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Sustainability and company performance:

Evidence from the manufacturing industry

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Abstract

This dissertation approaches the question of sustainability and its influence on company performance, with special focus on the manufacturing industry. In the contemporary production environment, manufacturing operations must take into account not only profit, but also environmental and social performance, in order to ensure the long-term development of the company. Companies have to decide whether they should allocate resources to environmental and social practices in order to improve their competitive advantage. Consequently, in decision-making processes concerning operations, it is important for companies to understand how to coordinate profit, people, and planet.

The objective of this dissertation was to investigate the current situation regarding manufacturers' sustainable initiatives, and to explore the relationship between these sustainable practices and companies' performance, including financial performance, operational performance, innovation performance, environmental performance, and social performance. First of all, a structured literature review was conducted to identify sustainable factors considered to be important in the decision making of manufacturing operations. The findings were synthesized into a conceptual model, which was then adopted as the basis for designing the survey instrument used in this dissertation. Drawing on Global Reporting Initiative (GRI) reports, empirical research was performed to explore the relationship between environmental management practices and company performance. Interestingly, the findings showed that many environmental management practices had a strong positive impact on innovation performance. Sustainability disclosures and financial performance were further analyzed using extended data from the GRI reports. The results also showed that several social sustainability indicators, such as product responsibility, human rights, and society, displayed a significant and positive correlation with return on equity in the sample companies.

In order to further explore the research area and to verify these findings, a triangulation approach was adopted and new data were collected via a survey conducted among middle and large sample companies in the Swedish manufacturing industry. The results indicated that the sustainable improvement practices had a positive impact on company performance. Some environmental and social improvement practices had a direct and positive correlation with product and process innovation. Furthermore, findings suggested that better cooperation with suppliers on environmental work could help to strengthen the organizational green capabilities of the focal companies.

When considering the company's general approach to implementing sustainable practices, some interesting findings emerged. There were limited significant differences in sustainable practices when comparing different manufacturing sectors, and different countries and regions. However, the results showed that Swedish manufacturing companies often place higher priority on implementing economic and environmental sustainability practices than on social ones.

This dissertation contributes to the literature on manufacturing sustainability. The study expands the understanding of how environmental, social, or economic perspectives as a triple bottom line can influence company performance and to a certain extent the supply chain. Identifying and understanding such relationships gives companies the opportunity to integrate sustainability into their manufacturing operations strategy in order to sustain their manufacturing operations over the long term.

Keywords: *empirical research*, *sustainable practices, company performance*

Svensk sammanfattning

Denna avhandling tar sig an frågan om hållbarhet och dess påverkan på hur företag presterar, med ett särskilt fokus på tillverkningsindustri. I dagsläget har produktionen inte bara kravet att skapa vinster utan också att prestera väl med liten miljöpåverkan samt under goda sociala omständigheter, för att säkerställa företagets långsiktigt hållbara utveckling. Företag måste besluta sig för i vilken omfattning miljömässiga och sociala satsningar ska ske för att öka sin konkurrenskraft i olika avseenden. I beslutsprocessen för hur ett företag ska bedriva sin verksamhet måste företaget i fråga därför förstå hur balansen mellan vinst, människa och planet, bör hanteras.

Syftet med denna avhandling är att undersöka den nuvarande situationen för den tillverkningsindustrin med avseende på dess åtaganden för hållbar utveckling. Därtill har avhandlingen för avsikt att utforska förhållanden mellan hur företag praktiskt arbetar med hållbarhetsfrågor och hur det hänger samman med företagets prestation i olika avseenden såsom: finansiellt, operationellt, innovationsmässigt, miljömässigt och socialt. Till att börja med genomförs en strukturerad litteraturgranskning för att identifiera de nyckelfaktorer som anses vara viktiga för beslutsfattare i producerande verksamhet. Resultatet från litteraturgranskningen används sedan för att utforma en konceptuell modell som sedermera används som utgångspunkt i utformningen av en enkätstudie som genomförs i denna avhandling. Dessutom genomförs en empirisk studie baserat på företagens hållbarhetsredovisningar (på engelska: Global Reporting Initiative, GRI) för att utforska förhållanden mellan hur företagen arbetar med miljöledning och hur detta påverkar företagens prestation. Intressant nog visas att det finns en positiv korrelation mellan många delar av miljöledningsarbetet och en förbättrad innovationsförmåga. Hållbarhetsfrågorna och finansiell prestation analyseras också djupare genom att nyttja utökad data från hållbarhetsredovisningarna. Detta visar att många hållbarhetsfrågor såsom: produktansvar, mänskliga rättigheter, och samhälle signifikant korrelerar med avkastningen på eget kapital bland de företag som studerats.

För att vidare utforska forskningsområdet och verifiera avhandlingens resultat, genomförs med ett metodmässigt triangulärt förhållningssätt ytterligare en enkätstudie bland stora och medelstora tillverkande svenska företag. Resultaten indikerar att förbättringar i hållbarhetsavseenden kan ge positiva resultat för företagens prestationer. Vissa förbättringsåtgärder i socialt och miljömässigt avseende har en direkt positiv korrelation med produkt- och processinnovation. Vidare kan miljömässigt samarbete med leverantörer stärka gröna organisatoriska förmågor hos företaget i fråga.

Intressanta slutsatser kan också dras utifrån hur företagens generella angreppssätt i arbetet med hållbarhetsfrågor. Det är begränsade signifikanta skillnader i arbetet med hållbarhetsfrågor vid jämförelse mellanolika sektorer inom återanvändning, olika länder och regioner. Däremot prioriterar ofta svenska tillverkande företag implementering av rutiner för ekonomisk och miljömässig hållbarhet i högre utsträckning än motsvarande inom socialhållbarhet.

Denna avhandling bidrar till litteraturen inom hållbar produktion. Studien ger en förståelse för hur miljömässiga, sociala och ekonomiska perspektiv, kan påverka företagens prestation och i viss mån även dess försörjningskedja. Att identifiera och förstå dessa förhållanden ger företagen bättre

möjligheter att integrera hållbarhetsfrågor med utvecklingen av sina produktions- och verksamhetsstrategier, vilket i sin tur kan göra företagens tillverkande verksamhet hållbar i det långa loppet.

Nyckelord: empirisk forskning, arbete med hållbarhetsfrågor, företags prestation

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List of Publications

Dissertation outline

The dissertation entitled *Sustainability and company performance: Evidence from the manufacturing industry* is a summary of the author's studies in the doctoral research program in the Division of Production Economics, Department of Management and Engineering at Linköping University.

This dissertation includes two parts, the introductory part as well a selection of five papers. The current statues of appended papers are displayed in the following list.

Paper 1:

Chen, L., Olhager, J., & Tang, O. (2014). Manufacturing facility location and sustainability: A literature review and research agenda. International Journal of Production Economics, 149, 154-163.

An early version of this paper was presented at 17th International Working Seminar on Production Economics, February 20-24, 2012, Innsbruck, Austria

Paper 2:

Chen, L., Tang, O., & Feldmann, A. (2014). Applying GRI reports for the investigation of environmental management practices and company performance in Sweden, China and India. Journal of Cleaner Production, 98, 36-46.

An early version of the paper was presented at 18th Greening of Industry Network Conference, Linköping, Sweden

Paper 3:

Chen, L., Feldmann, A., & Tang, O. (2015).The relationship between disclosures of corporate social performance and financial performance: Evidences from GRI reports in manufacturing industry. International Journal of Production Economics, accepted, DOI: 10.1016/j.ijpe.2015.04.004

An early version of this paper was presented at 18th International Working Seminar on Production Economics, February 20-24, 2014, Innsbruck, Austria

Paper 4:

Chen, L., Feldmann, A., & Tang, O. (2014). An empirical evaluation of sustainable operations practices and performance in Swedish manufacturing industry. Submitted to Journal of Cleaner Production

An early version of the paper was presented at the 21th International Annual EurOMA Conference, 20-25 June, 2014, Palermo, Italy.

Paper 5:

Chen, L., & Tang, O. (2015). Does the supplier involvement affect manufactures' sustainability? Submitted to Journal of Business Ethics

Received Purchasing & Supply Management Best Paper Award at 6th European Decision Sciences Institute Conference, 31 May to 3 June 2015, Taormina, Italy.

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1. Introduction

In the manufacturing industry, the concern over sustainability is greater than ever. In addition to facing high-pressure competition, manufacturers must increasingly pay attention to resource usage, waste treatment, air emissions, water pollution, employee welfare, and so on. Failing to manage these sustainability issues can substantially damage the image of the company and thus affect its performance. For instance, Apple Inc. has been blamed for using child labor in producing its iPhones and Macintosh computers; the Coca-Cola Company has been defamed for damaging local water resources in India; Dell Inc. has been criticized for disposing of electronic waste in an environmentally unfriendly way (Parmigiani et al., 2011); Chinese dairy manufacturers have suffered from environmental and safety crises (Chen et al., 2014). These companies' misbehaviors in their environmental and social management have affected their company performance and destroyed their reputation in some cases. These examples indicate the importance of understanding sustainability management and its relationship to the company's reputation and performance.

1.1 Sustainability and company performance

In 1987, the Brundtland Report first provided the concept of sustainability development, describing it as "a development that meets the needs of the present without compromising the ability of future generations to meet their own needs" (WCED, 1987, p. 45). Kleindorfer et al. (2005, p. 485) developed the concept of sustainable operations management, which is defined as integrating "the profit and efficiency orientation of traditional operations management with broader considerations of the company's internal and external stakeholders and its environmental impact." There has been a lack of consensus regarding the definition of sustainable supply chain management (SSCM; see Krause et al., 2009). The literature has emphasized the complex nature of supply chains and the difficulty in providing cross-industry framework due to the wide spectrum of issues affecting different sectors (Pullman et al., 2009).

Furthermore, there are different ways to measure company performance. A common categorization has been to divide performance into financial and non-financial performance (Ittner, 2008). Traditional accounting measurements of financial performance have

included sales growth, return on equity (ROE), earnings before interest and taxes (EBIT), and return on investment (ROI), among others (Eldenburg at al., 2010; Orlitzky, 2011; Zahra, 1995). Such financial measurements often measure an organization's profitability. On the other hand, innovation performance, market share, and other operational key performance indicators (KPIs) are usually applied to measure non-financial performance (Hyvönen, 2007). Moreover, in the sustainability research literature, scholars have argued that company performance should have a broad scope that includes a triple bottom line, instead of only focusing on a single aspect of company performance, such as financial performance. More specifically, company performance refers to environmental performance, social performance, economic performance, operational performance, and innovation performance.

In light of these developments, the perspectives on manufacturing companies' operations have expanded from economic to environmental and social aspects in current trends. Manufacturing companies are not only aiming to improve operations in terms of flexibility, delivery, quality, and cost, but also attempting to be competitive in terms of environmental and social issues (Caniëls et al., 2013; Vachon and Klassen, 2008). For companies operating in a competitive global environment, studying sustainability issues is necessary and should be prioritized in the decision-making processes by company management. Otherwise, companies will not be able to maintain their competitive advantage in the long run (López et al., 2007). However, there is still a question as to whether investments in environmental management practices and other corporate social responsibility (CSR) initiatives offer direct returns in terms of improvements to a company's performance.

Several studies have supported the notion that there is a positive relationship between sustainable practices and better company performance. Initial research by Spicer (1978) indicated that there was a medium to strong association between financial indicators, such as profitability, and some environmental indicators, such as pollution control, especially for the pulp and paper industry. Further research by Zhu et al. (2012), among others (e.g., Hart, 2005; Shrivastava, 1995), has supported this conclusion, suggesting that improved environmental and social practices can help companies to gain competitive advantage and subsequently improve their performance. Hart (1995) used a natural-resource-based view to

explain the above link. The central idea of the natural-resource-based view is that companies that foster and maintain good relationships with the ecosystem can achieve sustainable competitive advantage from their efficient usage of natural resources. Shrivastava (1995) further argued that such a positive relationship can be facilitated through technology transfer, total quality environmental management, and so on. Zhu and Sarkis (2004) conducted empirical research on the Chinese manufacturing industry, concluding that significant relationships exist between overall green supply chain management practices and environmental and economic performance. Montabon et al. (2007), Russo and Fouts (1997), Wu and Pagell (2011), and Hofer et al. (2012) have all supported the premise that environmental management practices can lead to innovation. Innovation, in turn, can help companies to increase their market share and to reduce their costs, resulting in greater financial gains.

At the same time, some studies have supported the opposite claim that there is a negative relationship between sustainable initiatives and company performance. The main argument here is that sustainable initiatives often increase operational costs and boost product prices, thus having a negative impact on financial performance and market share (Brammer and Millington, 2008; Cornell and Shapiro, 1987; Friedman, 2007; Tang et al., 2012; Walley and Whitehead, 1994; Williams et al., 1993).

However, only a few studies have focused on the manufacturing industry, despite the fact that the manufacturing industry contributes significantly to the world's economy. Moreover, the manufacturing industry plays a crucial role in global sustainability, contributing substantially to labor employment, resource consumption, and energy usage. Meanwhile, manufacturers are facing more regulatory restrictions and greater pressures in terms of raw material consumption, energy usage, and employee welfare. Manufacturers must deal with pollution risks during production processes, and various demands from investors, NGOs, governments, customers, and other stakeholders. Therefore, it is necessary to conduct in-depth investigations into the relationship between sustainability and company performance in the manufacturing industry. According to the APICS (2005, p. 65) dictionary, the manufacturing industry is defined as "a series of interrelated activities and operations

involving the design, material selection, planning, production, quality assurance, management, and marketing of discrete consumer and durable goods."

In addition to examining the manufacturing industry, the scope of this study is extended from a company level to a supply chain level, considering the impact of suppliers and other members of the supply chain. Understanding the link between sustainability and performance in this case is important in industrial practices. According to Carter and Rogers (2008, p. 368), sustainable supply chain is defined as "the strategic, transparent integration and achievement of an organization's social, environmental, and economic goals in the systemic coordination of key interorganizational business processes for improving the long-term economic performance of the individual company and its supply chains." Given the complexity of the current global operations environment, focal companies in supply chains should integrate suppliers into their consideration of strategy development. Otherwise, focal companies may face a variety of risks, such as environmental, economic, and social risks (Tang and Musa, 2011). For instance, the focal companies in developed countries such as Sweden are now outsourcing their production overseas. However, are their suppliers adhering to proper environmental and social standards? Do suppliers cooperate efficiently with the focal companies in terms of their environmental and other CSR practices? These questions are critical; if there is mismanagement of sustainable work on the part of the supplier, the focal company can face serious punishment. For example, IKEA suffered from the scandal of horse meat being found in its "Köttbullar" line of meatballs (Stanciu et al., 2013); Samsung was blamed for their Chinese suppliers using child labor (Zutshi et al., 2009); Nike had to face the issue of local pollution caused by its suppliers (Parmigiani et al., 2011).

Questions remain, which have not been clearly answered by previous empirical studies. Specifically, it is important to investigate the different patterns of environmental management practices in developing and developed countries; the relationship between sustainability performance and a company's innovation capabilities; the relationship between a company's strategy and its sustainable practices and performance; the impact of a company's mapping methods on its sustainability strategy and targets; the companies' status with respect to sustainability and their general approaches toward implementing

sustainable practices, including the economic, environmental, and social ones. In effect, what are the specific environmental practices and other social responsibility practices that lead clearly to greater returns in terms of financial performance? The dissertation thus adopts an empirical research methodology and attempts to answer the above questions by investigating companies in the manufacturing industry.

1.2 Research objectives

This dissertation aims at investigating the relationship between sustainability and company performance in the manufacturing industry from an operations management perspective. Operations management can be defined as "the activities that transform inputs into finished goods and services" (APICS, 2005, p. 76). The overall research objective is to examine the relationships between sustainability improvement practices and a company's performance in terms of the triple bottom line of economic, environmental, and social performance, as well as operational performance and innovation performance. These relationships are investigated both for a single company and at the supply chain level. In order to achieve this objective, sustainability factors and general approaches in implementing sustainable practices need to be identified and comprehended. Moreover, the difference between developed and developing countries and regions, different sectors of the manuacturing industry, and the involvement of suppliers should also be investigated.

More specifically, to fulfil the study's objective, the following research questions are explored.

Research question 1: What sustainability issues and factors are considered to be important for supply chain and operations management?

Research question 2: What is the status of sustainable practices in the manufacturing industry, and what general approaches are being used for implementing such practices, including economic, environmental, and social ones?

Research question 3: What is the relationship between sustainable practices and company performance, with the latter including environmental performance, social performance, economic performance, operational performance, and innovation performance?

Research question 4: What are the current sustainable operations practices and performance in the Swedish manufacturing industry? In particular, how are Swedish

manufacturers configuring their sustainability strategies, and does supplier involvement affect Swedish manufacturers' sustainability?

1.3 Research design and limitations

In order to provide an overview of the papers appended to this dissertation, Table 1 presents the study objective, general ideas, research methods, and data sources of each paper. The relationship among these papers is briefly described below.

Paper 1 presents a comprehensive literature review of related studies on sustainability and facility location. Drawing on the knowledge gathered from literature, this paper investigates how sustainability aspects are included in the decision making concerning manufacturing facility locations and the role of location in evaluating manufacturing sustainability. This literature review provides a synthesized framework for examining sustainability, along with some basic theoretical knowledge and a research agenda. Even though manufacturing location is not the focus of this dissertation, it is a typical problem for operations management. Thus, the framework presented should still be valid for companies with manufacturing operations as their business focus. Furthermore, this framework serves as the theoretical background for the survey design and data collection in Paper 4 and Paper 5.

Although laws and regulation can be the main drivers for companies to adopt sustainability practices, we still need to understand which environmental management practices (EMPs) have positive correlations with company performance. The result will affect the company's operations strategy and determine how to best allocate resources in green initiatives. Another question is whether these EMPs differ across countries, which is especially useful knowledge for multinational companies operating in a global environment. In Paper 2, the relationship between EMPs and company performance is mapped and analyzed. The data are collected from a content analysis of standard environmental data from Global Reporting Initiative (GRI) reports and financial reports of the sample companies. The analysis and comparison study are conducted in different sub-sectors of the manufacturing industry, as well as in developed and developing countries.

Table 1. A brief presentation of the appended five papers

Paper Number	Main topic	Research methods	Statistical analysis method	Data source
Paper 1	Manufacturing facility location and sustainability	Literature review	None	81 related articles
Paper 2	Environmental management practices and company performance	Secondary data analysis	Non-parametrical Kruskal–Wallis one-way ANOVA test, Spearman's rho test for correlation	37 manufacturing companies in Sweden, China, and India
Paper 3	Disclosure of corporate social performance and financial performance	Secondary data analysis	Descriptive analysis, cluster analysis, non-parametrical Kruskal–Wallis one-way ANOVA test, Spearman's rho test for correlation	75 manufacturing companies in automotive, metal products, forest and paper, chemical, and health care products
Paper 4	Sustainable operations practices and performance in the Swedish manufacturing industry	Survey	Factor analysis, cluster analysis, Pearson test for correlation	101 Swedish manufacturing companies
Paper 5	Moderating role of supplier involvement in the focal companies' initiatives	Survey	Partial least squares structural equation modeling, t-test	101 Swedish manufacturing companies

Paper 3 is in line with the thoughts and methods of Paper 2, but extends the usage of GRI reports to investigate whether corporate social performance affects financial performance in the manufacturing industry. This third paper focuses on the social aspects of CSR indicators, rather than on environmental ones, and studies the relationship between the disclosures of a company's social performance and its financial performance. Moreover, the social practices across different manufacturing sectors are examined. In this way, Paper 3 provides insights into the inherent interrelationships among the different categories of CSR analyzed.

Paper 4 and Paper 5 are based on the data collected from a survey of the Swedish manufacturing industry, using a questionnaire designed based on the results of Paper 1. Paper 4 aims at investigating the links between the three bottom lines, namely the environmental, social, and economic aspects of sustainability and company performance. The paper analyzes the implementation of sustainability improvement practices in different companies, and the correlation between the company's strategy and its sustainable practices and performance. There is a particular emphasis on technology innovation and technology strategy due to the results of Papers 2 and 3. Paper 4 can be viewed as a triangulation study, since it attempts to further verify some of the results generated by Papers 2 and 3. However, Paper 4 draws on the empirical data from the Swedish manufacturing industry, instead of secondary data (GRI reports) as in the two previous studies.

Paper 5 tests the indirect impact of supplier involvement on the focal company's sustainable initiatives. Partial least squares structural equation modeling is used to confirm the causal relationship between sustainability drivers, sustainable practices, and performance. Meanwhile, the indirect effects of suppliers are investigated in this paper. This study attempts to test and further develop the existing research on sustainability and company performance, especially with respect to supplier involvement. Paper 5 further verifies the previous research results found in Papers 2, 3, and 4, confirming the causal relationship between sustainability drivers, sustainability improvement practices, and overall sustainable performance.

Despite its in-depth investigation, this dissertation still has some limitations. First, this study has a static viewpoint of the research questions; a longitudinal analysis is missing from both the content analysis of the GRI reports (Papers 2 and 3) and the data collection in the survey (Papers 4 and 5). This gap is mainly due to the limited time resources in the doctoral study program. In other words, the research is based on a snapshot investigation. Further in-depth analysis is needed in order to fully examine the topics. More supporting data should be gathered, for instance, through a longitudinal survey investigation.

Second, the sample selection could be another research limitation of this dissertation. The survey data (Papers 4 and 5) include only middle and big companies, whereas small

manufacturers are excluded. In addition, the survey data are based on the Swedish manufacturing industry. Thus, conclusions and interpretations drawn from the study results should be considered carefully. It is as yet unknown whether the research conclusions can be generalized to other industries and other countries. Nevertheless, these results provide the direction for future investigation.

Third, although some statistical tests were performed to check for data bias, reliability, and validity, some data errors, such as self-report response bias, may still exist. In both the survey study and GRI reports, there may have been a tendency for respondents to present a better image of their company's sustainability than the reality.

Finally, the measurement of sustainability practice and performance is still a controversial topic in the literature. The measurements for Paper 4 and Paper 5 were selected using the results from the literature review in Paper 1. A potential limitation could be related to the measurement scales in this newly designed questionnaire. In order to overcome this limitation, the questionnaire was pilot tested among academic experts and industry practitioners. In addition, rigorous statistical methods were used to examine the reliability and validity of the questionnaire.

2. Research Methodology

In order to achieve the research objectives introduced in Section 1.2, different research approaches have been applied to deal with various problems concerning sustainability and company performance. The applied research methodology and general research process are presented in this section. In addition, the validity and reliability of this study are also discussed. In the following subsections, brief overviews of the literature review, secondary data, and survey instrument are presented. Meanwhile, the respective advantages and disadvantages of each research method are discussed.

2.1 Literature review

Fink (2005, p. 3) defined a literature review as "a process of reading, analyzing, evaluating, and summarizing scholarly materials about a specific topic." It is important to conduct a literature review as part of a research project, as it can help authors to authenticate the authority and legitimacy of their research, to define the potential contributions of their project, and to limit their research to a reasonable scope (Croom, 2009).

According to Seuring and Müller (2008), Croom (2009), and Machi and McEvoy (2012), the typical steps for conducting a systematic literature review can be summarized as follows:

- Decide on a topic to be investigated, as well as the component issues related to the review topic;
- Set the research boundaries;
- Search for existing literature in order to find information relevant to the topic under investigation;
- Evaluate and manage the collected literature in order to file and classify relevant materials. This step includes the denotation of relevant findings, as well as the editing and extraction of the findings;
- Analyze, synthesize, and interpret the findings. The intention is to identify the potential gaps in the research, as well as future research opportunities;
- Write the review report.

There are a variety of different methods that can be used to analyze and interpret the findings, for example, a qualitative approach, often conducted through content analysis. Seuring and Müller (2008) conducted their literature review by analyzing the content in order to make structural and descriptive analyses according to the defined content criteria. The typical steps for structuring a content analysis can be generalized as: Collect the relevant material, and select the structural dimensions and analytic categories in the research field. Carefully determine the definition and coding of each category. Evaluate the material, including the denotation, editing, and extraction of the related findings. Finally, report the results (Seuring and Müller, 2008).

A quantitative approach, in this case citation/co-citation analysis, is represented by Tang and Musa (2011). The objective of citation/co-citation analysis is to review the current status and development of a particular area of research. Once the citation/co-citation analysis has been conducted, statistical data can be obtained from the gathered materials. Citation/co-citation is a useful tool for determining the academic structures affecting a particular field (Tang and Musa, 2011).

At the beginning of this doctoral study project, a literature review was conducted with the aim of better understanding the existing knowledge concerning the environmental and social issues related to manufacturing location problems, and the relationship between them. The main reason for considering the location problem was due to the research funding received from VINNOVA (Swedish Govermental Agency for Innovation Systems) for a research project entitled "Manufacturing Location and Facility Roles." Although the research included in the dissertation is not focused on manufacturing location, the literature review still helped to clarify the academic and industrial perspectives on sustainability in relation to operations management, especially since manfacturing location is an important part of operations management. This systematic literature review futher helped to categorize and identify the questions and directions of future research on sustainability issues with respect to supply chain and operations management.

In Paper 1, the literature search included peer-reviewed journal articles published between 1990 and 2011. First of all, a descriptive analysis of the reviewed literature was developed

along with a categorization of the journal articles into two dimensions: research methodology and topic area. Following a content analysis, the environmental and social factors, and perspectives affecting location decision making were identified. The findings were then synthesized into a sustainability manufacturing facility location framework, and a future research agenda for sustainable locations was produced.

2.2 Secondary data analysis

According to the definition by Vartanian (2010, p. 3), "secondary data can include any data that are examined to answer a research question other than the question(s) for which the data were initially collected."

Secondary data analysis is widely used in exploratory research, as well as in business research. For example, Venkatraman and Ramanujam (1986) applied secondary data to measure business performance in strategy research. Bottomley and Holden (2001) used secondary data to analyze how consumers evaluate brand extensions. Secondary data are also a trusted and popular source in CSR investigations (Luo and Bhattacharya, 2006). Taneja et al. (2011) conducted a literature review of CSR-related studies over 38 years starting in 1970. They found that 60% of published CSR studies applied secondary data analysis (Baumann et al., 2013).

There are multiple sources of secondary data. For example, Luo and Bhattacharya (2009) collected company social performance data from the list of Fortune's most admired companies. Baumann et al. (2013) obtained CSR and financial indicators from BrandFinance and CSRHub. Karake (1998) measured CSR performance using a company's reputation index. Other possible data sources for CSR indicators include FTSE4Good, the Dow Jones Sustainability Index, and the Domini Social 400 Index (Brown et al., 2009).

There are some benefits to using secondary data analysis (Cowton, 1998). These include:

- Reducing the investment in time and money;
- Enabling researchers to carry out cross-country and longitudinal analyses;
- Allowing most of the secondary data to be treated systematically (Kamins and Stewart, 1993);
- Achieving greater external validity.

Meanwhile, there are also some disadvantages to using secondary data (Cowton, 1998), including:

- Difficulty accessing the collection of primary data, especially in business ethics research (Liedtka, 1992);
- The potential for social desirability response bias (Randall and Fernandes, 1991). For example, self-report data may cause companies to hide ethically undesirable characteristics and inflate ethically desirable characteristics;
- Loss of depth despite providing comparatively larger samples.

In this dissertation, secondary data were obtained from Global Reporting Initiative (GRI) reports. Usually, the GRI reports have been used for measuring sustainability indicators. There are several advantages to using the GRI reports as a secondary data source. First, GRI reports are globally accepted sustainability disclosures (Chen et al., 2015). Second, unlike other CSR reports, GRI reports have a sufficient component related to environmental issues (Marimon et al., 2012). Third, GRI reports are advantageous in terms of their comprehensiveness, visibility, rate of uptake, and perceived prestige. Therefore, they can be viewed as a reliable and efficient source of secondary data.

2.3 Survey

Surveys can help researchers to gather information from individuals about themselves or concerning the organizations to which they belong (Forza, 2002; Rossi et al., 2013). The survey is a very important method in the operations management field, especially in the case of theory development and theory testing (Forza, 2002). Since the 1980s, there has been a growing trend toward designing and executing surveys in operations management research (Rungtusanatham et al., 2003). Operations strategy, quality management, and supply chain management are among the top three subfields of operations management, in which the survey method has been widely applied (Karlsson, 2009).

Surveys can be categorized into different types according to their contribution to the knowledge (Forza, 2002; Fowler Jr, 2008; Singleton Jr et al., 1993):

- Descriptive survey: Descriptive surveys are not concerned with how/when/why questions; they are designed to focus primarily on the "what" questions. Such an approach can also be used to uncover the distribution of an event in a population (Forza, 2002). It can be used in situations where limited knowledge is available on research issues (Karlsson, 2009).
- Exploratory survey: The aim of conducting an exploratory survey is to gain first insight into a research topic for which there is limited knowledge. Exploratory surveys always form the research basis for future in-depth surveys (Forza, 2002). Moreover, exploratory surveys can determine whether what is being observed can be explained by existing theories.
- Confirmatory/Explanatory/Theory-testing survey: This type of survey is derived from theory-based expectations and tries to answer the research questions of how and why variables relate. The research hypothesis is often developed based on the research needs and can be further tested to indicate the existence of the predicted relationships, pointing out the negative or positive direction of the relationships (Malhotra and Grover, 1998).

The shortcoming of both descriptive surveys and exploratory surveys is that they cannot effectively confirm the results of complex or subtle relationships or new perspectives (Karlsson, 2009). Exploratory surveys help us to explore something new, to establish the groundwork. Then, descriptive surveys can be conducted to increase the knowledge initiated in the exploratory surveys. Finally, explanatory surveys can help to explain the knowledge developed.

The survey process can be described in the following steps (Flynn et al., 1990; Forza, 2002):

- Link to the theoretical level by defining the construct, developing hypotheses, and setting research boundaries;
- Design the research by considering macro-constraints, defining information needs, establishing a target sample, specifying the data collection method, and selecting the measurement instruments;

- Pilot-test the survey, including survey control testing, developing procedures for handling missing data, and evaluating measurement quality in an exploratory way;
- Collect data for theory testing and dvelopment. This implementation stage includes data gathering, cleaning, and input, as well as quality measurement.
- Analyze the collected data, including preparatory data analysis and research hypothesis testing.
- Generate reports to discuss theoretical and managerial implications, and replicability, and to present future research possibilities.

This dissertation examines the relationships between sustainability improvement practices and a company's triple bottom line performance, as well as the moderating role of supplier involvement in the manufacturing industry. In order to further understand and verify the findings of Papers 2 and 3 derived from the GRI reports, a theory-testing survey was employed as the principal research method in Papers 4 and 5.

2.4 Data analysis method

Methods of data analysis can differ according to the research objectives. Methods can take either a qualitative or a quantitative approach. In this dissertation, a quantitative approach was used as the main method for quantifying and analyzing the data.

As listed in Table 1, different statistical methods were applied to analyze the data. Cluster analysis, non-parametrical Kruskal–Wallis one-way ANOVA test, and Spearman's rho test for correlation were applied to the non-parametric data, whereas cluster analysis, factor analysis, t-test, and Pearson test for correlation were used with continuous data.

Structural equation modeling (SEM) was also used in this dissertation. SEM is widely used in theory testing and theory development surveys, contributing greatly to the validation of instruments and the testing of linkages between constructs (Gefen et al., 2000). Compared to the first-generation multiple regression method, SEM has the advantage of being able to work with multiple equations simultaneously and construct latent (unobservable) variables. Two SEM methods are widely used in the field of operations management: the covariance-based method and the variance-based method. The covariance-based method is the more traditional method. There are several types of software that can be used, such as LISREL

(Jöreskog and Sörbom, 1982), Analysis of Moment Structures (AMOS), EQS, and MPLUS. Covariance-based SEM can be used in both theory testing and confirmation, but it is unable to explain variances and make predictions. The variance-based method, on the other hand, is represented by partial least squares (PLS) path modeling. Related software includes Smart PLS, PLS-Graph, and SPAD PLS. PLS SEM has the advantage over traditional covariance SEM with respect to theory development, prediction, formative measurement, and complex modeling (such as second-order models).

2.5 Research quality

This section discusses the quality of research in terms of validity and reliability. Validity and reliability are the critical foundations of scientific work and integral to both quantitative and qualitative methodologies.

There are four characteristics necessary for rigorous research to be described as reliable and valid: dependability, confirmability, transferability, and credibility (Guba and Lincoln, 1981; U.S. Government Accountability, 1990). According to Kidder and Judd (1986) and Yin (2013), there are four common tests of validity and reliability that can be applied to all research in the field of social science:

- Construct validity: defining accurate measures at the operational level for the concepts under investigation;
- Internal validity: building causal connections and investigating whether certain conditions lead to other conditions.
- External validity: determining whether the research results can be generalized.
- Reliability: proving that the research can be repeated, i.e., the same results can be achieved by applying the same methodology.

2.5.1 Validity

The meaningfulness of a research concept and its various elements can be defined as validity. In other words, validity is concerned with whether the research is well-founded and resembles the real-world (Drost, 2011). In order to achieve validity, a research project should be designed structurally and logically. The key issue for validity is that the research

should measure what it purports to measure and measure it correctly (Thomas and Nelson, 1996).

Validity can be categorized as external validity and internal validity. External validity is the extent to which specific research findings can be generalized to a larger population, different settings, and so on. Internal validity is the extent to which the principles of causal connection have been followed in the research design.

In this dissertation, different validation methods were applied depending on the characteristics of the research. For the content analyisis of the GRI reports, the validity was ensured by using a consistent, valid coding scheme. The coders follow the GRI report indicators, which itself is considered to be a valid measurement system (Chen et al., 2014). For the survey part, the convergent and discriminant validity of the reflective measurement models were tested using average variance extracted (AVE) and heterotrait-monotrait ratio (HTMT). The validity of the formative measurement models was tested using a variance inflation factor (VIF) and indicator weights.

2.5.2 Reliability

Reliability is defined by Joppe (2000, p. 1) as "the extent to which results are consistent over time and an accurate representation of the total population under study." One important criterion for relablity is that the study can be repeated using a similar methodology. Generally speaking, reliability can be achieved by measuring the same object with multiple times or in different ways. Therefore, to produce a reliable scientific work, a consistent measurement instrument is essential. A reliable measurement tool should be characterized by minimal error.

Internal consistency is one dimension of reliability. It verifies whether several related items/observations that are designed to measure the same general construct will lead to similar results with the same dimensions. In statistical analysis, Cronbach's alpha is the approach applied most often for testing internal consistency (Fowler Jr, 2008; Zhu and Sarkis, 2004).

Inter-rater reliability is another kind of reliability, which is an important criterion for content analysis. For instance, when different individuals conduct obervations on the same

subject, they will have different judgments. In this case, the degree of agreement among raters is a kind of inter-rater reliability. To confirm inter-rater reliability, correlation coefficients such as the Pearson correlation test or Spearman correlation test can be applied.

For the content analysis in Papers 1, 2, and 3, research objectivity was ensured by using a systematic approach and a structured process (see Seuring and Müller, 2008). The goals were to identify the objectives of the research, to design a standard coding process, and to ensure the consistent usage of the code sheet.

In the above three papers, multiple independent researchers followed the same structured guidelines for conducting the content analysis, which improved the reliability. Differing analyses were addressed and resolved through meetings.

For the survey studies (Papers 4 and 5), reliability was tested using different methods:

- Exploratory factor analysis (EFA) was employed to test the unidimensionality of the items. This test was used to investigate " whether the measurement items converged in the corresponding factor " (Urbach and Ahlemann, 2010 , p. 18). In other words, this test checked "if every item loads with a high coefficient of one factor, and this factor is identical for each item that is supposed to measure it" (Urbach and Ahlemann, 2010, p. 18). If the loading coefficient is higher than 0.6, the reliability is considered to be high. Meanwhile, if the loading coefficient is lower than 0.4, the reliability is considered to be low (Urbach and Ahlemann, 2010).
- Cronbach's alpha was employed to measure the internal consistency. A value for Cronbach's alpha higher than 0.6 implies that the scores of all of the items under a specific construct have identical scope and meaning (Cronbach, 1987; Urbach and Ahlemann, 2010).
- Indicator reliability "represents the degree to which a variable/sets of variable is consistent considering what it aims to measure" (Urbach and Ahlemann, 2010, p. 18). It can be tested by measuring indicator loadings. The threshold value is 0.7 for indicator relaibility at a significance level of $p < 0.05$ (see Chin, 1998). However, Chin (1998) also stated that a lower item loading is acceptable in exploratory research.

3. Theoretical Framework

The purpose of this section is to present the literature most relevant to the studies carried out for this dissertation. There are three main areas of interests: i) sustainability at the company level; ii) sustainability and company performance; and iii) related organizational theory. The first two are directly related to the topic of this dissertation, whereas the last one provided the theoretical basis for hypothesis development.

3.1 Sustainability at company level

Sustainability is a broad topic that can be viewed from many different perspectives, such as sustainable city, sustainable society, and so on. In this dissertation, the concept of sustainability has been narrowed to the company level and seen as strongly connected to the concept of corporate social responsibility (CSR) and the triple bottom line, namely economic sustainability, environmental sustainability, and social sustainability.

There is a long history of scholarship in this area. Barnard (1968) discussed corporate social responsiblity at the organizational and executive levels. Carroll (1979) framed corporate social performance as economic, legal, ethical, or discretionary obligations to society. Clarkson (1995) established a framework for CSR based on the company's relationship with its stakeholders. He stated that stakeholder engagement was very important for achieving overall company sustainability. Elkington (1997) developed the idea that a company's economic sustainability, environmental sustainability, and social sustainability are inter-related. These three bottom lines of a company's sustainability can influence each other. Dyllick and Hockerts (2002) expanded Clarkson's idea, not only recognizing the importance of stakeholder engagement, but also providing a conceptual model and related criteria for narrowing down sustainability at the company level. Furthermore, they tried to integrate economic, ecological, and social aspects over both the short and long term.

At the industry level, there are more regulations that drive companies to become more sustainable. ISO 26000, for example, was launched by the International Organization for Standardization (ISO) in 2010 to provide new guidelines for companies and organizations on how to operate effectively in an environmental and humane manner (Lu et al., 2013).

For EU countries, there are special strategies in place for promoting environmental and social responsibility, such as the Renewed 2011–14 European Union Strategy for CSR. This particular strategy attempts to integrate environmental and social considerations into the comapany's core business strategy and daily operations (Crane et al., 2013; Lu et al., 2013). In a global context, there are several popular guidelines for shaping companies' sustainable operations, including the United Nations Guiding Principles on Business and Human Rights, the United Nations Global Compact, the International Labour Organization's Declaration of Principles Concerning Multinational Enterprises on Social Policy, and the Organisation for Economic Co-operation and Development (OECD) Guidelines for Multinational Enterprises.

In this dissertation, the investigation of sustainability is largely focused within the company's organizational boundaries. When a supply chain is investigated, the influence of suppliers on the focal company is investigated, while highlighting the perspectives of the focal company.

3.2 The relationship between sustainbility and company performance

As mentioned in the introduction, debates over the relationship between CSR and financial performance have existed for decades. Some important empirical studies are presented in Table 2. There are also several meta-reviews of the literature in the field, conducted by Griffin and Mahon (1997), Roman et al. (1999), Orlitzky et al. (2003), and Lu et al. (2014).

The existing empirical studies on sustainability and company performance have been divided into two streams according to their research methodologies: secondary data analyis and survey. Secondary data analysis represents the majority of the contributions in this field. One possible reason for this dominance might be the ability of secondary data to eliminate certain biases, such as common methods bias and principal informant bias (Gattiker and Parente, 2007; Hofer et al., 2012). Another possible reason for many researchers to adopt secondary data is that it reduces the amount of time and financial resources necessary to conduct the study.

Examining the studies in Table 2, it is evident that most research has focused exclusively on the relationship between CSR and financial performance, neglecting other aspects of company performance, such as operational performance and innovation performance.

These collected studies reveal diverse results with respect to the relationship between sustainability and company performance. One possible reason for these discrepant results is that corporate social performance can be measured in different ways. When the measurement indicators and scales are different, the measurement results of corporate social performance can vary. Thus, a summary of the literature from the 1970s up until now is presented below, showing the four main streams investigated. These results are consistent with the previous findings of Orlitzky et al. (2003) and Chen et al. (2015).

i) Reputation ratings. Reputation ratings are based on a collection of opinions that some entities hold about the corporate social performance of specific companies, most of them calculated by indexing techniques. Several cases in point are the annual social responsibility ratings contained in the Kinder, Lydenberg, and Domini (KLD) database (Lu. et al., 2014). This stream is represented by Vance (1975), Alexander and Buchholz (1978), Cochran and Wood (1984), Spencer and Taylor (1987), McGuire et al. (1988), Herremans et al. (1993), Preston and O'Bannon (1997), Brammer et al. (2006), Luo and Bhattacharya (2006), Surroca and Tribó (2008), Lee and Park, (2009), McPeak et al., (2010), Lamond et al., (2010), Salama et al., (2011), Wang et al. (2011), and Ortas and Moneva (2011);
ii) Social audits and observations. According to Orlitzky et al. (2003, p. 408), social audits "consist of systematic third-party effort to assess a firm's 'objective' CSP behaviours, such as community service, environmental programmes, and corporate philanthropy." This stream is represented by Belkaoui (1976), Chen and Metcalf (1980), Fombrun and Shanley (1990), Russo and Fouts (1997), Goll and Rasheed (2004), Luken and Stares (2005), Brammer and Millington (2005), Peinado-Vara (2006), Wen and Yuan (2008), and Okamoto (2009);
iii) Managerial principles and values. Managerial principles and values are how managers evaluate social information. This stream is represented by Reimann (1975), Ingram and

Frazier (1980), Aupperle et al. (1985), Dooley and Lerner (1994), Agle et al. (1999), and Godfrey et al. (2009);

iv) Disclosures. An organization evaluates the CSP information and the associated reports can be seen as sustainability disclosures. This stream is represented by Abbott and Monsen (1979), Anderson and Frankle (1980), Patten (1990), Wolfe (1991), Seifert et al. (2003, 2004), Fauzi et al. (2007), Kobeissi and Damanpour (2007), Brammer and Millington (2008), Aras et al. (2010), and Siregar and Bachtiar (2010).

Using the above categories to compare the empirical results in Table 2, one can see that these various methods of measurement can yield very different results with respect to the relationship between company sustainability performance and company performance.

Furthermore, it should be noted that even though the Global Reporting Initiative is an internationally accepted format for corporate social performance disclosure, it has still not been widely used in research in this field. Several studies, e.g., Brown et al. (2009), Chen and Bouvain (2009), and Tate et al. (2010), have used GRI reports as the data source. However, these studies have not focused on the relationship between sustainability and company performance.

Table 2. Selected empirical research in the field of sustainability and company performance

Authors	Focus	Methods	Findings
Ullmann (1985)	Corporate social performance and financial performance	Secondary data	Positive relationship between CSP and CFP
McGuire et al. (1988)	Social responsibility reputation and a company's total assets	Secondary data	Positive relationship between social responsibility reputation and a company's total assets
Waddock and Graves (1997)	Corporate social performance and financial performance	Secondary data	Positive relationship between CSP and CFP over the long term
Preston and O'Bannon (1997)	Company social performance and financial performance	Longitudinal investigation in large U.S. companies in 1982–1992	Positive relationship between CSP and CFP
Karake (1998)	Corporate social performance (measured by reputation index) and financial performance (measured by return on equity)	Secondary data	Positive relationship between the company's reputation index and its return on equity
Agle et al. (1999)	Relationship among stakeholder attributes, CEO values, and corporate performance	Survey of 80 large U.S. companies	Strong and positive relationship between stakeholder salience, CEO values, and CSP
McWilliams and Siegel (2001)	Corporate social responsiblity and financial performance	Secondary data	Neutral relationship between CSP and CFP
Seifert et al. (2003, 2004)	Corporate philanthropy and financial performance	Secondary data	No significant relationship between corporate philanthropy and CFP
Luo and Bhattacharya (2006)	CSR and market value	Secondary data	Negative relationship between CSR and market value

Table 2. Selected empirical research in the field of sustainability and company performance (Continued)

Authors	Focus	Methods	Findings
Brammer et al. (2006)	CSP reputation ratings and financial performance	Secondary data	Negative relationship between CSP and CFP
Marom (2006)	Theory building for corporate social performance and corporate financial performance	Conceptual modeling	A conceptual model on the relationship between CSP and CFP
Surroca and Tribó (2008)	CSP reputation ratings and financial performance	Secondary data	Negative relationship between CSP and CFP
Luo and Bhattacharya (2009)	Company social performance and risks	Secondary data	The relationship between CSP and company risks can be moderated by advertising and R&D
Brown et al. (2009)	The degree of embedding GRI within the company	Secondary data and interviews	For sustainability, reputation, and brand management by companies, GRI reports can be regarded as a fundamental tool
Chen and Bouvain (2009)	Impact of membership in the Global Compact on CSR reporting	Secondary data	Global Compact membership influences several fields of CSR reporting
Aras et al. (2010)	CSP disclosures and CFP	Secondary data	Negative relationship between CSP disclosures and CFP
McPeak et al. (2010)	CSP reputation ratings and CFP	Secondary data	Negative relationship between CSP reputation ratings and CFP

Table 2. Selected empirical research in the field of sustainability and company performance (Continued)

Authors	Focus	Methods	Findings
Lamond et al. (2010)	The impact of CSR on company identity, image, and performance	Survey	CSP has a strong positive relationship with a company's identity-building and positive impact on company success
Tate et al. (2010)	Supply chain strategies factor in environmental, economic, and social responsibility	Secondary data	Supply chain management activities are an important part of company sustainability
Siregar and Bachtiar (2010)	CSP and stock value	Secondary data	Negative relationship between CSP and CFP
Lu et al. (2013)	CSR and semiconductor companies' performance	Secondary data	Positive relationship between social responsibility investment and company performance
Lee et al. (2013)	CSR and company performance in the airline industry	Secondary data	Positive relationship between operations-related CSR and company performance

3.3 Related organizational theory

Organizational theory plays a crucial role in the research on sustainability and company performance. Sarkis et al. (2011) conducted a comprehensive review of organizational theory, identifying the most relevant organizational theories in the green supply chain management field as complexity theory, ecological modernization theory, information theory, institutional theory, resource-based view, resource dependence theory, social network theory, stakeholder theory, and transaction cost economics. Considering the background and research methods of this dissertation, several most related organizational theories are described in the following subsections. The presented theory has played an important role in the hypothesis development and explanation of the results of this dissertation.

3.3.1 Institutional theory

Institutional theory was first suggested by Selznick (1948), who argued that the behavior of a company can be influenced by its institutional environment. The central idea of this theory states that "organizations must conform to the established rules and norms of dominant institutions in order to gain support and be perceived as legitimate" (John et al., 2001, p. 151).

If we further categorize the institutional context into either formal or informal, institutional context can be generalized as:

i) Formal institutional context includes regulations, laws, and industry self-regulations (La Porta et al., 2008)
ii) Informal institutional context includes religious beliefs, cultures, ethics, norms, traditions, and values (DiMaggio and Powell, 1983; Meyer and Rowan, 1977).

Institutional theory has also been widely applied in sustainability research when considering cross-industry and cross-country comparisons. In various countries and industries, divergent cultural and industrial values lead to differences in organizational behavior. Consequently, these institutional variances yield different standards and expectations with respect to sustainability. Therefore, the expansion of the notion of sustainability necessarily takes different paths in different industries and countries (Visser and Tolhurst, 2010). In other words, specific institutional settings within a particular country/industry can influence how the organization engages in sustainability activities and the level of engagement, as well as performance.

Campbell (2007) argued that, in different socio-cultural environments, the engagement of companies in sustainability issues depends on the existence of isomorphic drivers, including coercive, normative, and mimetic ones. Based on research by Sarkis et al. (2011), such isomorphic pressures can explain why organizations need to adopt sustainable practices, i.e., why the company should behave in socially responsible ways. Companies are expected to act rationally, according to early institutional studies (Greenwood et al., 2008), while commonly accepted social understandings determine what it means to be rational.

The following are different kinds of isomorphic drivers in institutional theory:

i) Coercive pressure. This pressure is mainly from governments, and it is a key factor in companies adopting environmental management practices (Kilbourne et al., 2002; Sarkis et al., 2011). For instance, in Sweden, manufacturers have to adhere to a series of environmental and social regulations and laws, such as the restriction of hazardous substances (RoHS), waste electrical and electronic equipment (WEEE) regulations, and the Social Accountability 8000 International Standard (SA 8000).
ii) Normative pressure. This pressure is driven by consumers (Ball and Craig, 2010; Sarkis et al., 2011). For example, for Swedish manufacturers, consumer demand for green products is one of the main drivers to adopt more sustainable strategy and practice in operations.
iii) Mimetic pressure. Imitation also plays an important role in EU companies participating in more sustainable friendly initiatives (Aerts et al., 2006; Sarkis et al., 2011). Companies choose to imitate other companies' behaviors in order to avoid the risks associated with complex environments (DiMaggio and Powell, 1983). In the manufacturing industry itself, there is a trend of companies moving toward standardized processes and products as a kind of mimetic isomorphism (John et al., 2001).

3.3.2 Stakeholder theory

Ansoff (1965) first introduced stakeholder theory to explain the importance of identifying crucial stakeholders of an organization. As Ansoff stated, the company's primary strategic objective is to achieve the capability to balance the different needs of diverse stakeholders in the company. This notion was further developed by Freeman (1983), who integrated stakeholder theory into the corporate social responsibility model and business policy model.

Stakeholder theory indicates that groups of stakeholders can develop and approve the company's strategic decisions concerning business policies. Furthermore, stakeholder behavior can constrain the company's strategy, which is developed by managers to match appropriate resources with its surroundings. Freeman (1984, p. 46) defined the stakeholder as "any group or individual who can affect or is affected by the achievement of the firm's

objectives." According to this definition, stakeholders can be owners, customers, suppliers, and public groups.

Stakeholder theory can also be applied to describe and explain how managers plan and make strategy (Brenner and Molander, 1977; Donaldson and Preston, 1995) and how companies are actually managed (Clarkson, 1995; Donaldson and Preston, 1995; Kreiner and Bhambri, 1988). As such, stakeholder theory is often applied when discussing a company's sustainable strategy, since a company's sustainable strategy and related practices are influenced by different kinds of stakeholders, such as customers, suppliers, line leaders, government, regulators, advisory boards, and NGOs (Donaldson and Preston, 1995).

3.3.3 Resource dependence theory

Resource dependence theory was first proposed by Emerson (1962) based on social exchange theory, and further developed by Pfeffer and Salancik (1978, p. 26-27) to suggest that "organizations depend on others in their environment for resources to ensure their long run viability." Within the field of strategic management and organizational theory, resource dependence theory is considered to be one of the most prominent theories (Singh et al., 2011).

Resource dependence theory assumes that organizations must depend on other organizations to secure strategically significant resources (Heide, 1994; Singh et al., 2011). Consequently, organizations structure their relationships with other organizations, either formally or semiformally, so as to reduce uncertainty/risks and dependency on other organizations, such as suppliers (Ulrich and Barney, 1984; Singh et al., 2011). Consequently, a rational organization seeks to secure significant and limited resources, particularly in competitive environments (Banaszak-Holl et al., 1996; Hollos et al., 2012). Since closer relations with suppliers establishes greater interdependence (Aiken and Hage, 1968; Hollos et al., 2012; Pfeffer and Salancik, 1978), resource dependence theory suggests that resource exchange between partners should be used as a mechanism to control environmental risk.

Resource dependence theory has also been used to explain the role of manufacturing in creating and sustaining ongoing competitive advantage (John et al., 2001). According to resource dependence theory, partner companies across the supply chain, such as suppliers and focal companies, should not only depend on but also cooperate with each other. Such cooperation can lead to better performance in the long run, and is preferable to pursuing short-term profits at the expense of others (Sarkis et al., 2011).

Thus, supplier involvement can impact the sustainable work of focal companies. Moreover, organizational capabilities can be enhanced through green cooperation between focal companies and suppliers.

3.3.4 Ecological modernization theory ("win-win" principle)

Ecological modernization theory was first suggested by Joseph Huber (2000). Since then, environmental sociologists have widely adopted or adapted this theory to explain green economics and green growth initiatives. Generally speaking, ecological modernization theory can be seen as a systematic eco-innovation theory that can be applied at the micro level, such as at the organizational or supply chain level. This theory supports the idea that companies can invest in process/product innovation to decrease environmental degradation and thus help with economic gains. Ideally, ecological modernization theory describes a "win-win" scenario whereby technological development and innovation can help industries and countries to achieve both economic and environmental benefits (Murphy and Gouldson, 2000; Sarkis et al., 2011). In effect, ecological modernization theory supports the idea that there is a positive relationship between environmentalism and economic benefits.

A review of the related literature reveals additional research supporting and enriching the ecological modernization theory. Zhu et al. (2012) applied ecological modernization theory to the Chinese manufacturing industry, stating that manufacturers can implement environmental and technological innovations, such as new, cleaner production equipment and eco-design, in order to obtain economic benefits. More empirical evidence has come from Demark, where Sønderg åard et al. (2004) investigated the Danish textile industry. They concluded that environmental innovations can help companies to build innovative competencies within the organization. Such competencies can even extend to the

companies' supply chains. Another empircal study by Huber (2008) tested technological, environmental innovations from a chain-analytical and life-cycle-analytical perspective. Huber concluded that such innovations usually occur upstream of the supply chain, i.e., with suppliers, instead of downstream, i.e., with customers.

Ecological modernization theory explains companies' motivations for improving environmental practices, suggesting that green practices can help organizations to achieve better performance in both environmental and economic outcomes.

Ecological modernization theory remains useful for future research. For example, one could investigate how ecological modernization theory impacts the sustainable supply chain, or whether there is a mechanism helping focal companies to have better green cooperation with their suppliers, thereby transferring eco-innovation more efficiently.

4. Overview and Summary of Papers

The research objectives presented in Section 1.2 have been fulfilled through the studies reported in the appended five papers. Table 3 provides an overview of the five papers.

Table 3: The five papers categorized according to the research questions, methodological purpose, and research method

	Paper 1	Paper 2	Paper 3	Paper 4	Paper 5
Research objectives					
RQ1	X				
RQ2		X	X	X	X
RQ3		X	X	X	X
RQ4				X	X
Methodological purpose					
Descriptive	X				
Exploratory	X	X	X	X	
Confirmatory					X
Theory development					X
Research method					
Literature review	X				
Secondary data analysis		X	X		
Survey				X	X

In this part, the main results and managerial highlights of the five papers are compiled. Therefore, the reader can get a concise overview of the research findings. The five papers are appended in full later in the dissertation, and the author's individual contributions and responsibilities are clarified for each paper.

4.1 Paper 1 – Manufacturing facility location and sustainability–a literature review and research agenda

This paper answers the first research question by reviewing the relevant literature on sustainability and facility location. The paper highlights that sustainability is an area that has recently gained growing interest in the manufacturing industry. The literature review focused on peer-reviewed journal articles from 1990 to 2011 in related areas. Then, a literature analysis scheme with respect to the research methodology and research focus was developed. In addition, a systematic content analysis was conducted, and location decisions

related to economic, environmental, and social dimensions were classified. The findings were used to develop a conceptual model to guide manufacturing facility location decision making, especially over the long run. The accompanying research agenda was designed to address gaps in the research and verify the conceptual model. In order to build a feasible and comprehensive research agenda, strategic dimensions, practical perspectives, and social concerns were discussed.

Several research gaps were identified in the course of this literature review. First, there have been very few investigations taking the triple bottom line into consideration when making facility location decisions. Second, the manufacturing strategy aspects of industrial firms have remained absent from the current research on sustainable facility locations and global operations footprints.

The main results of Paper 1 were:

- There has been an increasing interest in sustainable concerns related to manufacturing locations, especially since 2005.
- Most current research has focused on sustainability in specific regions and in supply chain settings.
- There has been a lack of research with an explicit focus on the sustainable location problem.
- The majority of research has been about environmental and economic issues, while social dimensions have often been missing.
- The paper developed a conceptual model for synthesizing different perspectives on sustainability in the manufacturing industry.

4.2 Paper 2 –Applying GRI reports for the investigation of environmental management practices and company performance in Sweden, China and India

The objective of this paper is to investigate the correlation between environmental management practices (EMPs) and company performance in different manufacturing industries in developed and developing countries. The research objective is achieved by employing a combination of diverse methods, including literature review, content analysis, and statistical assessment.

The first step was to conduct a literature review in order to establish the theoretical background and research framework. Research hypotheses were developed based on relevant organizational theories. Then, content analysis was applied to standard environmental data from GRI (Global Reporting Imitative) reports. The levels of EMPs in manufacturing firms were coded according to the content analysis. Financial performance figures were obtained from the published annual reports of the sample companies. Finally, statistical analysis was performed to test the hypotheses. The results were also compared against those reported by Montabon et al. (2007). The results of Paper 2 indicate that innovation performance strongly correlates to several EMPs in various companies. Managers must be aware of several green environmental practices, such as eco-design, at early stages of the production process in order to achieve innovation performance and further improve financial performance. The results of paper 2 are also consistent with ecological modernization theory, which states that sustainability practices can enhance innovation opportunities, including product and process innovation in organizations, and thus achieve economic profitability.

This research found that:

- Most EMPs did not correlate significantly with financial performance.
- Plenty of EMPs had positive, strong correlations with innovation performance for the companies.
- Innovation should gain substantial attention when employing EMPs to improve long-term financial performance.
- There were no significant differences between the process industry and other manufacturing industries with respect to the EMPs employed.
- There were seven EMPs employed significantly differently among the manufacturing industries in Sweden, China, and India.

4.3 Paper 3 – The relationship between disclosures of corporate social performance and financial performance: Evidences from GRI reports in manufacturing industry

The aim of this paper was to investigate whether the disclosures of corporate social performance affect financial performance, especially in the manufacturing industry.

The theoretical background was based on institutional theory, exploring the inherent interrelationships among various aspects of CSR. Standard disclosures of corporate social performance needed to be applied to measure all the sample companies' CSR indicators in a standard and consistent way. Since the GRI reports are considered to be the standard format of CSR measurement, it was used as the principal data source for this research. Structured content analysis was used as the primary method in making cross-company comparisons of CSR. The coding process was undertaken by different researchers in order to obtain data from the annual GRI sustainability reports of the case companies.

Seventy-five case companies met the research requirements across the following industries: automotive industry (14 companies); metals products (24 companies); forest and paper (13 companies); chemical (10 companies); and health care products (14 companies).

Statistical analysis was conducted to analyze the correlations between the disclosure of corporate social performance and financial performance. It was observed that several specific social sustainability indicators that were easily quantifiable or measurable, such as injury rates, had higher scores than others. The indicators that tend to receive high media attention had higher mean values. The indicator protocols set for product responsibility got more attention from companies since it is strongly correlated to the product's reputation. However, this research presented scant evidence of a relationship between different categories of corporate social performance disclosures and financial performance. Moreover, causality could not be shown in this paper.

The main results of Paper 3 were:

- Labor practices and work standards have received the most attention from the manufacturing industry among the different categories of corporate social responsibility.
- The CSR indicators that are most easily measured/quantified received more attention than others from the manufacturing industry.
- There has been a parallel adoption of four categories of CSR indicators, instead of a sequential progress
- Many CSR indicators had significant and positive correlations with return on equity.

- There was no significant difference in CSR practices across different manufacturing sectors.

4.4 Paper 4 –An empirical evaluation of sustainable operations practices and performance in the Swedish manufacturing industry

This paper investigated the relationships between sustainability improvement practices and companies' triple bottom line performance. The research constructs were derived from the literature review and framework developed in Paper 1. Sustainable theory and a dynamic resource-based view comprised the theoretical background. This research was mainly based on a survey conducted in Swedish manufacturing companies during the first half of 2014.

Factor and cluster analyses were employed to investigate when companies implement different sustainability improvement practices and to evaluate their performances. Correlation analysis was employed to explore the relationship between the sustainability improvement practices and company performance. The results of the survey and their managerial implications indicated that economic, social, and environmental practices had strong positive correlations with economic, social, and environmental performance, individually. Nevertheless, companies' economic performance was not improved by the direct input of most social and environmental practices. Still, investments in environmental health improvement, individual development, and education showed the possibility of return, especially in the realm of product and process innovation. Thus, the company's economic performance can be improved in the long run.

The main results of Paper 4 were:

- Overall sustainability improvement practices are correlated positively with operational performance, innovation performance, economic performance, environmental performance, and social performance.
- Sustainable operations practices, including environmental health improvement, individual development, and education, should receive special attention since they positively correlate to innovation performance, thus contributing to a company's economic performance.

- In terms of the companies' sustainability improvement practices, the economic practices received the highest attention, followed by environmental practices and then social ones.
- In terms of the companies' sustainability performance, environmental and social sustainability could be combined into one category.

4.5 Paper 5 – Does supplier involvement affect Swedish manufacturers' sustainability?

Sustainable responsibility and initiatives do not only exist in focal companies, but extend to the supply chain. Sustainability is a problem particularly for manufacturers in developed countries that outsource their products overseas to low-cost regions. If their suppliers have a poor record on sustainability issues, the focal companies' reputation and related market shares will be damaged. Therefore, it is important to analyze the indirect effects of suppliers on the manufacturers' sustainability.

In Paper 5, the samples were collected the same way as in Paper 4. Common method bias was evaluated with Harman's single factor test. Average variance extracted, composite reliability, and Cronbach's alpha were also employed to evaluate the reflective constructs' convergent validity and internal consistency reliability. Furthermore, the discriminant validity was tested using the heterotrait-monotrait ratio (HTMT). Indicator loadings were tested to ensure indicator reliability. For the formative measurement model, indicator weights and variance inflation factor were evaluated to confirm the validity and reliability of the model.

For the data analysis, a second-generation multivariate analysis tool (Partial Least Squares (PLS) structural equation modeling) was applied to test the moderating effect of supplier involvement on the focal company's sustainable work. The results showed a causal relation between sustainability drivers, sustainability improvement practices, and overall sustainable performance. Meanwhile, only supplier involvement in the focal company's environmental work moderated the focal company's sustainable practices and performance. A further t-test was performed in order to explore how supplier involvement affected the focal companies' environmental focus. The main differences between the higher supplier involvement group

and lower supplier involvement group were due to environmental practices related to ecosystem vitality and environmental health. The evidence from the Swedish manufacturing industry showed that better sustainable practices can offer gains in overall sustainable performance. Moreover, good cooperation with suppliers, especially with respect to the environmental practices, can strengthen the organization's green capabilities through organizational learning. Thus, it is important to make sustainability an important strategy that is integral to the whole supply chain, instead of simply an add-on.

The main results of Paper 5 were:

- A causal relationship between sustainability drivers and sustainable improvement practices was found.
- A causal relationship between sustainable improvement practices and company performance was found.
- Moderating effects were only found with respect to supplier involvement in the focal companies' environmental work.
- Considering environmental work involvement, the main differences between the higher supplier involvement group and the lower supplier involvement group were in their environmental practices with respect to ecosystem vitality and environmental health.

5. Discussions and Conclusions

This section offers a discussion of the research findings, drawing conclusions from the study and presenting the direction for future studies.

5.1 Discussions

This dissertation's overall objective was to explore the relationships between sustainability practices and company performance with a special focus on the manufacturing industry, using a triangulation method.

Developing a comprehensive view of sustainability in the manufacturing industry is an important task. Such a view should consider economic, environmental, and social dimensions. However, the empirical results from the Swedish manufacturing industry showed that the consideration of social sustainability still lags behind economic sustainability and environmental sustainability. This result indicates that the manufacturing industry needs to place more emphasis on this area and should develop appropriate policies so that social sustainability can be properly incorporated into the triple bottom line. Achieving a better balance between environmental, social, and economic sustainability requires a lot of work. Companies should incorporate the operations strategy perspective into their sustainability aspects, employ the GRI reporting system, and develop better collaboration with suppliers.

There is also a contextual dimension that is important from an institutional theory perspective. Formal and informal institutional contexts may affect companies' operational choices. Although the results of this research do not suggest significant differences between subsectors of the manufacturing industry, nor different countries such as Sweden, China, and India, differences may exist between economic, environmental, and social dimensions under other circumstances. One example is that the manufacturing industry and service industry may have different focuses with regard to sustainability issues. For example, the service industry may not focus on CO_2 emissions in the production process as much as the manufacturing industry. With the rapid development of the service industry, understanding such differences has become even more important. Therefore, future research should look at the different sustainability focuses and related strategies in the service industry.

According to stakeholder theory, stakeholders influence companies' sustainability choices. Considering that different industries have different stakeholders (Sweeney and Coughlan, 2008), sustainability focuses may vary as a result. Based on the empirical investigation of this study, the main drivers for the Swedish manufacturing industry adopting sustainability practices were found to be government and regulators, customers, advocacy organizations, NGOs, and advisory boards. This situation can shift in other countries and other industries. For example, Zhu and Sarkis (2007) found that the main drivers for Chinese manufacturers were from governmental, market, and competitive sources.

This dissertation also supports some of the notions of the "win-win" discussion concerning the relationship between sustainability and company performance. This result is in line with ecological modernization theory. More specifically, there is a positive link between sustainability practices and company performance in the manufacturing industry. According to the findings of this study, employing environmental management practices properly can help companies to achieve better innovation performance. In turn, the level of process and product technology is often positively correlated to environmental performance and innovation performance. As such, the suppliers' involvement in the focal companies' environmental work can strengthen the focal companies' green capabilities. Therefore, companies should allocate resources to improving their environmental management practices, technology level, and cooperation with their suppliers.

The manufacturing strategy perspective is also useful for investigating sustainability issues in the manufacturing industry. In exploring the configuration of sustainability strategy in the Swedish manufacturing industry, this study showed that sustainability is indeed on the Swedish manufacturer's strategic agenda, particularly in manufacturing networks with multiple locations. The level of centralization of the sustainability strategy decreases from economic sustainability, to environmental sustainability, and to social sustainability. In the literature, the centralized/decentralized orientation of an organization's sustainability strategy has not been explored in-depth empirically. This topic is definitely worth studying in different contexts.

The moderating role of supplier involvement in the focal company's sustainable initiatives was confirmed in the Swedish manufacturing industry. More specifically, the suppliers' involvement had the greatest effect on the focal company's environmental sustainability. This finding is in line with resource dependence theory (Emerson, 1962; Pfeffer and Salancik, 1978), in that, focal companies and suppliers depend on each other to ensure their long term competitive advantage. The empirical investigation of the Swedish manufacturing industry indicates that focal companies should have better collaborative relationships with their suppliers in order to both reduce risk and strengthen green capabilities.

5.2 Conclusions

The following conclusions have been drawn in response to the research questions.

RQ1: What are the sustainability issues and factors considered to be important for supply chain and operations management?

This study investigated sustainability concerns in the manufacturing industry, resulting in a framework summarizing the perspectives, approaches, and factors related to different aspects of sustainability (i.e., strategic, environmental, social, and economic) and decision making processes in manufacturing operations. The main results are shown in Table 5 and Figure 3 of Paper 1. These findings were subsequently used to design the survey questionnaire, offering clear guidelines for understanding research in sustainable operations management, especially in the manufacturing industry.

RQ2: What is the status of sustainable practices in the manufacturing industry, and what general approaches are being used for implementing such practices, including economic, environmental, and social ones?

This dissertation explored the approaches to implementing sustainable practices considering different manufacturing environments, such as industrial sectors and manufacturing locations. The results showed no significant difference in the implementation of environmental management practices or social management practices in different industrial sectors, such as the process industry and other manufacturing industries. Moreover, environmental management practices differed (with limited significance, $p <$

0.05) among countries such as Sweden, China, and India. This result was less expected. Among 33 environmental management practices, only seven were implemented differently across these countries. These practices were particularly related to innovation and suppliers, including waste reduction (reactive), product development and innovation, supply chain management, environmental standards for suppliers, environmental participation, specific design targets, and corporate policies and procedures.

Nevertheless, a general pattern for sustainable practices implemented in the manufacturing industry across different sectors could be seen. When implementing sustainable improvement practices, companies often place different levels of emphasis on these practices. The first priority is often given to economic sustainability practices, followed by environmental ones, and finally social ones. In addition, when suppliers are involved in sustainable initiatives, they mostly affect the focal company's environmental practices, often in a positive manner.

RQ3: What is the relationship between sustainable practices and company performance, with the latter including environmental performance, social performance, economic performance, operational performance, and innovation performance?

This dissertation used different data sources and applied different methods of analysis, yet with a holistic view of sustainability. The results supported the claim that investments in sustainable practices can lead to improvements in company performance. Positive causal relationships were found between overall sustainable improvement practices and overall company performance. Several environmental management practices had strong correlations with innovation performance, which can further improve financial performance. Meanwhile, those manufacturing companies with good GRI indicators were also more likely to perform well financially, particularly in terms of ROE. A moderating effect was found for supplier involvement in focal companies' sustainable initiatives. In other words, supplier involvement can enhance the relationship between sustainable practices (especially environmental practices) and company performance.

RQ4: What are the current sustainable operations practices and performance in the Swedish manufacturing industry? In particular, how are Swedish manufacturers configuring their sustainability strategy, and does supplier involvement affect Swedish manufacturers' sustainability?

Examining the Swedish manufacturing industry showed that the triple bottom line represents a valid outline for interpreting a company's sustainability practices in this context. Nevertheless, when implementing environmental sustainability and social sustainability improvement practices, companies often adopt relatively weak practices with respect to social sustainability. Meanwhile, the sustainability performance in the Swedish manufacturing industry is less diversified than the sustainability improvement practices.

There are different levels in the configuration of sustainability strategy in a manufacturing network with multiple manufacturing locations. Economic sustainability is often considered in a centralized manner by the focal company, whereas social sustainability is more localized. In addition, environmental sustainability is often managed in a mixed pattern, with a combination of centralized and localized strategies. Moreover, Swedish manufacturers often employ a relatively high level of technology in developing their products and processes. This study found a strong positive correlation between a company's process and product strategy and its sustainable practice and performance. More specifically, if companies had a higher level of product and process technology, they had better environmental practices and performance. Furthermore, better social practices and performance were also detected in these companies.

To conclude, this dissertation contributes to the literature on sustainability operations management in the manufacturing industry by offering empirical evidence and theory development. Compared to previous studies conducted in this field, this dissertation contributes to the development of an empirical foundation in the Swedish context, which has been dominated by case studies. Furthermore, this dissertation synthesizes the strategic and sustainability perspectives by investigating the configuration of sustainability strategy—a topic that has not been examined in prior literature. This dissertation shows that there is a "win-win" opportunity for the manufacturing industry in terms of sustainable

practice and company performance. A company's sustainability is becoming even more critical to remaining competitive in the market. To remain competitive, manufacturing companies should transform their products, process, technology, business strategies, and models to meet this sustainability challenge. Innovation is crucial for this transformation, just as green cooperation with suppliers can enhance sustainability opportunities. Thus, manufacturing companies should extend their sustainability efforts from a single plant to the whole supply chain.

5.3 Future research

Companies now face not only economic competition in the market, but also environmental and social pressures (Wu and Pagell, 2011). The tradeoffs between economic interests, environmental impact, and social influence represent a topic that has been investigated by academics and practitioners for many decades, and remains critical in the contemporary climate. Based on the results of this dissertation, the following issues are proposed for further investigation.

Since this study was conducted over a limited period of time, a longitudinal study of the research topic has not been carried out. In a manufacturing company, manufacturing strategy affects operations, but may do so with a time lag. Therefore, the results of this study may differ from a long-term perspective. Thus, a longitudinal study should be conducted to further verify the results. Furthermore, as the results showed, the implementation of sustainable practices often occurs sequentially—from economic practices, to environmental practices, to social ones. Therefore, manufacturing strategy, sustainability practices, and performance could dynamically influence one another. In light of these observations, a longitudinal study using the same survey instrument would be of great interest.

Moreover, due to limited accessible data, the survey only targeted the Swedish manufacturing industry. With the development of global supply chains, sustainable manufacturing should also be considered within the context of the global operations of multinational companies. In this case, the operations strategies and sustainability concerns may differ between countries and regions. Therefore, additional effort should be given to

expanding and developing a solid database with which to further explore sustainable manufacturing issues from a global perspective. This task will not be easy, but the outcome will be extremely useful for defining a sustainable operations strategy in multinational companies.

The third possible avenue for future research is to examine the interrelationship between sustainability strategy and operations strategy. Such an inquiry is necessary for investigating whether sustainability factors can be integrated into a company's overall operations strategy. Often, a manufacturing company defines its operations strategy with a main focus on economic performance. As environmental and social aspects are becoming more important in manufacturing, these factors should be integrated into operations strategy in order for companies to sustain their development. In future research, multi-case studies could be conducted to examine the effects of such an integration.

Multi-tier sustainable supply chains could be another topic for future studies. Companies have increasing interest in developing sustainability across the whole supply chain. Nevertheless, most studies on sustainable supply chains have only focused on extending sustainability beyond the focal company to its first-tier suppliers. As such, there is a need to increase the supply chain scope to include sub-suppliers. A large-scale survey is needed to identify the contingencies in this field, such as the difference between managing environmental sustainability, which is easily measured, and managing other social sustainability issues, which are largely intangible. The sample companies should contain multi-tier suppliers, and if possible, should represent different industries in different countries and regions. In doing so, the sustainability management capabilities of suppliers can be explored. Another study could examine the critical contingencies that define how customers impose their sustainability concerns on the focal companies.

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Appendix A-English translation of questionnaire

Dear Sir/Madam:

The purpose of this survey is to investigate issues related to sustainability in Swedish manufacturing industry. This questionnaire is conducted by researchers from Linköping University and Kungliga Tekniska Högskolan (KTH). The survey will only take you 10-15 minutes to fulfill, but will provide valuable input for research. The questionnaire is voluntary and the data collected is strictly confidential. Answers from individual participants will NOT be identified and you have the option not to answer a particular question. The data collected will not be used for anything other than research. If you have any questions for the survey please contact Lujie Chen with lujie.chen@liu.se or by phone with 0765680008.

Your contribution is important for our research and the development of Swedish manufacturing industry. We really appreciate your help!

Thank you!

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A01 Which position do you hold at the company?_____

A02 For how many years have you been working in manufacturing industry?

☐Less than 2 years

☐3 to 5 years

☐6 to 8 years

☐More than 8 years

A03 Would you be interested in participating in future research in the area?

☐Yes

☐No

B01 What is the force of your competitive position?

☐Cost leadership (buyer needs are satisfied at the lowest cost on the market)

☐Differentiation (buyer needs are satisfied uniquely for which a price premium is realized)

☐Focus (ability to serve specific buyer groups better than competitors)

B02 What is the overall level of process technologies employed by your company?

☐very low

☐low

☐medium

☐high

☐very high

B03 What is the overall level of product technologies employed by your company?

☐very low

☐low

☐medium

☐high

☐very high

B04 What is the degree of your product customization?

☐very low

☐low

☐medium

☐high

☐very high

Describe your global footprint in term of share of employees per region? (The sum should be 100 %)

B05_1 Europe_____

B06_1 America_____

B07_1 Asia_____

B08_1 Oceania_____

B09_1 Africa_____

B10_1 Others_____

VAR07C Comment on global footprint_____

How influential is each of the following in driving your company's attention to sustainability?

		very low	low	medium	high	very high
B11	Government and regulator	☐	☐	☐	☐	☐
B12	Advisory board	☐	☐	☐	☐	☐
B13	Line leaders	☐	☐	☐	☐	☐
B14	Advocacy organizations and NGOs (Non Governmental Organizations)	☐	☐	☐	☐	☐
B15	Customers	☐	☐	☐	☐	☐

Do you have goals for the following areas?

		No goals	Goals	Goals with numerical targets
C01	Cost e.g: labor cost, energy cost, material cost, facility cost, logistic cost	☐	☐	☐
C02	Economic stability e.g: favorable tax, exchange rate fluctuations	☐	☐	☐
C03	Market e.g: international markets and potential demand	☐	☐	☐
C04	Growth e.g: sales growth and growth in market share	☐	☐	☐

Where are these goals set? (Skip this question if you are in an organization with only one site)

		Locally	Mostly locally	Mixed	Mostly centrally	Centrally
C05	Cost	☐	☐	☐	☐	☐
C06	Market	☐	☐	☐	☐	☐
C07	Economic stability	☐	☐	☐	☐	☐
C08	Growth	☐	☐	☐	☐	☐

C09 To what degree are suppliers involved in the work related to the economic perspective (cost, market, economic stability, growth)?

☐very low

☐low

☐medium

☐high

☐very high

Do you have goals for the following factors?

		No goals	Goals	Goals with numerical targets
D01	Eco-system vitality e.g: Air pollution and water quality related to the ecosystem, biodiversity protection, climate change performance	☐	☐	☐
D02	Environmental health e.g: Air pollution, water quality, and other environmental factors related to the health of humans	☐	☐	☐
D03	Environmental factors within production e.g: Material use, energy consumption, renewable resources, waste generation, waste treatment, waste disposal, recycling of material, energy and waste	☐	☐	☐

Where are these goals set? (Skip this question if you are in an organization with only one site)

		Locally	Mostly locally	Mixed	Mostly centrally	Centrally
D04	Eco-system vitality	☐	☐	☐	☐	☐
D05	Environmental health	☐	☐	☐	☐	☐
D06	Environmental factors within production	☐	☐	☐	☐	☐

D07 To what degree are suppliers involved in the work related to the environmental perspective (Eco-system vitality, Environmental health, Environmental factors within production)?

☐very low

☐low

☐medium

☐high

☐very high

Do you have goals for the following areas?

		No goals	Goals	Goals with numerical targets
E01	Governance e.g: Corruption, political stability, trade and tariff barriers	☐	☐	☐
E02	Individual e.g: Civil liberties, human rights	☐	☐	☐
E03	Education e.g: General education level	☐	☐	☐
E04	Community e.g: Equity, safety, cohesion	☐	☐	☐

Where are these goals set? (Skip this question if you are in an organization with only one site)

		Locally	Mostly locally	Mixed	Mostly centrally	Centrally
E05	Governance	☐	☐	☐	☐	☐
E06	Education	☐	☐	☐	☐	☐
E07	Individual	☐	☐	☐	☐	☐
E08	Community	☐	☐	☐	☐	☐

E09 To what degree are suppliers involved in the work related to the social perspective (Governance, Education, Individual, and Community)?

☐very low

☐low

☐medium

☐high

☐very high

Rate the following areas based on the amount of effort put into improving them?

		very low	low	medium	high	very high
F01	Cost e.g: labor cost, energy cost, material cost, facility cost, logistic cost	☐	☐	☐	☐	☐
F02	Economic stability e.g: favorable tax, exchange rate fluctuations	☐	☐	☐	☐	☐
F03	Market e.g: international markets and potential demand	☐	☐	☐	☐	☐
F04	Growth e.g: sales growth and growth in market share	☐	☐	☐	☐	☐
F05	Eco-system vitality e.g: Air pollution and water quality related to the ecosystem, biodiversity protection, climate change performance	☐	☐	☐	☐	☐
F06	Environmental health e.g: Air pollution, water quality, and other environmental factors related to the health of humans	☐	☐	☐	☐	☐
F07	Environmental factors within production e.g: Material use, energy consumption, renewable resources, waste generation, waste treatment, waste disposal, recycling of material, energy and waste	☐	☐	☐	☐	☐
F08	Governance e.g: Corruption, political stability, trade and tariff barriers	☐	☐	☐	☐	☐
F09	Education e.g: General education level	☐	☐	☐	☐	☐
F10	Individual e.g: Civil liberties, human rights	☐	☐	☐	☐	☐
F11	Community e.g: Equity, safety, cohesion	☐	☐	☐	☐	☐

How well does your company perform in relation to competition in the following areas?

		very poor	poor	fair	good	excllent
G01	Cost e.g: labor cost, energy cost, material cost, facility cost, logistic cost	☐	☐	☐	☐	☐
G02	Return on Investment (ROI)	☐	☐	☐	☐	☐
G03	Economic stability e.g: favorable tax, exchange rate flucations	☐	☐	☐	☐	☐
G04	Market e.g: international markets and potential demand	☐	☐	☐	☐	☐
G05	Growth e.g: sales growth and growth in market share	☐	☐	☐	☐	☐
G06	Quality conformance to specification	☐	☐	☐	☐	☐
G07	Delivery e.g. delivery speed and on-time deliveries	☐	☐	☐	☐	☐
G08	Flexibility e.g. volume, product mix	☐	☐	☐	☐	☐
G09	Product innovation e.g. rate of new product introduction	☐	☐	☐	☐	☐
G10	Process innovation e.g. rate of process improvement	☐	☐	☐	☐	☐
G11	Eco-system vitality e.g: Air pollution and water quality related to the ecosystem, biodiversity protection, climate change performance	☐	☐	☐	☐	☐
G12	Environmental health e.g: Air pollution, water quality, and other environmental factors related to the health of humans	☐	☐	☐	☐	☐
G13	Environmental factors within production e.g: Material use, energy consumption, renewable resources, waste generation, waste treatment, waste disposal, recycling of material, energy and waste	☐	☐	☐	☐	☐
G14	Governence e.g: Corruption, political stability, trade and tariff barriers	☐	☐	☐	☐	☐
G15	Education e.g: General education level	☐	☐	☐	☐	☐
G16	Individual e.g: Civil liberties, human rights	☐	☐	☐	☐	☐
G17	Community e.g: Equity, safety, cohesion	☐	☐	☐	☐	☐

Appendix B-The author's contributions to the appended papers

For this doctoral dissertation "*Sustainability and company performance: Evidence from the manufacturing industry*," the author Lujie Chen's contribution to each appended paper is summarized below.

Paper 1
Chen, L., Olhager, J. & Tang, O. 2014, "Manufacturing facility location and sustainability: A literature review and research agenda", *International Journal of Production Economics*, vol. 149, pp. 154-163.

Paper 1 was co-authored with Prof. Jan Olhager and Prof. Ou Tang. Lujie Chen took the leading role in initiating the research idea. The authors jointly contributed to the data collection, data analysis, and writing process.

Paper 2
Chen, L., Tang, O. & Feldmann, A. 2015, "Applying GRI reports for the investigation of environmental management practices and company performance in Sweden, China and India", *Journal of Cleaner Production*, vol. 98, pp. 36-46.

Paper 2 was co-authored with Prof. Ou Tang and Dr. Andreas Feldmann. Lujie Chen took the leading role in initiating the research idea and was largely responsible for the whole research process, analysis of the final results, and writing.

Paper 3
Chen, L., Feldmann, A. & Tang, O. 2015, "The relationship between disclosures of corporate social performance and financial performance: Evidences from GRI reports in manufacturing industry", *International Journal of Production Economics*, Advance online publication, doi:10.1016/j.ijpe.2015.04.004

Paper 3 was co-authored with Dr. Andreas Feldmann and Prof. Ou Tang. Lujie Chen took the leading role in initiating the research idea and was largely responsible for the whole research process, analysis of the final results, and writing.

Paper 4
Chen, L., Feldmann, A. & Tang, O. 2014, "An empirical evaluation of sustainable operations practices and performance in the Swedish manufacturing industry"

Paper 4 was co-authored with Dr. Andreas Feldmann and Prof. Ou Tang. Lujie Chen took the leading role in initiating the research idea and was largely responsible for the whole research process, analysis of the final results, and writing.

Paper 5
Chen, L. & Tang, O. 2015, "Does supplier involvement affect manufacturers' sustainability?"

Paper 5 was co-authored with Prof. Ou Tang. Lujie Chen took the leading role in initiating the research idea and was largely responsible for the whole research process, analysis of the final results, and writing.

Papers

The articles associated with this thesis have been removed for copyright reasons. For more details about these see:
http://urn.kb.se/resolve?urn=urn:nbn:se:liu:diva-121052