppliers in, for example, the logistics function revealed that the logistics function plays the role of an “integrator” both across company functions and across organizations when implementing strategic plans for CO₂ emission reductions in ongoing logistics operations. The study highlights that there is not only a need to develop clear coordination mechanisms for cross-functional coordination, but also for coordination between buyer and supplier to ensure effective boundary management and a good fit with concrete operational contexts. Moreover, the study describes and explains the effect of multiple-order decoupling and order penetration points in both demand and supply chains (see PAPER 3).
The contribution of the study involves the addition of insights for understanding the complexity of the organizational aspects of the implementation of sustainability in ongoing supply chain operations (cross-functional and cross-organizational aspects) on the three levels of a system within the chosen boundaries (Figure 4-1). Insights are context-specific for the successful implementation of sustainability. The provision of insights allows this study to provide valuable contributions to both academia and industry.

The results of this study are conceptual, and they are presented as a system framework consisting of three conceptual frameworks covering three levels of a business system (macro, meso, and micro level) (Figure 8-1) that uncover the complexity of the phenomenon. Explanations and insights into the framework are presented in Chapter 9, through the discussion of the means for deploying sustainability in supply chain operations presented.

The single, in-depth case study research and developed conceptual frameworks led to the suggestion of several research propositions, which are derived from discussions and described in Chapter 9 and which are presented as follows:

**PROPOSITION 1.** *In a purchasing portfolio approach for sustainable companies, the choice of mode for supplier-buyer relationships is contingent upon an item’s “sustainability opportunities.”*

**PROPOSITION 2.** *A clear systematic approach to cross-functional coordination has a moderating effect on the effective implementation of sustainability in supply chains.*

**PROPOSITION 3.** *Communication towards achieving a mutual basis for understanding sustainability demands, directions, and perspectives within a company are important both for forming a basis for effective coordination and for ensuring collaboration among the companies in a supply chain.*

**PROPOSITION 4.** *The development of tangible sustainability performance measures for tactical and operational practices, which are translated from the strategic agenda level, should be coherent with other operational objectives of a department’s functional area.*
**PROPOSITION 5.** The companies currently leading in sustainability are overcoming the trade-off approach on the operational level and, instead, using a value-seeking approach. A clear understanding of the links between environmental activities and economic effects will enhance the implementation of sustainability in supply chains.

**PROPOSITION 6.** The existence of a function-integrator in the deployment of sustainability initiatives has a mediating effect on the effective implementation of sustainability in ongoing supply chain operations (both across functions and across organizations).

(Proposition P6 was developed based on the discussion in PAPER 3.)

The system framework and related propositions are a first step in answering the call for more theory-building research in SSCM, which is necessary for the maturation of the field (Meredith, 1993). The system framework represents theory-building research (Meredith, 1993) and can be referred to as “middle-range theory,” which strives to meet the requirements of good theory (Weick, 1989).

The system framework is supported through an explanation of the means for implementing sustainability, which brings insights and provides an understanding of the phenomenon. By applying this system framework at three different levels of the supply chain, managers may reduce the complexity of implementing sustainability initiatives. Additionally, the case study offers supply chain managers an example of how to develop SSCM practices within their organizations.

In the study, one of the objectives was to investigate in detail how the sustainability agenda affects supplier-buyer relationships, given that there is little empirical research studying the operationalization of a sustainability agenda in dyadic relationships. Taking my departure from a portfolio approach, I set strategic and commodity items as key contingencies for buyer-supplier relationships. In investigating the dynamic of the relationships, I identified the relationships’ patterns of change, which are illustrated in a table (PAPER 2). This empirical evidence, combined with the previous literature, allows for the development of a model that can be used as a decision-making tool for making the right choice of
The model is presented here in Figure 8-3, and an explanation can be found in PAPER 2.

The main difference between my contingency model for the choice of mode of supplier-buyer relationship in the context of the introduction of sustainability targets and Pagell’s sustainable purchasing portfolio matrix (Pagell et al., 2010) is that I pursue a value-seeking approach, as opposed to a “threat to the triple bottom line” approach. The study by Lee et al. (2014) on the managerial responses to the “green” bullwhip effect for companies facing tightening environmental regulations from the European Union is similar to and supports my observations of changes in purchasing strategies resulting from a sustainability agenda.

The results of the study show that, to achieve the implementation of a sustainability initiative in a supply chain, the logistics function of a sustainability-conscious buyer plays the role of an integrator both across company functions and across organizations. It is therefore suggested that companies prioritize the role of the function integrator, for instance through establishing clear authorities and responsibilities. The study also shows that companies in a supply chain begin to overcome the traditional trade-off view when negotiating with suppliers towards value-seeking activities. The operational coordination that occurs when a sustainability agenda is introduced in a supply chain leads to an increased number of joint activities between buyers and suppliers. These activities are concerned not only with cross-organizational processes, but also with cross-functional processes. Collaboration in sustainability initiatives creates value for both buyers and suppliers. The VOP/OPP tool can be used by suppliers of logistics services when sustainability concerns are raised by global companies (which are buyers of logistics services), since the VOP/OPP concept considers both buyers and suppliers to be potential co-producers of value. Logistics services providers can be inspired through the use of this tool to develop new green offerings for customers.

While the strength of this qualitative case study is its ability to provide in-depth insights into occurs in the implementation of sustainability agendas, the nature of the data received from the single case study is also a limitation. Therefore future research needs to address the issue using much larger samples, including companies from a wide range of industries. In this way, a deeper understanding of practices
and an examination of more settings will refine the developed frameworks. The other way to enhance theory-building in the domain of SSCM is to test the conceptual frameworks developed by applying a quantitative approach. For example, a structural equation modelling technique is suggested. In this case, the propositions developed in this study could form the basis for testing the linear relationships in observed variables (see example in Shah and Goldstein, 2006).

For the future research, it could be interesting to study the contingencies that determine effectiveness of the means discussed in this study. For instance, the need for adequate coordination was indicated as one of the means for deploying SSCM strategies in supply chain operations. Therefore, the taxonomy of coordination modes or coordination mechanisms (Schneider et al., 2014; Simatupang et al., 2002) may be suggested to study the contingencies of coordination.

The limitations of this research are determined by the industrial practice of the given single company in Denmark. Thus, it is suggested to investigate the implementation of sustainability into the supply chain operations of companies located in other countries. Furthermore, to validate the sustainable purchasing portfolio model, it will be necessary to support the model through additional research, including research from a supplier perspective.
REFERENCES


REFERENCES


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Appendix A. Protocol for data collecting (interviews)

For Explorative Study “Sustainable Supply Chain Management”

DATE: ___________ PLACE: ______________________

INTERVIEWER: _______ INTERVIEWEE: _______ INSTRUCTIONS:

QUESTIONS:

1. How do you approach sustainability in your company? How long have you been working with sustainability?

2. To which extent sustainability is approached in supply chains? How do you approach sustainability in Supply Chains? Could you name main issues which are addressed: climate change, social development, resource depletion?

Which department and who are the managers who are responsible for the implementation of sustainability? Is sustainability embedded into strategy and operation management of company

3. Can you describe and define any effect for the company when approaching sustainability issues? Cost reduction, risk reduction, supplier relationships, innovation of products, etc. In other words what are the drivers for embedding sustainability in to supply chain? Can you link sustainable development of the company and future competitive advantage?

4. Do you see any barriers for implementing sustainable development strategy in the supply chain? For examples: competing strategic priorities, long term expectation of effect

5. Which tools are used in the company in relation to sustainability? Code of conduct, standards ISO, etc.? How the performance for sustainable development is estimated? Which decision variables are used?

Closing interview: A final thank you statement to acknowledge the time the interviewee spent during the interview
Appendix B. Literature reviews in sustainable supply chain management

<table>
<thead>
<tr>
<th>Reference</th>
<th>Description</th>
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<tbody>
<tr>
<td>Ahn and Sweeney (2013)</td>
<td>The authors identify and analyze 22 published definitions of SSCM.</td>
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<tr>
<td>Anishetty et al. (2012)</td>
<td>The authors provide a new and more comprehensive definition of SSCM.</td>
</tr>
<tr>
<td>App 3</td>
<td>The authors identify and analyze 22 published definitions of SSCM.</td>
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<tr>
<td>Carter and Rogers (2008)</td>
<td>A long-term become recover. They belong to the group of explicated list of SSCM and develop research propositions based on economic performance and competence.</td>
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<td>Centre and Facion (2009)</td>
<td>The literature reviews and economic papers are based on the firm.</td>
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<tr>
<td>Cusumano et al. (2003)</td>
<td>The authors identify and analyze 22 published definitions of SSCM.</td>
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<tr>
<td>Experimental literature</td>
<td>The authors identify and analyze 22 published definitions of SSCM.</td>
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<td>experimental literature 2</td>
<td>The authors identify and analyze 22 published definitions of SSCM.</td>
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<td>experimental literature 3</td>
<td>The authors identify and analyze 22 published definitions of SSCM.</td>
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<td>experimental literature 4</td>
<td>The authors identify and analyze 22 published definitions of SSCM.</td>
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<td>Hassan et al. (2013)</td>
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<td>Gupta and Pishva (2010)</td>
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<td>Celik et al. (2010)</td>
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<td>Title</td>
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<td>Literature Reviews in Sustainable Supply Chain Management</td>
<td>Seglin and Muller (2008)</td>
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<td>Santis et al. (2011)</td>
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<td>Libano et al. (2007)</td>
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APPENDIX B. LITERATURE REVIEWS IN SUSTAINABLE SUPPLY CHAIN MANAGEMENT
<table>
<thead>
<tr>
<th>Results and identified suggestions for future research</th>
<th>Reference</th>
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</thead>
<tbody>
<tr>
<td>The problem context, adopted methodologies, and approach to address sustainability objectives. The literature review of green supply chain management (GSCM) approaches in recent years includes the focus on reverse logistics and classification of operations strategies and more recently, the concept of operation excellence.</td>
<td>Wüthrich, 2013</td>
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</tbody>
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<th>Key Issues, particular aspects investigated</th>
<th>Reference</th>
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<td>The relationship between sustainability and profitability, and the role of governance and stakeholders in achieving sustainability goals.</td>
<td>Seuring et al., 2007</td>
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Appendix C. Focused literature review  
– list of literature


