INFLUENCES OF POWER ON SUPPLIERS' ADAPTATION FOR SUSTAINABILITY—A DYADIC PERSPECTIVE

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ABSTRACT

WHAT WAS DONE?   In this study, the adaptive behaviour towards sustainability initiatives is investigated in interorganizational exchange relations. To do so, Small and Medium-sized Enterprises (SMEs) in a supplier role that experienced a situation where a buyer asked them to adapt to a certain sustainability initiative are asked about their power relation with their buyer. During this process, suppliers' perceived dependence and buyers' perceived power are compared, and the outcome of these measures on the adaptive behaviour towards sustainability is modelled. In order to explain the power relation in the dyad in more detail, the framework of the bases of power as initially introduced by French Jr. and Raven (1959) is integrated in the analysis.

WHY WAS IT DONE?   Sustainability in the current globalised business environment needs to be tackled on a systems level rather than by focusing on a site. The purpose of this research is to shed some light on the permeation of sustainability initiatives through the upward supply chain. The current academic literature about the drivers of Sustainable Supply Chain Management (SSCM) point towards the buyers as a powerful driver. Therefore, this driver is scrutinized in detail with the aims to: *a*) deliver practical advice on how to improve sustainability permeation from a buyer's perspective; and *b*) contribute to academic knowledge by dismantling and analysing the mechanism behind buyer power driven sustainability permeation.

HOW WAS IT DONE?   An online questionnaire was deployed to collect data from SMEs in a supplier role. The participants were contacted and reminded via email. The questionnaire is based on established instruments to

measure suppliers' dependence (Bode et al., 2011) and the bases of power (Raven et al., 1998). The quantitative analysis of the responses to the questionnaires is built around a mediation model with suppliers' dependence as Independent Variable (IV), the binary outcome of sustainability adaptation as Dependent Variable (DV) and two mediators representing the magnitude of hard and soft power bases in the dyadic exchange relation.

WHAT WAS FOUND? The established framework of the bases of power is a suitable instrument to explain the relationship between a supplier's adaptive behaviour towards sustainability and its dependence on its buyer. Measurements solely of how a supplier perceives its dependence on the buyer do not explain the adaptive behaviour of a supplier towards a buyer-requested sustainability initiative. Introducing the bases of power framework and distinguishing between soft and hard bases of power explains why suppliers experiencing *hard* power bases are more likely to reject a buyer-requested sustainability initiative, whereas suppliers experiencing *soft* power bases show a significantly higher acceptance of buyer-requested sustainability initiatives. Without dismantling the black box *power*, the observation that the two effects neutralize each other if not distinguished cannot be made.

WHAT IS THE SIGNIFICANCE OF THE FINDINGS? The original contribution to knowledge is the mechanism behind power in dyadic exchange relations and how this mechanism conduces to the permeation of sustainability through the supply chain. Knowing about the different pathways *hard* and *soft*, and their opposite effect on sustainability adaptation, advances knowledge in the SSCM literature and provides guidance for practitioners.

KEYWORDS Sustainability, Supply Chain, Interorganizational Adaptation, Power, Dependence, Buyer, Supplier, Seller

ACKNOWLEDGEMENTS

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Part I

THEORY

OVERVIEW

1.1 TOPIC

An increasing population on earth, and particularly fast-growing developing countries, require changes in sustainability behaviour of everyone. Popular issues arising across industrialized and developing countries are: *a*) labour conditions such as child labour or health and safety; *b*) environmental influences such as global warming; and *c*) economical catastrophes such as the "euro crisis", the "banking crisis" or simply a shift of manufacturing towards developing countries. Hence, it appears desirable to strive for sustainability in order to create a globally viable system for people, planet and profit. The interplay of these three areas is often described as Triple Bottom Line (TBL).

In operations management, the principle of Supply Chain Management (SCM) became popular in the 1990s. The general idea is to manage the interaction of company networks instead of focusing only on one's own operations. Well executed, this approach leads to better results for the considered network. Combining the idea of SCM and sustainability leads to the synergistic effect of not only improving

You've got to think about big things while you're doing small things, so that all the small things go in the right direction.
— Alvin Toffler, futurist and author

one focal firm's sustainability, but also enhancing the so-called TBL of a whole network. This idea is called SSCM.

This research investigates a snippet of this SSCM: a dyadic exchange relation (supplier–buyer). To narrow it down further, the focus of this research will be a mechanism prevailing *within* this dyad. The mechanism to be explained is the role of power in this exchange relation in the case of a buyer requesting a supplier to comply with environmental or social guidelines. Past research suggests that it is not solely the dependence of a supplier that influences its decision towards compliance with buyer requests: more subtle power bases may also have an influence.

The thesis answers the following research questions:

Research Question 1 *Is the terminology SSC/SSCM widely used in publicly available presentation material from world leading FMCG retailers?*

Research Question 2 *Does a buyer's power have an impact on its supplier's adaptive behaviour towards sustainability?*

Research question 1 is used to underline the necessity of SSCM research as well as its contemporary importance. It therefore looks into the publicly available material of supermarkets to find out whether the terminology occurs within those. In order to gain further insight into the current stage of SSCM, the alignment of academics' understanding and practitioners' view of sustainability in a supply chain context is explored with the help of a questionnaire.

Answering research question 2 will deliver some empirical evidence to the impact of interorganizational relationships on the adaptive behaviour towards sustainability initiatives. This is understood

as a first step to understand the mechanisms of sustainability permeation through supply chains.

1.2 STRUCTURE

This document is structured as follows. After an introduction to sustainability, including how the perception of the terminology has evolved over time, the terms *sustainability* and *supply chain* are examined in more detail. The fusion of these two is considered. After a review of the literature, new insights are brought to the foreground.

Following the outline of the existing literature about SSCM, the mechanism for the implementation of sustainability in a dyadic buyer–supplier relation is explored. Therefore, suppliers to buyers with sustainability efforts in their procurement are surveyed to find out what exactly led them to join the sustainability agenda. Existing academic literature suggests the value of the resource dependence theory (Pfeffer and Salancik, 1978), which is based on interpersonal power relations. The underlying framework of the bases of power (French Jr. and Raven, 1959; Raven, 1965, 1992, 1993; Raven et al., 1998) is eventually applied in order to find out how different bases of power impact the adaption of sustainability principles in a buyer–supplier relationship. In earlier research this framework was successfully deployed not only in a sociological context, but also in interorganizational situations (Hunt et al., 1987; Hunt and Nevin, 1974) and the SCM context (Benton and Maloni, 2005; Maloni, 1997; Maloni and Benton, 2000).

PART I—THEORY This part gives the reader the theoretical background and justification for the research. It is the foundation for the two subsequent parts.

CHAPTER 1—OVERVIEW This short chapter will give the reader an overview of what to expect from this PhD thesis, as well as the structure.

CHAPTER 2—LITERATURE REVIEW The literature review chapter goes chronologically through the literature about sustainability, and sustainability in supply chains. The importance of sustainability in supply chains, as well as the discrepant perception of the term between academics and practitioners, is demonstrated by exploratory studies. This eventually leads to the focus of this research: sustainability permeation through a supply chain.

CHAPTER 3—SUSTAINABILITY PERMEATION The sustainability permeation chapter reviews the literature regarding the drivers of sustainability. The drivers most frequently mentioned in the literature are identified. It is found that sustainability permeation in exchange relations is mainly driven by the buyer.

Reviewing the literature about exchange relations leads to the hypothesis that a supplier's dependence on its buyer determines the adaptation process of the buyer-requested sustainability agenda. Furthermore, the literature about power in dyadic relations suggests French Jr. and Raven's (1959) theory of the bases of power to explain the underlying mechanism.

PART II—EMPIRICAL STUDY Having set the foundation of the research in Part I, this chapter sets out to explain the design and

methodology used to tackle the research question, before the results of the analysis are presented.

CHAPTER 4—RESEARCH DESIGN The design of the subsequent research is determined by systematically assessing the options. The data collection, questionnaire development and methods of analysis are presented in the second half of this chapter.

CHAPTER 5—FINDINGS The findings from the survey are presented in this chapter, beginning with descriptive statistics that led to a more individually tailored analytic approach. After confirming that a supplier's perceived dependence on its buyer is proportional to the buyer's power over the supplier, a model including supplier's dependence, and hard and soft power bases, as well as the likelihood of sustainability adaptation, was analysed. During the process, the widely used dichotomization of hard and soft power bases was questioned and a different categorization suggested.

PART III—CONTRIBUTION The third and last part of the thesis presents and discusses the findings in context to close the loop between contribution to academic knowledge and practical application. Concluding remarks include limitations and suggestions for follow-up research.

CHAPTER 6—DISCUSSION The meaning of the findings (particularly from a buyer perspective) are presented. Knowing whether hard or soft power bases are more likely to work in order to make a supplier adapt to a buyer's sustainab-

ility agenda is a valuable advantage. Further, the contributions to knowledge (in particular, the questionnaire tool and the results of the mediation model based on the survey) are highlighted.

CHAPTER 7—CONCLUSION Limitations of the current research as well as future research questions in this domain can be found in the last chapter of this thesis.

1.3 TYPOGRAPHY

This thesis contains different typographic environments to help the reader to follow the chain of thought.

SIGNPOSTS Signposts are boxes that sum up the most important findings or conclusions from a preceding passage in one or two sentences. For example:

> **Summary 0: Example Signpost**
>
> This is a summary of an important finding or conclusion from a preceding paragraph or section.

The signposts are consecutively numbered throughout the document.

RESEARCH QUESTIONS To draw a clear picture for the reader of what question will be answered by the following research, research questions are used. The formatting of the research questions is as below (research question 2) :

Research Question 2 *What is the research problem?*

RESEARCH OBJECTIVES To give a clear and concise target of what is expected from answering the research question, research objectives are formulated. The formatting is in line with the research questions. An example is given below (research objective 0) :

Research Objective 0 *To explore whether research objectives are related to research questions.*

Research questions and objectives are consecutively numbered through the whole document.

HYPOTHESES Based on existing literature, hypotheses will be created in this thesis. The hypotheses are formatted as below (hypothesis H_0) :

Hypothesis H_0 *There should have been a first bird that gave a beginning to eggs. (Aristotle, 384–322 BC)*

For statistical reasons, null hypotheses are created which deny the effect as stated in the respective hypotheses. Rejecting these null hypotheses leads to information about the probability of the respective hypotheses. Null hypotheses have the same number as their respective hypotheses and are formatted as listed below (null hypothesis $H0_0$) :

Null Hypothesis $H0_0$ *There was no bird to give a beginning to eggs.*

The thesis contains four parts—*Theory*, *Empirical Study*, *Contribution* and *Appendix*. These are numbered with Roman numerals (respectively parts I to III and IV). Further, the thesis is divided into seven chapters which are represented by Arabic numerals, with numbered

sections, subsections and sub-subsections. Sub-subsections are not listed in the table of contents. The header of each page gives the reader information about the current *section*.

Quotations in this thesis are marked with "quotation marks" if they are in-text; longer quotations are characterised by their formatting, similar to the following example by local author Lawrence (1923, p. 187):

> Men! The only animal in the world to fear!

Apart from the mandatory 1.5 line spacing, the graphical layout of this document follows strictly Bringhurst's (2002) recommendations in *The Elements of Typographical Style*.

2

LITERATURE REVIEW

2.1 SUSTAINABILITY

The idea of a literature review chapter is to determine and analyse the existing literature in order to find and justify the research gap, which is subsequently explored. By thoroughly and systematically assessing the literature belonging to the topic under scrutiny, theories and frameworks arise which can be considered in later processes. Another important part of a literature review chapter is to demonstrate to the reader what work has already been conducted in the area under study, and the current state of academic knowledge. Furthermore this literature chapter will show the reader the importance of the topic and will indicate in the form of research objectives what is to be done in the subject area. The research questions are helpful to guide the author through the research process and they will also give the reader an idea about what can be expected from this research (Blumberg et al., 2008).

For a concept which has attained such lofty heights in current intellectual discourse and political debate, "sustainability" is amazingly ill defined, or, rather, has acquired so many different definitions (and the number is increasing almost daily) that no one quite knows what is meant by the term.
— Jayasuriya (1992, p. 231)

In the research design chapter (chapter 4), a brief rerun through some of the contextual literature will be necessary to show which research designs and research methods have already been successfully

applied. This step is helpful in order to develop a research design that is sound in terms of validity and reliability. Further, the discussion chapter (chapter 6) points back to the literature review and elaborates on how the findings (chapter 5) fit into the current state of research.

The structure of the literature review in this thesis is as listed below:

- A taxonomic research regarding the derivation of the term *sustainability* , in which context the term occurs and what different academics understand by the expression *sustainability*. Due to a rapid increase in publications around the issue of sustainability, a stricter approach is used in the further steps to narrow the vast amount of available literature down to theoretical literature with high impact and, in a further step, to find the contextual literature (section 2.1.1).

- After having elaborated the variety of the utilization of sustainability in academia, the focus narrows further down to sustainability in SCM. Since there is a vast amount of documents available, it is necessary to restrict the analysis to publications in high-ranked journals in order to maintain a certain quality standard. Journals which fulfil the criteria of Thomson Reuters (2011) or Harvey et al. (2010) (Association of Business Schools (ABS) list) and achieve high scores, are considered to be of high quality, due to the strict peer-review process and control mechanism they undergo (section 2.2). This systematic review delivers themes of SSCM and subsequently a model that represents the author's understanding of SSCM (figure 2.5 on page 62).

- To determine what motivates firms to embrace the opportunity of improving their supply chain sustainability, the drivers for

firms to get involved in SSCM are extracted from the literature in section 3.1.

- The subsequent focus on dyadic exchange relations and their underlying power structures requires a further literature review. Hence, the evolution of French Jr. and Raven's (1959) *Bases of Power* is introduced and discussed in the context. In order to outline the literature about dyadic exchange relations, such as they occur in (sustainable) supply chains, principles from the interpersonal and interorganizational research are introduced in section 3.2.

2.1.1 *History of sustainability*

Sustainability has been discussed by a myriad of authors under many different circumstances. Particularly before the so-called "Brundtland Report" (Brundtland et al., 1987) (which is named after the former Norwegian prime minister Gro Harlem Brundtland who led the World Commission on Environment and Development (WCED) in 1983), the term *sustainable* was associated with issues from the research area of finance rather than environmental issues. In the following introduction and taxonomic analysis of the term *sustainability* , it is inferred that sustainability is the ability to sustain, and therefore the adjective *sustainable* derives from the same stem and has an adjacent meaning. The next paragraphs outline the history of the term *sustainability* until the 1990s. Because of the rapid increase in publications about sustainability in the 1990s (figure 2.1), a more focused review about sustainability in the context of SCM is conducted in section 2.2. Figure 2.1 shows a significant increase in publications containing the term *sus-*
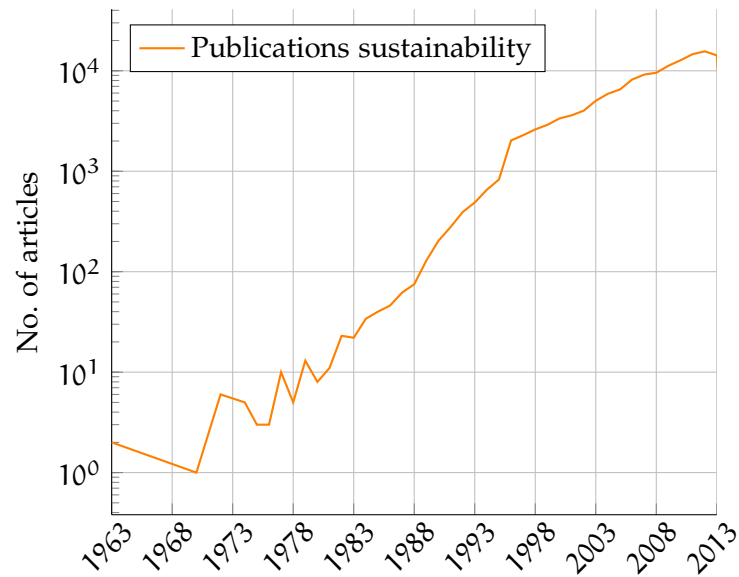
Figure 2.1.: Increasing publications about sustainability per year. The number of publications in 2013 is not representative. (Based on the search string in listing A.1)

tainability in their title or abstract between the late 1980s and the mid 1990s. In just five years, the annual publications about sustainability have multiplied approximately tenfold, with further exponential increase in the subsequent years.

Anderson (1960) is one of the first authors to mention the expression *sustainable* in an academic article by associating the term with economic growth. Anderson uses the expression "sustainable economic growth": this was understood as lasting economic growth that resists cyclical swings in the financial markets. Anderson's (1960) expression "sustainable growth" was later picked up by several other researchers in the financial sector (Babcock, 1970; Barker, 1971; Clark et al., 1985; Kefalas, 1979; Pirages, 1977). The actual meaning described by the adjective *sustainable* was the ability to have a lasting effect— permanently, strongly, ongoing. This is in contradistinction to what is generally understood now by the term *sustainable*. However, one has

to go farther to find out when the meaning of sustainability changed to the current use.

The Canadian researcher Hartwick (1974) introduced the expression "price sustainability", which was also focused on finance and economics research, and based on an idea of Koopmans et al. (1957). The terminology *price sustainability* , based on the "Koopmans-Beckmann Problem"[1] is later discussed by still more authors (Miron and Skarke, 1981). At the same time, the ability of monopolies to *sustain* was discussed under the heading of "sustainability of monopoly" by Baumol et al. (1977), Panzar and Willig (1977) and Baumol and Willig (1981). In the finance and economics literature, the expressions "sustainable income" (Easman Jr. et al., 1979), "sustainable competitive advantage" (Coyne, 1986a,b), and "sustainable advantage" (Ghemawat, 1986) started to appear amongst others. The common feature within the different areas of interest was the focus on sustainability, which was understood as endurance, persistence. If one is eager to relate the circumstance addressed by the authors in the 1960s and 1970s to a more recent principle, the idea of *resilience* comes quite close to it.

The first evidence of the occurrence of the term *sustainability* associated with agriculture was found in the 1980s when Fearnside (1980) discussed "the effects of cattle pasture on soil fertility" and the deriving sequels "for beef production sustainability". In the following years other authors adopted the term in their linguistic usage: for instance, Douglas (1984) used it for a conference on agricultural sustainability.[2] Out of this conference Douglas published a book chapter about agricultural sustainability, which gave the term *sustainability* ,

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1 A Quadratic Assignment Problem (QAP), which is an optimization algorithm for facilities and distances.

2 Conference on Agricultural Sustainability, Pomona College, Claremont, CA, US, April 1982.

or its deriving adjective sustainable, a new dimension: the environmental perspective. Some years later Byerlee (1992) produced an essay about sustainability and its place in agriculture and agricultural technology, with the focus on south Asia, in particular India, Pakistan and parts of Bangladesh. Byerlee's interpretation of sustainability was adopted from Lynam and Herdt (1989) and Byerlee (1989).[3]. The new issue in this study about sustainability was the attempt to find measurable metrics for agricultural sustainability. The authors introduce their ideas of how to measure sustainability in agriculture: for instance, by the stability of grain yields or the total factor productivity over a time period. Hence according to these ideas, sustainability meant a constant increase in agricultural productivity, while the quality remains at least the same, or even improves within this process. The main issues the authors applied in their case were "continued productivity increases" and "the ability of the system to withstand external shocks", whereas the system is meant to be the agricultural production. The understanding of Byerlee differs from what is understood in general as sustainability *after* Brundtland et al. (1987) and what was developed later by Elkington (1998). Byerlee's interpretation could rather be understood as a resilient agriculture production system with a Continuous Improvement Process (CIP) element.

In 1983 the United Nations (UN) established the WCED[4] as an independent expert commission based in Geneva. The purpose of this commission was the development of a viable long-term report about global environmentally friendly development reaching to the year

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3 "sustainability is the ability to achieve long-run stable gains in productivity while maintaining or even enhancing the quality of the agricultural resource base"

Byerlee (1992, p. 481).

4 The WCED is often named "Brundtland Commission" after its chairwoman Gro Harlem Brundtland.

2000 or even further. In 1987, Brundtland et al. (1987, p. 24) eventually formulated the expression sustainable development with the often cited sentence:

> Humanity has the ability to make development sustainable to ensure that it meets the needs of the present without compromising the ability of future generations to meet their own needs.

This citation is as often criticized for its inaccuracy as it is praised for its generalizability. The WCED was officially dissolved at the end of the year 1987 after it released the "Brundtland Report" (officially: "Our common future") and continued in April 1988 as the Centre for Our Common Future in Geneva; it was reactivated for the Rio conference 1992.[5] It was the Brundtland Report that started to coin the present common understanding of sustainability by clearly addressing three perspectives, namely "economic and social systems and ecological conditions" (Brundtland et al., 1987, p. 51).

The release of the Brundtland Report triggered a change of thinking in respect of the term *sustainability*. Its meaning as it was used before 1987—the ability to sustain—changed to a triangle which included the components *economics*, *humanity* and *environment*. The sustainability journey, which began in the year 1960, started off with the focus on economic matters; later on the environmental subject was present in the nexus with the expression sustainability, and from 1987 eventually the term *sustainability* was connected to the three spheres as addressed by Brundtland et al. (1987). The majority of subsequent publications understand sustainability, without further description,

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5 The Rio conference is a common expression for the United Nations Conference on Environment and Development (UNCED), also known as the "Earth Summit". The conference was held in 1992 in Rio de Janeiro with the goal of discussing global sustainability issues such as production and toxicity, the finite nature of fossil fuel, and scarcity of water.

as an interaction of all three components rather than one of the mentioned issues. An exception at the time was Spreckley, who demonstrated a good understanding of sustainability and systems thinking as early as 1981. As an early sign of what can develop out of sustainability, Spreckley (1981, p. 41) introduced in his book *Social Audit— A Management Tool for Co-operative Working* a model for co-operative work which includes not only the three dimensions as introduced by Brundtland et al. (1987), but also other characteristics that became important decades later: local and regional influence of companies regarding their technological, cultural, legal and political thinking (besides ecological, economic and social). The model adapted from Spreckley (1981, p. 41) is displayed in figure 2.2.
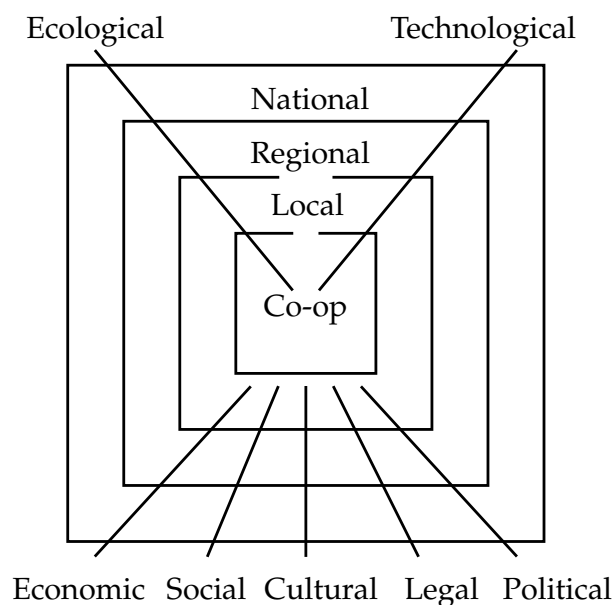
Figure 2.2.: Spreckley's model of co-operation

Common and Perrings (1992) discuss the difference between the ecological and the economic perspective on sustainability. The authors bring in their essay the different meanings of sustainability in economics (as it was mainly used in the early literature, before the

Brundtland Report) and its meaning regarding the environment on to a common thread. It is revealed by Common and Perrings that these two different perspectives of sustainability rather complement than exclude or contradict each other. However, the study does not contain the important perspective of social equity as a bottom line of sustainable development. In the same year, the Australian based researcher Jayasuriya (1992) published an article about an economist's view of sustainability in the *Review of Marketing and Agricultural Economics*. Jayasuriya confirms the idea that the understanding of the term *sustainability* has changed since the release of the Brundtland Commission's report—from a solely economic point of view, and used only in economics research, to a broader definition that mainly included environmental issues. An interesting point is the finding of Lynam and Herdt (1989, p. 381), which is picked up by Jayasuriya (1992, p. 231), that the word *sustainability* was not even present in popular dictionaries in 1988.

At the beginning of the 1990s the first articles linking sustainability to the energy problematic were published. For instance, Parthasarathi (1990) highlighted the necessity of a shift of energy sources, particularly for rural areas. As alternatives to conventional sources of electricity, Parthasarathi suggests photovoltaic and solar technology, as well as biomass-based systems. To guarantee an uninterruptible supply, the author hints at a hybrid model as a combination of those three technologies. Tasdemiroglu (1988) published an article about the energy consumption of Turkey and how long the natural energy reserves—namely coal, lignite (asphalts), petroleum and natural gas—will last. The study demonstrates two different scenarios: *a*) with consistent energy consumption; and *b*) a scenario with annually increas-

ing energy consumption. The remaining time for how long the energy reserves are secured is given in *sustainability years*. Byrne et al. (1991) wrote an article in the *Technology and Science Magazine* focusing on the energy consumption in east- and south-east Asia. Therein sustainability is linked to the inability to reproduce the raw materials that are used to satisfy the needs of the energy hungry population in the above mentioned areas and particularly in their metropolises. Further, Byrne et al. (1991, p. 24) state that the challenge of sustainability is to recognize "the finite capacities of the current resource base, and [embrace] the goal of balance in production, consumption, and conservation activities [. . .]". The common denominator of these studies is the predicted shortage of fossil fuels and the understanding that being sustainable in the generation and supply of energy means aiming for renewable energy production.

Possible positive outcomes of sustainability in supply networks are mentioned by Byrne et al.:"enhanced flexibility in responding to energy needs" and "the reduction of vulnerability to supply disruptions", as a result of more flexibility. This could be understood as the first association between resilience and sustainability in the supply chain management context.

One may ascribe the authors' focusing on sustainability and energy to a lack of holism: they do not include all three perspectives of sustainability, as suggested by Brundtland et al. (1987), and focus solely on the environmental side. However, the economic perspective and the social perspective are present in this area of research as well: the profitable production of energy (economic) and the environmental impacts on society—local, regional and global (social).

It is the responsibility of the developed countries in the northern hemisphere to resolve the sustainability dilemma, the scientist and politician Weizsäcker (1991) finds. Weizsäcker mentions his concerns about the waste of resources in developed countries and draws a scenario of how destructive it would be if the developing countries catch up to the natural resource per head consumption of the developed countries. In Weizsäcker's understanding of sustainability, mainly environmental factors are present (in particular, energy and shortness of natural resources), which goes hand in hand with the studies of Parthasarathi (1990), Tasdemiroglu (1988) and Byrne et al. (1991) discussed above. Weizsäcker's main concern however is the current social inequity between the developed countries and the developing countries, and the uncertain future for the environment if equilibrium between those two occurs. In the long run, it will be important to raise awareness in the fast growing population of "emerging market countries" and developing countries that their per capita consumption will never reach the equivalent of the developed countries, since this would go beyond the constraints of our earth's capacities.

In the following years, the annual publications of sustainability-related academic articles constantly increased, and the idea about sustainability evolved. New definitions arose. The basic understanding of sustainability however almost always leads back to the Brundtland Report. The ideas therein were further philosophically explored, sometimes exploited. One of the most often quoted definitions of sustainability is the TBL model introduced by Elkington which divides sustainability into three bottom lines (see figure 2.3a): *a*) economic prosperity; *b*) environmental quality; and *c*) social equity (Elkington, 1998). Elkington chose his words very carefully when he came to

We simply must do everything we can in our power to slow down global warming before it is too late. . . The science is clear. The global warming debate is over.

— Schwarzenegger (2006)

define the term sustainability. He particularly used the established expression "Bottom Line" to develop his model, which is a term widely used in financial terminology for evaluating a company's monetary success or failure. A rigid set of pillars carrying the sustainability thought would not fulfil the same purpose as bottom lines, due to the evolution process the model underwent; further, pillars are suspected to cause a lack of flexibility in the mindset of the people who were going to adopt Elkington's idea (see figure 2.3b). Bottom lines are understood as the quintessence—the result at the end of the day—and hence sustainability is the final outcome of an operation. This final outcome is determined by considering the operation's economic prosperity, its environmental quality and its social equity. This is still a vague definition and Elkington emphasizes the importance of focusing on the so-called "shear zones" (where the bottom lines overlap). By improving the shear zones, a business model becomes more sustainable, due to its synergetic consideration of the three bottom lines (see figure 2.3d). Thus the TBL model is, ultimately, akin to the definition of sustainable development introduced by the Brundtland Commission, just further developed. Elkington (1998) confirms the definition of the WCED and honours their wording as the best-known definition of sustainability.

Since the rate of publications about sustainability, in every conceivable area of research, escalated at the beginning of the 1990s, a more focused and systematic literature analysis process is followed from this stage.

(a) Initial TBL

(b) Constantly moving bottom lines

(c) Boundaries of the bottom lines

(d) Meeting points of bottom lines
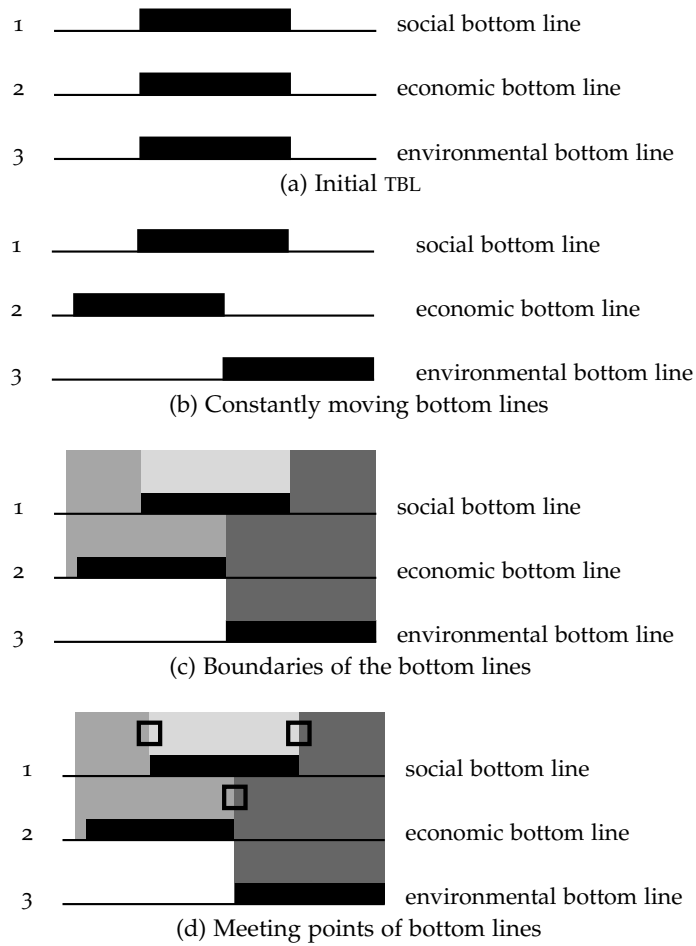
Figure 2.3.: Bottom lines as introduced by Elkington (1998, pp. 73–74)

Summary 1: Sustainability

The terminology arose in the literature as early as 1960 and has changed its meaning since. *Sustainability* is now a widely used term that signifies different attributes such as economic prosperity, environmental quality and social equity. In order to become sustainable these attributes will be incorporated in the business model and rather complement than impede each other.

A non-exhaustive list of examples for sustainability initiatives in a business environment which may be requested by another supply chain member are listed in table 2.1.

Table 2.1.: *Examples* for initiatives/adaptations on the two different bottom lines

EXAMPLES FOR POSSIBLE CHANGES ON THE ENVIRONMENTAL BOTTOM LINE
The B asks its S to reduce electricity/water/gas.
B requires ISO 14000 certification from S.
B asks S to source from sustainable forestry (e.g. FSC) or fishery (e.g. MSC).
B asks S to have its sourced material certified according to a certain industrial standard.
B asks for CO_2 footprint of Ss products.
B asks S to recycle a certain material/a percentage of its waste (see also section 2.2.13.5 on page 70).

EXAMPLES FOR POSSIBLE CHANGES ON THE SOCIAL BOTTOM LINE
B asks S to pay a defined minimum wage.
B requires ISO 26000 certification from S.
B asks S to do something for the surrounding community/town/village.
B asks S to train employees (in a certain manner).
B asks S to fulfil a certain gender quota among its staff.

2.2 SUSTAINABILITY IN SUPPLY CHAIN MANAGEMENT

SSCM is an often used term, however imprecisely defined. In the literature, the distinctions between Corporate Social Responsibility (CSR), Green Supply Chain Management (GSCM), environmental purchasing, value chain management and supply chain management are in many cases vague and unclear. In this research the term SSCM will be clearly distinguished from any environmentally focused principles such as GSCM or CSR focused activities. SSCM will be seen as a superior discipline—without neglecting all the different subgroup activities necessary for its existence. This point could not be expressed clearer than by drawing on Senge (2006, p. 122), who talks about "seeing the forest *and* the trees" [emphasis added].

A list of the different expressions used in the field of SSCM can be found in table 2.2. The list relies mainly on the findings from Seuring (2004) and Walker and Phillips (2006).

If you have to do a literature review, do one [. . .]; but just be open it will have nothing to do with, maybe, [sic] what you're studying
— Glaser (2010)[7]

Table 2.2.: Different terms used for sustainable SCM or its constituents

TERM USED FOR SSCM	AUTHOR(S)
Environmental Purchasing	Carter and Carter (1998), Carter and Ellram (1998), Carter et al. (2000), Legarth (2001), Murray and Cupples (2001) and Zsidisin and Siferd (2001)
Environmental SCM	Kogg (2003), Lamming and Hampson (1996), Narasimhan and Carter (1998) and Zsidisin and Siferd (2001)
Environmental Supplier Performance	Humphreys et al. (2003) and Noci (1997)
Green Purchasing	Chen and Paulraj (2004), Min and Galle (2001) and Ochoa et al. (2003)
Green Purchasing and Supply Policies	Green et al. (1998)
Green Purchasing Strategies	Min and Galle (1997)

Continued on next page

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6 Co-Founder of the grounded theory methodology.

TERM USED FOR SSCM	AUTHOR(S)
Green Supply	Bowen et al. (2002) and Bowen et al. (2001)
Green Supply Chains	Klassen and Johnson (2004), Rao and Holt (2005) and Walton et al. (1998)
Green SCM	Goldbach (2002, 2003), Sarkis (2003), Seuring (2001a,b), Walton et al. (1998), Wycherley (1999) and Zhu et al. (2005)
Green Value Chains	Handfield et al. (1997)
Integrated SCM	Boons (1998), Cramer (1996), Groene and Hermans (1998) and Wolters et al. (1997)
Material Flow Management	Enquête-Kommission "Schutz des Menschen und der Umwelt" des 13. deutschen Bundestages (1994)
Substance Chain Management	Enquête-Kommission "Schutz des Menschen und der Umwelt" des 13. deutschen Bundestages (1994)

In the following subsections (sections 2.2.2 to 2.2.12), the trees which build the SSCM forest are extracted and described by using peer-reviewed publications concerned with the topic.

2.2.1 *Methodology*

A systematic search and selection process is applied in order to find the relevant articles with the most valuable solution. This method is often applied in SCM and sustainability research (see also Ashby et al. (2012), Seuring and Gold (2012) and Wong et al. (2012)). For this review the Scopus® search engine is deployed. Thereby the fields title, abstract and keywords of all articles published in high-quality

journals[7] are searched for `sustain*` *and* any form of `supply chain`. The exact search string can be found in listing A.3. The outcome of this search delivered 443 results in total, of which 154 were found to be relevant. The relevance of an article was determined after reading its abstract and it was found that the article deals with SSCM in any form.

To give an overview of the considered articles, the distributions over years and across research areas are displayed respectively in figure 2.4b and figure 2.4a. The analysis of the articles will lead subsequently to a definition of the contents of SSCM (see figure 2.5).

(a) Field of research SSCM found in

(b) Increasing publications about SSCM per year
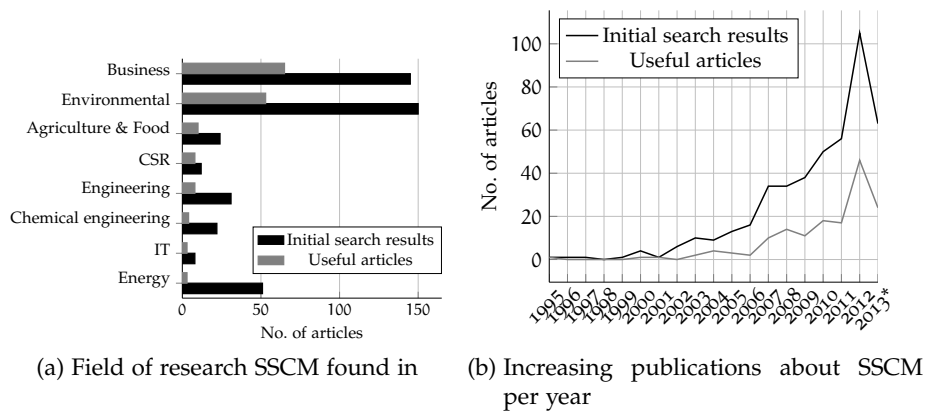
Figure 2.4.: Overview of the publications dealing with SSCM.
*The number of publications in 2013 is not representative.

The trend displayed in figure 2.4 (page 27) shows exponential growth over time for publications about sustainability in highly reputable journals. A similar development can be found if only journals about Operations Management (OM) are considered. Croom et al. (2009, p. 1) found that many special issues about sustainability in OM were published: for instance, "in the International Journal of Production Eco-

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7 Journals with an ABS ranking of at least 2 stars or an Thomson Reuters impact factor of $\geqslant$ 1. The International Standard Serial Number (ISSN) numbers of these journals are then fed into the search string.

nomics[8] (Piplani et al., 2008), Journal of Operations Management[9] (Jayaraman et al., 2007), Supply Chain Management: an International Journal[10] (Lindgreen et al., 2009), and Journal of Supply Chain Management[11] (Pagell et al., 2008)". Among the journals publishing special issues about sustainability are high-ranked journals, even within the research area of supply chain management, which indicates the importance of sustainability in this field.

Summary 2: Popularity

Research activity about sustainability in OM and SCM has strongly increased in popularity in the last decade.

Different issues and perspectives about sustainability in SCM are discussed in the literature. The discussions are contradictory regarding the scope and extent of SSCM, and particular regarding the focus of sustainability in a Supply Chain (SC) context. This section gives an overview about the discussion. Even though the discussed issues are subordinated under different headings, it is not said that this excludes them from overlapping into another category.

2.2.2 *Environmental bottom line*

Despite the importance of energy efficiency in times of climate change, supply chain management and logistics research has neglected this issue until recently (Halldórsson and Kovács, 2010). Different ideas

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8 3 Star Harvey et al. (2010)
9 4 Star Harvey et al. (2010)
10 3 Star Harvey et al. (2010)
11 1 Star Harvey et al. (2010)

about the environmental bottom line in the context of SSCM are clustered in the following subsections.

2.2.2.1 *China*

A lot of research about SSCM has focused on China. The reason for China being so particularly present on the radar of researchers might be founded in the increasing manufacturing output of China in the recent years. The Chinese automotive industry is found to be hesitating when it comes to environmental initiatives and GSCM. Zhu et al. (2007) find in a study amongst 89 Chinese automotive firms that GSCM is not widely implemented yet. The best environmental efforts are usually restricted to the boundaries of a firm. However, the pressure on Chinese firms to get involved in green initiatives along their supply chains increases (Zhu and Sarkis, 2007). For instance, the Chinese government has introduced a programme called Energy Saving and Emission Reduction (ESER) to reduce the environmental burden of its manufacturing sector. Zhu and Geng (2013) however find that the impact of the programme is rather low since the government does not coerce the manufacturer to environmental initiatives, and the trade-off on the economic bottom lines acts as another barrier for voluntary implementation.

One issue for the Chinese industry regarding the environment will be future water scarcity due to their coal-dependent energy supply. Pan et al. (2012) analysed scenarios of China's coal industry and conclude that the country is likely to "exceed [its] water supply capacity in the near-term future", if no counter measures are implemented.

2.2.2.2   *GSCM*

GSCM is often equated with SSCM. The differences will become clear on the upcoming pages and in the conceptual framework of SSCM on page 62. In a literature review Seuring and Müller (2008) find that SSCM often only deals with environmental issues in supply chains. Much scarcer are the studies considering social issues under the umbrella of sustainability in SCM, and even fewer articles were found by the authors considering the interaction of all three bottom lines. GSCM and Life-cycle Assessement (LCA) are related approaches, however, find Zhu and Cote (2004).

The principle of GSCM is prevalent in various different industries. Considering the example of the tourism industry, Adriana (2009) finds that the implementation of green initiatives along one's supply chain is not driven by legal regulations or policies, but rather by public pressures or an organization's general stand towards these issues. Another application of GSCM is presented by Wang et al. (2013). Wang et al. set out to apply GSCM to restaurants. By interviewing experts, the authors find that three facets are important to implement in order to achieve a green supply chain:

- Green foods

- Green environment & equipment

- Green management & social responsibility

One could argue that the authors have already gone a step farther than they intended to go, by including the social bottom line in their conceptual model.

2.2.2.3 *Retail*

Retailers and big brands are constantly in the public eye and under observation, not only by Non-governmental Organizations (NGOs), governmental institutions and shareholders, but also by their customers and stakeholders (Wolf, 2014). Styles et al. (2012) note that retailers are in a very good position to introduce and enforce supply chain eco-efficiency measures. The authors suggest environmental performance benchmarking of suppliers and third party certification as efficient environmental initiatives. Consumer awareness is created by labelling products with the relevant environmental metrics. However Gadema and Oglethorpe (2011) conclude that, even though most consumers in United Kingdom (UK) supermarkets are influenced by carbon footprint labels on products, the voluntary labelling as it is currently practised does not improve the environmental impact of food products significantly. Even more diminishing results about the impact of big brands' efforts are presented by Dauvergne and Lister (2012) who claim that, even though the CSR agendas of big brands and firms with a high buyer power have an influence on the environmental impact of consumerism, it is not enough to "resolve the problems of global environmental change". For significant results, broader over-arching legislation is necessary to make a significant impact on the environmental change. Delai and Takahashi (2013) on the other hand find the "privileged position between supply and demand" of major retailers important and powerful enough, to the extent that the sustainable practices of these retailers would have a significant impact on "sustainable consumption". One may conclude that retailers and big brands have an educating task when it comes to consumers' be-

haviour; this could have a higher impact on general environmental health than any extrinsic initiative.

2.2.2.4   *Transportation and logistics*

As part of every SC, transportation and logistics offer some opportunities to improve environmental sustainability systematically. Sim et al. (2007) find in a case study of different types of produce that transportation has the greatest impact on the environmental bottom line in international food supply chains. Hence the authors recommend the consumption of regional *and* seasonal food as far as possible. In another study about the efficiency of transportation and its impact on environmental sustainability, Sanchez-Rodrigues et al. (2010, p. 61) point out the main drivers responsible for difficulties in maintaining sustainable transport logistics. According to the authors, these are: "delays, variable demand/poor information, delivery constraints and insufficient supply chain integration." In addition, Mundler and Rumpus (2012) find that short distance transportation is *not* more inefficient when measured on a $\frac{GOE}{\unicode{x20AC}}$ scale, but is rather similar to long-distance transportation efficiency.

Another pathway to reduce the environmental footprint of transport networks is presented by Acreche and Valeiro (2013). Acreche and Valeiro found that due to the Greenhouse Gas (GHG) emission during the *production* of ethanol, the overall decrease when using 95:5 blend at a later point in the supply chain is negligible. A similar idea is investigated by Finnan and Styles (2013), who claim that replacing oil seed rape with hemp as an energy crop could lead to significant systemic environmental improvement in bio-energy supply chains.

In general, it can be said that smart logistics and transportation can reduce CO_2 emissions significantly—up to 80-fold in some applications, as Cholette and Venkat (2009) indicate. In the case of a California based winery, Cholette and Venkat present transportation network improvement that can lead to an 80-fold decrease in carbon emissions. This example shows how a simple re-configuration of logistic networks can have a significant impact on CO_2 emissions and hence contribute towards a sustainable supply chain.

Another approach to reduce the environmental impact of transport networks is using alternative modes of transportation. By introducing high-speed trains and similar infrastructural improvements, the environmental impact of supply chains can be reduced by shifting transport from the road network on to other modes (Chester and Horvath, 2012; Chester et al., 2013)

2.2.2.5 *Solutions and applications*

The academic literature also offers case studies with solutions and recommendations for the implementation of the environmental bottom line in SCM. An example where technology has a significant systemic effect on SC sustainability is published by Van Velzen and Linnemann (2008). Van Velzen and Linnemann find that Modified Atmosphere Packaging (MAPA) significantly improves the sustainability of the Dutch meat supply chain by decreasing food losses. The authors are critical of the fact that, even though the positive effects of this packaging technology were already known in the 1960s, it took four decades to fully implement MAPA in the Dutch meat SC. Also environmentally beneficial for a SC is the localization of an industry or a supplier network. Anderson (2008) discusses the value of localization

of supply chains towards their sustainability. It is found that the main benefit for local sourcing is the improvement on the environmental bottom line due to less transport. Apart from that, local sourcing, which is demonstrated by the authors using the example of a food supply chain, can be beneficial for the local community. In addition, processes that are in use by large companies with sophisticated distribution systems are found to be sensible to implement across all industries. Ülkü (2012) demonstrates this with the example of a linear optimization model for shipment consolidation, which can save a firm "truckloads of money" on top of the environmental benefits.

Re-manufacturing is another solution to increase environmental sustainability in a supply chain. Quariguasi Frota Neto and Bloemhof (2012) find that re-manufacturing of mobile phones and personal computers does actually decrease the total energy consumption of a product per life cycle. The authors note that this finding *only holds if* the re-manufactured product's life cycle is about as long as a new product's life cycle.

Another important tool to reduce the environmental impact of supply chains are information systems. So-called Interorganizational Information Systems (IOISs) are found to not only increase the environmental bottom line of a SC, but also improve the competitive advantage of all stakeholders (Shaft et al., 2001). Wognum et al. (2011) note that SC information systems need to be upgraded to provide stakeholders with TBL information, which would also increase consumer trust. Often, environmental information is calculated with some form of LCA. Applications of LCA are further elaborated in section 2.2.9 as this tool is found useful to reduce a supply chain's environmental impact. Ewing et al. (2011) demonstrate from the example of a mar-

ine freight transportation company that carefully assessing a firm's footprint with an appropriate LCA systematic reveals potential capabilities to reduce the environmental impact of its supply chain.

2.2.3   *Social bottom line*

Even though the social bottom line is now regarded in most companies under the umbrella of CSR, a more holistic perspective across a whole supply chain is not always prevalent. CSR is mainly driven by public pressure, as Preuss (2008) finds by scrutinizing the CSR agendas of FTSE100 companies. White and Lee (2009) find that OM and sustainable development mostly focus on the environmental bottom line. The authors suggest that the social dimension of the TBL in this context is under-explored. Klassen and Vereecke (2012, p. 103) provide a definition of social issues in supply chains, by denominating these as "a product- or process-related aspects of operations that affect human safety, welfare and community development". In the academic literature, principles and ideas are prevalent which have similarities and overlaps with the social perspective to SSCM. One is presented by Ciliberti et al. (2008) who develop a framework for Logistics Social Responsibility (LSR). Thereby not only are classical social issues considered, but also environmental sustainability categories are created under the umbrella of LSR. That is, "Sustainable Transportation, Sustainable Packaging, Sustainable Warehousing and Reverse Logistics" are found to be categories of LSR; this therefore strongly overlaps with current understanding of SSCM.

Social issues in supply chains can involve child labour, of which tobacco companies are found guilty. Otañez and Glantz (2011) find

that even though tobacco companies present themselves as proactive towards sustainability in their supply chains, a substantial amount of agricultural work is still carried out by children. The authors accuse the tobacco industry of disguising this problem by emphasizing their green supply chain efforts. Another example of how supply chains can influence stakeholders is presented by Dixon and Isaacs (2013), who illustrate a phenomenon with a case where a supermarket's advertisements affect the landscape and design of whole cities and towns.

In the following subsections various issues as they are reported in the SSCM literature about the social dimension are clustered and described.

2.2.3.1 *Measuring the social bottom line*

In section 2.2.9 different approaches to the measurement of sustainability in Sustainable Supply Chains (SSCs) are presented. This subsection will only introduce some ideas of how to measure the social bottom line along a supply chain. The measurement of the social bottom line is expected to be the first step to improve social equity (Hutchins and Sutherland, 2008) in SCs.

Andrews et al. (2009) adapted the Life-cycle Attribute Assessment (LCAA) method for a case study of a tomato supply chain. The idea is not only to measure quantitative environmental impacts as in a conventional LCA, but also to determine other attributes. Such an attribute can be represented for instance through a certain social policy. The LCAA can deliver information about what percentage of a product's supply chain has followed the chosen social policy. This method could be used to develop a sustainable footprint of products.

Baskaran et al. (2012) conducted a study across the Indian textile and clothing industry, with the goal of measuring sustainability. Baskaran et al. applied the Grey approach[12] to determine buyers' and suppliers' behaviour in relation to:

- discrimination,

- abuse of human rights,

- child labour,

- long working hours,

- unfair competition, and

- pollution.

Hence, the author's understanding of sustainability in a supply chain context varies from the perspectives that are often focused on the environmental bottom line.

Awaysheh and Klassen (2010) explore the "integration of social issues in the management of supply chains". This is found to be part of SSCM. By doing so, the authors find four social dimensions for which a supplier should be monitored:

1. the suppliers' accordance with human rights,

2. the labour practices at a supplier,

3. the existence and content of a supplier's own code of conduct, and

4. social audits that are to be conducted at a supplier's site, as well as by a supplier.

This will ensure upstream compliance with the social agenda.

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12 The Grey system theory is a mathematical modelling approach for decision making with partly unknown variables.

Nikolaou et al. (2013) go one step further with a model that integrates CSR and sustainability issues in reverse supply chains. However, this can be understood as exaggerated, since all three principles are already interconnected under the umbrella of SSCM.

2.2.4   *TBL interaction and the economic bottom line*

From the beginnings of sustainability research, the interaction among the three bottom lines was emphasized by Elkington (1998). SSCM research has also considered this idea, which will be elaborated with some examples in the following subsection, before focusing on the economic benefits that come with SSCM.

2.2.4.1   *TBL interdependence*

Gopalakrishnan et al. (2012) try to draw a picture of the contents of SSCM by assessing the literature and complementing their findings with an in-depth case study. The authors conclude that all three aspects of sustainability as defined by the TBL are interdependent in a SC context. Practical evidence is delivered by Park et al. (2010, p. 1494) who set out to find whether there are opportunities for firms in developing countries to create "a better balance between economic growth and environmental stewardship". The authors find that these opportunities exist for firms involved in electronic supply chains. Similarly Hall et al. (2012) demonstrate with the example of Brazilian biofuel supply chains that sustainability initiatives on all three bottom lines are found to interact with each other. A quantitative approach to support the existence of TBL interdependence is delivered by Gimenez et al. (2012) who find that initiatives addressing different bottom lines

of the TBL have synergistic effects, by analysing International Manufacturing Strategy Survey (IMSS) data. In particular, environmental initiatives are found to have a positive impact on the economic and social bottom line, whereas social initiatives showed a negative impact on the short-term economic bottom line.

The reporting of the interconnectedness and interdependence of the three bottom lines currently falls short, Markley and Davis (2007) find. After a thorough analysis of sustainability reports, Markley and Davis (2007) find that the three bottom lines of sustainability are consistently reported independently of each other, in separate chapters of the reports. To achieve true sustainability in operations and supply chains, the authors recommend a stronger focus on the inter-connectedness of the bottom lines. This suggestion is not new, as Elkington (1998) had already emphasized the necessity to look at the "shear zones" of the three bottom lines in 1998.

On the other hand, the overarching effects on the TBL are not always immediately positively correlated, as one may conclude from the previous paragraphs. After discussing sustainability issues and development in supply chains with global leading companies and supply chain professionals, Hoek and Johnson (2010) find possible reasons for firms to hesitate when it comes to new sustainability initiatives. One major barrier for investing in new sustainability opportunities is if the write-off period of the investment is longer than the anticipated marketing effect lasts. Similarly Wu and Pagell (2011) find that decision makers need to evaluate trade-offs on the TBL when implementing SSCM. These are often characterized by short-term decrease of economic profitability as a sacrifice for long-term environmental benefits.

2.2.4.2 *Economic bottom line*

The academic literature has discussed different mechanisms for an improvement in the economic bottom line through SSCM. A rather simple but valid idea is provided by Bose and Pal (2012) who find that the announcement of green initiatives, particularly among manufacturing firms, has a significant positive effect on their stock prices on the day of the announcement. In an interorganizational context Barari et al. (2012) find that incorporating environmental sustainability in one's business and supply chain can be a lever to increase economic profitability of products in the downstream chain. In addition to a possible increase of profitability on a product level, Wang and Chan (2013) state that GSCM can lead to "more business opportunities"—hence improving the economic bottom line. To be most efficient in the choice of the green initiatives in which a firm invests, the authors propose a fuzzy hierarchical model to compare one's options.

Leaner processes, such as reducing waste, provide a different perspective on the question of how SSCM affects one's economic performance. In a study amongst 972 Mexican SMEs Van Hoof and Lyon (2013), find that initiatives tackling waste, such as recycling or prevention of waste, are superior to energy saving or water saving initiatives on the environmental *and* economic bottom line. Coca-Cola and Apple are used as case studies by Kumar et al. (2012) to demonstrate that eliminating waste along one's supply chain will not only make it "greener", but also more profitable. However, not all optimization of processes leads to more sustainability. Through the example of the automotive industry's supply chain in Europe, Harris et al. (2011) show that logistic design optimization for cost efficiency does not necessarily deliver the most eco-friendly solution.

Recycling processes fall under the responsibility of the *reverse supply chain*, which generates profits and costs similarly to a traditional forward supply chain. Hence similar methods for cost reduction and profit maximization can be applied in this system with the same beneficial effects. This is discussed by Simpson (2010), who finds a phenomenon in reverse supply chains where firms collaborate in order to extract the best economic performance from a recycling process. In some cases simple, feasible changes at the End-Of-Life (EOL) treatment can result in significant economic success, as demonstrated with the example of a furniture supply chain by Michelsen and Fet (2010) and Michelsen et al. (2006).

Faccio et al. (2013) highlight that the new models of closed-loop SCs, which are often driven by legislation and policy, create additional costs. These costs must be accounted for in the forward SC in order to cover the necessary processes after the product's life.

Further ideas include innovation of the packaging industry (Lewis, 2005), or simply reusable packaging systems. However a rather surprising finding to the packaging discussion is presented by Pålsson et al. (2012). The authors conduct a case study about the environmental and economic performance of packaging systems in automotive SCs and conclude that an intelligently designed one-way packaging solution outperforms the widely used returnable packaging systems on both bottom lines.

The major economic benefits of GSCM, SSCM and sustainable practices in general, however, are found in the marketing effect of sustainability. Sharma et al. (2010) investigated the roots of these economic benefits and found that, even though some are accounted for by more efficient operations, the main contributor to the economic

benefits is the marketing effect of green initiatives. This idea is in line with a study from Flint and Golicic (2009), who interviewed managers from New-Zealand based wineries, restaurants and retailers, and came to the conclusion that SSCM is used as an advantage for the sale of products and services. In particular, presenting a story about the sustainability of a product or service seems to be a popular marketing campaign.

2.2.5   *Product and design*

Ramani et al. (2010) find that the sustainability of a product during its life cycle is determined by the product design. Therefore, the authors suggest using design for sustainability in the very early stages of product development. Sustainable product design should consider the upgradability of a product, as this functionality can significantly increase the life cycle of products (Pialot et al., 2012). Sharma and Iyer (2012) find another approach to develop environmentally friendly products by simply being restricted in resources, which can result in environmentally friendly product design and subsequently in a systemic reduction of environmental harm.

The design of a product also determines its usability after its first life cycle, which is demonstrated by the example of the reverse supply chain of microwave ovens as scrutinized by Dindarian et al. (2012, p. 22). The authors find that the only reason for not using parts of recycled microwave ovens is the actual product design and not, as one might have expected, "the quality of discarded products nor the costs of electrical spare parts".

2.2.6 *Holism*

SSCM should be a holistic concept—holistic by including the three dimensions of the TBL and their interconnectedness, as well as implementing this school of thought into classic SCM understandings and closed-loop SC theory (Nikolopoulou and Ierapetritou, 2012; Winter and Knemeyer, 2013). Based on well-established theories, such as transaction cost economics, resource dependence theory and population ecology, Carter and Rogers (2008) find evidence for synergistic effects of the three bottom lines in a supply chain scenario. The authors suggest SSCM as a strategic tool for long-term success of a company.

In the following subsections, the general idea of SSCM as presented in the academic literature is presented, followed by academics' thoughts on the idea of incorporating the sustainability concept into SCM and finally a subsection about SSCM studies related to closed-loop supply chains.

2.2.6.1 *SSCM*

SSCM is an outstanding idea to reduce environmental harm and social inequity. In a large-scale study it was found that "greening" supply chains could lead to helping threatened species. After analysing more than five billion supply chains, Lenzen et al. (2012) report that the global supply chains, which mainly served developed countries, threaten a large number of species there. As a counter measure, the authors recommend SSC certification and improved labelling of products to inform consumers.

The popularity and acceptance of the SSCM principle is growing in all industries (Linton et al., 2007; Piplani et al., 2008). Tang and Zhou (2012) note that consumers and governments drive firms to more sustainable business models. The challenge for these firms is to manage the three bottom lines successfully, which only works if a holistic concept such as SSCM is in place.

Different definitions of SSCM (which is named "integrated chain management" by some authors (Seuring and Müller, 2007, p. 699)) are available; for instance Büyüközkan and Berkol (2011, p. 13731) propose:

> Sustainable supply chain management (SSCM) provides economic, social and environmental requirements in material and service flows occurring between suppliers, manufacturers and customers.

Other authors such as Ahi and Searcy (2013, p. 339) find the current definitions of SSCM rather vague, and provide their own definition:

> The creation of coordinated supply chains through the voluntary integration of economic, environmental, and social considerations with key interorganizational business systems designed to efficiently and effectively manage the material, information, and capital flows associated with the procurement, production, and distribution of products or services in order to meet stakeholder requirements and improve the profitability, competitiveness, and resilience of the organization over the short- and long-term.

A definition formulated for the purpose of this thesis is presented on page 62 after systematic assessment of all facets discussed under the term SSCM.

2.2.6.2   *SCM*

Already in 1995 Bloemhof-Ruwaard et al. (1995) appealed to the operations management research community to include environmental issues in their perspective when analysing supply chains. This should not only offer OM researchers a new angle towards supply chains, but also provide environmental researchers with an understanding of the SC way of thinking. The SCM research community now agrees that in future SCM discussions "the incorporation of [. . .] sustainability aspects is also considered" (Papageorgiou, 2009, p. 1931). In practice, the implementation of sustainability in SCs is already increasingly observed in developed countries: the Wolf (2011) report on German manufacturing is an example.

A systems approach towards sustainability, such as SSCM, outperforms focusing on a single firm's operations, Geldermann et al. (2007) show by the example of a Chinese bicycle company. Similarly, instead of focusing at company level, Isaksson et al. (2010) suggest the application of systems thinking to improve sustainability throughout a supply chain. The goal of a supply chain, and the resulting product, should be the maximization of stakeholder value whilst minimizing any harm, such as environmental or social harm. This systemic introduction of sustainability helps to build viable supply chain relationships on top of other benefits, such as better consumer and community relationships (Closs et al., 2011). Furthermore, not only does the inclusion of a network in the sustainability agenda (instead of just one firm) increase sustainability, the supply chain strength, defined as the number and quality of suppliers, is also positively related to the environmental and social performance of the supply chain (Vachon and Mao, 2008).

A slightly different approach on how to build a SSC is introduced by Moore and Manring (2009). After emphasizing the positive effects for SMEs of becoming more sustainable in their operations, the authors conclude that by forming networks of sustainable SMEs, and by doing so SSCs, further advantages are created.

A possible negative side-effect of SSCM is reported by Perez-Aleman and Sandilands (2008), who warn that high sustainability requirements in supply chains can be challenging for small firms in developing countries and eventually lead to the exclusion of these poorest links in the chain. To prevent this from happening, the authors suggest "active assistance" for those who are in need.

2.2.6.3 *Closed loop and reverse supply chains*

"Closed-loop supply chains are assumed to be sustainable supply chains almost by definition", explain Quariguasi Frota Neto et al. (2010, p. 4463). Certainly, closed-loop supply chains represent some of the features of SSCM, such as a contribution to the environmental bottom line and the reclamation of economic value. However, as stated by a number of authors above and as will be concluded on page 62, there is more to SSCM.

The academic literature provides a number of tutorials (Souza, 2013) and optimization models for closed-loop supply chains. Depending on the purpose of a closed-loop supply chain, the processes need to be optimized with regard to the specific focus (e. g. Özkır and Başlıgil, 2013)):

- material recovery,
- component recovery, and
- product recovery.

Implementing reverse logistics and closed-loop supply chain strategies not only reduces the environmental impact *and* costs, but is also found to increase customer satisfaction (Eskandarpour et al., 2012).

However, like forward supply chains, reverse supply chains also harbour uncertainties. Huang et al. (2009, p. 2279) present three uncertainties in closed-loop supply chains: "(1) uncertainty of time-delay in re-manufacturing and returns, (2) uncertainty of system cost parameters, (3) uncertainty of customers' demand disturbances."

Examples of reverse supply chains, which are also named secondary supply chains, are also presented in the SSCM literature. Using the example of aluminium cans in the United States (US), Buffington (2012) build their case on primary and secondary supply chain integration. In the example, the primary supply chain is the manufacturing of the can, which happens (according to the authors) according to good practice with a vertically integrated supply chain. The secondary supply chain, also known as the reverse supply chain, is postconsumer. In this area, there is particular potential for improvement in the US aluminium market. Besiou et al. (2012) find that beneath official government-run waste recovery schemes, scavengers play a role in closed-loop supply chains. The authors suggest that incorporation of these scavengers by legislation will turn out beneficial for the TBL of the respective waste recovery system.

2.2.7 *Internal operations*

As introduced in section 2.2.6 the sustainability performance of the internal operations of a firm play a role in SSCM. In the following

paragraphs, effects of and influences on operations and production are introduced as they appear in the literature.

From an overview of sustainability articles in the journal *Production and Operations Management*, Kleindorfer et al. (2005) conclude that the pressure on businesses to include the TBL philosophy in their operations grows continuously. To successfully implement sustainability into the product and process design in a systematic way within the boundaries of an organization, tools such as Plan Do Check Act (PDCA) are found beneficial (Naka et al., 2000). On the journey to implement a sustainability agenda, Perrels (2008) suggest proceeding stepwise, as opposed to pushing for radical changes in short periods of time. The authors argue that the latter approach bears some risks that might be counter-productive. Moreover, sustainability agendas need to be as flexible and dynamic as the whole business model and the operations of the implementing firm itself, notes Beske (2012).

Authors in the field of SSCM also find the roots of the operations and productions principles within the boundaries of an organization. Carter and Easton (2011) for instance find in a systematic literature review that SSCM research is mostly based on CSR and environmental business practices, such as green production or logistics. The SSCM subgroup GSCM is found to be based on sustainable manufacturing (Chun and Bidanda, 2013).

Within a firm, lean business practices are quite capable of working as a catalyst for the implementation of green business practices and, conversely, green business practices often come with a lean process (Dües et al., 2013). This is also demonstrated through the example of a medical product manufacturer by Lee and Lam (2012), who find

that a product can become more sustainable in the sense of the TBL, by improving the efficiency of the underlying operations.

By becoming more sustainable in the procurement operations, a firm can also benefit from a systemic effect on other areas of its operations. This idea is demonstrated in a study of 400 Malaysian manufacturing companies by Zailani et al. (2012). The authors find that the two sustainability initiatives *environmental purchasing* and *sustainable packaging* improve the performance of several other areas of a firm too. The initiatives were found to have a positive impact on the three bottom lines, as well as on a firm's operations.

2.2.8 *Legislation and standards*

Whilst developing sustainable logistics networks, in which the effort of reducing the costs is in equilibrium with the effort of reducing environmental impact, Quariguasi Frota Neto et al. (2008) propose that sustainability integration is generally driven by consumers and legislation. Similarly, Chaabane et al. (2012) find that Environmental Trading Schemes (ETSs) can promote sustainable practices (environmental friendly practices in this case) due to economic incentives. A practical example of this scenario is given by Choi (2013) and illustrates that, in fashion SCs, penalties for CO_2 intense transportation of production will increase a buyer's willingness to source locally. The development of legislation for the environmental agenda in SCs is currently ongoing, as the guidelines for environmental assessment of food supply chains by the European Commission demonstrate (Peacock et al., 2011).

Legislation however is not the only mechanism to get organizations involved in GSCM, Tsireme et al. (2012) note. Although it may work *in some cases*, other firms seem not to be affected by legislative power due to their international supply chains.

Koh et al. (2012) find that standards, such as the Waste Electrical and Electronic Equipment Directive (WEEE) and the Restriction of Hazardous Substances Directive (RoHS), are beneficial towards a more environmentally friendly supply chain in the Information Technology (IT) industry. These standards are best implemented by collaboration with supply chain partners. With the example of food supply chains, Smith (2008, p. 849) confirms this finding by stating that sustainable food SCs are built on "interpersonal trust and working to standards". Further, Oosterveer and Spaargaren (2011) highlight the need for reliable and trustworthy labelling of sustainable sourced fish. The alternative, which would be local sourcing, is just not feasible; hence, certification bodies need control by NGOs in order to guarantee their legitimacy to the consumers.

2.2.9 *Measurement and LCA*

Measurement of environmental impact along a product's lifecycle is frequently undertaken with a number of LCA approaches. Before an overview of these LCA studies is given, alternative methodologies of measurement of SSC performance are introduced.

2.2.9.1 *Measurement*

Morali and Searcy (2012) notice, after analysing 100 sustainability reports of Canadian firms and talking to involved managers, that in

particular the inter-connectedness of the three bottom lines is little reported. This is due to difficulties on how to measure these over-arching effects. A very simplified approach to measurement of all three bottom lines is presented by You et al. (2012) for the sustainability of a cellulosic biofuel SC. The authors simply measure one Key Performance Indicator (KPI) for each bottom line:

ECONOMIC Total annualized cost

ENVIRONMENTAL Life-cycle GHG emissions

SOCIAL Number of accrued local jobs

Similarly Gerbens-Leenes et al. (2003) propose a simplified model to measure the sustainability performance of a food production operation, by reporting the following KPIs: "the total land, energy and water requirement per kilogram of available food". The authors note, however, that one of the major drawbacks of developing a new measurement system is the lack of comparability. Gaussin et al. (2013) summarize the existing methods of calculating carbon footprints and conclude that a standardized index would provide better insight and comparability for products and supply chains. Similarly Jensen (2012) finds the differing calculation methods for environmental footprints impractical.

By analysing the publications about SSCM between the years 2000 and 2010, Hassini et al. (2012) synthesize a framework for performance measures of sustainability in supply chains, although the authors remain somewhat vague about the actual metrics involved. Hassini et al. suggest measuring all three bottom lines of all involved supply chain partners, which seems obvious if one understands the holistic perspective of SSCM. Being more specific, Erol et al. (2011) have

developed a framework to measure the performance of a SSC. The framework attempts to measure all three bottom lines, which is described as difficult, whilst still being too simplified to represent a precise measure of the performance. Yakovleva et al. (2012) propose an approach based on Analytical Hierarchy Process (AHP) to measure supply chain sustainability; however, the authors also admit that there are difficulties in creating comparable measures for SSCs.

2.2.9.2 *LCA*

Cellura et al. (2012) find in a case study evidence for the suitability of a LCA to develop viable environmentally friendly solutions, such as product design efforts. This can improve the overall sustainability of a product along its supply chain or life cycle. After investigating the interplay of the principles "green, lean and global" in a supply chain context, Mollenkopf et al. (2010, p. 14) propose that integrated LCA is the most suitable tool to measure the performance of similar SCs. This idea is extended by Adhitya et al. (2011), who propose a framework for LCA which not only evaluates the environmental bottom line, but also considers the economic perspective: this is demonstrated in a case of diaper production. Another extension of LCA is proposed by Benoît-Norris et al. (2011), who discuss the content of the guidelines to ISO 26 000 and their applicability to conducting a social LCA. The necessity of further guidelines to the standard ISO 26 000 is highlighted in an earlier issue of *International Journal of Life Cycle Assessment* by Benoît et al. (2010). Synthesizing these ideas of measuring all three bottom lines individually via LCA results in what Sala et al. (2012) call Life-cycle Sustainability Assessment (LCSA): a measurement methodology for sustainability along a product's life.

This extends the environmentally focussed LCA to all sustainability criteria.

Examples in the SSCM literature for applications of LCA are numerous, and the results often surprising. Arena et al. (2004) scrutinized the process of the after life cycle treatment of paper products in Italy. The method the authors applied in order to gain some information about the environmental performance of their different options was LCA. The outcome of the study shows that material recycling is not the favourable option, if the environmental issues are the focus. By conducting a "plough to plate" LCA of porridge oats, McDevitt and Milà i Canals (2011, p. 484) found that "the greatest environmental impact [...] occurs in crop production and cooking". The authors consider that this finding is transferable to other agricultural produce and suggest that the focus on efforts for environmental harm reduction should be re-adjusted. In a study about the Australian red meat supply chain, Peters et al. (2010, p. 311) find a LCA method to determine the water use of beef production. The idea is to measure how much water "is removed from the course it would take in the absence of production or degraded in quality by the production systems". A common thread that goes through discussion of LCA is the differing settings of the system's boundaries. This variance makes it almost impossible to compare findings from different studies for similar products.

The accuracy of a LCA stands or falls with the data availability. Nemecek and Erzinger (2005) emphasize the need for large amounts of data for an accurate and holistic LCA. This need has led to databases called Life Cycle Inventorys (LCIs), which provide data for products, processes and infrastructure. The availability of these LCIs is still very

restricted and not available for many industries and countries. The non-availability of data and the large range of products of some firms make the principle of LCA not applicable under any circumstances. Kalleitner-Huber et al. (2012) present a study about an industrial wholesaler carrying >100,000 products, on its journey to greater sustainability. Since a thorough LCA of all products was not feasible, an estimation-based screening tool was introduced which rates the products in three categories: Risks, Chances and Strategic Impact. Those products with high scores are then considered for the highest impact sustainability improvement.

2.2.10 *Systems perspective*

Dividing an elephant in half does not produce two small elephants.
— Senge (2006)

The terminology of *supply chain management* is misleading to a certain extent. Neither the goal to focus on suppliers nor the system under consideration is designed like a chain (in most cases). Arndt (2010) find the terminology "Demand Net Management" rather more fitting for the task, which is understood to be accomplished from SCM. Nevertheless, the expression supply chain management prevailed and is widely accepted to be a discipline for the management of material, information and value throughout a network of collaborating firms – ideally from the cradle to the grave of a product. The goals of SCM reach from cost-reduction through process optimization up to throughput time minimization for high customer satisfaction. Clearly the significant and beneficial idea of SCM is managing a system rather than just focusing on a part of it without considering the big picture .

Different tools and methods have evolved in SSCM that consider the whole system as such. On a product level, LCA is a successful tool that

is used to analyze the whole life cycle of a product, while focusing one's attention on all the *Muda* the product causes. A common standard for LCA is BS EN ISO 14 040 (2006) in association with BS EN ISO 14 044 (2006).

On an organizational level, closed-loop supply chains enjoy growing popularity. The key element in closed-loop supply chains is the focus on the cradle-to-cradle approach. The underlying idea is to avoid a product's "grave" and steer the product back into the value chain after it has accomplished its purpose in the end-user's hands. In order to achieve a closed-loop in a SC (which is a step towards a SSC), Metta and Badurdeen (2011) suggest that the "6Rs of sustainable manufacturing" be applied. The "6Rs" as cited by Metta and Badurdeen are based on an idea from Joshi et al. (2006) who extended the 3R concept as it is in the waste hierarchy (Finnveden et al., 2005; Yoshida et al., 2007):

REDUCE The first goal of the 3R principle is to reduce waste as far as possible. This can be achieved through innovative technology, process optimization, sustainable product design or simply raising customer awareness (e.g. pointing out the negative environmental effects of plastic bags).

REUSE The use of the product for a second term ("second hand") is called reuse. In a global environment this could for instance be the shipping of household appliances that are still in working condition to a developing country (instead of dumping them).

RECYCLE Recycling is understood as either the re-use of parts of a product or the process of generating a new raw material or part from an old product, which can then be used in a new product.

The additional 3Rs as introduced by Joshi et al. are "Recover, Re-design and Remanufacture". By applying the 6R principle, the resulting closed-loop supply chain is understood as beneficial for the environment and society in the broadest sense. However, this stands in contrast to the drivers which lead most implementers to the development of a closed loop SC, as Mann et al. (2010) discovered. Supported by multiple cases and datasets, Mann et al. conclude that the main driver for introducing a closed loop into a SC is an "improved economical performance". Matos and Hall (2007) bring the conceptualities of LCA and closed-loop systems together by denoting the LCA as a tool which can be used to improve, assess and eventually optimize a closed loop SC. A closed loop SC requires a good knowledge of the product and market in order to correctly estimate the amount of products which are actually coming back into the system through the backloop (Guide and Wassenhove, 2009).

In this piece of research reverse logistics is understood as the operational side of a closed-loop system. Reverse logistics is required to enable hitch-free flow back from the consumer to the retailer or manufacturer.

> **Summary 3: Systems Perspective**
>
> The systems perspective represents the other (SCM) dimension of SSCM, which extends SSCM to a hardly graspable concept.

2.2.11 *The driving firm*

Leppelt et al. (2013) find that a firm's corporate image, as perceived by the public, draws on the TBL performance of the firm. Sustainab-

ility *leaders* are found to invest heavily not only in their own opera-
tions to improve TBL performance, but also "beyond their corporate
boundaries" in their supply chain partners. In order to meet better
"green customers' needs", Liu et al. (2012) recommend a seamless in-
tegration between green marketing and SSCM. Pullman and Dillard
(2010) agree to the marketing efficiency of SSCM and find in a case
study of one organization that SSCM can be used as a Unique Selling
Proposition (USP) which allows a firm to achieve premium prices
(Rosenbloom, 2007). This mechanism works both ways, as Roep and
Wiskerke (2012) find with the example of food supply chains. The
authors look at how marketing influences sustainability and find that
sustainability in food supply chains is promoted through the efforts
of the involved firms in embedding, marketing and managing their
SSC.

2.2.12 *Dyadic exchange relation and power*

The direct links of an organization interested in implementing SSCM
are the first to start with. From these first contact points, the sustain-
ability agenda is to permeate through the supply chain. The follow-
ing paragraphs summarize the current state of SSCM literature regard-
ing suppliers, dyads and interorganizational issues as well as power
within these relationships.

2.2.12.1 *Supplier*

In order to achieve sustainability in a supply chain, it is important to
select the right suppliers who are willing and capable of participating
(Bai and Sarkis, 2010). The capability of a supplier to adapt to a given

sustainability agenda is scrutinized in the example of the Brazilian biofuel supply chain presented by Hall and Matos (2010). The authors demonstrate obstacles for introducing sustainability in a supply chain. The authors note that in the supply chains under scrutiny, the farmers at the beginning of the SCs were often not familiar with the idea of sustainability and hence rather interested in the economic bottom line. This issue can only be overcome by engaging with those farmers and contributing to their TBL education. This finding goes hand in hand with Hollos et al.'s (2012) study of European companies, in which it was found that sustainable supplier co-operation can increase a firm's performance on all three bottom lines. However, *environmental* sustainability efforts in particular were found to increase both other bottom lines, whereas initiatives on the social bottom line failed to have any overarching beneficial effects.

Vachon and Klassen (2006) find in a study of the North American market in 2002 that technological supplier integration increases the environmental collaboration of the dyad. Vachon and Klassen (2007) reproduce the findings of an earlier study (Vachon and Klassen, 2006) showing that strategic integration of a supplier has a positive impact on its pollution prevention efforts. Furthermore, the authors find evidence of the permeation of environmental initiatives in a SC travel upstream.

To find the right suppliers, methodologies for sustainable supplier selection have been developed, which rank suppliers according to their sustainability (Amindoust et al., 2012). Similarly Büyüközkan and Çifçi (2011) find the choice of a supplier which fulfils certain sustainability criteria essential for achieving a SSC. Since not every responsible person for supplier selection is fully comfortable with

sustainability requirements, another tool for sustainable supplier se-
lection is developed and successfully tested. The importance of a suit-
able supplier is highlighted by Tuzkaya et al. (2009) who conclude
that firms should be interested in greening their upstream supply
chain, since the bad reputation of a supplier can be projected on the
customer in the public eye. Similarly Roberts (2003) emphasizes the
necessity for SSCM by explaining that events outside the direct control
of a company can still harm its reputation. In particular, ethical and
environmental issues in a firm's supply chain can affect its reputation
negatively.

2.2.12.2 *Dyad*

Globalization has changed the competition for most firms and forced
them to work closer together with their suppliers and other stakehold-
ers in their SC. This fact needs to be recognized by researchers and a
broader focus needs to be applied, such as cross-organizational stud-
ies. To improve and develop the sustainability of a supply chain, Fres-
ner and Engelhardt (2004) suggest beginning with a focus company
and its direct links with suppliers or buyers. In subsequent steps, the
efforts can then be extended to the whole supply chain. Roh et al.
(2013) specifically suggest that sustainability in an SC context, as well
as buyer-supplier relations, needs further attention by researchers. In-
terorganizational efforts should be undertaken in order to implement
a holistic concept such as SSCM. Schliephake et al. (2009) find that col-
laborating with suppliers adjacent to a primary company increases
the chance of achieving a SSC. This finding is supported by (Seur-
ing, 2004) who found that co-operation in the supply chain reduced
environmental harm. Moreover, in a study of US companies, Albino

et al. (2012) find a positive causation and correlation between inter-organizational collaboration and a firm's "overall environmental performance". Practical evidence of Swedish firms' striving towards sustainability is delivered by Kogg and Mont (2012), who find that the trend goes towards sustainability integration into the supply chain, as opposed to sustainable operations. This is achieved through inter-organizational management.

2.2.12.3 *Power*

Boons et al. (2012) outline the idea of SSCM with four principles:

- "The consequences of geographical dispersion of economic activities." This is thoroughly discussed in the literature about globalization.

- The "measurement of ecological and social impact." This ongoing debate about measuring *sustainability* has resulted in standards for social and environmental LCA.

- "Managing sustainability in supply chains." The art of managing and permeating sustainability initiatives and goals throughout a supply chain is understood as a key contributor towards SSCM.

- "Power asymmetry among economic actors." Power imbalance and the permeation of sustainability principles along a supply chain are expected to correlate. This particular issue is also further investigated in Boons et al.'s research.

At this stage the power asymmetry in supply chains, when it comes to the integration of sustainability, is not explored in the academic domain. The implementation of SSCM and the difficulties that come with

it are found to be an important issue however (Al Zaabi et al., 2013). Taking the example of Unilever's agricultural supply chain, Pretty et al. (2008) elaborate how important (although challenging) it is to encourage SC partners to adapt to sustainability agendas. Vurro et al. (2009) find that a firm's centrality in the SC is positively related to its influence on other SC partners regarding *their* adaptive behaviour towards sustainability initiatives.

Little is known about the mechanism that makes other supply chain members adapt to sustainability agendas of an organization striving for SSCM. Simpson et al. (2007) find in a study amongst Australian automotive suppliers that a higher investment in interorganizational relationships leads to suppliers being more responsive towards buyer-suggested environmental measures. The authors also note that there is no research looking into this important piece of the puzzle: the mechanics of how interorganizational relationships impact the adaptive behaviour towards (environmental) sustainability. One hint can be found in a study by Wiengarten et al. (2013) who find that firms adopt ISO 14 000 not because some legitimate power source asks them to do so, but rather based on intrinsic motivation such as the desire to reduce the SC's environmental impact. On the other hand, Tsoi (2010) find that firms in developing countries only become involved in CSR if this is a customer requirement; otherwise the firms simply comply with sometimes insufficiently strict environmental and labour legislation.

Having assessed the literature regarding sustainability in a SCM context systematically, leads to a picture of SSCM as it is currently understood by academia. An overview of this perspective is given in figure 2.5. All the topics within the circle of SSCM are currently

discussed and researched under the academic SSCM domain. Drawing a picture of SSCM helps to understand the current state of research and identifying gaps.

This literature review highlights the necessity to look deeper into the mechanism of how sustainability actually permeates through the supply chain, and how this mechanism of permeation works in the dyadic exchange relation—as a starting point. As pointed out in the above subsections about *dyad* and *power*, the importance of those two issues has been acknowledged by academics in the field, however no in-depth research has been published to deliver empirical evidence to built on.
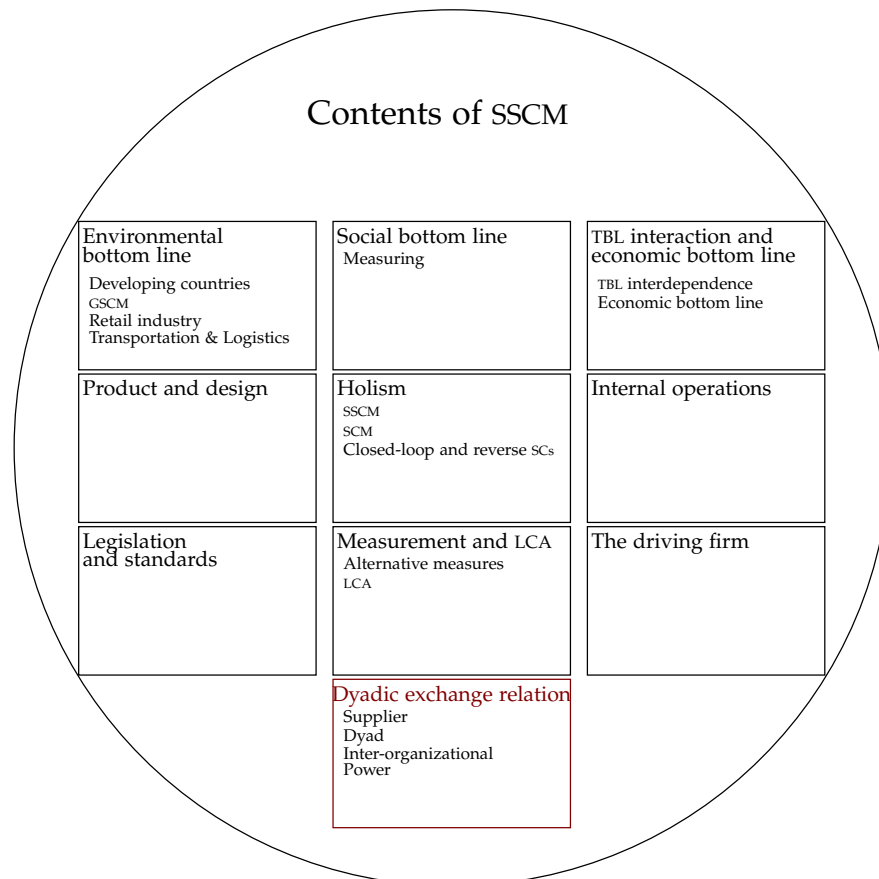
Figure 2.5.: SSCM model based on the emerging themes from the systematic literature review

In the following section 2.2.13 the models and frameworks about SSCM as they appear in the peer-reviewed literature shall be introduced to demonstrate the variety of perceptions regarding this topic.

2.2.13   *Academic models for SSCM*

Various academics have published their ideas, models and frameworks for SSCM. An overview of these will be given in the following subsections, before a model comprising the ideas found in this review is presented.

2.2.13.1   *Linton et al.*

Models of SSCM are numerous but inconclusive. Linton et al. (2007) explore how supply chains interact with sustainability, and develop a conceptual framework which strives to find issues to integrate in a supply chain in order to become sustainable. The exploration reveals the following issues to be added to the conventional perspective of SCM:

PRODUCT DESIGN: Considering the whole life cycle of a product at the designing stage. Linton et al. focus here on environmental issues rather than including the social and economic bottom line. The environmental perspective of product design with life cycle consideration is described and standardized in the PD ISO/TR 14 062 (2002).

MANUFACTURING BY-PRODUCTS: Minimizing all sorts of wastes. Similar to lean manufacturing. Linton et al. emphasize the positive effect on the environment by reducing *Muda*[13]. The authors focus on environmental issues, even though the reduction of by-products can clearly be seen as an economic advantage.

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13 *Muda* is a Japanese word for waste, which is not only literally rubbish but also any activity which wastes resources without creating a value (Hopp and Spearman, 2001).

BY-PRODUCTS PRODUCED DURING PRODUCT USE: Supplementary products to the main product can increase sales. Hence, the economic bottom line is addressed by offering additional products which go well with the main product.

PRODUCT LIFE EXTENSION: Increasing the life of a product. By making products that last longer, their influence on resources is reduced. The trade-off on the economic bottom line can be reduction in consumption.

PRODUCT END-OF-LIFE: Product design has a significant influence on the products future after end-of-life. A large share of what is happening with a product after it has worn out is predetermined by the design of the product. Whereas Linton et al. emphasize that an elaborate product design improves the environmental bottom line, a positive influence on the economic bottom line is given as well, if one considers that re-use of components can be added.

RECOVERY PROCESS AT END-OF-LIFE: Linton et al. found different case studies for the recovery of products after their end-of-life. This is not further elaborated; however, the positive consequences are already listed under the previous item.

Generally Linton et al. notice a trade-off by implementing SSCM. Whereas the whole supply chain may most likely benefit on *all* three bottom lines, some entities in the SC may have to compensate with less profit for themselves in order to enable this holistic sustainability.

Linton et al. focus in their model mainly on the environmental and economic bottom line, if one underlays Elkington's framework. Even though Linton et al. refer to Elkington (1998), the authors find the

social issues more a consequence of inappropriate fulfilment of the economic and environmental bottom line. Hence the social issues are not particularly addressed in this work.

2.2.13.2   *Pagell et al.*

Pagell and Wu (2009) created a model for SSCM by scrutinizing case studies from different industries. The cases are recorded through semi-structured interviews. The analysis reveals a discrepancy between what the literature up to this date suggested to be conducive for SSCM and what the cases delivered. As a result of this study, the authors present three different perspectives: *a*) sustainability-promoting practices as they were found in the literature; *b*) sustainability-promoting practices as they were derived from the interviews; and *c*) a link between these two results in the form of what practices identified in the literature were used from the industry or what practices applied in the industry were not listed in the literature. The literature and the industry were aligned for items such as:

SUPPLIER DEVELOPMENT: Pagell and Wu find that encouraging suppliers regarding sustainability is likely to improve SC sustainability.

INTERNAL SC INTEGRATION: Internal integration, which mainly deals with the processing of data through Enterprise Resource Planning (ERP) systems (Zhao et al., 2011), is found to have a positive influence on promoting sustainability through the SC.

TRACEABILITY: The interviewed companies found traceability through the complete SC beneficial for sustainability, whereas transparency (which was communicated as a transparency to outsiders) was not deemed to be helpful.

MANAGEMENT COMMITMENT: A firm's commitment to sustainability from its management was proven to have a positive influence on its sustainability.

Pagell and Wu found evidence for the necessity of applying the following principles in order to support SSCM in the literature, which were *not* aligned with their evidence from practitioners:

- Lean Management and Total Quality Management (TQM)

- Transparency

- Closed loop supply chains and reverse logistics

- Collaboration with customers

- KPIs and bonus system for sustainability performance

The message Pagell and Wu bring across with their framework is the importance of organizational commitment and the willingness to work together with capable suppliers and associates. The framework does not clearly declare what are understood as sustainability issues in a supply chain; however, the philosophy that is expected to be in the minds of the influential players in a supply network is disclosed. The framework can be understood as a payback from the industry to the research, since it clearly shows the discrepancies between academia and practice, and emphasizes in which direction further SSCM research efforts should be developed in order to become congruent with reality.

In contrast to their research findings, Pagell and Wu (2009) developed a model (figure 2.6) which includes all SSCM features from the literature—even issues such as "Rewards and Incentives" which were only found in three out of ten scrutinized industrial cases.
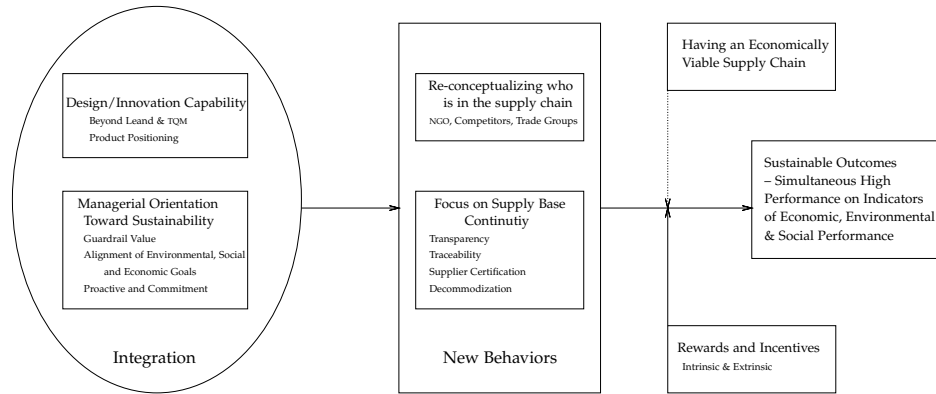
Figure 2.6.: Pagell and Wu's (2009) model for SSCM

2.2.13.3 *Guan et al.*

In order to create awareness among manufacturers, and particularly to emphasize the systems issue of sustainability, Guan et al. (2010) developed a framework for Sustainable Supply Chain Management. The framework is built on some academic articles and based on the TBL approach. The visualization is created as a "three-way ring" which emphasizes the interaction between the social and the environmental bottom line and the SC itself (see figure 2.7).
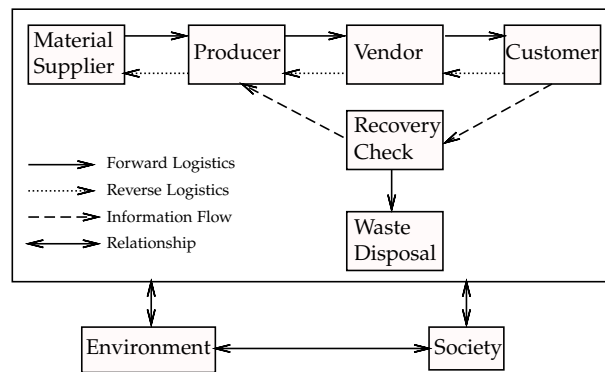
Figure 2.7.: Guan et al.'s (2010) model for a SSC

2.2.13.4 *Wittstruck and Teuteberg*

Wittstruck and Teuteberg (2010) define SSCM as a combination of SCM and sustainability. For this, they avail themselves of one of the definitions from Harland (1996)[14] for SCM and definitions from Srivastava (2007) and Sikdar (2003) for sustainability. By doing so the authors denote Sikdar correctly as being one of the pioneers for transferring the triple bottom line into the SCM concept. Debatable on the other hand is Wittstruck and Teuteberg's finding that Sikdar was the first to add a social dimension to the idea of GSCM, which was allegedly introduced by Srivastava. These conclusions are chronologically indefensible.

The framework Wittstruck and Teuteberg built on their compilation of definitions is displayed in figure 2.8.
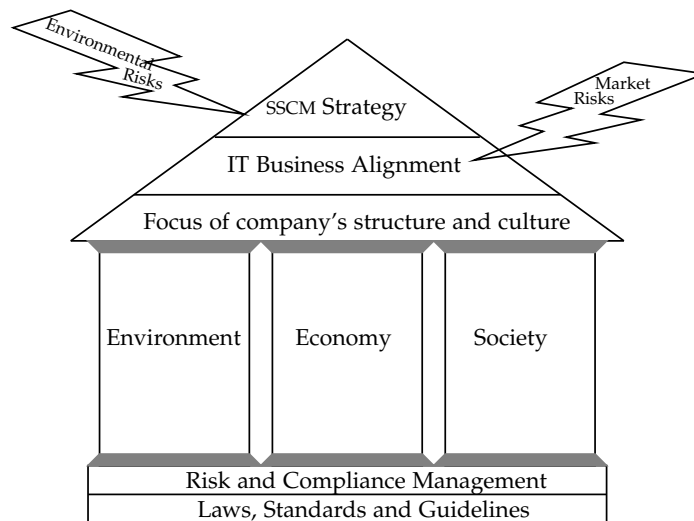
Figure 2.8.: Wittstruck and Teuteberg's (2010) concept of SSCM

In Wittstruck and Teuteberg's concept of SSCM (in other publications also referred to as *House of SSCM* (Teuteberg and Wittstruck, 2010a,b; Wittstruck and Teuteberg, 2011)), the TBL is represented through

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14 The term supply chain management is used as a synonym for "the management of a network of interconnected businesses involved in the ultimate provision of product and service packages required by end customers" (Harland, 1996, p. 64).

Table 2.3.: Quality of journals included in Wittstruck and Teuteberg's (2010) analysis

ABS STARS	4	3	2	1	0
NO. OF INCLUDED JOURNALS	2	2	2	2	3

the three pillars. These pillars are built on the legality of the business model of the focal company, and the compliance of the supply chain entities with all relevant laws and regulations. Further, Wittstruck and Teuteberg's idea is a supporting and environmentally sound IT infrastructure, with a high level of ethics along the entire SC contributing to a successful SSC. The outcome is a minimization of risks that are known to decrease the performance of the supply chain.

Wittstruck and Teuteberg leave their research open for discussion, due to their restriction of academic journals they used for their literature review. Eleven journals are considered, from which eight appear in the ABS ranking (see table 2.3). Important journals in the field, such as the International Journal of Production Economics (IJPE), the International Journal of Production Research (IJPR), the Journal of Operations Management (JOM) or the Journal of Cleaner Production were not included in the research.

2.2.13.5 *Aarabi et al.*

Aarabi et al. (2011) created a model focused on IT utilization which is also intended to be beneficial as a general management information system for SSCM. The model is based on the Supply Chain Operations Reference (SCOR) model. The underlying sustainability theory is, on the one hand, the TBL and, on the other hand, sustainability as it is defined in the SCOR model. Therefore the *6Rs* are considered. Jawahir (2008) describes the 6R concept as an extension of the 3R concept (re-

duce, reuse, recycle) by adding further environmentally sound post-use processes such as: recover, redesign and remanufacture.[15]

In their management information system for SSCM (see figure 2.9), Aarabi et al. apply the 6R concept and extract from every process phase related data which are then sent to a central database. The advantage of using a central database for all data along the SSC is complete transparency and accurate information.
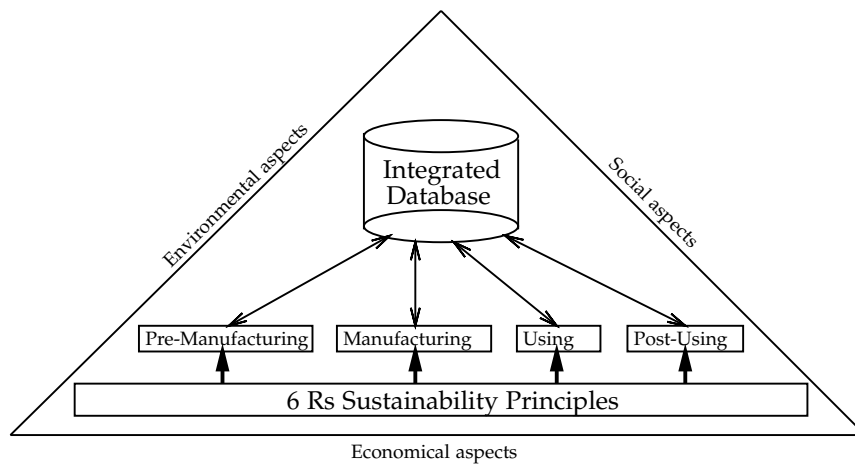
Figure 2.9.: Aarabi et al.'s (2011) model for a management information system in SSCM

Even though Aarabi et al. underscore their model with a practical example, the literature suggests that such a high level of transparency is unusual (cf. Pagell and Wu, 2009).

2.2.13.6 *Svensson*

Another attempt to "describe and illustrate aspects of Sustainable Supply Chain Management" is published by Svensson (2007). The author builds his picture on the three dimensions of sustainability (economic, environmental and social) and emphasizes the need for

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15 See also Linton et al.'s (2007) model on page 64.

a holistic view of the supply chain. Svensson lists a number of principles which he considers to be promotive for SSCM (see figure 2.10).
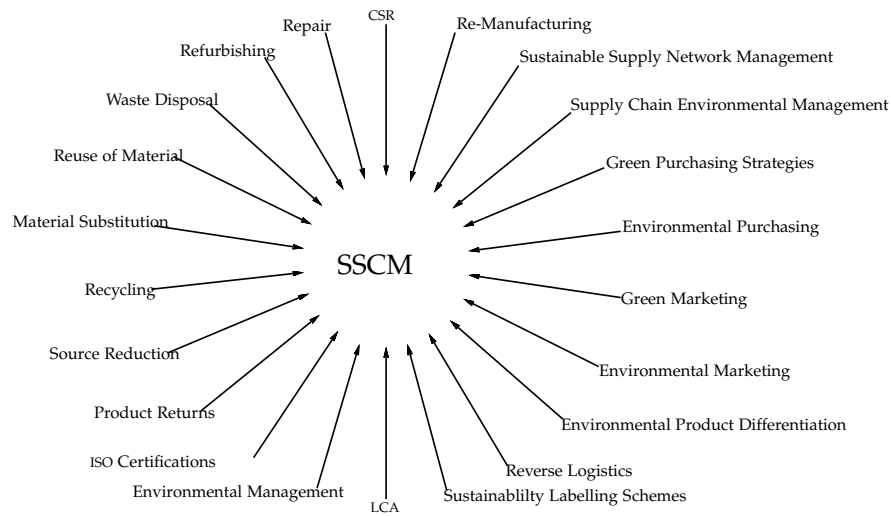
Figure 2.10.: A model of influential factors on SSCM according to Svensson (2007)

Svensson supports the thesis that SSCM is based on stakeholder theory, since the purpose of this whole principle is the consideration of all stakeholders affected by the supply chain's processes. Further, Svensson emphasizes his expectation of an increase in *second-* and *n-order supply chains*, which is the terminology he uses for supply chains dealing with used products. Examples given are the second-hand clothing "industry" and the trade in used car parts (e.g. from scrapped cars).

> **Summary 4: SSCM Models**
>
> A variety of *SSCM Models* exist in the academic literature. They vary regarding scope and content.

The models found in the academic literature vary widely regarding their focus, content and general understanding of the definition of SSCM. Even though most models agree on Elkington's (1998) TBL

theory, the actual implementation and the scope differs from author to author. The model used in this research, as derived from an exhaustive and systematic review of the literature dealing with SSCM, is displayed in figure 2.5 and includes all facets. The model in figure 2.5 also highlights the current weaknesses of SSCM research such as the power relation in an exchange relationship and its impact on the permeation of the sustainability agenda throughout the supply chain. Even though this issue has been raised by some researchers (e.g. Boons et al., 2012), the literature delivers no clear theory regarding dependencies, power relations and sustainability diffusion through supply chains.

2.2.14 *Discrepancy between academia and practice*

The models available in the scholarly literature are not completely coordinated with what the industry currently understands under the concept of sustainability in their supply chains. This is indicated after assessing Pagell and Wu's (2009) model, one of the most cited models in the academic world. After comparing the perspectives from the academic literature about SSCM with ten case studies, Pagell and Wu (2009, p. 44) come to the conclusion that "the within case analysis also identified practices that were reinterpretations of concepts that had previously appeared in the literature and/or practices that were truly novel". This phenomenon may lead to an unclear definition of SSCM which is suspected to prevent companies from denoting their supply chains as sustainable.

Since retailers are constantly under the observation of the public, it is expected that they exercise a particular diligence. Furthermore, the

sustainability efforts that retailers undergo are often publicly available from their websites. According to Deloitte (2011), the world's ten largest retailers are as listed in table 4.1.

In order to find out whether the terminology of SSCM is used in practice, an examination of publicly available information about the world's leading supermarkets was conducted.

Research Objective 1 *To explore whether the term Sustainable Supply Chain is widely used amongst companies in the public eye.*

Knowing whether the terminology SSCM and the respective principles are used in practice, justifies looking further into the permeation of sustainability through the supply chain and assessing the impact of factors such as power imbalances in exchange relations.

3

SUSTAINABILITY PERMEATION

3.1 DRIVERS OF SUSTAINABILITY IN A SUPPLY CHAIN

A good intention clothes itself with sudden power.

— Emerson (1860, p. 40)

The academic literature about SSCM has picked up the question of what drives SSCM. A search through the Scopus® database reveals 84 articles dealing with the issue of `sustainable supply chain` and `driver`. A thorough analysis of these 84 articles results in 24 relevant articles about drivers for SSCM. Before describing the themes deriving from these articles, a strict distinction has to be made between the two questions:

1. What are the drivers motivating a *focal firm* to get started with SSCM?

2. What are the drivers motivating exchange partners along a supply chain to follow/comply with someone's sustainability efforts?

Mostly the question in item 1 is addressed by academics. An overview of what drives focal firms to get started with SSCM will be given in the following section by reviewing the relevant articles for the above-mentioned results. The question in item 2 however is not

less important, since it opens the *black box* of SSCM and scrutinizes the mechanism behind the permeation of sustainability throughout a SC. This question will be addressed later on (section 3.2 commencing page 91).

An overview of the drivers for SSCM (that is, for a certain focal firm to become interested in striving for sustainability along its supply chain) is given in table B.3.[1] The various different drivers are then further elaborated in sections 3.1.1 to 3.1.4. Following table B.3, the frequency distribution of drivers as listed in overview table 3.1 arises. It emerges that the top four most often mentioned drivers account for over fifty per cent and the top eight most often mentioned drivers for almost eighty per cent of all drivers. The further review focuses mainly on the four drivers accounting for over half of the occurrences in the literature.

3.1.1 *Customer or buyer influence*

Pressure to become sustainable is not only exerted by end-customers, but also from buyers within the supply chain (Caniato et al., 2012; Liu et al., 2012). The literature suggests this as being the greatest driver of sustainability in a supply chain (cf. table 3.1). This comes also with the consumer asking for more *green* products in current markets and the suppliers providing these products, which improves their profitability based on "added customer value" (Mollenkopf et al., 2010, p. 22). Generally buyers and consumers increasingly ask for labels on products which ascertain their compliance with environmental (e.g. *organic*), social (ISO 26 000) and economic (e.g. *fair trade*) responsibil-

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1 All drivers as sorted by the articles they were found in are listed in table B.4 (page 391)

Table 3.1.: Overview of how often which driver for SSCM is mentioned in the literature

DRIVER	FREQUENCY	PERCENTAGE MENTIONED	CUMULATIVE PERCENTAGE
Customer/Buyer	20	17.39 %	
Government regulation	19	16.52 %	
Cost reduction	11	9.57 %	
Industry norm/standard	10	8.70 %	52.17 %
Organizational commitment	9	7.83 %	
Competitive advantage	8	6.96 %	
Focal firm's reputation	7	6.09 %	
Following competitors	7	6.09 %	79.13 %
Supplier	5	4.35 %	
NGOs	4	3.48 %	
Transparency/risk mitigation	3	2.61 %	
Community/society	3	2.61 %	
Increase in productivity	2	1.74 %	
Managerial commitment	2	1.74 %	
Securing supply	1	0.87 %	
Subsidized	1	0.87 %	
Attract investors	1	0.87 %	
Stakeholder concerns	1	0.87 %	
Labour organizations	1	0.87 %	100 %
Total	115	100.00 %	

ity (Chkanikova and Mont, 2012). The UK manufacturing sector was investigated by Holt and Ghobadian (2009), who found customers playing a minor role as pressure for the implementation of sustainable practices. Gopalakrishnan et al. (2012) suggests that the size of the focal company, as well as its reputation regarding sustainability, influence the susceptibility of a firm to pressure from buyers to introduce SSCM. Meehan and Bryde (2011) find that particularly firms in the public eye, such as pharmaceutical companies or retailers (Walker et al., 2008), experience more pressure from consumers through media coverage. This finding is supported by Mollenkopf et al. (2010). At this point, the boundaries appear seamless between market pressure and public pressure. Shi et al. (2012, p. 60) even suggest that following sustainability requests from customers "will also increase market share".

Customer-demanded sustainability, and industrial norms and standards (section 3.1.4), are grouped together as market drivers by some authors (Chkanikova and Mont, 2012). Even though the literature has not yet suggested that this is the case, *reputation* and *following competitors* are understood to be market drivers as well. Apart from *reputation*, all market drivers have a common stakeholder—*the buyer*. The three bottom lines of sustainability are addressed by different drivers. So, for instance, the environmental bottom line is particularly susceptible to pressure from consumers and customers (Meehan and Bryde, 2011).

Customers are found to be drivers not only in western markets but also in China, where Birkin et al. (2009) and Zhu and Geng (2013) find customer pressure to be one of the main drivers for firms to initiate SSCM. Cambra-Fierro and Ruiz-Benítez (2011, p. 401) found

in a case study of two Spanish SMEs that customers can even "force companies to implement sustainable practices". This phenomenon is also denominated *responsive product strategy* (Hong et al., 2012). Particularly in international trade, customers (also called buyers) often choose their suppliers according to some environmental criteria, if nothing else differentiates the suppliers significantly from each other (Mollenkopf et al., 2010; Zhu et al., 2007).

Summary 5: Customer/Buyer Pressure

Academics agree that buyers play a major role in pressuring companies to become involved in SSCM.

3.1.2 *Government regulations*

Government regulations are the second most often detected driver in table 3.1: 19 out of the 24 articles under consideration emphasize the importance of government regulations as a driving force for the implementation of SSCM. Some authors even find government policies, regulations and laws the key driver for companies to introduce a holistic sustainability effort that includes their SC (Giunipero et al., 2012). Meehan and Bryde (2011, p. 101) found that "current governmental legislation/regulation" is a strong driver of sustainability. In recent years governments have started to set up regulations, for instance grounded on LCA bases, in order to minimize environmental damage caused by products and services (Fava, 2006). Various governments have reacted with new environmental and social laws due to "extreme climate change and global warming" (Gopalakrishnan et al., 2012, p. 195). Even though there are regulations about environmental

friendliness and social conditions, currently there is no governmental regulation about sustainability from a TBL cross-functional perspective, Gopalakrishnan et al. note.

Tachizawa et al. (2012) show a shift in the environmental legislation from laws that only control the *output* of a firm to a particular law that looks at which materials go *into* a product, the so-called RoHS. In a quantitative study Tachizawa et al. find that firms that are not collaborating with their buyers, or are not being assessed by their buyers, are mostly driven by government legislation. This finding underscores the ranking of drivers as presented in table 3.1.

An example of a government regulation promoting sustainability is the 2005 ESER programme introduced by the Chinese government to reduce energy consumption and emissions in production (Zhu and Geng, 2013; Zhu and Sarkis, 2004; Zhu et al., 2007). In the UK, Meehan and Bryde (2011) note the guidelines provided by the former Department of the Environment, Transport and the Regions (DETR), whose environmental responsibilities were taken over by Department for Environment, Food and Rural Affairs (DEFRA). In their guidelines, DEFRA gives advice on sustainability reporting and KPIs, and provides calculator tools for GHG emission calculations.[2]

Motivation to become sustainable based on government regulations is also linked to cost reduction (section 3.1.3), since non-compliance is often associated with considerable costs. Despite initiatives from governments to reward firms for achievement in relation to their environmental bottom line, Giunipero et al. (2012) found that the fear of costs associated with non-compliance is a strong driver, whereas the rewards are a rather weak driver. Further, Giunipero et al. (2012,

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2 http://www.defra.gov.uk/environment/economy/business-efficiency/reporting

p. 259) find a historical pattern behind the main drivers for sustainability. The authors find that extrinsic pressures (e.g. compliance with governmental regulations) were the main drivers 50 years ago, but that now businesses have moved to "internalizing the concept of sustainability into their own value sets".

Hong et al. (2012) claim that firms are looking actively for supply chain partners (including suppliers) that are capable of meeting the current environmental laws given by the government they are dealing with.

Zhu and Sarkis (2004) find government environmental regulations are the most important driver for greening the supply chain in Chinese companies. On the other hand Zhu and Sarkis also find that US companies are more monetary driven, and driven by the fear of liabilities resulting from the use of hazardous materials. Further, Hong et al. (2012) suggest that non-compliance with environmental laws can result in high costs for companies and also damage their reputation.

The ultimate goal of most companies is to maximize their profit whilst *only* trying to comply with the current environmental and social laws while doing nothing beyond the legal requirements (Isaksson et al., 2010). Santolaria et al. (2011, p. 1319) measure a company's perception about their "attitude towards sustainability". The scale for the perception reaches from negative to excellent (negative, passive, indifferent, reactive, proactive, excellent). Companies just complying with the environmental legislation are considered to be reactive. In Santolaria et al.'s sample of Spanish innovation-driven companies, the proactive group is significantly larger than the reactive or any other group, and accounts for almost fifty per cent. This allows the conclusion that, in this sample, firms are rather proactive than re-

active and go beyond the governmental regulations when it comes to attitude towards the environment. Shi et al. (2012) also denominates the reactive approach as that of companies which only comply with, and thus *react* to, government regulations without going ahead of them. Proactive and environmentally well-prepared companies welcome stricter laws regarding environmental friendliness, whereas solely reactive firms fear the costs of stricter environmental legislation.

Isaksson et al. (2010) give a list of possible stakeholders with the ability to influence the SSCM efforts of a firm. Isaksson et al. distinguish between primary stakeholders (government, customers, suppliers, shareholders, co-workers and management) and secondary stakeholders ("individuals or organizations that [...] are able to influence primary stakeholders to withdraw essential support, thereby causing the organization to fail, or inflicting unacceptable levels of damage") (Isaksson et al., 2010, p. 427). Zhu et al. (2007) find four factors for GSCM: *a*) government regulation, *b*) market pressure, *c*) pressure from suppliers and *d*) internal drivers. These drivers can also be understood as the stakeholders having an influence on the supply chain sustainability of a firm and go hand in hand with the role of the stakeholders mentioned by Isaksson et al. (2010). Noticeable in this comparison is the importance given to the government as a stakeholder by both Isaksson et al. (2010) and Zhu et al. (2007).

Particularly in international trade environments, challenges regarding the legislation of more than one single government legislation affect the introduction of TBL. Mollenkopf et al. (2010) mention the difficulties experienced by multinational companies dealing with dif-

ferent environmental and social laws across various countries/governments.

Liu et al. (2012) raise concerns about green marketing and how the government controls green marketing. The authors suggest stricter government regulation of green marketing, which puts the government again in the role of a regulator and driver for sustainability-focused business models. Liu et al. argue that a stricter regulation of the green marketing practices through legislation would be a step towards prevention of fraud committed in green marketing initiatives. In their case study-based research, Liu et al. found that governmental regulations and customer demands are the main external drivers for firms to become sustainable.

Millard (2011) notice that coffee and cocoa farmers particularly lack a certain regulation from the government in their countries because the government encourages them to clear forest for new plantations in order to create more income in rural areas. Ghana is mentioned as an example: it represents one of the world's largest producers of cocoa with a lack of government interest in sustainable agriculture. The case of palm oil and the Roundtable on Sustainable Palm Oil (RSPO) is another example where government regulations have failed. However NGOs and the industrial standards created a standard, which is the RSPO certification (Nikoloyuk et al., 2010).

Summary 6: Pressure Through Government Regulation

Government regulations and legislation are identified as a driver for firms to become more environmentally friendly and socially responsible, also on a supply chain level. However government regulations vary along global SCs and one should therefore not rely solely on this driver.

3.1.3   Cost reduction

In a qualitative study across 20 manufacturing companies in China, Birkin et al. (2009) found that about sixty per cent of these are driven to improve their environmental performance by a potential increase in cost efficiency. Even though the top driver was found to be the customer/buyer, cost efficiency seems to be an additional important *and driving* factor. This finding is supported for the Swedish food retail sector through a study conducted by Chkanikova and Mont (2012), according to whom cost savings alongside sustainability in the upstream supply chain, for instance, can be achieved by increasing material efficiency in products. This means that not only the costs of input materials can be lowered, but also the costs for waste disposal (Giunipero et al., 2012). Cambra-Fierro and Ruiz-Benítez (2011) find that it strongly depends on the industry or the business model of a firm whether sustainability initiatives can result in cost-savings, and on how well the initiatives can be embodied into the current operations. Gopalakrishnan et al. (2012) indicate that transport/logistics optimization and energy saving initiatives such as low energy buildings are examples of environmental initiatives with foreseeable cost

savings. Evidence from past literature for cost savings through environmental initiatives within the boundary of the environmentally responsible firm is found by Hong et al. (2012). In the case of coffee and cocoa farmers, Millard (2011) highlights that a higher price is paid for their produce if environmentally friendly practices are deployed in the agricultural processes. In manufacturing companies, it is found "that implemented pollution prevention technologies improved their manufacturing performance in terms of cost, speed, quality and flexibility" (Shi et al., 2012, p. 56). Pollution as well as high energy consumption can be understood as a costly waste, the prevention of which results in benefits on all three bottom lines (Walker et al., 2008; Zhu et al., 2007). Another generally useful idea which addresses simultaneously the economic and environmental bottom line, applicable for almost every industry and company size, is communication with stakeholders through a company website instead of bulk letters (Stuart, 2011).

Social equity is an equivalent part of the TBL; however, this is less often discussed. A typical example for social equity in SSCM is fair wages. In a study about some Chinese manufacturers, Caniato et al. (2012) find difficulties in implementing social and environmental initiatives in global supply chains. Manufacturers in the study were worried about the final product price being undercut by domestic and foreign competitors. On the environmental side, the authors raise concerns from a different angle about shifting manufacturing to countries with lower labour costs and stress the increased transportation expenditure incurred by moving production farther away from target markets. Thus, even though costs are reduced by these measures, the remaining two bottom lines may be affected negatively by globaliza-

tion of SCs (Mollenkopf et al., 2010). Following this idea, one may conclude that saving costs does not necessarily improve social equity and environmental friendliness; however, implementing environmentally and socially sound initiatives is likely to improve the economic bottom line. This problematic is discussed by Holt and Ghobadian (2009, p. 951) who claim that "the most common green supply chain practices focus on internal cost saving activities".

Cambra-Fierro and Ruiz-Benítez (2011) see sustainability in companies and their SCs as a "long-term investment" and therefore rather cost-efficient than costly. This perspective is shared by Gopalakrishnan et al. (2012) who find that an immediate economic benefit is not always observable when implementing sustainability initiatives. Reactive behaviour (meaning compliance with government legislation solely at the time it takes effect) has neither a cost advantage nor disadvantage, since it applies to all firms equally in the same economy. However, compliance with legislation regarding environmental and social laws is necessary to avoid costs for penalties and fines (Giunipero et al., 2012; Zhu and Geng, 2013).

Caniato et al. (2012, p. 662) find that companies' internal drivers for sustainability "can be related to efficiency objectives (cost reduction)" or organizational commitment. This finding would suggest that an external stakeholder with little power, such as a non-dominant buyer, should be informative and helpful when trying to convince the focal firm to adapt to certain sustainability initiatives. In this way, either a cost-saving potential can be explained to the focal firm or the responsible managers' conscience can be addressed, which may lead to greater sustainability commitment.

Cost-savings are particularly obvious for companies dealing directly with the end-customer, since these are found to be more critical regarding environmental sustainability. The monetary value of these initiatives is still hard to determine; however, it can be understood as an investment towards the improvement of the brand image (Caniato et al., 2012; Santolaria et al., 2011) or even lead to a decrease in operational costs (Chkanikova and Mont, 2012). By increasing the product quality, costs can be saved and often the environmental bottom line can be improved, find Isaksson et al. (2010). It is advantageous to generate cost savings through the implementation of sustainability initiatives, as the customer is not always willing to pay a surcharge for sustainably sourced products (Nikoloyuk et al., 2010). This makes the idea to rely on higher sales prices a risky option.

It is understood that the implementation of sustainability initiatives will always come with a cost benefit, although it is not clear whether this is measurable or not (e.g. investment for the future, marketing purpose). However since sustainability is defined through the principle of the TBL (see figure 2.3 on page 23) the three bottom lines will contribute to each other and not subtract value from each other. That is, improving the social conditions will decrease neither the environmental friendliness nor the economic survivability of a firm, to mention just one scenario as an example.

A study contradicting the results found in this literature review is presented by Meehan and Bryde (2011). The authors find that "the three weakest drivers are cost savings, customer pressure and third party pressure". This finding is based on a survey with just 44 respondents; the bottom two drivers have coefficients of variation > 0.34 ($c_v = \frac{\sigma}{\mu}$). These statistics make the validity *and* reliability of

the results questionable. A larger sample (n = 158) is presented by Zhu et al. (2005), who find that the most important drivers for environmental initiatives are: *a*) SC pressure (see section 3.1.1); *b*) cost reduction; *c*) regulations (see section 3.1.2); and *d*) marketing. Marketing can be understood as competitive advantage and is found on the sixth rank in this analysis (see table 3.1).

> **Summary 7: Cost Reduction as a SSCM Driver**
>
> Cost reduction does drive firms to get engaged in SSCM. Often sustainability initiatives come with cost savings.

3.1.4 *Industrial norms and standards*

Compliance with common standards is found to be particularly important in global supply chains, because the legislation regarding social and environmental issues in the countries which the supply chain spans can vary significantly (Mollenkopf et al., 2010). Authors agree that industrial standards and norms are indeed a driver for sustainability in SCs (Chkanikova and Mont, 2012; Gopalakrishnan et al., 2012). A popular industrial standard is the Global Reporting Initiative (GRI) model, which is comprehensive and gaining acceptance in various industries (Caniato et al., 2012).

A widespread standard addressing the environmental bottom line is the International Organization for Standardization (ISO) 14 000 series. According to Diabat and Govindan (2011), more than 40 000 companies have already implemented the ISO 14 001. Other standards for the environmental bottom line, which are also considered as drivers for sustainability in supply chains are, for instance, the WEEE and the

RoHS (Giunipero et al., 2012). Often the standards are product specific: for example, the Sustainable Agriculture Standard is widely used in coffee and cocoa production (Millard, 2011). Another illustration for standards impacting supply chain sustainability is given by Zhu et al. (2007), who note that the cars manufactured in China will have to meet the Euro 2 emission standards, in order to be allowed on the European market. Complying with this standard lowers the total CO_2 emission of the vehicle during its life cycle.

Certification according to environmental standards is increasingly gaining importance in the supplier selection process (Mollenkopf et al., 2010). Buying organizations "select their suppliers based on their environmental performance and motivate them to adopt ISO standards" (Gopalakrishnan et al., 2012, p. 196). If suppliers struggle to comply with the latest environmental standards or regulations, buyers are increasingly willing to assist suppliers in order to meet the most recent environmental standards (Hong et al., 2012). Large car manufacturing companies such as General Motors (GM), Toyota and Ford are known to require their suppliers to comply with the ISO 14 001 standard (Zhu and Geng, 2013).

An ethical standard to fit sustainable supply chains needs to be "compatible with different global value systems" (Isaksson et al., 2010, p. 426). Currently there is no dominant standard even though a number of guidelines have been published in recent years (Shi et al., 2012).

Environmental and social standards can contribute to the reputation of a firm as much as the widespread and well-known quality standard ISO 9000 (Mollenkopf et al., 2010). To measure the TBL criteria, it is important to implement not only environmental standards such as ISO 14 001, but also Social Accountability (SA) standards such

as SA 8000 or ISO 26 000. In the case of the firm BAe Systems, Gopalakrishnan et al. (2012, p. 201) elaborate that in practice suppliers are only chosen if they "comply with environmental and social standards [. . .] such as ISO 14 001, ISO 9001, OHSAS 18 001 [. . .]". Generally however there is a lack of sustainability standards that consider all three bottom lines (Giunipero et al., 2012).

Often standards are also used to *measure* the environmental bottom line (Mollenkopf et al., 2010). However Meehan and Bryde (2011) raise concerns that the ISO 14 001 takes an "attenuated" view of sustainability, since it focuses only on the environmental bottom line and not sustainability as a whole concept. Nevertheless Tachizawa et al. (2012, p. 742) find "a public standard such as ISO 14 001" a valuable tool to monitor the sustainability performance of a supplier. So generally it can be said that complying with standards enables comparable measurement systems which are valuable as decision support systems for supply chain managers.

It is also found that a firm following the ISO 9000 standard is more likely to adopt social and environmental standardizations such as ISO 14 000 (Mollenkopf et al., 2010). However complying with standards at the time they arise on the horizon, or just when a buyer asks for them, is often not enough; Liu et al. (2012) suggest proactive behaviour in order to achieve TBL objectives.

Interorganizational power plays a role in implementing standards along a SC. Buyers often determine which standards are to be followed by the suppliers (Gopalakrishnan et al., 2012). Moreover, not only buyers, but also competitors can be seen as driving forces for the implementation of sustainability standards (Walker et al., 2008). In the coffee and cocoa supply chain, however, Millard (2011) find

that the leading international companies are the ones who establish new standards and norms in their supply chains. Often suppliers can be convinced to implement environmental or social standards by explaining the increased productivity and efficiency that comes with following the necessary processes (Gopalakrishnan et al., 2012). Hence interorganizational collaboration is important for the implementation of sustainability standards (Shi et al., 2012).

Meehan and Bryde (2011) find that a supplier's adherence solely to some environmental or social standards does not always lead to more commitment regarding sustainability. Another concern is raised by Millard (2011), who suggests that the smallest businesses at the end of the coffee supply chain might be excluded by not being able to comply with the required standards.

Summary 8: Norms and Standards as SSCM Drivers

Norms, standards and certifications drive sustainability through the supply chain. Often compliance with these is enforced by customers/buyers.

3.2 ADAPTING SUSTAINABILITY—INTERORGANIZATIONAL CHANGE

All things must change
To something new, to
something strange
— Longfellow (1878, p. 5)

The above exploratory analysis (section 5.1), as well as the in-depth literature review (sections 2.1.1, 2.2 and 3.1), lead to the assumption that practitioners and academics follow different ideas in SSCM. Linking these two perspectives will be approached by exploring how the commitment to sustainability permeates along different entities within a supply chain. A starting point is the dyadic relationship between a buyer and a supplier.

It is understood that three major stakeholders have the ability to influence a supplier regarding its sustainability efforts (see section 3.1):

1. Customer/Buyer/Original Equipment Manufacturer (OEM)

2. Legislation/Government/Law

3. Public pressure

The stakeholders for item 2 and item 3 do not leave much room for interpretation and the mechanism of their influence is obvious. The mechanisms behind the interplay between stakeholder 1 and a supplier regarding the implementation and adaptation of sustainability, however, has not yet been investigated in the academic literature. For practitioners, particularly buyers in a position (and keen) to increase sustainability in their upstream supply chain, it is important to understand how their power should be exerted in order to achieve this goal.

This research will contribute to the field of SSCM, which means the involvement of more than just one company's sustainability efforts. Considering one firm as the initiator of sustainability (it is likely that business partners have a different comprehension of sustainability and different motivations in becoming sustainable), their aim will be to change the sustainability behaviour of their supply chain partner. The change of behaviour within an organization's boundaries is dealt with in the change management literature (Lewin, 1947). In order to find out how buyer-supplier relations change (the implementation of sustainability could be considered as a change), the influence of different forms of power in exchange relations will be scrutinized. Power has been found to play an important role in exchange relations (Cook, 1977, p. 65) (section 3.2.1): this is how buyer-supplier relations

are understood. The constantly prevailing power relations in supply chains are described by Cox (2001c, p. 9) as:

> The point is that all buyer and supplier (and extended supply chain) relationships operate in an environment of relative buyer and supplier power.

Furthermore power is considered as influential in interorganizational change management research (section 3.2.2), as well as in supply chain performance research (section 3.2.5).

3.2.1 *Interorganizational relation*

Without attempting to answer in depth the question why firms *have* power, a brief introduction of Provan and Gassenheimer (1994) will give some insight. Provan and Gassenheimer find evidence in the literature that "all power arises from dependence"; however, it is not said that firms, or persons, who have this power do actually exert it (Provan and Gassenheimer, 1994, p. 55). By investigating different bases of power, which might have been undetected by some "possessors" so far, new opportunities to implement change, particularly on the triple bottom line, will be presented (more on dependence as a foundation of power on page 97).

Interorganizational for the purpose of this research is understood as focusing on two companies which stand in an *exchange relation*. A fitting definition for exchange is offered by Cook (1977, p. 64) according to whom an "*exchange relation* (e.g. $A_x; B_y$) consists of a voluntary transaction involving the transfer of resources $(x, y, \dots)$ between two or more actors $(A, B, \dots)$ for mutual benefit". The power in this re-

lationship is determined through the dependence of the exchange related actors:

> In any exchange relations $A_x; B_y{}^a$ the *power* of A over B (P_{AB}) is the ability of A to decrease the ratio x/y (Cook, 1977, p. 66).

---

a (Where A and B represent the actors, and x and y the resources involved in the exchange and x/y the exchange ratio)

These findings are related to the resource dependence theory which is introduced briefly in section 3.2.2.

3.2.1.1 *Critical Theory*

Another attempt to explain the management of change is the *Critical Theory* (Carr, 2000). Derived from the so-called *Frankfurt School* (Horkheimer, 1937), the critical theory will be used to "explain what is wrong with current social reality [and] identify actors to change it" (Bohman, 2012). Further the critical theory includes power and domination as driving forces for the change of the current situation, which could be translated to the need for change of methods and processes in a buyer-supplier relationship in order to become more sustainable. The critical theory fits in between the power influences on change management and the discrepancy of sustainability awareness in a buyer-supplier relationship with the need to change (section 3.2.1.1).
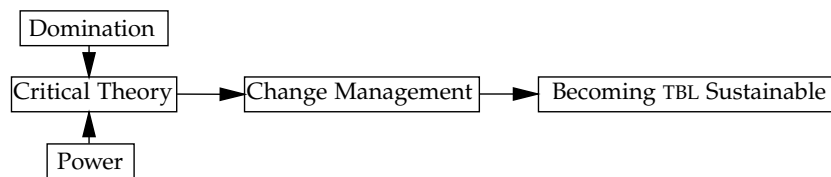
Figure 3.1.: Critical theory in context: The Critical Theory links power, change management and sustainability in buyer-supplier relations

It is further believed in the literature about interorganizational change that, based on the critical theory, change beyond organizations' boundaries occurs through pure domination (Grubbs, 2000; Sydow and Windeler, 1998). Grubbs (2000, p. 225) compares the change in interorganizational relations to cultural adaptations such as "myths, rituals and other artifacts" as they were imposed by British imperialism.

3.2.1.2 *Social Exchange Theory*

Social exchange theory explains adaptations based on two mechanisms: trust and power. Emerson (1976) finds a similarity between social exchange theory and economic exchange theory, in that most negotiations are based on a power/dependence imbalance, which then explains the outcome. Even though the principle of exchange theory is often discussed in detail and extensively in the literature, a definition from Emerson (1976, p. 359) helps to grasp the message:

> 'Exchange theory' is not to be taken as a theory. Rather, it is a frame of reference that takes the movement of valued things (resources) through social process as its focus. As I see it, its scope is defined by an assumption: that a resource will continue to flow only if there is a valued return contingent upon it. Psychologists call this contingent return reinforcement—economists simply call this reciprocally contingent flow exchange.

3.2.1.3 *Social Power*

Lippitt et al. (1952, p. 39) define social power as "the potentiality for inducing forces in other persons toward acting or changing in a given direction". This can be transferred to the current research problem and one may understand that the ability to change one's direction, e.g. the sustainability agenda, can be equated with *having*

power. Lippitt et al. further found in their approaches to measuring power that the "self-perception of own power" is usually in line with how one is using power "towards other members" of the group or, in the case at hand, a business partner. This is an important finding for the tool introduced later to measure dependence, power and the subsequent adaptive behaviour of sustainability initiatives.

A transition is found in the literature from using the above broached principles from sociology (and particularly from interpersonal relationships) to the environment of firms. The principles for interpersonal relationships are widely accepted in the area of interorganizational relationships too.

> **Summary 9: Perception of Power**
>
> The *perception* of power determines the resulting actions in interpersonal and interorganizational relationships

3.2.2   *Power induced change management in buyer-supplier relations*

In general terms, it can be argued that supply chains must exist as structural properties of power.
— Cox (1999, p. 173)

Power and dependence in interpersonal relationships are found to be influential for change and adaptation. This is elaborated further in the following paragraphs. Emerson (1962, p. 33) found that the power-dependence relation is proportional: this is called the *Dependence Theory*:

$$P_{ab} = D_{ba} \qquad (3.1)$$

$$P_{ba} = D_{ab} \qquad (3.2)$$

P: Power; D: Dependence; a: person A; b: person B

Equations (3.1) and (3.2) demonstrate the power influence of person A over person B (P_{ab}) is equal to the dependence of person B on person A (D_{ba}). The power-dependence relation between the two persons is balanced if P_{ab} equals P_{ba}, since this would equalize the interdependence between person A and B according to equations (3.1) and (3.2). Building on Emerson's (1962) finding, equation 3.3 emerges, which is also known as *Resource Dependence Theory* by Pfeffer and Salancik (1978). The Resource Dependence Theory (RDT) transferred t he findings from interpersonal research in sociology to an interorganizational environment.

$$\frac{P_{ab}}{P_{ba}} \propto \frac{D_{ba}}{D_{ab}} \qquad (3.3)$$

> **Summary 10: Transition: Interpersonal → Interorganizational**
>
> The widely recognized resource dependence theory adapted findings from interpersonal relationships to the context of interorganizational exchange relations.

The question *which components award one power* is answered in the resource dependence theory as proposed by Pfeffer and Salancik (1978, p. 108):

> The forms which organizational adaptations take are contingent on the environment and depend on the nature and amount of interdependence confronted by the organization. [...] Recall that the two major components of interorganizational power are (1) the focal organization's dependence on important critical resource exchanges, and (2) the control which other organizations might possess over the exchange of that resource. Organizational attempts to manage and avoid dependencies focus on these two components of interorganizational power.

A "model of interperson adaptation" based on interdependency was developed by Hallén et al. (1991). This model is grounded on *Social Exchange Theory* (page 95) and the RDT, even though *Transaction Cost Theory* and *Agency Theory* were considered as other solutions for the analysis of dyadic business relationships. The model claims that besides trust, an imbalanced interdependency between persons accounts for adaptation. The most common adaptation is found to be the customization of products. This adaptive initiative can occur at a seller's as well as a buyer's business. Sustainable product design, which has a high systemic influence on sustainability over a product's life cycle (Kleindorfer et al., 2005), may be considered as a product customization which needs to be adapted in SSCM-like buyer-supplier relationships.

Interdependency is understood to play a key role in adaptation processes in interorganizational relationships. Later research however applies the inverse relationship of one's dependence to its power and focuses mainly on power relations amongst trading partners (Kumar,

1996), instead of emphasizing the interchangeability of dependence and power. Hence relative power in an exchange relationship, such as a buyer-seller relationship as a small part of a SC, is determined by the inverted relative dependence (Emerson, 1962) (see equation 3.3).

Summary 11: Base for Interorganizational Adaptation

Interorganizational adaptation, and with it organizational change, is based on the influence of a powerful agent.

Brennan and Turnbull (1999) conducted a case study in order to find important drivers for adaptive behaviour in buyer-supplier relationships. A relevant finding, which extends the theory about interorganizational adaptive behaviour, is the demonstration "that power alone is insufficient as an explanation of adaption behaviour" (Brennan and Turnbull, 1999, p. 490). Nevertheless the case study also showed that power *does* significantly influence adaptive behaviour between exchange partners; however, in cases where the only relevant factor was that the supplier was more powerful than the buyer, the power criteria failed to explain the adaptive behaviour. To preclude this uncertainty, the dependence of the relationships that undergo scrutiny regarding their adaptive behaviour on the supplier side will be assessed.

Summary 12: Adaptive Behaviour and Power Balance

The power balance between a buyer and a supplier influences their adaptive behaviour.

Christopher and Towill, 2001 demonstrate the important role of supply chain managers in implementing change—and hence acting in the role of a change manager—with the example of the implement-

ation of agile principles throughout a SC. As with sustainability, the introduction of agility as a principle requires the restructuring of interorganizational relationships. Similarly, as important as working on the relationship itself is for both ideas, there is a need to convince upstream SC partners to adopt certain operational principles.

"Power in relationships" is understood as one of the "principal component bodies of supply chain literature", more specifically in the category of organizational behaviour (Croom et al., 2000, p. 70). On top of the findings from the literature about social exchange (Blau, 1964; Cook, 1977; Emerson, 1962), French Jr. and Raven (1959, p. 260) found further bases of power which go beyond the solely dependence-based power advantage (equation 3.4). Power is defined "in terms of influence, and influence in terms of psychological change" (equations (3.5) and (3.6)). Following the Theory of Planned Behaviour (TPB), a psychological change in the mindset (*attitude*, equation 3.7) is what brings adaptation to a common sustainability understanding between buyer and supplier (Ajzen, 1991) (equation 3.8).

$$\frac{1}{\text{Dependence}} \propto \text{Power} \tag{3.4}$$

$$\text{Power} \rightarrow \text{Influence} \tag{3.5}$$

$$\text{Influence} \rightarrow \text{Psychological Change} \tag{3.6}$$

$$\text{Psychological Change} = \text{Change of Attitude} \tag{3.7}$$

$$\text{Change of Attitude} \rightarrow \text{Change of Behaviour} \tag{3.8}$$

3.2.3 *French and Raven's Bases of Power*

3.2.3.1 *Five Bases of Power*

For the determination of power relationships, French Jr. and Raven (1959) have selected five particularly important bases of power. The bases of power are used to describe *due to which perceived circumstance* the power is allocatable. The influence, which is found to cause a change in attitude and ultimately in behaviour, is based on the five circumstances French Jr. and Raven describe. The identification of the types of power and their systematic definition allows a comparison of the changes they can produce. The change that can be achieved through the exertion of power can be of various types. French Jr. and Raven (1959, p. 260) list the following possibilities of change occurring due to exertion of power:

- Behaviour,

- opinion,

- attitude,

- goals,

- needs, and

- values.

An "agent", which could be a powerful person or firm, is considered to exert positive control if it can produce an intended change. Positive control is therefore needed by a firm ambitious to drive its sustainability agenda through the supply chain.

From the perspective of the more influential and hence more powerful entity in the relationship, the five original power bases are (French Jr. and Raven, 1959, p. 263):

REWARD POWER: Reward power is based on the influenced entity's perception that the agent "has the ability to mediate rewards for him".

COERCIVE POWER: Coercive power is based on the influenced entity's perception that the agent "has the ability to mediate punishments for him".

LEGITIMATE POWER: Legitimate power is based on the influenced entity's perception that the agent "has a legitimate right to prescribe behaviour for him".

REFERENT POWER: Referent power is based on the desire of the influenced entity to be associated with the agent.

EXPERT POWER: Expert power is based on the influenced entity's perception that the agent "has some special knowledge or expertness" which is either useful or necessary for him or her.

Please note that the power bases are mainly grounded on the *perception* of the entities in the relationship. This goes hand in hand with Lippitt et al.'s (1952) conclusion that actions resulting from power influences are based on the perceived power, not on an objective measure of power (see also summary 9).

The Scopus® database reveals 1,358 citations of the original work of French Jr. and Raven (1959).[3] The interest in the framework is gaining popularity as the climbing numbers of annual citations in fig-

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3 Google Scholar finds even more articles citing French Jr. and Raven's framework (see page 124).

ure 3.2a show, whilst it is widespread across different subject areas (figure 3.2b).

(a) Distribution over the years   (b) Distribution over subject areas
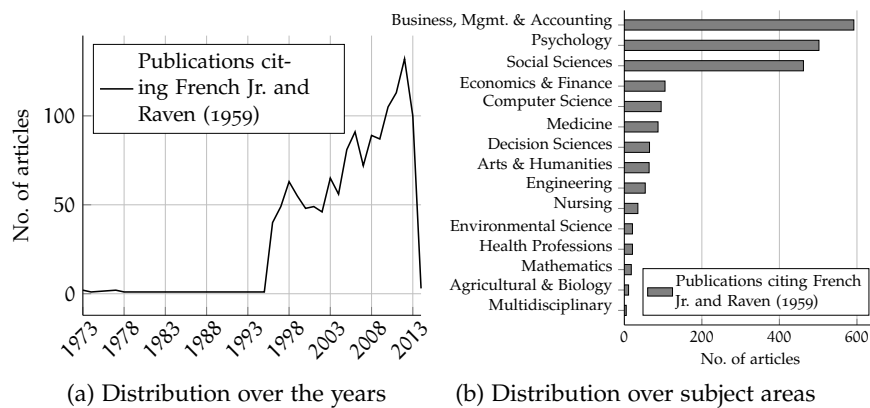
Figure 3.2.: Statistics from the Scopus® database for the citation of French Jr. and Raven (1959)

French Jr. and Raven (1959) further elaborate the five bases of power. In order to provide an idea of what is behind these bases of power, a description in note form is given for each base. The description uses the abstract terminology of influenced and influential party. Projected on the case of a dyadic exchange relation with a powerful buyer trying to permeate its sustainability agenda upstream, the influential party would be the buyer and the influenced party the supplier.

REWARD POWER.

- Having the capability to reward.

- The perception of the magnitude of the reward of the influenced party determines the strength of this power. Rewarding positively and the removal of negatively perceived penalties both count as reward power.

- Piecework in the manufacturing industry is an example of reward power.

- Reward power increases the attraction of the influenced party to the influential party.

- The proximity of reward to coercive power is close. If the influenced party "conforms in order to obtain praise for conformity", reward power has been exercised; on the other hand if the influenced party conforms to the norms of a group "only because he fears ridicule or expulsion [. . .] for nonconformity", coercive power is executed.

COERCIVE POWER.

- Having the capability to punish.

- The perception of the magnitude of the possible punishment of the influenced party determines the strength of this power. Further, the chances of the influenced party to avoid the punishment through conforming play a role in the perceived magnitude.

- Minimum quantity output goals in production with the threat of losing the job at non-fulfillment would be an example of coercive power.

- Depending on the situation, the "withdrawal of a punishment" equals a reward, and the "withholding of a reward" equals a punishment. Hence, in some situations the coercive power and the reward power a quite similar.

- Coercive power tends to decrease the attraction of the influenced party to the influential party.

LEGITIMATE POWER.

- The influenced party has the perception that the influential party "has a legitimate right to influence" and that the influenced party "has the obligation to accept this influence".

- This perception derives from experiences in the past (or in the case of an individual from, for example, education and values taught while growing up) or just cultural values. These perceptions in social life could be obeying an older person or a person from a different caste.

- Legitimate power is related to authority.

- By trying to apply legitimate power that does not exist in the perception of the influenced party, the attraction to the influencing party decreases and so does the possibly small amount of available legitimate power.

REFERENT POWER.

- The influenced party identifies itself with the often prestigious influencing party.

- Striving for "oneness" with the influencing party.

- The influenced party may feel like a member of a group, which is then the influencing party.

- If the parties are closely related, the influenced party will try to maintain this relationship.

- The influenced party may be unaware of the power the influencing party exerts through this channel.

- Referent power is about achieving satisfaction from the perspective of the influenced party, rather than being controlled by an influencing party.

- A higher attraction to the influencing party leads to more referent power.

EXPERT POWER.

- The influenced party in a relationship decides through its perception of the influential party's expertise the strength of the prevalent expert power.

- The expert power can only be exerted in the area of expertise (a lawyer would be trusted for legal advice, less for medical advice; a medical doctor would be trusted for medical advice, less for legal advice).

- Expert power can be based on the credibility of the influential party (trust), as well as logical reasoning based on facts supplied by the influential party ("informational influence").

- The influenced party has to believe that the influential party tells the truth *and* has some expert knowledge about the matter under discussion.

- Expert power is delimited. It appears to be of greater influence in cases where a certain referent power is installed as well.

French Jr. and Raven (1959) conclude that referent power has the broadest range of all five bases of power. Further, the usage of any form of power outside its sphere of action will reduce the power. Since coercive power is likely to decrease attraction from the influenced party to the influential party, a more legitimate coercion can be exerted in order to minimize this effect.[4]

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4 "The more legitimate the coercion the less it will produce resistance and decrease attraction."   French Jr. and Raven (1959, p. 268)

A desired change can only be triggered if the correct base of power is exerted on the influenced party. The influenced party must hold the perception that the influential party can actually draw on this power. If this is not the case, the power of the influential party is likely to decrease and the desired change is not triggered through this channel.

Other models have extended or compressed the findings from French Jr. and Raven (1959) (Handy, 1976; Morgan, 2006).

3.2.3.2 *The Sixth Base of Power*

Yukl and Falbe (1991) found in an exploratory study that different situations or relations require differently exercised power. By applying the principle of the five bases of power, the authors find two groups suitable for different tasks: *a*) reward power and coercive power were found to be more appropriate for middle managers as a tool to influence their subordinates, whereas *b*) legitimate and expert power, as well as agent persuasiveness, were applied most effectively to achieve influence over managers or peers. It is understood that the aim is to influence peers in the scenario of implementing sustainability in a dyadic buyer-seller relationship. Persuasiveness is understood as *informational power*, which was added later to the bases of power.

> **Summary 13: Effective Application Of Different Power Bases**
>
> Legitimate power, expert power and "agent persuasiveness" are found to be most effective in influencing peers.

Yukl and Falbe emphasize the additional base of power: *informational power*. Informational power (also denominated as persuasion[5]) will be held by the "possession of information other people need to do their work" (Yukl and Falbe, 1991, p. 416). Informational power was indeed added as a base of power by Raven (1965) under the terminology "persuasion" (Raven, 1993).

INFORMATIONAL POWER.

- The powerful agent possesses some information valuable for the target.[6]

- Informational power is likely to lead to socially independent change. Similar to expert power (page 106) informational power is found to change a target's sustainable behaviour, without an agent reminding or controlling the target.

The research design in Yukl and Falbe's study is based on a questionnaire survey. According to the authors this is a typical research design for correlating power with performance or satisfaction. The analysis of the literature (see table 3.2 on page 126) supports this statement.

Even though Yukl and Falbe (1991) added three more power bases to the original idea of French Jr. and Raven (1959), the results of their factor analysis revealed that already six factors explained 60 per cent of the item variance. In a further correlation analysis strong overlap between three pairs is observed; however, this is not significant. The pairs are:

---

5 "Informational power, or persuasion, is based on the information, or logical argument, that the influencing agent can present to the target in order to implement change."   Raven (1992, p. 221)

6 *Target* stands for the entity in the dyadic exchange relation with less power in the issue under discussion. The exerting entity is called *Agent*.

1. Reward & coercive,

2. persuasive & expert, and

3. charismatic & referent.

The correlation of the pair under item 1 is already discussed by French Jr. and Raven (1959), as they state that an ease of a penalty (coercive) could be understood as a reward, and on the other hand a retraction of a reward may be perceived as a penalty from the target. The pair under item 2, persuasion and expert power, may be explained through the ordinary application of expert power which comes into play when persuasion of a target is achieved—not through sheer force (coercion) and not through remuneration (reward). Moreover, since persuasion is later declared as informational power, it appears comprehensible for an expert to have desirable information, which then builds on a similar base of power. Charismatic and referent power fall together in this study since it deals with persons and not organizations. Hence, the referent was more than likely rated twice regarding his or her personal characteristics and appearance. Raven et al. (1998) explain the overlap between these factors in a similar way.

3.2.3.3 *Extension to 14 Bases of Power*

Raven (1992, 1993) extended the bases of power framework to 14 bases. The extension is based on the existing six bases, and some derivations of these. Figure 3.3 gives an overview of the added bases of power.

IMPERSONAL AND PERSONAL COERCION.   Impersonal coercion, as defined by Raven (1992) and utilized by Raven et al. (1998), relates to how unpleasant an agent could make a situation for a target. Per-
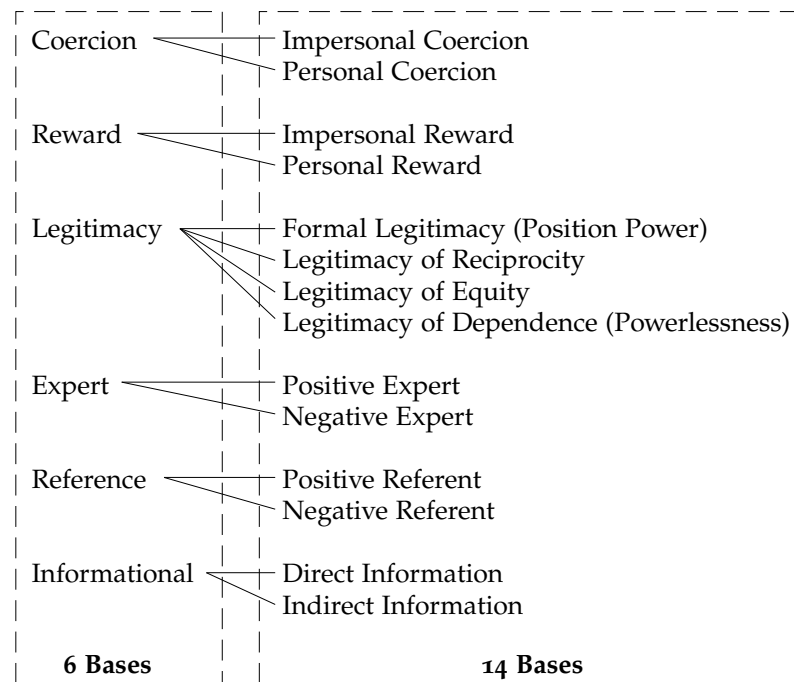
Figure 3.3.: Raven's (1992) extension from 6 to 14 Bases of Power

sonal coercion on the other hand relates to what the target believes the agent's perception of the target to be. A practical example from interpersonal relations such as a supervisor and a subordinate is the unpleasant feeling of the subordinate when under the impression that the supervisor is *not* pleased with something he or she has done or, particularly, has not done. It is the fear of disappointing the agent. Both forms of coercion are categorized as hard power bases.

IMPERSONAL AND PERSONAL REWARD.   Like coercive power, reward power is also further subdivided into impersonal and personal reward power. One main difference here is that the base of personal reward power is considered as a soft power base, whereas impersonal reward power is understood as a hard power base (Raven et al., 1998). An impersonal reward power that a buyer has over a supplier could

be the perception of the buyer (target) that a good evaluation, e.g. the quality of the traded good, could lead to an increase in the purchase price the buyer (agent) is willing to pay. Any kind of benefit the agent could grant the target can be understood as an impersonal reward power base.

To exemplify, personal reward power will be explained as the relationship between a supervisor and a subordinate. There is a close similarity to personal coercion, with one important distinction: personal reward power is experienced by the subordinate (target) when the subordinate feels the urge to *make* the supervisor (agent) feel pleased—it is not the fear of disappointing the agent.

DIFFERENT FORMS OF LEGITIMACY.   Raven (1992) distinguishes between four different forms of legitimate power an agent can have over a target. *Legitimate power of position* is comparable to a rank order in the military. The target perceives the agent as powerful due to its position in the environment. In the case of interorganizational exchange relations, this could have to do with a strong brand name of the agent, its popularity or simply its size (economically speaking). This power is categorized as a hard power base. *Legitimate power of reciprocity* is based on the urge of the target to return a favour to the agent. An example of two firms in a buyer–supplier relation could be a case of :"… they have done the same thing for us when we needed it". This base of power and the following *legitimate power of equity* are categorized as hard power bases. Legitimacy of equity is very similar to legitimacy of reciprocity; however it is not based on returning a favour, but rather rectifying something the target has done unsatisfactorily for the agent in the past. The fourth form of legitimate power

is called *legitimate power of dependence* and is classified as a soft power base. Raven describes this base of power also as the "power of the powerless", since the agent appeals to the target's conscience without having any real substantial power. It is more a case of making the target feel sorry for the agent and feel obliged to fulfill the request based on that feeling. In the case of a buyer–supplier relation, this could mean that the supplier (target) complies to something which it does not necessarily have to, but non-compliance would bring the buyer (agent) into a very unpleasant situation.

POSITIVE AND NEGATIVE EXPERT POWER.   Expert power was originally considered only in its positive form. This meant that the target does something because it is told to do so by a perceived expert (agent), simply because the target assumes the expert has knowledge about the issue (Raven, 1992). Negative expert power is explained by Raven as a target doing the opposite of what an expert advises. This issue may arise when the target thinks the expert (agent) knows more about the relevant issue and is trying to use this knowledge to its advantage by luring the target in a wrong direction. In later research, expert power was no longer distinguished and only positive expert power was considered in the measurement tools developed by Raven et al. (1998). Expert power is listed under the soft power bases.

POSITIVE AND NEGATIVE REFERENT POWER.   Positive referent power is as described in section 3.2.3.1. Negative referent power was added by Raven (1992, p. 221) and understood as doing "exactly the opposite of what we see a particularly unattractive or unappealing

person may do". In later research by Raven et al. (1998) this distinction is omitted and referent power is listed as a soft power base.

DIRECT AND INDIRECT INFORMATIONAL POWER.   The distinction between these two different approaches of influencing through information is the deliverance of the information. The direct approach—e. g. trying to convince someone (target) based on new information one (agent) has—might only work if the agent is in a position that allows him or her to influence the target. This can be, for instance, any additional form of legitimacy. However if the target perceives itself powerful on other bases, the agent would be well advised to deliver the information in a indirect, more diplomatic approach. Clearly in this case the agent is only assigned any power if it holds some game-changing information. This very fine distinction between direct and indirect informational power is omitted in later research (Raven et al., 1998), where simply informational power is considered as a soft power base.

Raven (1992) already emphasized the difficulty in the definition of the power bases. Several authors have used the concept since its introduction in 1959; however, the bases of power were not understood equally by them all. In particular, the operationalization of the variables in measurement tools such as questionnaires has varied and hence has led to inconclusive research. Raven announced therefore the development of a measurement tool to be applied in order to get comparable results in studies. This measurement tool is introduced in Raven et al. (1998) and restricted to eleven bases of power.

3.2.4 *The role of dependence*

Frazier (1983) agrees to a certain extent with French Jr. and Raven (1959) by stating that the power between persons is based in the perception of each other. However Frazier finds the five bases of power inappropriate to "explain the source of a persons power" (Frazier, 1983, p. 71). Instead Frazier finds that two primary factors, and the way they are perceived, determine the power of a person: "(*1*) authority, and (*2*) dependence" (Frazier, 1983, p. 71). Dependence is "the need to maintain the relationship in order to achieve desired goals" (Frazier, 1983, p. 71). This finding goes back to Emerson's (1962) *dependence theory*. The *degree of dependence* is a term defined by French Jr. and Raven as the difference between the condition of a system (e. g. a buyer-seller relationship) whilst it is under the influence of the powerful source, and its condition after removing the exerted power.

French Jr. and Raven's (1959) bases of power are also defined amongst other factors according to their degree of dependence. A low degree of dependence, not only on the buyer's side, appears to be desirable for several reasons. Elaborated for the case at hand (the creation of a sustainable system through adaptation of a buyer's sustainability agenda), the following scenarios are imaginable:

- A change induced through a power exerted with a low degree of dependence would mean in practice that even after a termination of the dyadic exchange relation, the sustainability agenda as adapted remains to the maximum possible extent. One may denominate this as a sustainable change of sustainability commitment.

- In a buyer-supplier relation where the buyer is about to bring the supplier to an equal level of sustainability, the goal of the buyer will be to waste as few resources as possible in this process. The exertion of a base of power with a low degree of dependence gives the buyer certainty that the changes implemented at the suppliers will continue even after the power is eased. Hence again, the exertion of power with a low degree of dependence is likely to be more efficient in the longer term.

A dichotomization could be made between power bases with a high degree of dependence and those with a lower degree of dependence.

In social sciences research into interpersonal power relations, and in organizational behaviour and SCM literature, the questions as to *what* gives one power is often answered by the framework of the bases of power with all its variations. In this research the existing framework will be used. The influence of different bases of power (French Jr. and Raven, 1959) on relations in any form has been proven through several studies (please find an non-exhaustive overview in table 3.2 on page 126).

3.2.5 *SC performance and power relations*

From a SCM perspective, and pointing towards a buyer–seller relationship, Cox (1996, p. 58) ascertains that "all contractual relationships [...] are based on [...] power struggles over scarce resources". This finding can be related to the RDT as introduced by Pfeffer and Salancik (1978). This permanently present dependence, and hence power imbalance, removes the idealistic concept of *win-win* in interorganizational exchange at its foundation.

The power relation between a buying and a supplying person can also have an influence on the proximity of those persons. This proximity is understood by Cox (1996) as either keeping one at "arm's length" (in case one has power over another, e. g. an influential buyer and a commodity supplier in a highly competitive market) or having a closer relationship with less power imbalance (e. g. a single source procurement or a preferred supplier). A "strategic supplier alliance" is understood to be based on equalized power balance.

Cox (1999) emphasizes that there is a power struggle in supply chains, which does not only spread horizontally between different suppliers, but also vertically between business partners. Having power is found to help the possessor to extract value out of the business relationships it occupies. Hence, each supply chain entity's desire to increase its power is thereby based on the causal correlation between power and sustainable business success. To achieve the best possible results, the detection and management of the power structures within one's supply chain is therefore important for supply chain managers.

As introduced in equation 3.3, Cox (1999) explains from a rather practical point of view the importance of retaining power over suppliers, whilst keeping one's own dependency on the suppliers low. Even though, as an example, the underlying theory of power relations within supply chains is presented from a case where the buyer/OEM has power over the supplier, this is not to be generalized (Cox, 2001a). In many cases suppliers have some form of power over a buyer which requires compromise solutions and negotiating skills from the buyer in order to achieve a satisfying result (a piece of the "value cake" passed along the supply chain). Cox (2001c) concludes that having power over one's suppliers *and* buyers, leads to extraordinary profit-

ability for the focal organization. This state of affairs is denominated as "janus-faced dominance".

3.2.6   *SC sustainability and power relations*

The implementation of sustainability in a SC relationship could be compared to the implementation of a Just in Time (JIT) system. Toyota, which is widely accepted as a leader in innovative manufacturing, was able to implement "an assembly-based, demand-pull and JIT system because it had a dominant power relationship with its suppliers" (Cox, 1999).

> **Summary 14: Adaptation of JIT**
>
> Lean management principles such as JIT were adapted by suppliers due to dominant power (*coercive power*) exerted from OEMs on to suppliers.

Cox suggests that an appropriate way of "managing business situations", requires intelligence about the "relationship management choices available" to the respective entity (Cox, 2001a,b, p. 43). This intelligence is based on in-depth knowledge about the respective power relationship. Convincing a business partner to adopt sustainability practices can be understood as the management of a business situation; therefore Cox's thought appears transferable to the issue under investigation.

Following logical reasoning, Cox (2001a) states that supplier development, as in implementing sustainability, can only happen if either dominance of the buyer is given, or an interdependent situation between

buyer and supplier is present.[7] This applies not only to the dyadic relationship between buyer and first-tier supplier, but also to the chain further upstream, which leads to permeation of the "supplier development" or, in the case at hand, permeation of sustainability.

Taking a simple SC into consideration, Cox (2001a) introduces four different supply chain power structures. Figure 3.4 illustrates the objective of this research regarding power structures and supply chains. Since this research is the first of its kind in the field of SSCM, the focus is rather narrow and on a dyadic exchange relation, which is highlighted in figure 3.4. The dyadic relationships between supply chain entities can have four different characteristics:
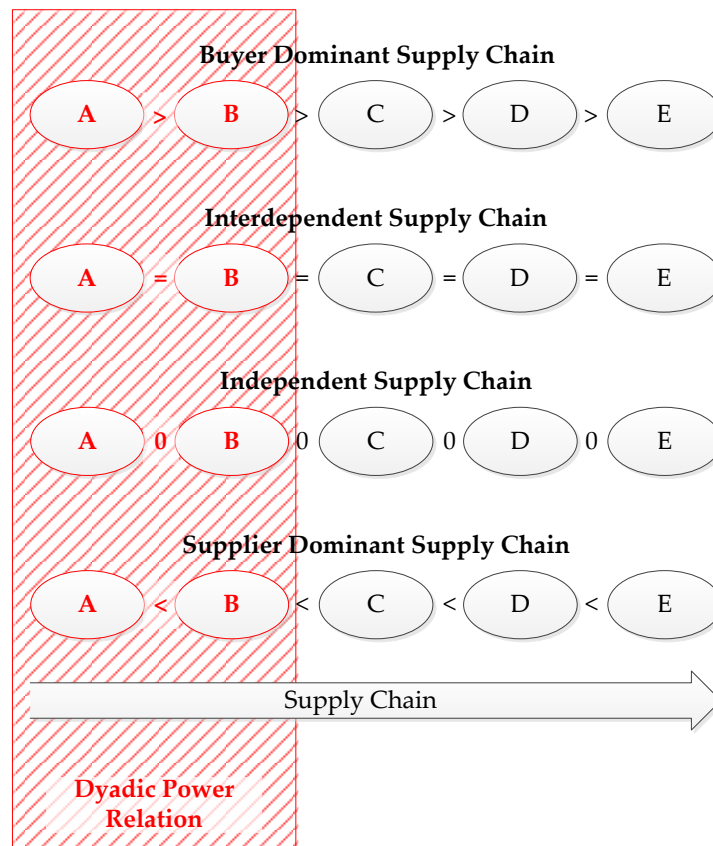
Figure 3.4.: Supply chain power relations according to Cox (2001a), with emphasis on dyadic interperson relations

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7 This example is based on a buyer wanting to implement the change.

1. Buyer dominant ($>$),

2. Interdependent ($=$),

3. Independent (0) or

4. Supplier dominant ($<$).

The power relationship between different entities within a supply chain or network is called *power regime* (Cox et al., 2001). As introduced above, the power regimes can take four different characteristics. These characteristics can be mapped out throughout the supply chain or network in order to achieve greater clarity about the power relations. In future research it might be interesting to find out how well sustainability principles permeate through a supply chain, considering the underlying power regimes.

Cox (2001a) elaborates that innovation can only happen through domination,[8] which links back to power relations. Following the literature up to this point, it is understood that dominance of the buyer, which gives the buyer a certain power and the supplier a certain dependence, is likely to influence their interorganizational change management. The subject of change is sustainability. Since the dominant and powerful entity in the scenario will be a stakeholder as listed under item 1 on page 92, a supplier's performance of adaptation of sustainability will be scrutinized.

Research Objective 2 *To test whether a buyer's power impacts the adaptive behaviour towards sustainability of a supplier.*

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8 "Only when the buyer is in a position of dominance over the supplier and capable of leading innovation, or there is an interdependence of power in which a mutual coincidence of interest encourages joint learning, can this approach be made to work successfully. When the supplier dominates the power relationship, or there is buyer–supplier independence, it is unlikely that suppliers will have any real incentive to undertake specific innovations for any one customer."   Cox (2001a, p. 46)

Research objective 2 will be tackled by answering research question 2 (page 4). Research question 2 asks particularly for the adaptive behaviour regarding *sustainability initiatives*; hence a word of clarification about what is understood as such will be given. Sustainability in this research is based on Elkington's (1998) TBLs. This means initiatives are considered as sustainable if they account for the social and/or the environmental bottom line, whilst not lessening the results on the respective other bottom line *and* whilst not reducing the economic bottom line. Examples:

GREEN An automotive supplier wants to become more sustainable and decides to implement a *green initiative*. The turnery decides to use recycled material for the parts they turn instead of the Polyoxymethylene (POM) they used before. This appears clearly more environmentally sound to the manager of the firm. The only downside is that, because of the material's properties, the turned parts have to be deburred manually with a deburrer device. This takes more time than the automated process that was possible with the POM and the workers start to complain about the increased workload.

At some stage the management decides not to become further involved in sustainability practices, since they have experienced decreasing product quality, higher average unit costs and worse working conditions.

To a sustainability literate person it becomes clear that the initiative was by no means sustainable. By increasing the environmental bottom line, the management of the turnery decreased not only their economic bottom line but also their social bottom line. Sustainability as it is understood in this research should,

while improving the environmental and/or social bottom line, at least not harm any of the others.

SOCIAL A manufacturer for circular knitting machines joins the employers' association of metalworkers due to increasing public pressure. The management understands this step as a stepping-stone towards sustainability and a starting point for their social bottom line improvement program. The membership comes with some duties for the firm, such as compliance to the respective trade union's working conditions. Hence the workers of the factory decrease their weekly working hours from 41 to 35 at the same salary. The management of the firm is enjoying its good reputation in the local news and the satisfaction among the associates. In order to keep the production output the same, the workers are paid extra hours according to the trade union's conditions.

Half a decade later the management of the company notices rapidly growing competition from Chinese companies. Even though these companies have been around for a while, and their machines were cheaper, the management of the focal firm did not consider them as a danger to their premium market machines, which were sold for premium prices. However, the competitors have caught up in quality, and are flooding the market with their lower-priced machines. After an important trade fair, this causes a sudden nosedive in orders. The focal company's only option, due to the commitment to the trade union's conditions, is to compromise the components' quality to lower the costs, scrap the plans for their planned investment in solar energy, and reduce the profit margin.

The social initiative reduced the firm's management flexibility and subsequently their capacity to act according to an economic situation. Hence, the improvement on the social bottom line decreased the economic bottom line substantially and led to an unsustainable business model. Sustainability as it is understood in this research should be based on initiatives which either affect the three bottom lines synergistically or at least not do not affect other bottom lines negatively.

Initiatives impacting the economic bottom line of a firm or a SC have been explored in SCM literature. Even the particular issue of how the bases of power impact the performance of supply chains and the satisfaction of the supply chain members has undergone scrutiny in past research (Benton and Maloni, 2005; Maloni and Benton, 2000). The crucial findings regarding the impact of the bases of power are their impact on the buyer-supplier relationship, which then again influences the buyer's, the supplier's and the overall performance. In detail, Maloni and Benton (2000) found that coercive and legal legitimate power, which they categorized as mediated power bases, have a negative influence on the buyer-supplier relationship. Non-mediated power bases, in which the categories expert and referent power are found, have a significantly positive effect on the buyer–supplier relationship. Inconclusive results are shown for the relationship with underlying reward power, which was categorized by the authors as a mediated power base. In conclusion, it is found that non-coercive power bases promote the performance of a buyer–supplier relation, whereas performance is a result measured on the economic bottom line.

Cox's (2001) idea of the importance of power relations in a buyer–supplier relationship is also grounded in *Porter's five forces* (Porter, 1979, 2008) with its bargaining power of customers/buyers. These powers again refer to a resource dependency as it is discussed by Pfeffer and Salancik (1978).

3.2.7 *Hypotheses*

According to Punch (1998, p. 16), this research follows a *theory first* approach, meaning that, based on the existing theory, hypotheses are derived which are then to be tested. Building on the literature about sustainability, SSCM and interorganizational relations, hypotheses will be developed within this section.

Sustainability for this research is understood as comprising the three bottom lines: environmental quality, social equity and economic prosperity (Elkington, 1998). When looking at sustainability in supply chains, dyadic exchange relations or just a single firm, the characteristics of each bottom line become strongly sector related.

Since it is the goal of the SSCM principle to implement sustainability throughout the supply chain, a change process at a business partners' (e. g. suppliers') location needs to be initiated by the sustainability-driving focal firm. Following the findings from section 3.2.2 (summary 11 on page 99) suggests that this interorganizational change needs to be triggered by the more powerful entity in the exchange relation. Based on this well-founded idea, research hypothesis H_1 is proposed as follows:

Hypothesis H_1 *A supplier's dependence on its buyer is positively related to its adaptive behaviour towards sustainability.*

For the upcoming statistical tests (chapter 5), the following mutually exclusive null hypothesis Ho_1 will be used.

Null Hypothesis Ho_1 *A supplier's dependence on its buyer is unrelated to its adaptive behaviour towards sustainability.*

Influencing an exchange partner to adapt to a change, such as implementing sustainability, is achieved by exerting power (French Jr. and Raven, 1959). However if the power is not administered in the correct way, the wanted effects may fail to appear, according to Frazier (1983, p. 71), who claims that "possessing authority does not guarantee achieved influence on another's behavior if it is not used or not used effectively". A similar point is made by Rahim (2009), who elaborates in relation to the example of a supervisor–subordinate relationship how important it is to exert the right type of power in order to achieve the desired result. Further Rahim and Buntzman (1989, p. 224) find that power gives one the ability "to change or control the behaviour [. . .] of another party".

3.2.7.1 *Dichotomization of Power Bases*

In order to find more conclusive results, a thorough search through the literature dealing with bases of power and interorganizational change is conducted. The underlying systematic is:

1. Finding the original article published by French Jr. and Raven in 1959 in the Google Scholar search engine.

2. Search within the approximately 6500[9] articles which have cited French Jr. and Raven (1959) for:

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9 On the 4th of February 2012 the Google Scholar search engine counted 6453 citations of the title *The bases of social power* by French Jr. and Raven. On the 5th of December 2013 the number of articles citing French Jr. and Raven (1959) had already reached 7220.

a) Interpersonal power relations

b) Sustainability

c) Case studies about interorganizational change (Lean, Business Process Reengineering (BPR), SCM)

The distribution of the studies building on French Jr. and Raven (1959)'s framework and considered in the further process is as graphically presented in figure 3.2. Since it is differentiated between intrinsic and extrinsic motivation regarding the success of different bases of power (Pierro et al., 2012), it has to be clear that in the research on hand the motivation shall always be external. This is due to the focus on buyer-induced change regarding the sustainability agenda of a supplier. The buyer represents the external impact. The survey tool used in this research presumes that the target initially hesitated to adapt to a certain change, hence an external influence (which is a form of power) changed the behaviour of the target firm. Therefore, in this research the motivation to adapt to the change of implementing sustainability as it is understood by the agent is extrinsic.

Table 3.2.: Analysis of research deploying French Jr. and Raven's bases of power

Author (Year)	Description	Effective Power Base
Yukl and Falbe (1991)	Finding out which power bases are better to (a) influence subordinates or (b) peers in a working environment. (b) is found to be comparable to the case at hand.	Legitimate power, expert power, agent persuasiveness
Cox (1999)	Lean management principles such as JIT were adapted by suppliers of Toyota due to dominant power (coercive power) exerted from the OEM onto suppliers.	Coercive power
Brennan and Turnbull (1999)	Persuasion of supplier to share proprietary source code with the agent.	Coercive power
Raven et al. (1998)	Study 1: Students are asked which of the 11 bases of power exercised by a supervisor persuaded them to change their approach to how to do their job (from their favorite approach to a requested approach).	Ranking: (1) informational power, (2) legitimate power of position, (3) expert power, (4) legitimate power of dependence, (5) personal reward power, (6) personal coercive power, (7) referent power, (8) impersonal reward power, (9) impersonal coercive power, (10) legitimate power of reciprocity, (11) legitimate power of equity

Author (Year)	Description	Effective Power Base
Raven et al. (1998)	Study 2: Hospital personnel were asked which of the 11 bases of power exercised by a supervisor persuaded them to change their approach to how to do their job (from their favorite approach to a requested approach). Further sample was surveyed regarding their job satisfaction.	Ranking: (1) informational power, (2) legitimate power of position, (3) expert power, (4) legitimate power of dependence, (5) referent power, (6) personal reward power, (7) legitimate power of reciprocity, (8) personal coercive power, (9) impersonal coercive power, (10) impersonal reward power, (11) legitimate power of equity
Pierro et al. (2008)	Study 1: Investigating which bases of power are more effective for intrinsic/extrinsic motivated people.	Extrinsic motivation (= interorganizational change): hard power; Intrinsic motivation: soft power
Pierro et al. (2008)	Study 2: Measuring the receptivity of people to obeying supervisors regarding their exercised power base.	Soft power
Pierro et al. (2008)	Study 3: The correlation between hard/soft power bases and the relation of a supervisor to a subordinate (getting ahead/getting along) was investigated.	Getting ahead (= interorganizational change): soft power; Getting along: hard power
Hinkin and Schriesheim (1989)	Measurement of job satisfaction and power of supervisor exerted on subordinates (three samples: undergraduate students, hospital employees, MBA students).	Global satisfaction: expert and referent power Technical satisfaction: expert and referent power Human relations satisfaction: expert and referent power Organizational commitment: reward power (inconclusive)

Author (Year)	Description	Effective Power Base
Frost and Stahelski (1988)	Measuring power use (as opposed to power potential) in leadership activities: (1) between a more powerful and a less powerful leader in an organization, (2) "what must be done and how", (3) "treating subordinates as equals and as strengthening their self-esteem"	(1) Organizational level: coercive, reward and legitimate (2) Initiation of structure: expert and referent power (3) Consideration: coercive and NOT referent power (negative correlation)
Carson et al. (1993)	A meta-study across several studies relating to the bases of power is conducted. It presents findings regarding: (1) the satisfaction with a supervisor, (2) the job satisfaction and (3) the performance of subordinates in relation to the exercised power of a supervisor.	(1) Satisfaction with supervisor: expert and referent power and NOT coercive power (negative correlation) (2) Job satisfaction: expert and referent power and NOT coercive power (negative correlation) (3) Performance: expert and reward power
Swasy (1979)	Undergraduate students were assessed on a scenario based questionnaire to which base of social power they respond.	No effective base is determined. Only a scale for measurement is developed and analysed.
Cobb (1980)	Measuring "relationship between power base utilization and informal influence in the organization". Power bases were measured through only one item per base.	Legitimate power (legitimate organizational authority) affects informal influence between work unit peers and up the chain of command the most. Coercive power the least.
Comer (1984)	Measuring the satisfaction of sales representatives with their sales managers regarding the power base they perceive between them.	Expert and referent power, NOT coercive (negatively correlated) were found to exist in the relationship.

Continued on next page

Author (Year)	Description	Effective Power Base
Greene and Podsakoff (1981)	Investigating "the effects of removing a pay incentive on the bases of power of supervisors".	Removing someone's reward power results in a decrease of legitimate and referent power. Coercive power becomes more prevalent
Martin and Hunt (1980)	Investigating leaders' power bases and their relation to job satisfaction and finally personnel turnover in a construction bureau.	Referent and expert power were found to have a positive influence on job satisfaction and hence on intentions to stay.
Martin and Hunt (1980)	Investigating leaders' power bases and their relation to job satisfaction and finally personnel turnover in a design bureau.	Expert power was found to have a positive influence on job satisfaction and hence on intentions to stay.
McDaniel et al. (1985)	"The purpose of the research was to investigate whether or not a relationship exists between organizational climate [...] and the particular social power base of the marketing executive" (343 marketing executives).	The organizational climate was measured based on four factors. All four correlated positively with referent power and legitimate power: three of the factors were significantly correlated to expert and reward power.
Ragins (1988)	Subordinates were questioned as to whether the gender of their supervisor makes a difference in leadership effectiveness, or whether this solely depends on the power exercised.	Perceived leader power accounts significantly to perceived leader effectiveness, whereas gender does not. All power bases except coercive power correlated positively with leader effectivity
Rahim (1989)	Investigating "the effectiveness of the bases of leader power [...] in influencing behavioural compliance with the superior's wishes and satisfaction with supervision".	Expert, referent and legitimate power are positively correlated with compliance. Legitimate power however is also negatively correlated with satisfaction.
Spekman (1979)	Investigating which power is most efficiently deployed by a Boundary Role Person (BRP)' this deals with extra-organizational entities.	Expert power

Author (Year)	Description	Effective Power Base
Student (1968)	A supervisor's exerted power was correlated with the performance of its working group.	Referent and expert power.
Sembi (2012)	Case study of an implementation of a technology-based innovation at a university and the implementers' strategies regarding the bases of power.	No clear result.
Lines (2007)	Investigating the influences of expert power and position power (coercive, reward, legitimate) on the success of the implementation of change in an organization.	The "change agent expert power based on task relevant competence" is strongly correlated with the achievement of the goal.
Hunt and Nevin (1974)	Investigating the consequences of differently utilized power bases in a franchisor–franchisee relationship. The study is based on over 800 participants (franchisees) which were fast-food restaurants.	Non-coercive bases of power increased franchisee satisfaction. Coercive power is heavily used.
Hunt et al. (1987)	The study aims to answer the question: "What factors affect the probability that the less powerful channel member will comply with the wishes of the more powerful channel member?" Manufacturer representatives and their compliance towards the manufacturer were assessed.	A target is more likely to comply with an agent's requests when the perception of expert, referent and legitimate power bases increases.

Raven et al. found, based on two studies and their factor analysis, two "categories of bases: harsh and soft" (Raven et al., 1998, p. 307). According to Pierro et al. (2008), the power bases that appear to be particularly effective in the overview are categorized as soft power bases (expert, referent, informational and legitimacy of dependence). Hard power bases are found to consist of reward, coercion and legitimacy of position power. A meta-analysis of studies deploying the framework of French Jr. and Raven (1959) or the extended framework including informational power (Raven, 1992) sheds some light on the effectiveness of the power bases in interpersonal relations. The graph in figure 3.5 represents the findings from the meta-analysis. The bar chart is generated from the conclusions of the studies listed in table 3.2. If it is clearly stated which power is effective, this power counts into the totals; if a ranking is given, the top three power bases are accounted as effective. Soft and hard power are considered with all four of their contributing power bases. The total number of effective power bases in the selected studies build then the base for the percentages of the respective effective power bases (the underlying data can be found in table B.2 in the appendix).

It is found that expert power in particular is effective in achieving the desired behaviour in a subordinate from a supervisor's point of view. Legitimate power and referent power appear to play a role as well. Legitimate power is mainly understood as the perception of the subordinate as to whether the supervisor possesses any form of power; hence the relatively high appearance will not surprise. The power base named *informational power* was not prevalent in all studies, since many authors apply the original five bases of power as introduced initially from French Jr. and Raven (1959).
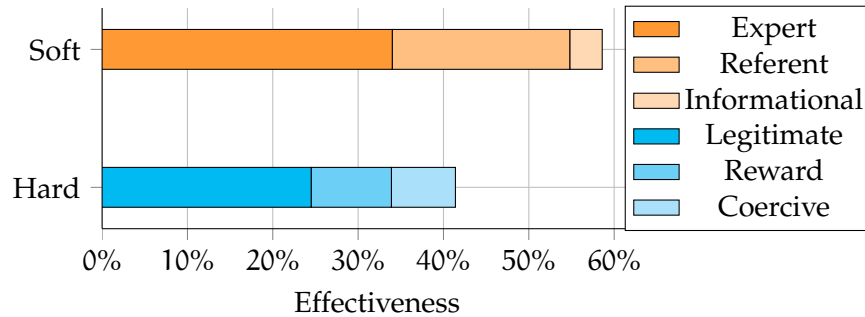
Figure 3.5.: Effectiveness of Power Bases

Figure 3.5 accounts for all forms of legitimate power and both forms of reward power as hard power bases. However, as introduced in section 3.2.3.3 (page 109 onwards), Legitimate Power of Dependence (LED) and Personal Reward Power (PRE) are actually understood as soft power bases. This fine distinction was not possible in the meta-analysis of the studies, because most articles use either the original five bases of power, or include only the additional Informational Power (INP). This restriction however means that in reality the difference between the effectiveness of hard and soft would even be greater than represented in figure 3.5—in favour of the soft power bases.

Following the approach of Maloni and Benton (2000) a dichotomization of power bases to declare their influence on sustainability adaption seems appropriate. For the performance outcome of supply chains, Maloni and Benton found a *mediated* and *non-mediated* group of power bases helpful. Most of the studies using French Jr. and Raven's (1959) bases of power do not assess the impact of each single base of power on the outcome variable of interest, but rather find a dichotomization or trichotomization which encompasses several bases. The most common dichotomizations in similar research contexts is highlighted by Oke et al. (2008, p. 573). The first group

comprising referent, expert and informational power is referred to as:

- Soft power (Raven et al., 1998; Zhao et al., 2006),

- personal power (Oke et al., 2008),

- non-mediated power (Bastl et al., 2013; Flynn et al., 2008; Handley and Benton Jr., 2012; Ke et al., 2009; Sanfiel-Fumero et al., 2012),

- non-coercive power (Chang et al., 2012; Leonidou et al., 2008; Yen et al., 2012) or

- positive power (Pinnington and Scanlon, 2009).

The second group, which includes reward, coercive and legitimate power, is often consolidated with the terms:

- Hard or harsh power (Chang and Huang, 2012; Raven et al., 1998; Zhao et al., 2006),

- position power (Oke et al., 2008),

- mediated power (Bastl et al., 2013; Flynn et al., 2008; Handley and Benton Jr., 2012; Ke et al., 2009; Sanfiel-Fumero et al., 2012),

- coercive power (Chang et al., 2012; Leonidou et al., 2008; Lindblom et al., 2009; Terpend et al., 2011; Yen et al., 2012) or

- negative power (Pinnington and Scanlon, 2009).

Two categories were not always found to be accurate enough to describe at least five bases of power. In a study about influencing a supply chain partner's adaptive behaviour, Nyaga et al. (2013) use two categories, mediated and non-mediated, whilst treating power based on rewards as a third category. The same trichotomization is used by Benton and Maloni (2005) for the scrutiny of power in dy-

adic exchange relations in relation to satisfaction. Another trichotomization approach is made by Terpend and Ashenbaum (2012) who only measure the impact of coercive power, referent power and legitimate power on some suppliers' KPIs. Other authors (Boons et al., 2012; Duke, 1998) omit a categorization and report the impact of each single power base.

Belaya et al. (2009) find the bases of power an adequate tool to measure power in interorganizational relations. The process of measuring the bases of power itself is often accomplished with well-established instruments. Therefore, scales from Brown et al. (1995) or Maloni and Benton (2000) are often used to determine bases of power in dyadic exchange relations and supply chains.

Hard and soft power bases were originally separated by the dependence of the power-induced change to its agent. Less dependence, and hence a change in attitude rather than just compliant behaviour,[10] is achieved through softer power bases. A summary of French Jr. and Raven's (1959) thoughts on the bases of power, and how the resulting behaviour is coupled to dependence, is given in table 3.3.

Drawing parallels to interorganizational change—and particularly the change of behaviour with regard to sustainability practices—it can be concluded that the exertion of soft power bases on a buyer results in a more effective change of behaviour than the exertion of hard power bases.[11]. In order to prove this, further investigations of the buyer–supplier relationship regarding adaptive behaviour need to be undertaken.

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10 cf. TPB from Ajzen (1991)

11 Spekman (1979) found the base *expert power* to be most efficient in an interorganizational study about power. Expert power is included in the soft power bases.

Table 3.3.: Exerted power bases and the degree of dependence of the change they have initiated on the influencing power.

EXERTED BASE OF POWER	DEGREE OF DEPENDENCE
Reward Power	"highly dependent" (French Jr. and Raven, 1959, p. 263)
Coercive Power	"leads to dependent change" (French Jr. and Raven, 1959, p. 264)
Legitimate Power (authority & values)	Highly dependent while induced in order to activate the influenced party's own values. After that, good chances for independence.
Expert Power	"initially relatively dependent" (French Jr. and Raven, 1959, p. 267). Over time however the change in the system becomes independent from the initiating influencer.
Referent Power	Initially the change is dependent on the influencer, even though the influenced might not be aware of this – not even aware of the existing power base. However, there is "a tendency for some of these dependent changes to become independent" (French Jr. and Raven, 1959, p. 267) after only a short period of time.

Summary 15: Soft Power For Adaptation

The literature delivers support for the idea that, for a buyer, building on soft power bases to make its supplier adapt to sustainability initiatives outperforms utilizing hard power bases.

The literature does not completely agree on the finding as proposed in summary 15 however. With Walmart as an example of a very powerful retailer, Quinn (2009, p. 24) introduces the effort of the retail giant to achieve SSCM with the following sentence:

> When Walmart sends out a new circular, consumers pay attention. When it sends out a new supply chain policy, hundreds of thousands of direct and indirect suppliers around the world pay attention.

This follows the common understanding in the SSCM literature that a powerful firm has the opportunity to introduce sustainable practices along its supply chain. In the context of SSCM, Boons et al. (2012) find it important to differentiate between industries, since it is not always clear at which position in the chain the most powerful entities are found. The authors suggest that food and apparel supply chains are driven by retailers and big brands, whereas automotive or computer supply chains are driven by the producers. This finding is supported by Leat et al. (2011) with a study of food supply chains in Scotland. Leat et al. notice that environmental and social initiatives in the supply chain can be implemented by supermarkets, due to their dominance in the supply chains. This position gives the supermarket chains influential power over the processes that other supply chain entities have to follow. In the case of the Dutch potato supply chain, Smit et al. (2008) find that power asymmetry such as interdependen-

cies and dependencies between organizations play a major role in the implementation of more environmentally sustainable practices. Similarly to most other supply chains, in the potato supply chain the most powerful actors are found at the consumer end of the network. Smit et al. see fast food restaurant chains in particular as powerful buyers in this context, with the opportunity to change sustainability practices along the supply chain.

Boons et al. (2012) also find evidence that sustainability is, according to the authors, permeated through a supply chain due to dependence or power asymmetry amongst supply chain partners. The power used to influence a supply chain partner's decisions is denominated channel power. Michelsen and Fet (2010) find that purchasing power is one of the key factors determining the influence of a buyer on the eco-efficiency behaviour of its supplier. In the framework of the bases of power, the source of purchasing power would be based on legitimate power. However, the way in which this card is played might load on to a different base of power, depending on the interorganizational relationship in focus.

The implementation of sustainability at a target is understood as an interorganizational change driven by a powerful agent. Changing the sustainability behaviour of suppliers can be understood as a similar change to the JIT implementation that Toyota's suppliers had to undergo in the 1990s (Cox, 1999). This change was led by Toyota as a dominant entity in the supply chain, which means there was no need for anything else besides hard power bases. There are contradictions in the literature regarding the power bases to be used by an agent in order to be successful in the most effective manner. Cox (1999, 2001a,c) suggests that, in the case of pushing JIT through the supply

chain, coercive power would be the base of choice (see page 117). This example contradicts the conclusion from summary 15 and invites the conclusion that the prevalence of hard power bases leads to supplier's adaptation. This also follows Grubbs (2000) and Sydow and Windeler (1998) with their "critical theory"-based findings that interorganizational change is based on pure domination.

> **Summary 16: Hard Power For Adaptation**
>
> The literature delivers support for the idea that, for a buyer, building on hard power bases to make its supplier adapt to sustainability initiatives outperforms utilizing soft power bases.

> **Summary 17: Power Bases For Adaptation**
>
> The literature delivers contradictory views of what power should be based on to promote adaptation of buyer-requested sustainability initiatives at a supplier.

3.2.7.2 *Model*

The purpose of this research will be to extend the knowledge in the field of interorganizational exchange relations and sustainability adaptation, and to deliver useful information for practitioners who strive for sustainability—not only sustainability in a focal firm, but with the intention to permeate sustainability initiatives upstream through a SC. Knowing how to treat a supplier, with the goal of making this firm comply with one's own sustainability agenda, will be helpful in practice.

Based on hypothesis H_1 the direct causal inference model as proposed in figure 3.6 is drawn. It includes power in exchange relations

and suppliers' adaptive behaviour of buyer-requested sustainability initiatives. Instead of using the buyer's power as predictor, this research follows Emerson's theory of power-dependence relations and uses the supplier's dependence as a predictor (inversely proportional to the buyer's power; see equation 3.3 on page 97).
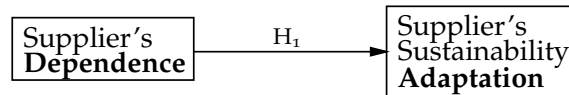
Figure 3.6.: Causal inference model for supplier's dependence and adaptation of buyer-requested sustainability initiatives

Section 3.1 revealed the drivers of SSCM as they appear in the current literature. These drivers are understood as both *a*) the drivers that bring a focal firm to change its attitude and engage actively in SSCM or GSCM (sustainability leader) and *b*) the enablers for a firm within the SC of a sustainability leader (agent). The drivers can be summed up as:

1. Customer/buyer pressure

2. Government regulations

3. Cost reduction

4. Industry norms and standards

5. Organizational commitment

6. Competitive advantage

7. Reputation

8. Following competitors

9. Supplier pressure

10. NGOs

Only the strongest driver (item 1) is further scrutinized in this research.

3.2.7.3 *Mediator or moderator*

Instead of focusing solely on hypothesis H_1, light will be shed on the contradiction in the literature regarding adaptive behaviour of suppliers and which type of power works most effectively in the case of sustainability. Hereafter, the terms *predictor variable* and *outcome variable* are preferred to the often used terminology of *independent variable* and *dependent variable*, since the latter terms are, according to Frazier et al. (2004), reserved for experimental research. The predictor variable X in this model is the degree of dependence, the outcome variable Y is the likelihood of the suppliers' sustainability adaptation.
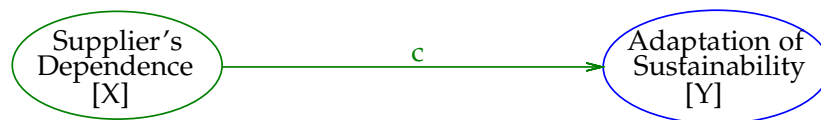
Figure 3.7.: Total effect model of dependence and buyer's sustainability adaptation

Figure 3.7 suggests that the degree of dependence[12] of a supplier influences its adaptive behaviour towards sustainability as requested from a buyer. The interplay between dependence and the bases of power, or rather their characteristics *hard* and *soft*, is noted in summary 15 and 16. The dichotomization of the power bases is assumed to mediate the effect between the predictor and the outcome variable. Since mediators and moderators are often mixed up, a systematic assessment of the variables is conducted in the following paragraphs. The decision regarding whether hard or soft power is moderating

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12 The degree of dependence, from a buyer's perspective, can vary between dependent, interdependent or independent.

the effect of dependence on suppliers' sustainability adaptation, or whether the power bases are a mediating explanation is based on the following arguments:

- Does the theory suggest that the strength by which the degree of dependence (predictor variable X) influences the sustainability adaptation (outcome variable Y) depends on the prevailing power base (moderating variable)?

    - It is suggested in the literature that one party's power, which is, according to Emerson (1962), proportional to another party's dependence, has an influence on adaptive behaviour within supply chains (Cox, 1999).

- Has recent literature found a *weak* correlation between the degree of buyers' dependence and the sustainability adaptation of suppliers? This would justify the attempt to introduce a moderating variable in order to distinguish cases with a strong correlation and cases with a weaker correlation, and a moderator as explanation.

    - No support from the existing literature.

- Is the scrutinized effect in this research rather a "when" or "for whom" question, or a matter of "how" or "why"?

    - Frazier et al. (2004) suggest that moderating variables are more often used when distinctions between groups are made in order to explain a certain effect, whereas mediating variables are used when an existing correlation between a predictor variable and an outcome variable needs further explanation. In this research, the answer to the question is

yet somewhat unclear. It could be understood as a distinction between groups which experience hard or soft power bases: on the other hand, it could be understood as an attempt to explain the correlation between a buyer's dependence and its willingness to adapt to a requested change—in this case a change on the TBL. An example for a mediation would be: The reason that the dependence had an effect on the sustainability adaptation behaviour of suppliers is because it had determined the prevailing base of power.

- Is the relation between the predictor variable X and the outcome variable Y already strong, although the mechanism (mediating variable) in this black box is somewhat unclear?

    - Yes. The literature suggests (see three bullet points above) that the buyer's dependence (predictor variable X) has an influence on its adaptive behaviour, accordingly its sustainability adaptation (outcome variable Y). This is also manifested in hypothesis H_1. The literature further suggests that the underlying mechanism could be grounded on the bases of power (see 3.2.3). This circumstance indicates the use of a mediator model.

- In this research, where the bases of power are an outcome of the degree of dependence, it is also expected that in cases of high dependence on the supplier side, the buyer has a choice of which base of power to utilize. Hence the mediating "bases of power" variable could also have a moderating effect. This would mean that a moderated mediation exists.

– However, the literature does not support the idea that a powerful buyer would use anything but coercive power if it wants a supplier to adapt. Hence the bases of power, or the dichotomization of soft and hard power bases, are a mediating variable and not a mixture or even a moderating variable.

The model which is expected to fit the purpose best is a mediation model as presented in figure 3.8. Following Kenny (2012) the most important criteria to support mediation are *a*) the correlation of the predictor variable X to the mediator variables M_1 and M_2 (i. e. a correlation between a buyer's dependence and the prevailing bases of power) and *b*) the correlation of the mediator variables M_1 and M_2 to the output variable Y (respectively hard or soft power bases to the likelihood of sustainability adaptation). Conclusions derived from the literature postulate these correlations. An overview of these conclusions is given in table 3.4.

Table 3.4.: Support for mediation model

VARIABLES	PATH	SUPPORT
$M_1 \rightarrow Y$	b_1	Summary 13 on page 107; summary 15 on page 136
$M_2 \rightarrow Y$	b_2	Summary 14 on page 117; summary 16 on page 138
$X \rightarrow M_1$	a_1	Equation 3.4 suggests that a supplier's dependence is proportional correlated to a buyer's power. Which base of power is likely to be promoted with higher dependence remains unclear. Hence it is expected that both, M_1 and
$X \rightarrow M_2$	a_2	M_2 are increasing with X

The model as presented in figure 3.8 can be divided into two parts: *a*) the existing drivers for SSCM, which are not going to be measured in the upcoming process (see figure 3.9a); and *b*) the mediating model which underlies the mechanism of the hard and soft power bases
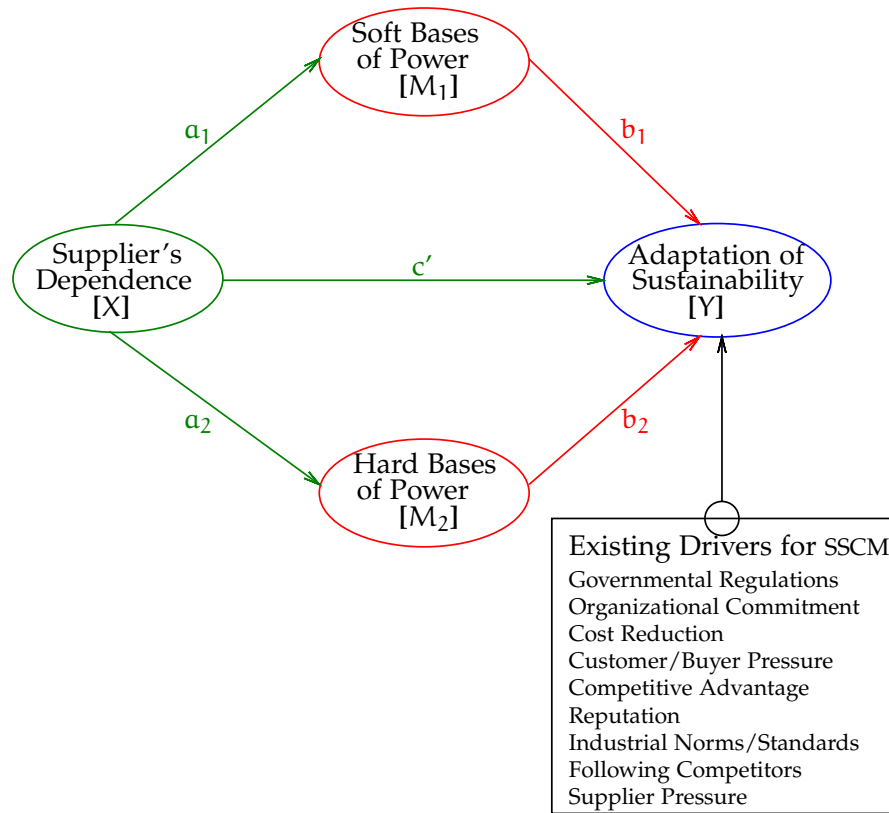
Figure 3.8.: Structural mediating model for buyers' sustainability adaptation based on their dependence

M_1 and M_2 to the correlation between a supplier's dependence on a buyer X and the likelihood that this supplier would adopt an item from the respective buyer's sustainability agenda Y (figure 3.9b). The first model is thoroughly discussed in the literature (see section 3.1) and the most important driver was found to be the buyer. Therefore, the mechanism of how a buyer's power is used to successfully permeate sustainability through a supply chain gets further attention in this research. Hence, the second model (figure 3.9b) will be used to determine whether using power to achieve adaptation of sustainability initiatives at a supplier is adequate (research question 2 on page 4). Further, through the dichotomization of the bases of power, and subsequently using those as mediators, further insight about the mech-

anism behind buyers' power and suppliers' sustainability adaptation shall be gained.
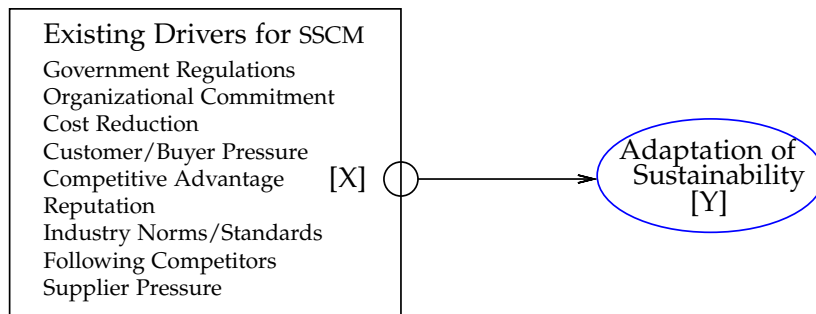
(a) Drivers of SSCM, cf. section 3.1
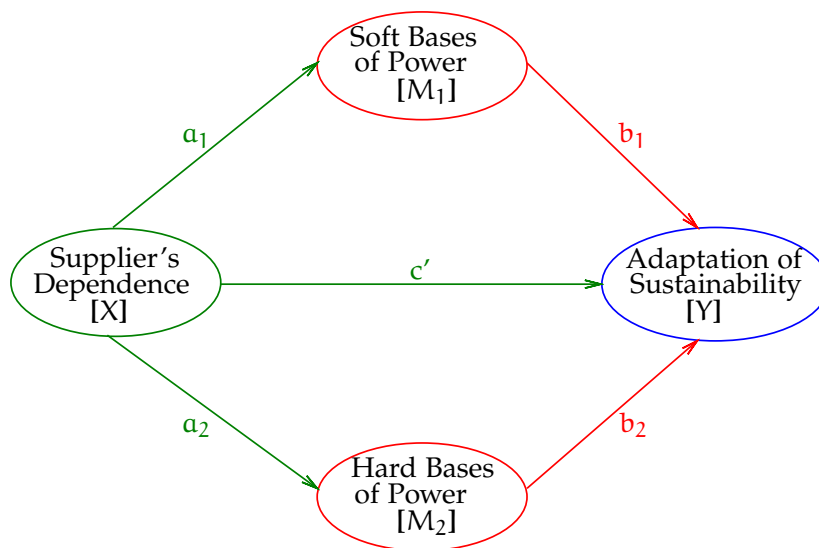
(b) Structural mediating model for dependence and sustainability adaptation

Figure 3.9.: Distinction between the drivers of SSCM and the model of supplier's dependence, its likelihood of sustainability adaptation and the underlying mechanism in the bases of power.

After exploring the literature about sustainability (section 2.1.1), SSCM (section 2.2), drivers of SSCM (section 3.1) and finally power in interorganizational exchange relations (section 3.2), the newly developed model (figure 3.9b) as well as the underlying hypothesis (hypothesis H_1) will be tested. The next part of this thesis explains the

research design formulated to answer research question 2 (chapter 4) followed by the statistical analysis of the empirical results (chapter 5).

Part II

EMPIRICAL STUDY

4

RESEARCH DESIGN

4.1 OVERVIEW OF THE RESEARCH DESIGN

This section will give the reader a principal idea of the whole upcoming research design chapter. In order to systematically derive a well-suited research design, which considers every important detail, a strict process is followed. The process utilizes the analogy of the "research *onion*" as proposed by Saunders et al. (2003, p. 83). The idea of the research onion (see figure 4.1) is the achievement of a solid and individually fitted research design, which is created stepwise from the outer towards the inner layer of the onion. The research design chapter contains sections for each layer in which the respective options are further discussed and decisions regarding the research are made (sections 4.4 to 4.8). The decisions are based on further literature and the nature of the research problem. This process will finally lead to an adequate research design.

Before starting the systematic research design process, the research design of the preliminary work, which eventually led to the research gap, will be elaborated (sections 4.2, 4.2.1, 4.2.2, 4.3.1 and 4.3.2).

Without systematic unity, our knowledge cannot become science; it will be an aggregate, and not a system. Thus architectonic is the doctrine of the scientific in cognition, and therefore necessarily forms part of our methodology.

— Kant (1781, Chapter 3)
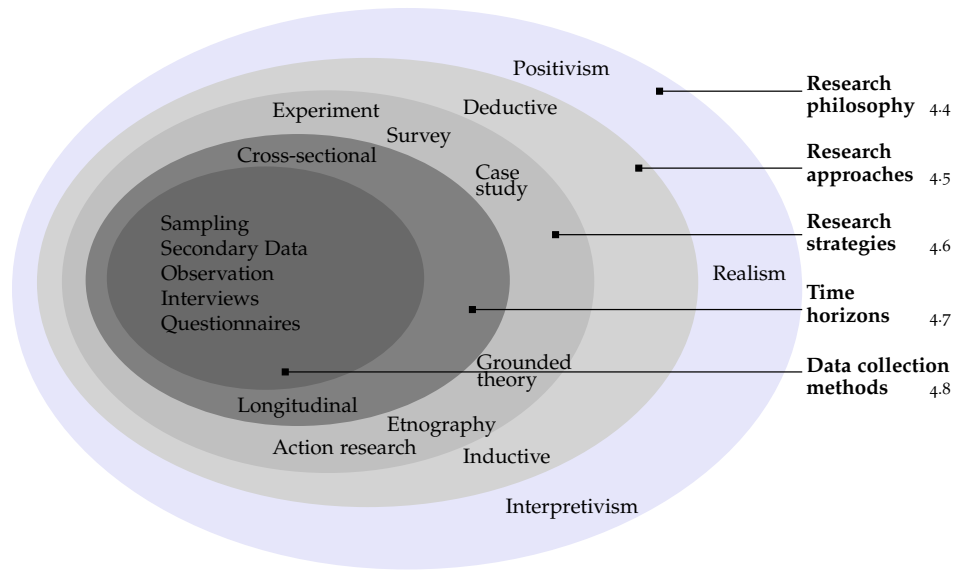
Figure 4.1.: Saunders et al.'s (2003) research process onion

After discussing the points as they are presented in figure 4.1, the development of the questionnaire as used in this research, as well as the strategy for its analysis, are presented in sections 4.9 and 4.10. At the end of this chapter, similar research designs are briefly introduced to strengthen the case to proceed with the analysis as proposed (section 4.11).

4.2   PRELIMINARY WORK

The research into the topics sustainability, SSCM and interorganizational exchange relations, which has been conducted in the previous chapters, is understood as preliminary work. This preliminary work is characterized as qualitative, exploratory and descriptive.

4.2.1 *Literature review: sustainability*

In order to understand the development of the term *sustainability* ,
a literature review is conducted, which takes the historical devel-
opment into account (section 2.1.1). This is done by systematically
searching for publications containing the term sustainability and as-
sessing those up to publication dates before the 1990s. The 1990s are
chosen for two reasons: *a*) understanding of the term *sustainability*
has not changed since then; and *b*) the number of annual publica-
tions containing the term sustainability vastly increased at around
this time (see figure 2.1 on page 14). Since the number of publications
using sustainability in their title becomes multitudinous after 1992, a
further restriction for the consideration of articles in this taxonomic
process is set: the publishing journal must have a Journal Citation
Reports (JCR) rating of $\geqslant 1$ and the keywords, title or abstract of the
article must indicate a supply chain application of sustainability. This
search is conducted on the Scopus® search engine. The search string
to include only these selected journals is complex and is understood
to be valuable information; hence it can be found in listing A.2.

The literature review about sustainability revealed that the term
sustainability changed its meaning between the 1960s and the 1990s
(see summary 1 on page 24). From a purely financial and economic
description, a more holistic TBL based philosophy was created during
these years.

4.2.2   *Literature review: SSCM*

After elaborating on how sustainability was understood in the past and how it is understood nowadays, another more focused literature review is conducted on sustainability in supply chains, or SSCM (section 2.2). The goal of this literature review is to understand how SSCM is currently understood in the academic community, and what principles are addressed when SSCM is mentioned. Because already sustainability is somewhat unclearly defined and leaves room for interpretation, the definitions about SSCM do not become more precise or congruent either. After a systematic assessment and synthesis of the high quality literature derived from the Scopus® search string in listing A.3, a model of SSCM content is presented (figure 2.5). Further, the models and frameworks for SSCM are extracted from the literature in the field, in order to create an overview of the current perceptions of the academics in the field (section 2.2.13).

Some insights from practitioners regarding SSCM are gathered through an exploratory survey as well as a longitudinal study of retailers' websites. The details for the design of the two studies are described in section 4.3.1 and section 4.3.2.

As it is found important to understand how the principle of SSCM is implemented, the literature about SSCM drivers is systematically reviewed in the next step (section 3.1). It is found that buyers are the most influential stakeholders when it comes to the implementation of sustainability principles in firms (summary 5).

After the main driver for SSCM is ascertained, the literature about interorganizational exchange relations and the underlying power is explored with regard to similar adaptive behaviour and fundamental

principles. Theories such as the dependence theory and the theory of planned behaviour underlined the idea of power as an impacting factor on adaptive behaviour in dyadic exchange relations. Further, the literature suggests varying levels of success in interorganizational adaptation, depending on the base for the exerted power (summary 17).

4.3   EXPLORATORY STUDIES: SSCM IN PRACTICE

Equipped with his five senses, man explores the universe around him and calls the adventure Science.
— Hubble (1929, p. 732)

In research question 1 the idea of finding out more about the usage of the terminology SSCM in practice, and also finding out what facets of SSCM are most prevalent and understood as most important by practitioners, is introduced. Therefore two exploratory studies are conducted. The design of these studies will be explained in the following sections 4.3.1 and 4.3.2.

To understand SSCM and gather some primary data in addition to the secondary data presented up to this stage, exploratory work is conducted. The first exploratory study sets out to find support for the idea that SSCM is becoming more popular in practice (section 4.3.1); the second study sets out to explore whether the understanding of the terminology "SSCM" is similar amongst practitioners and academics (section 4.3.2).

It is expected that the current models available in the scholarly literature are not completely coordinated with what the industry understands under the concept of sustainability in their supply chains. This is indicated after assessing Pagell and Wu's (2009) model, one of the most cited models in the academic world. After comparing the perspectives from the academic literature about SSCM with ten case

studies, Pagell and Wu (2009, p. 44) come to the conclusion that "the within case analysis also identified practices that were reinterpretations of concepts that had previously appeared in the literature and/or practices that were truly novel". This phenomenon may lead to an unclear definition of SSCM which is suspected to prevent companies from denoting their supply chains as sustainable or even hindering the propagation of the SSCM principle.

In order to find out whether the terminology of SSCM is used in practice, an examination of publicly available information about the world's leading supermarkets was conducted. According to Deloitte (2011), the world's ten largest retailers are as listed in table 4.1.

Since retailers are constantly under the observation of the public, it is expected that they exercise a particular diligence when it comes to sustainable practices in their supply chains. Furthermore, the sustainability efforts that retailers undergo are often publicly available from their websites.

Answering research question 1 also gives some idea about the role of powerful SC entities such as the world's leading retailers when it comes to supply chain sustainability. This shall strengthen the case for the necessity of investigating research question 2 in the subsequent process.

After assessing the cases of the biggest retailers, practitioners with experience in SCM and sustainability are surveyed regarding their perception of SSCM. This shall give some contrast to the purely academic perspective as presented in the literature review (part I) and also highlight the gap between academic research and industry's needs. The focus will remain on the contents and definition of sustainability in a SC context before moving on to research question 2 and the idea

of permeating sustainability through the supply chain—after having established the practical relevance of the SSCM principle.

4.3.1 *Content analysis Study: World Leading Retailers' Websites and SSCM*

To investigate the practical application of SSCM further, a content analysis study within the retail industry is constructed. Therefore, the ten largest Fast Moving Consumer Goods (FMCG) corporations are chosen as a sample, since they are expected to report environmental, social and economical beneficial implementations to their stakeholders and shareholders very publicly (Deloitte, 2011). This assumption is based on *a*) experience gained through analysis of retailers' sustainability and CSR reports, and *b*) the understanding that companies, which stand in the middle of society, are most likely to report initiatives improving their reputation in this stakeholder group.

The content analysis study has a longitudinal and quantitative element to it, as it observes the frequency of the occurrence of the term *sustainable supply chain* on the respective websites of the retailers in different years. The detailed procedure with the technical details is described in the following paragraphs.

In order to find out if any of the retailers listed in table 4.1 uses the term *Sustainable Supply Chain Management* on their corporate website, a Google search for this term was conducted across each corporate website. This exercise was executed according to the following steps:

DETERMINATION OF SAMPLE The ten largest retailers worldwide were chosen to assist for an exercise which aims to find out how established SSCM is in practice. The decision to choose retailers instead of other industries was taken for two reasons:

Table 4.1.: Top ten retailers in 2009 (according to Deloitte, 2011)

RETAIL SALES RANK (FY09)	NAME OF COMPANY	COUNTRY OF ORIGIN	2009 RETAIL SALES (U.S. $MIL)	DOMINANT OPERATIONAL FORMAT	# COUNTRIES OF OPERATION
1	Wal-Mart Stores, Inc.	U.S.	405,046	Hypermarket/Supercenter/Superstore	16
2	Carrefour S.A.	France	119,887	Hypermarket/Supercenter/Superstore	36
3	Metro AG	Germany	90,850	Cash & Carry/Warehouse Club	33
4	Tesco plc	U.K.	90,435	Hypermarket/Supercenter/Superstore	13
5	Schwarz Unternehmenstreuhand KG	Germany	77,221[e]	Discount Store	25
6	The Kroger Co.	U.S.	76,733	Supermarket	1
7	Costco Wholesale Corp.	U.S.	69,889	Cash & Carry/Warehouse Club	9
8	Aldi Einkauf GmbH & Co. oHG	Germany	67,709[e]	Discount Store	18
9	THD	U.S.	66,176	Home Improvement	5
10	Target Corp.	U.S.	63,435	DDS	1

[e] Estimated figure

a) since supermarkets, and therefore retailers, are teleologically in the public eye, they are suspected to be keen on communicating environmental and social improvements concerning their business; and *b*) the data about this sample is conveniently accessible.

IDENTIFY THE CORPORATE WEBSITE In order to collect the publicly available data from all cases in the sample, the corporate website, which actually provides the intended information, must be determined. The Uniform Resource Locators (URLs) of these websites vary from the retailer's actual shop-front websites in most cases. Since some retailers have different corporate websites (e.g. for different regions), the appropriate search strings may contain more than one URL.

THE SEARCH PROCESS Google is used with three different search strings.

1. The search term "`sustainable supply chain`" is entered into the Google search engine, with the added restriction to search only through content which is hosted under the beforehand determined corporate websites URL. This restriction is fed into Google by adding `site:[URL]` to the search string, where [URL] is replaced with the corporate website's URL.

2. The second search string distinguishes itself from the first by not using quotation marks. The quotation marks force Google to search exactly for the included terminology, whereas the missing quotation marks allow Google to find a website which contains *all* search terms, however not necessar-

ily coherent, and in arbitrary order. In order to prevent Google from using "intelligent" alterations to the search, the *verbatim*[1] mode is activated.

3. The third search aims to include media coverage about the respective retailer and sustainable supply chain. For this reason, the restriction for the Google algorithm to search only on the corporate websites is not included in the search string.

VISUALIZING AND INTERPRETING The results are visualized (chapter 5) and interpreted (chapter 6).

The results of the search process and the exact search strings are listed in table B.1 (page 380).

4.3.2 *Exploratory questionnaire for practitioners*

Telephone interviews were conducted informally with a climate change manager from Tesco and a director at the leading sustainability consulting firm PE International. The findings of the interviews are presented in section 5.1.2 with the other findings of this exploratory study. The perspectives from the interviews led to the decision to deploy a questionnaire and to ask sustainability managers and senior supply chain managers for their opinion.

As mentioned at the beginning of section 4.3, the second exploratory study deals with practitioners perception of SSCM. To gain a first insight into the industry's perspective on the characteristics of SSCM,

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1 "... for the occasions when you want to search for very specific words, you can use the Verbatim tool so that Google searches using the exact words you entered." Google (2012)

an exploratory survey was the methodology of choice. Oppenheim (1992, p. 70) suggests using exploratory pilot work for the "*conceptualization* of the research problem" [emphasis added], which was exactly the purpose of this exercise in the present case. Oppenheim further states that exploring by interviewing is a good starting point to create an outline and justification for the purpose of further research.

The survey consists of an online questionnaire with open-ended questions, as well as questions to be answered on a five point Likert scale, and rankings. The participants are asked to comment on their choices for the closed-ended questions. The participants for the survey are selected on the business network *LinkedIn* which allows a search for professionals in the relevant field. In this survey only UK based industrial representatives are chosen. There are two reasons for this decision: *a*) it is not yet clear whether practitioners perspectives about SSCM vary from their geographical location; and *b*) in case a global follow-up survey is to be conducted, the potential for *fresh* (not survey fatigued) participants is still high. The participants are chosen according to their job description, which must either be a senior position in SCM or a sustainability manager. Further, only participants whose profiles included both keywords, sustainability *and* supply chain management, are considered.

The practitioners are then contacted on the *LinkedIn* platform with a short description about this research project and an invitation to connect. After connecting, the data from the profiles is exported, and a database with the names and email addresses of the potential participants is created. Further, at least one discussion group with each participant is shared on *LinkedIn*. The purpose of this move is to use the name of the shared discussion group as an icebreaker in the invit-

ation to the online survey. Hence, the name of the common discussion group is noted in the same database at the dataset of the respective participant. In addition, the participants are divided into two groups according to their main field of interest, as promoted through their *LinkedIn* profile: sustainability or SCM.

The invitation to the online questionnaire is then executed with a mass email. Email is considered to be the superior solution as compared to a *LinkedIn* message as it provides more personalization options. Every email is automatically personalized by accessing the database previously created. Hence every participant received a more detailed description of the goals of this exercise, as well as the offer of a report which would be created from the survey. Furthermore, every contact is personally acknowledged and the emails refer to the common discussion group. On top of that, the priority of the respondent's opinion is emphasized, since the respondent is a specialist in sustainability/SCM.

The analysis of the questionnaire is carried out after no more new questionnaires are filled out.

4.3.2.1 *Analysis of exploratory questionnaire*

The questionnaire presented to the practitioners consists of some open-ended questions, as well as pre-coded questions on a 5-point Likert scale. The scale, which is used to measure the degree of integration of popular sustainability initiatives, consists of the following items:

1. Fully integrated

2. Integrated to a great extent

3. Somewhat integrated

Table 4.2.: Surveyed SSCM characteristics

ABBREVIATION IN FIGURE 5.5	IMPLEMENTED CHARACTERISTIC
EMS	Environmental management system
Performance measure	Performance measurement of the sustainability of your supply chain
SCOR	SCOR framework
Legal	Changes in your SC governance based on legal regulations
SC Risk	Supply Chain Risk Management
LCA	Life-cycle assessment/analysis
Reporting standards	Implementation of standards for reporting
Strategy	Changes to your organizations strategy in order to implement SSCM
Orga. culture	Changes to your organizations culture in order to implement SSCM
Social equity	Initiative to improve the social equity along your supply chain
Multi. stakeholder	Sustainability initiatives affecting multiple stakeholders
Env. quality	Environmental quality improvement along the supply chain
Transparency	Mechanism which give you transparency and control over your complete SC
Econ. competitive	Initiatives to make your SC economically competitive (long-term)
Quality	Product quality control

4. Very little integrated

5. Not integrated at all

The sustainability initiatives, which were extracted from the literature, can be found in table 4.2.

The first two questions in the questionnaire aim to find out about the participants' professional background. The questions ask for *a)* the industry in which the participant is currently working and *b)* the job

category of the participant. Further an open-ended question about the participant's job is asked to obtain a more specific picture of the respondents.

4.3.2.2   *Implemented initiatives*

In the following questions, the participants were asked to what extent they have implemented some SSCM characteristics in the supply chain(s) in/with which they are working. The characteristics are derived from the academic literature and the degree of integration in the supply chain is indicated on the scale introduced above. The results will be presented graphically to get an overview.

4.3.2.3   *The Triple Bottom Line*

In a further section of the exploratory questionnaire, practitioners are asked different questions about the triple bottom line approach. The first question aims to find out how familiar the respondents actually are with this model. The questionnaire allows three possible answers to the question "Are you familiar with the theory of the triple bottom line?":

1. Yes

2. Not sure, but I have heard of it

3. No

It is expected to see almost all respondents on the *Yes* side, since only participants who claimed to be experienced in SSCM are invited.

Further, the practitioners are asked to rank the importance of each bottom line as defined in the TBL model. Before doing so, a short explanation of the triple bottom line is provided to the participants, in order to brief those unfamiliar with the model:

John Elkington is the author who used the expression "triple bottom line" first in his book *Cannibals with forks* (1996). The book's title refers to the Polish poet Stanislaw Lec who was cited: "Is it progress, if a cannibal uses a fork?".

In this book, Elkington describes that business models in the 21st century have to focus not only on the "bottom line", which is a commonly used synonym for financial figures of companies, but also on other bottom lines such as social equity and environmental quality.

Elkington was also one of the first people to use the expression *Sustainability* at the beginning of the 1990s. Hence he coined the expression of sustainability with his triple bottom line approach.

Currently his understanding of sustainability is transferred to SSCM with minor additions or alterations, dependent on the academic author.

All the preliminary work was necessary to clearly outline sustainability, SSCM, the drivers of SSCM and the mechanisms behind the most important driver—the buyer and its power. The now following part of the research design chapter aims to deliver a clear idea about the approach used to answer research question 2 and gain further insight in the permeation of sustainability through supply chains.

4.4 RESEARCH PHILOSOPHY

Going back to the main research concerning research question 2, a first distinction for the upcoming research approach should be made about the *research philosophy*. The research philosophy one follows does not only depend on the facts given through the nature of the

research topic, but a more personal and perceptive view can also be distinctive under certain circumstances. Saunders et al. (2003, p. 83) go as far as to claim that the kind of research philosophy one represents derives from the way one "think[s] about the development of knowledge" in the field under scrutiny.

A positivist approach is in many ways similar to the mindset of the natural science researcher. DiVanna (2010, p. 1054) describes positivism as a "fact-based investigation". The research conducted by a positivist is executed as a form of observation and its outcomes are meant to be rather "law-like" (Saunders et al., 2003, p. 83), with the possibility of generalization. In the case at hand, which is the question of how power and different bases of power interact with a supplier's adoption of a buyers' sustainability agenda, a positivist's approach could lead to clear findings which may then be applicable in practice—leading to the desired results in a supply chain.

An interpretivist's philosophy on the other hand is based on the precondition that the researcher is part of the phenomenon under scrutiny, and additionally that the research is driven by interest and curiosity rather than necessity and logical reasoning, Blumberg et al. (2008) claim. This is where the interpretivist's approach differs significantly from a positivist's perspective. Interpretivists tend often to conduct qualitative research and the outcomes of the research are more detailed, however less generalizable.

Following a realism research philosophy means to decouple the reality from the "human beliefs and behaviour" (Blumberg et al., 2008, p. 22). Saunders et al. (2003, p. 84) describe a realist's research philosophy as follows:

Realism is based on the belief that a reality exists that is independent of human thoughts and beliefs.

According to the above quotation, the realist's philosophy would thus be an addition to a reality which does not seem entirely exhaustive right now.

The research on hand will contribute to current knowledge by testing the application of an existing model (*Bases of Power* (French Jr. and Raven, 1959; Raven, 1965, 1992, 1993; Raven et al., 1998)), which a review of the literature suggests may be suitable to explain the adaptation of sustainability in a buyer–supplier relationship. This suggests approaching this research as a *realist*, who acknowledges the fact of the existing power bases between exchange partners, wanting to explore this existent circumstance further.

The complexity of exchange relations changes over time, and recent years have brought SSCM, which challenges existent trade relations with yet another issue. The observation of exchange relations, and the aim to generalize the findings for practical usability, however, suggests following a *positivists* stance for this research. A positivist's philosophy is widespread in SCM research (Burgess et al., 2006).

> **Summary 18: Research Philosophy**
>
> This research is conducted from a positivist's point of view with a pinch of realism in its beginnings.

4.5 RESEARCH APPROACH

Often the nature of the research problem determines without further doubt whether the research is going to be deductive or inductive. The

case on hand is debatable and leaves room for interpretation concerning which route to follow: deductive or inductive.

Following Jennings (2005) a deductive approach in quantitative research is also named the *hypothetico-deductive approach*, which implies that pre-existing hypotheses, built on solid theory, need to underlay the process. Blumberg et al. (2008) emphasize the meaning of deductive research as *conclusive*, which means in this context that the conclusion, or findings of the research, must derive from *true* and *valid* reasoning. A simple example of deduction deals with two conditional premises (e.g. operationalized variables from a questionnaire) which allow a conclusion. For example:

① All suppliers follow their buyers' sustainability requests exactly. (*Premise 1*)

② Company XYZ is a supplier. (*Premise 2*)

→ Company XYZ follows its buyers' sustainability requests exactly. (*Conclusion*)

The deductive research approach, which is based on hypotheses, is also denoted a "theory-first" approach (Chamberlain, 2013). This means the research follow these steps in a fixed order:

1. Researching the topic under investigation in-depth. This can be done for instance through an exhaustive literature review, or other research methods.

2. Forming hypotheses based on the research conducted as described under item 1.

3. Testing whether the hypotheses can be confirmed or refuted.

An inductive approach on the other hand distinguishes itself by a different sequence of actions. As compared to the deductive approach, where hypotheses are formulated *first* and the data collection happens afterwards, the inductive approach builds the theory on collected data: "theory would follow data rather than vice versa as in the deductive approach" (Saunders et al., 2003, p. 87).

Depending on how the data are collected, the inductive approach allows usually more flexibility than the deductive approach. The theory can be built gradually whilst interviewing people, or observing a certain issue. The deductive approach on the other hand is very rigid as soon as the hypotheses are postulated.

The research on hand follows a deductive research approach from this point. The structural mediated model (figure 3.9b, page 145), the respective hypothesis (hypothesis H_1 on page 123) and the idea of understanding the suggested underlying mechanism (table 3.4 on page 143) are created after a literature review and after studying the concepts thoroughly. The literature did not deliver clearly how the underlying mechanism is supposed to work. Hence this part of the research is still exploratory and aims to find an answer to the contradictory findings from the literature (summary 17 on page 138). A mediation model is found to be a suitable tool to confirm or refute this causal relationship between the predictor variable X and the outcome variable Y, as well as the mechanism of this relation (M_1 and M_2). Since it is assumed that the framework of the bases of power mediates the relationship between the predictor and output variable, the upcoming empirical study is found to be deductive rather than inductive.

Summary 19: Research Approach

This research follows a deductive research approach.

4.6   RESEARCH STRATEGY

In order to answer the research questions, a clear research *strategy* is recommended (Saunders et al., 2003). Up to this point two research questions have been asked:

RESEARCH QUESTION 1: Is the terminology SSC/SSCM widely used in publicly available presentation material from world leading FMCG retailers? (page 4)

RESEARCH QUESTION 2: Does a buyer's power have an impact on its supplier's adaptive behaviour towards sustainability? (page 4)

Research question 1 came up whilst exploring the field of SSCM. Exploratory work based on sustainability reports, publicly available information from leading retailers, and an exploratory questionnaire led to the finding that the term SSCM is understood differently by practitioners and academics. Various firms and, after a survey of individuals also various people, have expressed a different understanding of not only SSCM, but even sustainability itself. This finding makes one wonder how sustainability can be achieved at an interorganizational level. Hence, after assessing the literature about power in SCs and interorganizational power, which is mainly based on interpersonal power, research question 2 evolved. This research design section is about research question 2. Research question 1 is an intermediate research question which emerged during the process of exploring SSCM,

and subsequently led to identification of the gap in academic knowledge as expressed in research question 2.

In order to find an appropriate research strategy, the research questions were tested against the different available options. Neither research question is suitable for an experimental type of research strategy. The condition for an experiment is the researcher's control over the independent variable, or predictor variable, during sampling.

According to Saunders et al. (2003, p. 92), using a survey as a research strategy is "usually associated with the deductive research approach". A survey can be administered in different forms, which all have their advantages and disadvantages. Examples for possible communication methods with the sample population for the survey are (Blumberg et al., 2008, p. 282):

- Personal interviews

- Telephone interviews

- Self-administered questionnaires

    - Questionnaire via mail

    - Online questionnaire

    - Questionnaire at a centralized place (e. g. a voting computer)

- Group-administered survey (Mrug, 2010)

One of the main advantages of surveys is the possibility of standardizing the questions, to allow the researcher to collect comparable data as a result. Since the research on hand set out to test a hypothesis and its underlying mechanisms, a large amount of data needed to be collected. This data should be in a standardized form which allows testing of the hypothesis and the expected mediation. Using a sample

survey[2] instrument as research strategy appears to be an appropriate way to achieve these requirements.

Another possible approach would be a case study, which is particularly useful if an issue under study appears in "multiple sources of evidence"; SSCM, for instance, appears in different supply chains (Saunders et al., 2003, p. 93). Hence this approach seems useful for the investigation regarding research question 1. In order to answer this research question, a questionnaire was deployed, informal telephone interviews were conducted and a documentary analysis was accomplished. Literature suggests the case study strategy as a helpful tool for the exploration of existing theory, as well as to derive subsequent hypotheses based on this strategy (Eisenhardt, 1989; Saunders et al., 2003). This is exactly how the case study strategy with research question 1 is used in this piece of research.

Particularly in the research area of SSCM, a large amount of research is based on case studies: for instance, a recent publication from Hall et al. (2012) which aims to "understand why firms should invest in sustainable supply chains". Wolf (2011) follows a similar approach to develop a framework for SSCM integration and justifies her decision to develop theory from case studies by referring to Eisenhardt (1989). Another slightly different approach for developing theory in the field is deployed by Isaksson et al. (2010) who develop hypotheses from existing literature through inductive reasoning. None of these studies tests hypotheses built on existing knowledge however. This distinguishes these studies from the research on hand.

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2 "Sample surveys are defined as systematic studies of a geographically dispersed population by interviewing a sample of only certain members in an attempt to generalize to their population."

Scheufele (2010, p. 857)

An often quoted strategy for how to conduct research is the grounded theory, which was founded by Glaser and Strauss (1967). The aim of this method is to build unbiased theory based on data, as an inductive approach would suggest. The idea is to avoid bias from any existing literature or other information about the issue under research. Instead, only the collected data, which might be observations, should then lead to propositions. These propositions will be tested in the subsequent deductive approach of this research strategy. In SSCM, research authors have applied this strategy successfully (Carter and Rogers, 2008; Croom et al., 2000; Isaksson et al., 2010; Matos and Hall, 2007; McDonagh, 1998; Pagell and Wu, 2009; Sharma and Vredenburg, 1998; Wu and Pagell, 2011). However, since this work and the underlying hypothesis and framework are based on literature and are not unbiased primary data, it does not apply here. Charmaz (2000, p. 507) summarizes the principle of grounded theory as:

> Essentially, grounded theory methods are a set of flexible analytic guidelines that enable researchers to focus their data collection and to build inductive middle-range theories through successive levels of data analysis and conceptual development.

The above quotation implies already a common point of discussion when it comes to grounded theory: it is not absolutely clearly defined what is understood as grounded theory and authors disagree on the details.

An important research strategy in anthropological studies is ethnographic research. It can be applied when group behaviour is of particular interest. The focus however lies with the anthropological perspective. Caines (2010, p. 431) describe ethnography as:

> Ethnography, in the simplest sense, refers to the writing or making of an abstract picture of a group of people. 'Ethno' refers to people, and 'graph' to a picture.

An ethnographic research strategy could be applied under the umbrella of a case study research to investigate further how power in interorganizational exchange relations depends on persons. To test hypothesis H_1 and answer research question 2 and its mechanism, an ethnographic research strategy is not suitable.

Cunningham (1995) elaborate the research strategy *action research* with the example of change management within a health organization. The goal of action research is to look at an issue from different angles: change within an organization has various perspectives to it. The emphasis whilst conducting action research should be to research an issue that can be generalized or at least projected onto other similar problems. In the case of the change management scenario in a health organization, this would mean that the findings from this research should be valuable for, e. g., similar change management scenarios in other (health) organizations.

The research of social change is often addressed with action research (Adams, 2010). However, since this research follows a deductive approach, action research would not be an appropriate strategy. Depending on the outcome of the analysis of the proposed hypothesis (hypothesis H_1) and the corresponding model (figure 3.9b), action research might be adequate to investigate further. For instance, sector dependent research could be conducted as a follow up, which would then be suitable for a case study and action research.

Besides the preliminary work, which is built on literature reviews and to some extent case studies, the research strategy for evaluating

the mediation model is a survey. Following Chamberlain (2013, p. 48), surveys are an adequate tool to answer research questions asking a "what is happening?" or "why is it happening?" question. This research will not only answer research question 2 (page 4), which asks whether a supplier follows a buyer's request because of the existing power relation, but will also lift the lid on the mechanism behind power relations in exchange relations. This research problem is precisely addressed by the "what is happening?" and "why is it happening?" questions.

> **Summary 20: Research Strategy**
>
> The research strategy will be a survey.

4.7 TIME HORIZON

Research can generally follow two different time horizons, *longitudinal* or *cross-sectional*. This research contains both: the preliminary work which is based on secondary data (Boslaugh, 2010) sheds some light on how the sustainability issue has evolved over time, whereas the main part of this research focuses on a snapshot in time.

During the literature review in section 2.1.1, the development of what is understood under the term *sustainability* is observed on a timeline. This secondary data-based longitudinal study is subdivided into three periods: *a*) before the "Brundtland Report"; *b*) the "Brundtland Report"; and *c*) after the "Brundtland Report". This subdivision appears to be sensible regarding the changing meaning of the terminology. The purpose of this part of the study is to shed some light on the development of the understanding and meaning of the term

sustainability . This may help to understand the confusion of the term as found in the comparison of sustainability managers, supply chain managers and academics (cf. section 5.1.3 on page 210).

Research question 2 asks for the interplay of power and adaptive behaviour in a buyer-supplier relationship. Hypothesis H_1 and the dichotomization of French Jr. and Raven's (1959) bases of power form then a model which is grounded on literature and needs to be tested with primary data. Based on these circumstances, this research is classified as cross-sectional, which is understood to be suitable "to compare factors in different organisations" (Saunders et al., 2003, p. 96).

> **Summary 21: Time Horizon**
>
> This research is cross-sectional with preliminary longitudinal work.

4.8   DATA COLLECTION METHOD

Data can be obtained by different methods. The most usual options are introduced in this section and are discussed regarding their suitability for the research on hand.

4.8.1   *Observation*

Observation as a data collection method is widely used across different fields. Particularly when the behaviour of participants is the subject of the study, observation is found to be a suitable method of data collection. Kitsantas et al. (2005, p. 913) mention as examples "psychology, sociology, education, anthropology, nursing, and management".

The difficulties in observational studies often lie in the ethics as well as possible bias. Ethical issues can arise from confidentiality or dilemmata from observed behaviour that do not conform to ethical standards. The results are then difficult to use. Issues with bias can come up when the observer becomes emotionally involved in the observed actions, which is found to be a not uncommon human characteristic. Due to the confirmatory and quantitative nature of this research, an observation data collection method is *not* considered, even though the expected findings invite the use of triangulation with a further, more in-depth approach such as an observation.

4.8.2 *Secondary data*

In Part I literature about sustainability, sustainable supply chain management, inter-firm relations and power is analysed. The data in the existing literature, whether this is qualitative or quantitative, were collected by the original authors of these documents to answer research questions different from research question 2. This matches the definition of secondary data analysis as proposed by Riedel (2005, p. 455):

> Secondary data is information that was gathered for another purpose.

Further, the analysis of companies' annual CSR and sustainability reports is understood as secondary data analysis. The secondary data analysis in this research mainly fulfils the purpose of exploring the field and leading to the identification of a research gap, which is then researched with quantitative methods and primary data. This approach is recommended since the primary data can be tailored exactly to the research question to be answered (Hox and Boeije, 2005).

4.8.3 *Interviews*

During this research unstructured interviews were conducted in order to verify and discuss findings and ideas derived from secondary and primary data. Whilst exploring the field of SSCM, and the understanding and state of the art in academia and practice, telephone interviews were conducted with *a*) a climate change manager from the UK's largest retailer and *b*) a senior consultant of one of the largest sustainability and LCA consultancies. These interviews helped towards an understanding of the practitioner's perspective on sustainability along the supply chain and the difference of academics' ideas. Moreover, the difficulty of achieving sustainability along the chain by permeating sustainability upstream was addressed, which ultimately led to research question 2. However, in order to test the mediation model as proposed in figure 3.9b, quantitative analysis based on a sample is more appropriate (as laid out in the previous sections).

4.8.4 *Sampling*

The population of this research is all SMEs in the UK experiencing a buyer-requested change regarding sustainability. Since the term SME may leave some room for interpretation, EU recommendation 2003/361 (2003) is quoted for the definition of Small and Medium-sized Enterprises. Micro enterprises are not considered. EU recommendation 2003/361 suggests that a SME qualifies as such if the number of employees *and* either the annual turnover *or* the balance sheet matches the guidelines presented in table 4.3.

Table 4.3.: EU defined thresholds for SME (Verheugen, 2003, p. 14)

COMPANY CATEGORY	EMPLOYEES	TURNOVER in million Euro	BALANCE SHEET TOTAL in million Euro
Medium-sized	< 250	⩽ 50	⩽ 43
Small	< 50	⩽ 10	⩽ 10
Micro	< 10	⩽ 2	⩽ 2

The purpose of sampling is to reduce the population for which particular research will be conducted to a representative number of cases. Sampling is applied in this research because of restricted access to the whole population. Furthermore, the total population cannot be determined as it is unknown in how many businesses the situation of buyer-requested sustainability has occurred.

> **Summary 22: Population**
>
> The population to which the research problem applies is unknown.

The sample design for this research is adapted to the research question, as suggested by Handwerker (2005). Research question 2 looks into the interaction of two different variables: the prevailing power base in an inter-firm relationship and the adaptive behaviour of a supplier towards sustainability-related change requests of its buyer. This question, as well as the extension to the observation of the bases of power in the exchange relationship, led to a mediation model. This setup calls "for answers that come from the analysis of variables" (Handwerker, 2005, p. 429).

The addresses for the firms to approach are taken from the *Fame database*,[3] which allows filtering according to the following criteria:

---

3 The *Fame database* holds information about companies in the UK, including contact persons and their email addresses (https://fame.bvdinfo.com/).

1. Active companies

2. Number of employees: 10–249

3. Country: England, Wales, Scotland, Northern Ireland

4. Balance sheet total in million Pound Sterling: 2–43

5. Turnover in million Pound Sterling: 2–50

6. Statistical Classification of Economic Activities in the European Community (NACE) categories:

   01 Crop and animal production, hunting and related service activities,

   02 Forestry and logging,

   03 Fishing and aquaculture,

   10 Manufacture of food products,

   11 Manufacture of beverages,

   12 Manufacture of tobacco products,

   13 Manufacture of textiles,

   14 Manufacture of wearing apparel,

   15 Manufacture of leather and related products,

   16 Manufacture of wood and of products of wood and cork, except furniture; manufacture of articles of straw and plaiting materials,

   17 Manufacture of paper and paper products,

   18 Printing and reproduction of recorded media,

   19 Manufacture of coke and refined petroleum products,

   20 Manufacture of chemicals and chemical products,

21 Manufacture of basic pharmaceutical products and pharma-
ceutical preparations,

22 Manufacture of rubber and plastic products,

23 Manufacture of other non-metallic mineral products,

24 Manufacture of basic metals,

25 Manufacture of fabricated metal products, except machinery
and equipment,

26 Manufacture of computer, electronic and optical products,

27 Manufacture of electrical equipment,

28 Manufacture of machinery and equipment not elsewhere
classified,

29 Manufacture of motor vehicles, trailers and semi-trailers,

30 Manufacture of other transport equipment,

31 Manufacture of furniture,

32 Other manufacturing,

46 Wholesale trade, except of motor vehicles and motorcycles,

49 Land transport and transport via pipelines,

52 Warehousing and support activities for transportation,

53 Postal and courier activities

The choice of the sectors is due to their possibility of being involved
in supply chains, which encounter a top-down permeation of sustain-
ability initiatives (e. g. retail, automotive or textile SC). Further, in or-
der to comply with the EU definitions of SMEs (table 4.3), the search
criteria are logically linked as in equation 4.1.

$$1 \wedge 2 \wedge 3 \wedge (4 \vee 5) \wedge 6 \tag{4.1}$$

The database delivers the number of companies listed in table 4.4. A suitable contact person's details were not provided for every company and a significant amount of contact details were not valid (see item 1, page 182). This led to a further reduction in the possible firms. The process of how the last row in table 4.4 is calculated is described in figure 4.2. However, one should keep in mind that the actual number of firms, which have encountered the situation where a buyer asks them to implement a sustainability initiative, remains unknown (cf. summary 22).

Table 4.4.: Sampling with the *Fame* database

FILTER	RESULTS	TOTAL
1 Active companies	3,304,026	
2 Number of employees: 10–249	218,449	
3 Country: England, Wales, Scotland, Northern Ireland	7,916,348	
4 Balance sheet total in million Pound Sterling: 2–43	178,366	
5 Turnover in million Pound Sterling: 2–50	91,557	
6 NACE category filter	691,002	
Boolean search logic: $1 \wedge 2 \wedge 3 \wedge (4 \vee 5) \wedge 6$		23,002
Firms with suitable contacts (database)	11,104	
Suitable firms available (reality)		8,493

The goal during the sampling was to select a large sample ($\geqslant$ 200 cases) in order to perform the statistical analysis as described in section 4.10. The difficulty in achieving the desired sample size lies in the unpredictability of the response rate, since it cannot be said beforehand whether a firm has encountered a situation such as a buyer

Figure 4.2.: Determination of the sample size

requesting a change regarding sustainability. This fact of not know-
ing the *case characteristics* before surveying the firm excludes the pos-
sibility of any form of probability sampling or even non-probability
sampling methods, such as quota or purposive sampling (Galloway,
2005). The only possible sampling method is, due to lack of informa-
tion about the sample, availability sampling.

Summary 23: Sampling

Due to unknown case characteristics, availability sampling is ap-
plied in this research.

4.8.5 *Questionnaires*

Besides the exploratory questionnaire, which is described and discussed in section 6.1.2, a questionnaire with the purpose of testing the proposed model as displayed in figure 3.9b is administered. Section 4.9 elaborates the approaches to measure the different variables of the model (mediation model figure 3.9b of the respective total effect model figure 3.7). This subsection will only provide an insight about general precautions to be taken when applying questionnaires as the data collection method, before the development of the questionnaire tool for this research is introduced in section 4.9.

The data for the research are obtained by an online questionnaire. This method is chosen due to the necessity of approaching a large number of firms, in order to find those firms which have encountered a situation where they were approached by a buyer to implement a sustainability initiative. The advantages of a web-based survey are the low costs, as well as fast and easy to handle results (Alvarez and VanBeselaere, 2005). A first pilot survey revealed that the response rates are fairly low for the following reasons:

1. The email addresses extracted from the database are often invalid.

2. Firms have not encountered a situation such as a buyer asking them to implement a certain sustainability initiative.

3. Firms' policy of not filling out questionnaires.

4. General survey fatigue among managers.

5. Long survey.

Item 1 was addressed by approaching a large number of companies and more than one recipient in most firms. Item 2 could only be resolved by approaching a large number of firms, in order to find those who have encountered a situation as described. To motivate participants declining to participate for the reasons mentioned under items 4 and 5, an Amazon voucher is drawn as an incentive amongst those who left their email address after filling out the questionnaire.

Summary 24: Data collection

Primary data to test the mediation model as proposed in figure 3.9b are collected via an online questionnaire.

4.9 QUESTIONNAIRE DEVELOPMENT

Research question 2 allows, through the formation of hypothesis (hypothesis H_1), the application of the bases of power framework and the consequent mediation model (figure 3.9b, page 145), with a survey as research strategy (see also summary 20 on page 173).

Oppenheim (1992, p. 35) introduces a matrix which will help to find the appropriate design for an analytic survey (see table 4.5). Following table 4.5, two questions determine which survey design is used:

1. "How much is already known about the main causal variables and processes in the chosen area of enquiry?"

2. "How much control will there be over events [...]?"

Question 2 can be answered straightforwardly: There is no control over the events. Numerous SMEs are asked about their experience to

Table 4.5.: Oppenheim's (1992) survey designs for analytic studies

	LITTLE IS KNOWN	WELL-RESEARCHED DOMAIN
NO CONTROL OVER EVENTS	Cross-sectional designs Natural experiments Retrospective follow-up Panel studies	Factorial designs Multivariate analyses including multiple regression
POWER TO CONTROL EVENTS	Planned follow-up with control sample	Before and after designs (matched groups) Effects and intervention studies

a buyer's request for implementing a sustainability initiative. Thus the events have already happened in the past, it is unknown how they distribute through the sample and they cannot be controlled or influenced by the researcher. This means there is no control over the events.

Question 1 cannot be answered so easily. Hypothesis H_1 is well founded in the literature; however the mechanism behind the adaptive behaviour towards sustainability initiatives in dyadic exchange relations has not been researched at all. The framework of the bases of power, which is used to explain the mechanism, is however well established and measurement tools for analogical situations exist. Hence a multivariate analysis, such as a factor analysis or a statistical model, appears in line with Oppenheim's (1992) recommendations.

4.9.1 *Operationalization of supplier's dependence*

The variable X, supplier's dependence, is the supplier's perception of its dependence on the buyer. The term *perception* is used on purpose, since a representative of the supplier itself fills in the question-

naire, so the results will reflect only the supplier's point of view. In summary 9, it was established that the perception of the supplier regarding its dependence determines the extent of the buyer's power. As a control variable the supplier is asked for its perception of the power distribution in the dyadic exchange relation. According to the dependence theory (Emerson, 1962), the results should be inversely proportional.

By using Bode et al.'s (2011) questionnaire tool, the following set of statements is formulated to operationalize the perceived dependence of the supplier towards its buyer:[4]

> If our relationship with this buyer had been discontinued, we would have had difficulty achieving our business goals.
>
> *Strongly agree* ❍ ❍ ❍ ❍ ❍ ❍ ❍ *Strongly disagree*
>
> It would have been difficult for us to replace this buyer.
>
> *Strongly agree* ❍ ❍ ❍ ❍ ❍ ❍ ❍ *Strongly disagree*
>
> We were quite dependent on this buyer.
>
> *Strongly agree* ❍ ❍ ❍ ❍ ❍ ❍ ❍ *Strongly disagree*
>
> We did not have a good alternative to this buyer.
>
> *Strongly agree* ❍ ❍ ❍ ❍ ❍ ❍ ❍ *Strongly disagree*

The power of a supplier and the supplier's dependence on a buyer are based on its perception. According to Lippitt et al. (1952), on whose work substantial parts of the concept of power bases are grounded, is the power as one perceives it as being determinative for the power-related actions. This means that, in the case of sustainability adaptation at a supplier, the supplier's power-based decisions are not affected by its *actual power*. Actual power could be the power

---

4 In the original publication by Bode et al. (2011), these questions were asked of buyers; hence the term *supplier* from the original questionnaire was replaced by *buyer*. In Bode et al.'s *Academy of Management Journal (AMJ)* article, the scale measuring dependence achieved a reliability of $\alpha = 0.90$.

from the buyer's (or another independent outside entity's) point of view. French Jr. and Raven's (1959) concept of the various bases of power describes which perceived circumstance allows the allocation of power. Thus, these different *perceived* circumstances determine the bases of power underlying the exchange relation under scrutiny.

As mentioned at the beginning of this section, the supplier is eventually asked the direct question about the perceived power relation between him- or herself and the buyer at the time of the incident:

> Who was more powerful in the relationship between you and the buyer at the time of the adaptation request?

> ❍ I was more powerful

> ❍ The power relation was balanced

> ❍ The buyer was more powerful

4.9.2   *Operationalization of the bases of power*

The base of power is best described as the prevailing base of power on which the supplier made the choice of whether to adapt to or reject the requested change. A questionnaire tool which measures eleven bases of power is established in the literature. The tool was developed by Raven et al. (1998) in order to create comparable results in different studies applying the concept of the bases of power. This tried and trusted approach is used in the research on hand as well, in order to measure which base of power led a supplier to a decision regarding the request of a buyer to adapt to a sustainability initiative (adaptation *and* rejection). By doing so, it can be determined whether the supplier implemented the requested change, and which power base prevailed in the relation withthe buyer in the meantime. Furthermore,

the supplier's perception about his or her power and the dependence of the buyer are determined beforehand with the process described in section 4.9.1.

Until now, studies in SCM which regarded power bases, considered only five power bases (Benton and Maloni, 2005; Maloni and Benton, 2000). This research measures the prevailing power bases with a variation of the questionnaire suggested by Raven et al. (1998). The original questionnaire tool was developed to measure the power between supervisors and subordinates; hence it is adapted to the needs of this research. Raven et al.'s questionnaire asks subordinates to think of a situation in which they complied with a supervisor's request after initial hesitation. In contrast, this research allows the participants (suppliers) to describe a situation where a buyer asked them to follow a particular process, but the supplier may or may not have complied with it. The particular process should be an environmental or a social initiative. The reason for allowing both options (compliance and non-compliance) is to gain a binary value for the output variable Y, which indicates whether the approach of the buyer was successful or not.

A first alteration to the adapted questionnaire is the opening statement. The different statements for the two questionnaires are as listed below: on the left, the original statement by Raven et al. (1998) and on the right the adapted version.

"Often supervisors ask subordinates to do their job somewhat differently. Sometimes subordinates resist doing so or do not follow the supervisor's directions exactly. Other times, they will do exactly as their supervisor requests. We are interested in those situations which lead subordinates to follow the requests of their supervisor.

Often buyers ask suppliers to make changes to their operations. Sometimes suppliers resist doing so or do not follow the buyer's directions exactly. Other times, they will do exactly as their buyer requests. We are interested in the adaptation of sustainability initiatives on the suppliers' side.

Think about a time when you were being supervised in doing some task. Suppose your supervisor asked you to do your job somewhat differently and, though you were initially reluctant, you did exactly as you were asked. On the following pages, there are a number of reasons why you might do so. Read each descriptive statement carefully, thinking of the situation in which you were supervised. Decide how likely it would be that this would be the reason you would comply."   Raven et al. (1998, p. 313)

Think about a situation when your firm was asked by a buyer to run its operations somewhat differently with regards to social or environmental aspects. The situation may have resulted in either your firm adapted what you were asked for, or it did not. On the second page of this questionnaire are a number of reasons why you may have decided as you did. Read each descriptive statement carefully, thinking of the situation in which your firm was asked to alter its operative behaviour. Decide how likely every statement on the following pages may have influenced your firm's decision.

In the adapted questionnaire, the supplier has to think about a situation where a buyer asks for a change in the supplier's operations. The supplier has then to describe the requested change briefly, and tick a box whether this is a change on the environmental social bottom line. There are two ideas behind asking for a brief description of the situation: *a*) getting some information about what is considered as change towards sustainability amongst practitioners across different sectors; and *b*) shift the participant's state of mind to when the situation occurred. This will help with the further questionnaire which asks for other factors at the time of the adaptation request.

In which category fits the situation you have in mind (choose one)?

❍ Environmental

❍ Social

Since it may appear somewhat unclear to the participants what is meant by "run its operations somewhat differently with regards to social or environmental aspects", a table with five common examples for each bottom line is given (table 2.1 on page 24). This will give a "gut feeling" for what the questionnaires aims for, in case the participant is not sustainability literate.

After choosing a situation, the participant has to rate different statements as to whether they influenced his or her behaviour (adaptation or rejection) on a seven-point Likert scale. The statements are derived from the original questionnaire of Raven et al. (1998) and adapted to the situation of a buyer–supplier exchange relation. An overview of the original statements, which power base they are supposed to measure, and how the statements are adapted to this research, is given in table 4.6.

Table 4.6.: Statements for the operationalization of 11 different power bases

Power base	Original statement	New statement
IRE	A good evaluation from my supervisor could lead to an increase in pay.	A good evaluation from our buyer could lead to an increase in selling price.
LEP	After all, he/she was my supervisor.	It was a powerful buyer.
EX	My supervisor probably knew the best way to do the job.	Our buyer probably knew the best way to do the job.
INP	Once it was pointed out, I could see why the change was necessary.	Once it was explained, we could see why the change was necessary.

Continued on next page

Power base	Original statement	New statement
REF	I respected my supervisor and thought highly of him/her and did not wish to disagree.	We respected our buyer and thought highly of them and did not wish to disagree.
ICO*	My supervisor could give me undesirable job assignments.	Our buyer could reduce its volume of orders.
LER*	My supervisor had done some nice things for me in the past and so I did this in return.	Our buyer had done some nice things for us in the past.
PRE	I liked my supervisor and his/her approval was important to me.	We liked our buyer and its approval was important to us.
LED*	It was clear to me that my supervisor really depended on me to do this for him/her.	It was clear to us that our buyer really depended on us to do this.
PCO*	I didn't want my supervisor to dislike me.	We didn't want our buyer to dislike us.
LEQ	By doing so, I could make up for some problems I may have caused in the past.	We may have caused our buyer problems in the past.
LER	For past considerations I had received, I felt obliged to comply.	We had received considerations from our buyer in the past.
ICO	My supervisor could make things unpleasant for me.	Our buyer could make things unpleasant for us.
PRE*	It made me feel better to know that my supervisor liked me.	It made us feel better to know that our buyer liked us.
REF	I saw my supervisor as someone I could identify with.	We saw our buyer as someone we could identify with.
LED	Unless I did so, his/her job would be more difficult.	Unless we adapted the requested change, the buyer's job would be more difficult.
INP*	My supervisor had carefully explained the basis for the request.	Our buyer had carefully explained the basis for the request.
PCO	It would have been disturbing to know that my supervisor disapproved of me.	It would have been disturbing to know that our buyer disapproved of us.
EX	My supervisor probably knew more about the job than I did.	Our buyer probably knew more about the job than we did.
LEP*	It was his/her job to tell me how to do my work.	It was their job to tell us how to produce the products they buy from us.

Power base	Original statement	New statement
LEQ	Complying helped make up for things I had not done so well previously.	Previously we had made some mistakes affecting our buyer.
IRE	My supervisor could help me receive special benefits.	Our buyer could help me increase sales.
PCO	My supervisor may have been cold and distant if I did not do as requested.	Our buyer could have been cold and distant if we did not do as requested.
INP	My supervisor gave me good reasons for changing how I did the job.	Our buyer gave us good reasons for changing how we did the job.
LED	I understood that my supervisor really needed my help on this.	We understood that our buyer requested this change because they really needed our help.
EX*	I trusted my supervisor to give me the best direction on this.	We trusted our buyer to give us the best direction on the matter concerned by the requested change.
REF*	We were both part of the same work group and should have seen eye-to-eye on things.	We were both part of the same supply chain and should have had the same goals.
LEP	My supervisor had the right to request that I do my work in a particular way.	Our buyer had the right to request that we do our work in a particular way.
PRE	My supervisor made me feel more valued when I did as requested.	Our buyer made us feel more valued when we did as requested.
LEQ	I had made some mistakes and therefore felt that I owed this to him/her.	We had made some mistakes and therefore felt that we owed our buyer to adapt the requested change.
ICO	My supervisor could make it more difficult for me to get a promotion.	Our buyer could make it more difficult for us to get into a strong position on the market.
LER	My supervisor had previously done some good things that I had requested.	Our buyer had previously helped us out on our request.
PRE	It made me feel personally accepted when I did as my supervisor asked.	It made us feel personally accepted when we introduced what our buyer asked for.

Continued on next page

Power base	Original statement	New statement
LEP	As a subordinate, I had an obligation to do as my supervisor said.	As a supplier, we had an obligation to do as our buyer said.
REF	I looked up to my supervisor and generally modeled my work accordingly.	We looked up to our buyer and generally modeled our operations accordingly.
LEQ*	I had not always done what he/she wished, so this time I felt I should.	We had not always done what they wished, so this time we felt we should.
IRE	My supervisor's actions could help me get a promotion.	Our buyer's actions could help us get into a stronger position on the market.
EX	My supervisor probably had more technical knowledge about this than I did.	Our buyer probably had more knowledge about this than we did.
ICO	My supervisor could make it more difficult for me to get a pay increase.	Our buyer could make it more difficult for us to increase our margin.
LED	I realized that a supervisor needs assistance and cooperation from those working with him/her.	We realized that a buyer needs assistance and cooperation from those working with them.
IRE*	I expected to get some favorable consideration for this.	We expected to get some favorable consideration for implementing the requested change.
INP	I could then understand why the recommended change was for the better.	We could understand why the recommended change was for the better.
LER	My supervisor had let me have my way earlier so I felt obliged to comply now.	Our buyer had let us have our way earlier so we felt obliged to comply now.
PCO	Just knowing that I was on the bad side of my supervisor would have upset me.	Just knowing that we were on the bad side of our buyer would have upset us.

The development of the new statements as presented in table 4.6 was made in collaboration with the PhD supervisors, other academics from different fields of expertise, and practitioners. This effort was un-

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* These statements were excluded in the original questionnaire by Raven et al. (1998).

dertaken in order to create a questionnaire which is understandable for practitioners, whilst still measuring with a scale similar to the one proposed by Raven et al. (1998).

4.9.3 *Operationalization of the adaptation of sustainability*

Variable Y, the adaptation of sustainability, represents the likelihood that a supplier will adapt to a buyer's requested change regarding its sustainability. The variable is measured with the simple question:

> Have you accepted or rejected the change?
>
> ❍ Accepted exactly as requested
>
> ❍ Rejected (partly accepted means rejected)

4.10 ANALYSIS OF THE MEDIATED MODEL

Figure 3.9b suggests that the relation between a firm's dependence and its adaptive behaviour towards buyer-requested sustainability initiatives is mediated by the prevailing bases of power between the two entities. Mediation exists because of the proposed relationship of all three variables (table 3.4). The causal relationship between the bases of power and dependence is postulated in table 3.3 and further the effectiveness of power bases to change behaviour is summarized in figure 3.5. The addition of a third variable, in this case the *Base of Power*, will explain the *how* of the relation of the other variables *Dependence* X and *Adaptation* Y (MacKinnon, 2008). The third variable can take on various forms which will be explained in the following paragraphs.

Generally speaking, it can be said that mediation analysis is a helpful tool for researchers to understand mechanisms behind a causal correlation. The method is widely used in pharmaceutical studies, where in-depth knowledge about the mechanisms behind a cause–effect relation (e. g. a new drug and its effects/side effects) are safety relevant (Krause et al., 2010).

A very simple example for mediation is the relation between the age of a driver (X) and driving skills (Y). A significant correlation between the two variables can be observed. The strength of this correlation is reported as the estimate of path c and its p-value. However introducing the mediating variable M, which represents the driving experience, explains the cause even better than simply the correlation of the two variables. The measurement for this indirect effect ($a \cdot b$) is the product of the respective path estimates. Whilst estimating the paths a and b, one controls for the direct effect of X on Y, which is then called c'. If c' is smaller than the total effect c, mediation occurs. In this example, it means that the driving skills are better explained by considering the impact of the driver's age on the driver's experience, which then predicts the driving skills.

Examples for mediation models are numerous. Interestingly mediating effects have been found between predictor variable X and output variable Y, even if no significant correlation between these two could be observed. McFatter (1979), for instance, suggests a mediation model describing the impact of a worker's Intelligence Quotient (IQ) X on the resulting errors Y in his work on the production line. Meanwhile the authors observe a mediating variable M which describes the worker's intolerance of boredom. The analysis showed no correlation between IQ (X) and the resulting errors (Y). However, an important

mechanism in this relation was detected by entering the mediating variable M into the model and observing a significant mediation of the indirect effect. This showed that a higher IQ also increased the intolerance of boredom, which then resulted in more errors at work. Solely using the variable IQ as a predictor did not yield any useful result. This special case of mediation is called *inconsistent mediation* and occurs often if more than one mediator is entered, and the mediators are opposed to each other (MacKinnon et al., 2007).

Different approaches exist in the literature on how to evaluate a mediation model. Among the pioneers in the field of mediation models were Baron and Kenny (1986). Baron and Kenny's solution is a calculation of all paths in the mediation model (regression analysis), with subsequent subtraction of the paths a and b from c, in order to determine whether a mediation effect exists. Thereby, the size of the effects is more important than the p-value of each coefficient. This method is called the *causal step approach*.

Hayes (2009) finds evidence for the low statistical power of the *causal step approach* as introduced by Baron and Kenny (1986). This is particularly important, since Baron and Kenny's approach is still used frequently in the academic literature. Further criticism of the *causal step approach* is that the mediating effect is not quantified: it is solely tested whether some mediating effect exists or not. Hayes (2009) promotes his own tool to determine mediating effects, which is a proprietary plugin for the statistics software SPSS.

A third prominent researcher in the field of mediation models is MacKinnon. The definitions for the different terms used during the mediation analysis will be taken from MacKinnon (2008):

INPUT VARIABLE Even though various names are used for this variable by different authors, in this research the variable X shall be called the Independent Variable. IV in particular appears frequently in the literature. In this case the input variable is the dependence of the supplier on its buyer.

OUTPUT VARIABLE Similarly, as for the input variable, a number of names exist for the output variable (e.g. DV). In this research the output variable Y shall be the binary variable of adaptation of the buyer-requested sustainability initiative. This variable occurs *after* the input variable X in the time dimension.

MEDIATOR The mediator or mediating variable M shall be the underlying mechanism between the correlation of input variable and output variable. According to MacKinnon (2008, p. 8) the mediator is "intermediate in the causal chain relating X and Y such that X causes Z and Z causes Y". Instead of Z the letter M is used for the mediating variable. The direction of the causal chain as suggested by MacKinnon (2008) is given through the timely sequence of input and output variables.

SUPPRESSOR A suppressor is a variable which, when included, increases the correlation between the input variable and the output variable. Hence omitting the variable would suppress some effects in the model. According to figure 3.8 and the analysis of the driver of SSCM in section 3.1, all drivers apart from customer/buyer pressure are suppressors. The inclusion of all SSCM drivers would likely lead to a better fitting model than solely the observation of the buyer and the buyer's power relation to the supplier.

DISTORTER A distorter variable can change the direction of the correlation between the input and output variable, or even lead to correlations which are non-existent without the distorting variable.

COVARIATE If the mediator is found to be not significantly correlated to the input variable (however additional variance in the output variable is explained by adding M), it is most likely a covariate. This covariate is then an additional predictor for the output variable, although not a causal mediator.

MODERATOR A moderating variable influences the strength of the correlation between the input variable and the output variable, depending on its own value.

CONFOUNDER A confounder is a further variable, not considered in the model, which has an influence on the input variable X and the output variable Y.

Following the concern of Hayes (2009) that researchers do not always use the full potential of available statistical methods,[5] the most advanced and newest approach for mediation analysis will be applied in this research. The latest computation tool for analysing mediation models is the `mediation` package for R in its version 4 (Tingley et al., 2013). Since different methods to determine mediation are discussed amongst statisticians, all currently available methods will be used to increase the validity of the result.[6]

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[5] "Yet frequently, the analytical choices communication researchers make when testing intervening variables models are out of step with advances made in the statistical methods literature."   Hayes (2009, p. 408)

[6] *a*) The 3/4 step solution as suggested by Judd and Kenny (1981); *b*) A path modelling approach as recommended by Rosseel (2013); *c*) Preacher and Hayes's (2004) method with their proprietary SPSS macro; *d*) The previously described method of Tingley et al. (2013).

For the purpose of explaining the underlying statistics, the mediation model is printed in a standardized format as proposed by MacKinnon (2008, p. 105) (see figure 4.3b on page 199). Here, the terms e_2–e_4 represent error variability; e_1 is not found in figure 4.3b since it represents the error variability of the total effect model (cf. figure 4.3a). Further, the paths in the mediation model for soft and hard power bases are adapted to the standardized nomenclature, which means that the effects of the supplier's dependence (X) on the magnitude of soft or hard power bases (respectively M_1 and M_2) are represented by the terms a_1 and a_2. The effects of soft and hard power bases on the supplier's adaptation to the buyer-requested sustainability initiative (Y) are denominated b_1 and b_2 respectively. The path c' relates the input variable X to the output variable Y, after being "adjusted for the effects of the mediators" MacKinnon (2008, p. 106). The prime in c' is the common nomenclature for distinction between the direct effect adjusted for a mediator (c') and the total effect (c). M_1 and M_2 are the two mediating variables, following the dichotomization of soft and hard power bases.

Before the computation of the mediation model can happen, the raw data as obtained through the online questionnaire undergo further tests and preparation. This process will be described in the following subsections.

4.10.1 *Descriptive statistics*

In order to gain an overview of the collected data, descriptive statistics will be used. First, the single questions will be scrutinized and, after that, the new variables for the mediation model computed. These

(a) Total effect model

(b) Mediation model for soft and hard power bases
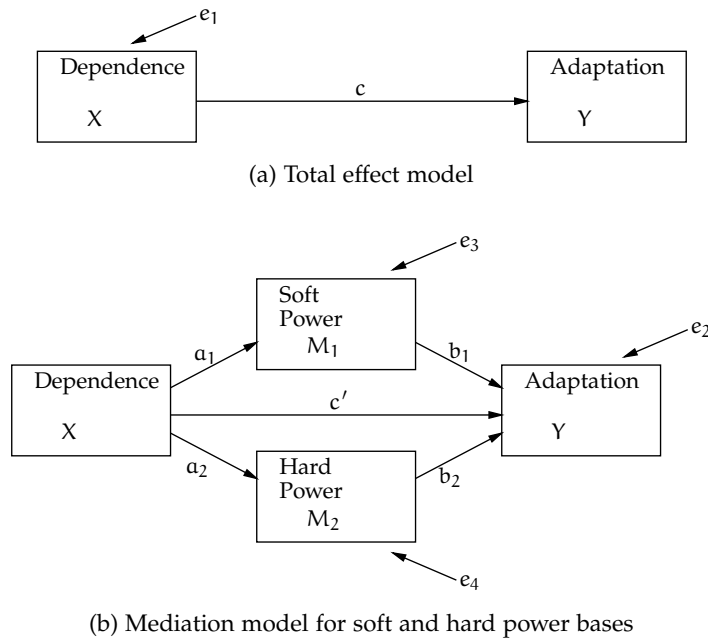
Figure 4.3.: Mediation model

variables will be soft and hard power (M_1 and M_2), as well as the variable X, dependence. The creation of those new variables depends on the reliability of the scales, which is determined as described in section 4.10.4.

In the first step of the analysis, descriptive statistics for the questionnaire items measuring dependence (four questions 7a–7d) and the item measuring power (question 8) will be reported. The descriptive statistics are reported as recommended by Revelle (2013a), which means that not only are mean and median values reported, but also skew and kurtosis of the items. A brief explanation about the reported measures is given at the place where the descriptives are reported (section 5.2.1 on page 221). The same descriptive analysis is then executed for the statements measuring the bases of power (44 questions 9a–9ar) with the aim of detecting anomalies. These anomalies can be a first sign for a weak indicator.

4.10.2   *Sample adequacy*

In the next step, the adequacy of the sample will be tested by comparing the data about the respondent's industries as well as their geographic location with the assumed population. Since the actual population of SMEs which encountered a situation of a buyer requesting them to implement a sustainability initiative is unknown, the overall population is estimated according to the criteria as set in equation 4.1 (page 180). Furthermore, the distribution of the sizes of the partaking companies to the underlying population will give some indication of the sample adequacy.

4.10.3   *Testing for normality*

Similarly to the approach in the paragraph about descriptive statistics, first the single questions and statements will be scrutinized as to whether they follow a normal distribution. As a first indication West et al. (1995, p. 68) criteria for 7-point Likert scales, which say that Kurtosis >7 and Skewness >2 are a concern, is used. These values are included in the descriptives. Furthermore, the widespread approaches of the Shapiro-Wilk and the Anderson-Darling normality tests are conducted (Anderson and Darling, 1952; Shapiro and Wilk, 1965). However it is expected that the null hypotheses that the data are normally distributed will be rejected, due to the large sample size and the type of the data (7-point Likert). The Shapiro-Wilk test and the Anderson-Darling test are very susceptible to minor outliers, which are more likely to occur with increasing sample sizes. A viable alternative which gives some insight into the distribution of the

data and their normality is graphical assessment with a QQ-Norm plot. To tackle severe deviations from normality, the `mediation` package for `R` offers the possibility of computing bootstrapped standard errors and confidence intervals, which are not susceptible to violations of the normality assumption. Similarly the `lavaan` package, which will be used for path modelling, offers the possibility to use a Weighted Least Squares Means and Variance Adjusted (WLSMV) estimator, which handles categorical data well at >200 observations (Brown, 2006; Finney and DiStefano, 2006; Muthén et al., 1997). After creating new variables for dependence and the power bases (following the process as described in section 4.10.4), the same tests are executed for those as well.

4.10.4 *Internal structure validity and consistency reliability*

For the application in the model as described in figure 4.3b, up to 15 different variables will be created out of the data obtained by the questionnaire (section 4.9):

- Input variable (X), Dependence

- Output variable (Y), Adaptation

- Eleven bases of power as precursor to the mediators hard and soft power bases (M_1 and M_2)

In order to find out whether the scales used for the operationalized questions in the questionnaire actually measure what they are supposed to measure, further tests need to be conducted.

Since some scales have been modified (measurement of the eleven power bases) and others have been adopted from the literature without

any changes (measurement of suppliers' dependence), different approaches will be undertaken. The internal consistency reliability of the scales (questions 7a–7d) measuring the variable *dependence* shall be determined by Cronbach's α.

The internal structural validity of the power bases needs to be tested in a different way. The original questionnaire from Raven et al. (1998) has been altered to some extent and is adapted to a new situation. The validity will be tested in a way very similar to that used in the original work by Raven et al. Hence, even though the literature suggests that eleven bases are measured with the set of 44 questions, an Exploratory Factor Analysis (EFA) will be conducted to see how well this adaptation has worked. The number of factors to be used in the EFA will be gauged by *a*) a parallel factor analysis, *b*) a Very Simple Structure (VSS) analysis and *c*) foremost, the underlying theory and suitability of new factor structures. Based on these results, the newly derived model will be tested with the mean scores of the best predictors. The predicting items will be chosen by the following criteria:

- The inter-item correlation of the item per scale,

- Cronbach's α of the scale and

- an Item Cluster (ICLUST) analysis of the lateral variables (Revelle, 1979).

The ICLUST analysis measures Cronbach's α, as well as Revelle's β for each item on a scale. The analysis suggests which items shall be included to build up the latent variables (up to eleven bases of power). This process will remove the weak predictors before building a mediation model, as displayed in figure 4.3b. Even though the scale

was built by Raven et al. (1998) to measure eleven bases of power, it has been shown in the past that it is likely to lead to a solution (Raven et al., 1998, p. 314) with fewer factors, and eventually to a form of hard/soft power dichotomization.

The mediating model with the categorization of hard and soft power bases will be tested according to Brown (2006, p. 323) regarding the underlying assumption that the power bases can be divided into hard and soft (Pierro et al., 2008). The models are used to compute estimates for the variables used in the mediation model (figure 4.3). The fit indices of the models will be reported; however, in accordance with Barrett (2007, p. 819), the often used threshold values for the fits will not be understood as a judgement of the suitability of the models:

> The criterion used for "fit" is actually an abstract concept in the majority of SEM models. It is clearly not predictive accuracy. In fact whether models "approximately fit" with an RMSEA of 0.05 or 0.07 is a literally meaningless scientific statement.

4.10.4.1 *Test of Emerson's power-dependence relation*

The relationship between a supplier's perceived power and its dependence will be measured. Due to the different nature of the variables, ordinal logistic regression can be used. However, to simply confirm Emerson's power-dependence relation, a graphical analysis in conjunction with a test for significant differences will be applied (Kruskal and Wallis, 1952). The Kruskal-Wallis test divides the three samples (powerful supplier, balanced, powerful buyer) and tests the following null hypotheses (McDonald, 2009, p. 165–172):

> The null hypothesis is that the samples come from populations such that the probability that a random observation from one

group is greater than a random observation from another group
is 0.5.

The test will statistically confirm the difference between the three
perceptions of power and their answers on the dependence scale
(Q7a–Q7d). The actual magnitude of the three different groups re-
garding their perceived dependence will be graphically demonstrated.

4.11   RESEARCH DESIGNS OF SIMILAR RESEARCH

4.11.1   *Dependence*

Leonidou et al. (2011) investigate the relation of adaptive behaviour
and relationship efficiency between British buyers and overseas sellers.
By doing so, Leonidou et al. (2011) find dependence to be a moderat-
ing variable for the aforementioned causal relation. Similarly Mukherji
and Francis (2008) find that automotive suppliers' adaptive behaviour
is positively influenced by their dependence on a buyer.

4.11.2   *Bases of power*

Yukl and Falbe (1991) evaluated their measurement tool for eight
bases of power with a factor analysis and reported the declared vari-
ance with a two factor solution at 43 per cent. Further, strong inter-
correlations were observed between coercive and reward power (0.42),
as well as between newly-introduced bases of power which are not
used in this research. Further, Yukl and Falbe (1991, p. 419) report
the internal consistency of their questionnaire, which is used in the

traditional way for interpersonal relationships, with α between 0.64 and 0.92; this is understood to be "very high".

Raven et al. (1998) evaluate the reliability of their scale in two steps: *a*) the inter-correlations of the statements (items) which are supposed to measure the same base of power (factor) were calculated and it was found that the items do not always correlate as well as expected; *b*) those items whose exclusion increases the α of the factors are dropped. The remaining items were found to produce seven factors after a Principal Component Analysis (PCA) following the rule of Eigenvalues >1. The α of these seven factors is found to be between 0.83 and 0.90, as opposed to the predicted factors which yielded, after dropping the lowest loading items, 0.67–0.86. A factor analysis of all eleven measured power bases returns a two-factor solution (soft and hard) which explains 59.3% of the variance (respectively 34.6% and 24.7%). Since the scale used in this research is very similar to Raven et al.'s (1998), these steps are followed with only minor adjustments. Instead of a PCA, a factor analysis with oblique rotation (oblimin) and a maximum likelihood estimator will be used. The criteria for the dimension reduction will not be the Eigenvalues of a PCA, but rather underlying theory.

A combination of French Jr. and Raven's (1959) bases of power and their application in interorganizational relations is demonstrated by Benton and Maloni (2005). The authors find their scale, which measures the original five bases of power, to have α's between 0.72 and 0.92. The further analysis is, based on the context, represented through various Structural Equation Models (SEMs).

4.11.3   *Interorganizational adaptation*

The adaptive behaviour of automotive suppliers, regarding environmental practices of their customers in Australia, is scrutinized by Simpson et al. (2007). Here, the variables are the suppliers' commitment as an output variable of a moderating model, the buyers' environmental performance requirements as an input variable, and different moderating variables assessing the interfirm relationship strength.

4.12   FOLLOW-UP STUDY

As a follow up test for the mediation models, and the restrictive dichotomization between hard and soft, further insight into the bases of power and their impact on sustainability adaptation shall be gained by regression analysis. Therefore a logistic regression model with all eleven bases of power predicting the adaptation of a buyer requested sustainability initiative is computed (*RegMod1*). The same data as for the hard and soft power bases in section 4.10 is used.

The model with the eleven power bases is analysed with a stepwise Akaike Information Criterion (AIC) algorithm to find a simple model with a better fit. The outcome of this second model (*RegMod2*) shall then give some clear information about which bases of power have a significant impact on the adaptive behaviour.

The Area Under the Curve (AUC) of the ROC of both models shall be compared in order to assess their accuracy in predicting adaptation.

5

FINDINGS

5.1 EXPLORATORY STUDIES

5.1.1 *Content analysis of retailers' websites*

In Figure 5.1 an overview of the search for the exact term *sustainable supply chain* on the retailers' corporate websites is given. Only Wal-Mart used this term in 2012. The other retailers did not use the expression sustainable supply chain on their corporate websites as of May 2012 (see figure 5.1).[1] The 2013 search revealed that Tesco began to mention SSC on their corporate websites. The latest search results from 2014 indicated that Costco and Carrefour started to report about SSC on their corporate websites too.

All other retailers under scrutiny (with the exception of Metro) have published articles and information where the words sustainable and supply chain are linked somehow. This was determined by searching for the exact terms: they were not written together as a compound term (Query 2). The number of search results found on the corporate websites with this method was reasonably higher. The

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1 All searchstrings and underlying figures can be found in the appendix in table B.1 (page 380).
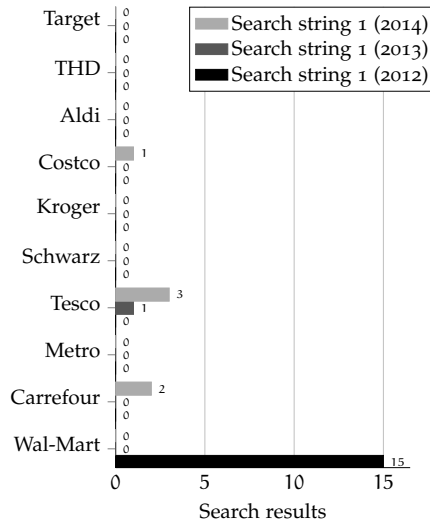
Figure 5.1.: Comparison of results with the first search string

distribution of the hits landed by Google is displayed in figure 5.2. Generalizations about the trend from 2012 to 2014 cannot be made based on the data available; however, a certain consistency about the mentioning of SSCM and world leading retailers can be observed.
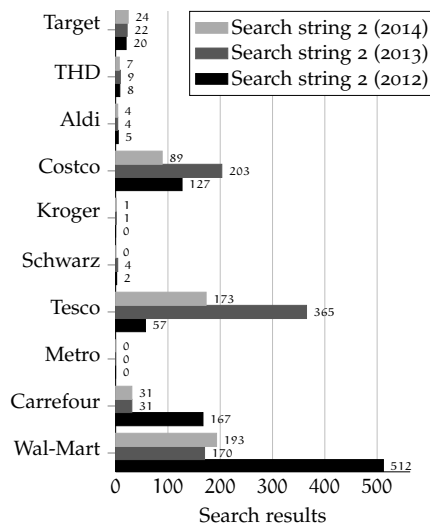
Figure 5.2.: Comparison of results with the second search string

Figure 5.3 shows that the non-English corporations have remarkably lower scores, compared with the companies originating from

English-speaking countries. The results for Metro and Target are questionable due to the ambivalent meaning of the companies' names. Looking at the results, it is also questionable what the Google algorithm did with the term Home-Depot. If the search included the terms *home* and *depot*, the result is also not valid. The available data indicate that the search results for SSC in context with the world leading retailers increased between 2012 and 2014.
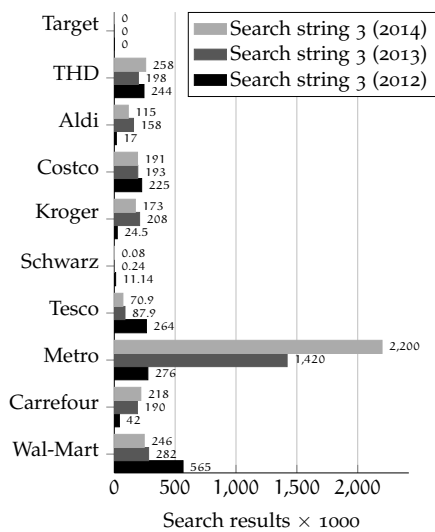
Figure 5.3.: Comparison of results with the third search string

As determined when discussing the sample, the world's largest supermarket chains are likely to adopt a principle such as SSCM at an early stage. The revelation that in 2012 only one out of the world's ten largest retailers published information about SSCM on their website, however, implies little prevalent focus of this sample group on SSCM. The results, and in particular the accurate search from the first search query, led to the finding in the following summary, which suggests an answer to the research question 1 (page 4).

Summary 25: Retailers and SSCM Terminology

The terminology Sustainable Supply Chain is increasingly used in the public communications of globally leading FMCG corporations.

The results of the content analysis study exercise suggests that global leading retailers do increasingly use the terminology *sustainable supply chain* in the public domain.

5.1.2   *Informal interviews*

After finding from the publicly available material of leading supermarkets that SSCM is prevalent in their strategy, the decision was made to get some expert opinions to the topic. Hence following interviews with specialists in the field were conducted in an informal manner.

Both interview partners supported the finding that it is difficult for practitioners to achieve SSCM as it is promoted through different academic models. The difficulty from their practical experience was also in the achievement of a balance between the economic bottom line and the other sustainability issues. Further, it was found that many companies have a fundamental lack of understanding of what a sustainable supply chain is.

5.1.3   *Practitioner's survey*

The practitioner's survey as introduced in section 4.3.2 was completed after about six weeks, when 39 responses were collected (28.8

per cent), of which 32 were filled out completely. However, for the analysis, all 39 responses were useful, since in general only participants' email addresses and personal details were missing from the incomplete responses.

The results show that only three quarters of the respondents answered the question whether they are familiar with the triple bottom line with *Yes*. To understand this distribution better, a distinction between respondents' occupation is made between *Sustainability Professional* and SCM *Professional*. The classification is made according to the job description of the participants. The results are graphically represented in figure 5.4.
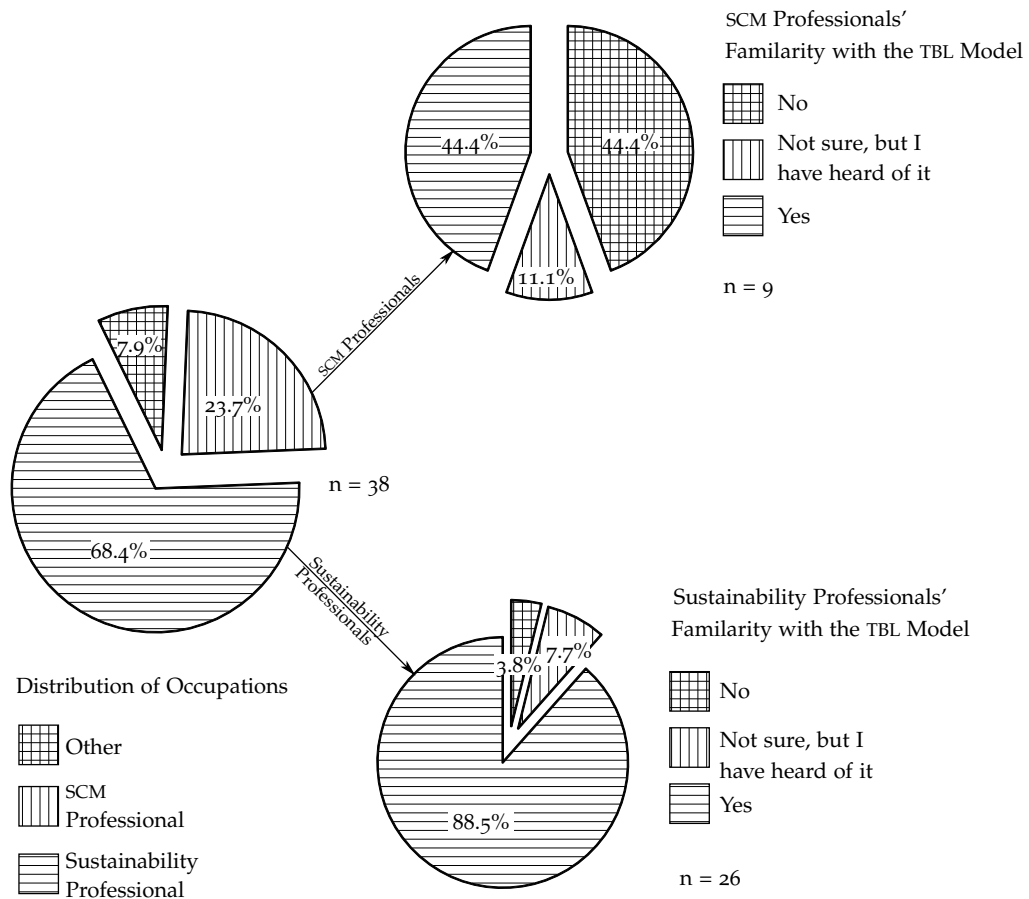
Figure 5.4.: Distribution of TBL familiarity by job description

A discrepancy in the understanding of sustainability between supply chain managers and sustainability managers is observed. An analysis considering the occupation of the participants revealed that almost half of the participating supply chain managers are not familiar with the triple bottom line model.

Further a discrepancy between academics and practitioners regarding the understanding of sustainability in a supply chain context is observed, after comparing the survey results, in particular the ranking of the importance of each bottom line, with the findings from the academic literature.

Only 12 of the respondents mentioned sustainability as a main task of their job. On the whole, the job descriptions revealed supply chain managers, procurement managers or consultants who are considering sustainability in their decisions. It is understood by a large part of the sample that sustainability implies acting responsibly towards the environment in their job. What stands out in the results of the survey is that about half of the respondents classified themselves as being employed in the consulting or construction sector (11 and 6 respectively).

The second question was dominated by job descriptions such as *Project/Programme Manager* and *Business/Strategic Management* (9 and 9 respectively). The answers fit to what is expected from the participants working in the industries as determined in the first question.

An overview of the core results of the survey is given in figure 5.5 which shows the stage of implementation of different sustainability characteristics in the respondents' supply chains. The graph shows the percentage of answers on the Likert scale for each sustainability characteristic. Beginning at the top, for example, 49 per cent of the

surveyed people found that *transparency* is either "fully integrated" or "integrated to a great extent", whereas 33 per cent found this characteristic "somewhat integrated" and 18 per cent of respondents chose "not" or "very little" integrated. A list with the full titles of the characteristics can be found in table 4.2.
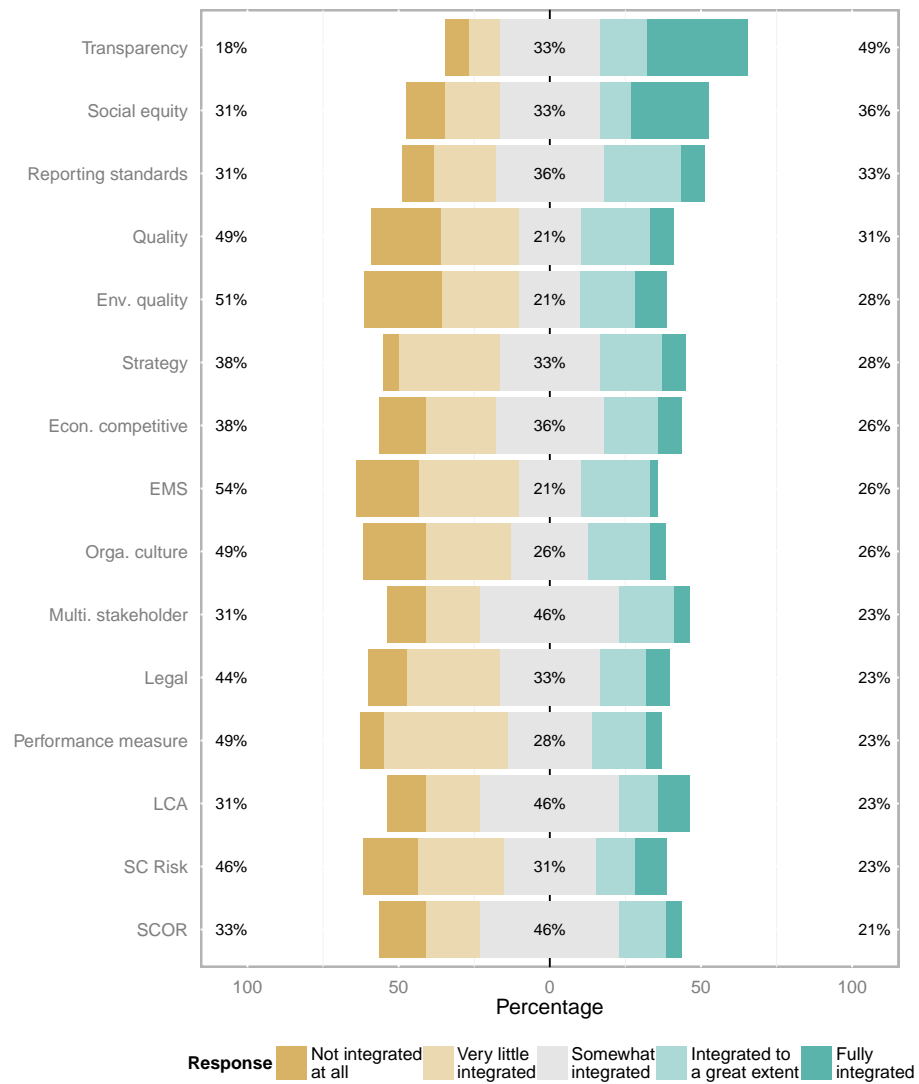
Figure 5.5.: Plots of the stage of implementation of SSCM characteristics in practice (N = 39)

The opportunity was given to the respondents to comment on their answers, which led to further revelations. Five respondents commen-

ted on the question about the implementation of product quality control. For instance, the application of BRE Environmental & Sustainability Standard (BES) 6001 was found to be helpful to increase product quality control integration. BES 6001 is a standard for responsible sourcing, particularly suitable for construction products. Another participant found it easier to meet the "frequent tension between sourcing a sustainable product and ensuring quality demands" when the buying volumes of the product are rather low. These comments underline the previous suggestion that quality issues are traditionally a topic in procurement.

One respondent found the primary driver for the implementation of sustainability initiatives in its SSC to be the increasing economic competitiveness deriving from becoming more sustainable.

A principle which is supposed to promote transparency is mentioned as "Auditing of all actors in the chain by the principle 'one up, one down'". How the respondent assures that this principle is followed through the whole supply chain is not mentioned. Another answer reveals the lack of transparency after the product leaves the gate of the focal company ("No integration after delivery to customer site"). This statement is underscored by a respondent who refers to BES 6001 and claims that over two-thirds of their products are equipped with transparent data; however, it is uncertain how the customers make use of this. What these answers have in common is a confession that real transparency, as it is understood from SCM and in particular SSCM, is currently not feasible for the respondents.

Two respondents commented on the question about to what extent environmental quality improvement initiatives are integrated in the supply chain. One states that the company has "one strategy and one

set of targets to 2020 with all our supply chain [partners]". This can be understood as a holistic approach which aligns all SC entities regarding their environmental goals. The second respondent goes into detail about measuring environmental influences, which is in this case particularly difficult and costly since it involves soil sampling and analysis.

The importance of stakeholder involvement and consideration on the path to a SSC is picked up by three respondents to give further information about their point of view. One respondent states that it is one of the company's objectives to "sensitize stakeholders" and this idea has transferred to some of their suppliers. Another respondent says that his company has well-established multi-stakeholder processes, but suspects them to be not very well executed.

According to the opinion of a respondent, the initiatives for social equity along the supply chain are "often better organized and established compared to monitoring environmental improvements"; however they are not as often publicly discussed and communicated—thus much of them remains undiscovered. Another respondent claims his company will have integrated initiatives to improve the social equity along its supply chain completely by June 2012, without going into further detail. A further response emphasizes that the focus of its social sustainability initiatives are mainly affecting the upstream direction of the SC, and do not therefore completely meet what is understood as the integration of the social dimension into a SC from the SSCM's point of view.

One commenter reported that, from his perspective, the organization's culture has "changed considerably over the last 6 to 7 yrs [*sic*] and there is now an integrated sector sustainability strategy and

better communication on sustainability". Regarding organizational strategy, two respondents indicated that the employees often act as the driver for sustainability promoting changes in organizations, whereas the management is not always easy to convince to a reorientation of strategy.

Nine respondents commented on the level of implementation of standards for reporting in their SSCM. Two of the commenters stated that the GRI guidelines are used, and three commenters mentioned different ISO and British standards, such as:

- ISO 14001

- ISO 14021

- ISO 9001 (*Quality management systems*)

- ISO 9002 (*Model for quality assurance in production, installation, and servicing*[2])

- ISO 50001 (*Energy management systems. Requirements with guidance for use*)

- BES 6001 (*Responsible Sourcing of Construction Products*)

- British Standard (BS) 8555 (*Environmental management systems. Guide to the phased implementation of an environmental management system including the use of environmental performance evaluation*)

- Occupational Health and Safety Advisory Services (OHSAS) 18001 (*Occupational health and safety management systems. Requirements*)

Further reporting standards such as the Waste & Resources Action Programme (WRAP) and Fairtrade were mentioned.

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2 The ISO 9002 is obsolete since the publication of the ISO 9001 in the year 2000 (BS EN ISO 9001, 2000).

The status of integration of LCA in practitioners' supply chains is not far progressed according to figure 5.5. Five practitioners elaborated their choice further: one respondent disclosed the LCA approach for his company's supply chain. This respondent uses the Leadership in Energy and Environmental Design (LEED) certification with the option of integrating LCA into this framework, which can be done to raise the points achieved in the LEED certification process. Another respondent claims that one particular company, which offers LCAs in the UK, dominates the market and hence sets the note.[3] A third respondent reveals that LCAs for farming are usually based "on incomplete and highly selective use of data", which would degrade the value of LCA drastically. The statements suggest that it is particularly difficult for companies to conduct a LCA with the required transparency and data. This understanding explains the low degree of integration as displayed in figure 5.5.

Comments differed on the question regarding implementation of supply chain risk management. Whereas one respondent stated that risk management is a major driver for SSCM, another respondent stated that risk management played a role in the past and has lost importance recently. Another commenter supported the low importance of Supply Chain Risk Management (SCRM) by claiming that most of the components for its product are locally sourced and have to conform with standards, which practically eliminates the greatest risk for this supply chain.

According to the rating of the survey participants, the SCOR framework was very little integrated. The comments revealed that many

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3 The respondent denotes the BRE group.

participants are not familiar with this framework, which indicates a low importance of SCOR in SSCM practice.

The performance measurement of sustainability in SSCM, which is still a little explored area was, again, perceived differently among respondents. Whereas one respondent claimed that sustainability in supply chains is fairly easy to measure (without further explanation), another respondent (consultant) revealed that most clients' SCs lack appropriate performance measures for sustainability. Further, one respondent finds "little agreement on how and what" is to be measured to evaluate the performance of a sustainable supply chain.

About half of the respondents claimed that they have an Environmental Management System (EMS) either fully, or to a great extent, implemented. A respondent from the construction industry commented on his choice and stated that his company's goal is to cover 95 per cent of all their construction sites with their EMS by the year 2020.

Comments as to the ranking of the bottom lines are very numerous and ranged widely. Thus, participants commented for instance in relation to the economic bottom line that "sustainability starts with being financially sustainable" or "profit was an integral part of how organisations are organised, how they operate and how they organise 90% of their activities". These comments are in line with the medium ranks of how the bottom lines are listed in table 5.1. The environmental bottom line is commented on with regard to the trade-off between economic profitability and environmental quality. One respondent mentioned in particular "the current economic condition means that profitability may not be compromised for more environmental quality". Another respondent pointed out that often the focus lies on the carbon footprint, whereas other environmental influences

are little considered. This finding can be supported with the performance measurement models for sustainability, which often focus on environmental sustainability and particularly on GHG emissions. Social equity is commented on similarly to the environmental dimension, as being a trade-off with the economic bottom line.

The median rank of each bottom line is listed in table 5.1. Since some respondents did not fill out the ranking conclusively (i.e. rank two or more bottom lines with similar importance), these cases (11) are removed from the calculation of the median ranks.

Table 5.1.: Descriptive statistics for the practitioners' ranking of the importance of the three bottom lines (N=39)

	MEAN	SD	MEDIAN	MIN	MAX	SKEW	KURTOSIS	SE
Env. Quality	2.31	0.73	2	1	3	−0.52	−1.04	0.12
Social Equity	1.36	0.67	1	1	3	1.54	0.92	0.11
Econ. Prosperity	1.95	0.69	2	1	3	0.06	−0.93	0.11

The review of the academic literature indicated a different ranking. According to Seuring and Müller (2008) most articles dealing with SSCM in academic literature focus on environmental issues, followed by social issues. The economic bottom line is often neglected. Since the economic bottom line turned out to be the most important criterion in this exploratory questionnaire, the result indicates a gap in the perception of sustainability in SCM between academics and practitioners, as displayed in table 5.2.

Summary 26: Exploratory Questionnaire

An exploratory questionnaire reveals that industry is not following the contents of academic SSCM models and has different priority rankings.

Table 5.2.: The table shows the different ranking of the importance of the three bottom lines; commonly understood under the term sustainability.

BOTTOM LINE	RANK PRACTITIONER	RANK ACADEMIA
ENVIRONMENTAL QUALITY	3	1
SOCIAL EQUITY	1	2
ECONOMIC PROSPERITY	2	3

5.2 DESCRIPTIVE

5.2.1 *Summary*

At the beginning of the analysis of the obtained data, a thorough scrutiny of the dataset is undertaken. Therefore the following statistical measures are calculated and observed for anomalies in the continuous data:

N Number of responses (observations).

MEAN A question's mean value across all observations.

SD Standard deviation.

MEDIAN A question's median value across all observations.

TRIMMED The trimmed mean value across the observations, with the lowest and highest 10% disregarded. This measure is only valuable if the distribution is rather symmetric.

MAD The median absolute deviation is a measure for the variability of the answers in the question. The lower this robust measure, the lower the variability of the data.[4]

MIN The minimum value amongst all answers to the respective question.

MAX The maximum value amongst all answers to the respective question.

RANGE The range between the minimum and maximum value.

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4 The default constant for the Median Absolute Deviation (MAD) in R is 1.4826 for reasons of the presumed underlying normal distribution. This means an MAD of 1 will be represented as this constant. More information and a mathematical derivation can be found on the developers' homepage `http://stat.ethz.ch/R-manual/R-patched/library/stats/html/mad.html`.

SKEW The skewness of the answers to the respective question. Negative values represent skewness towards the upper (right) end of the scale, positive values signalize the opposite.

KURTOSIS The measure of the kurtosis represents the shape of the peak of the data. Negative values (platykurtic) are rather flat when compared to a normal distribution; positive values (leptokurtic) stand for a higher peak than the normal distribution would deliver.

SE The standard error of the mean (based on $\frac{sd}{\sqrt{n}}$)

5.2.2 *Dependence and power*

The first set of variables undergoing the descriptive process are questions 7a–d and question 8 of the questionnaire. Question 7 measures the perceived dependence of the supplier on its buyer on a seven-point scale. Whereas high values represent a low perceived dependence, low values represent a high dependence on the buyer. Question 8 measures a supplier's perception of the power relation between his or her own company and the buyer's company on an ordinal scale with three choices: Answer 1 means the supplier found him- or herself more powerful than the buyer, answer 3 means the supplier found the buyer more powerful, and answer 2 stands for perceived equilibrium in power.

It can be noticed that all questions are slightly negatively skewed, which means the participants tended to find themselves little dependent on the buyer (see also figure 5.6). This can also be concluded from the mean values > 3.5 for questions 7a–7d and >2 for question 8.
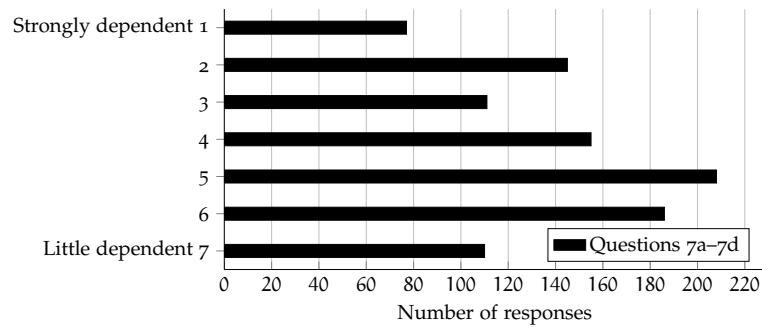
Figure 5.6.: Cumulative distribution of the responses to Questions 7a–7d

The so-called excess kurtosis is reported in table 5.3.[5] All variables presented in table 5.3 are platykurtic, which indicates a lower than normal peak in the distribution of the data. Also the items on the dependence scale are all slightly negatively skewed, which indicates a tendency towards higher values than the middle of the scale.

A graphical representation of the answer distribution to the dependence questions is given in figure 5.7a, before the mean values of all four questions are plotted in figure 5.7b. The descriptive statistics overview of the newly created variable *Dependence* can be found in table 5.4.

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5 Excess Kurtosis means that a kurtosis of 0 would represent the peak of a normal distribution.

Table 5.3.: Descriptive statistics for the dependence questions and the perceived power

	ITEM	N	MEAN	SD	MEDIAN	TRIMMED	MAD	MIN	MAX	RANGE	SKEW	KURTOSIS	SE
Dependence	Q7a	249	4.55	1.86	5	4.66	1.48	1	7	6	−0.48	−0.94	0.12
	Q7b	247	4.68	1.75	5	4.78	1.48	1	7	6	−0.42	−0.86	0.11
	Q7c	248	3.88	1.81	4	3.88	2.97	1	7	6	−0.04	−1.14	0.11
	Q7d	248	4.02	1.71	4	4.04	1.48	1	7	6	−0.08	−1.01	0.11
Power	Q8	251	2.35	0.66	2	2.44	1.48	1	3	2	−0.52	−0.72	0.04

Table 5.4.: Descriptive statistics for the variable *Dependence* (mean values of the questions Q7a–d)

ITEM	N	MEAN	SD	MEDIAN	TRIMMED	MAD	MIN	MAX	RANGE	SKEW	KURTOSIS	SE
Dependence	251	4.29	1.55	4.5	4.33	1.85	1	7	6	−0.26	−0.85	0.10

(a) Density plot of the four items on the dependence scale

(b) Density plot of the mean values of the four items on the dependence scale
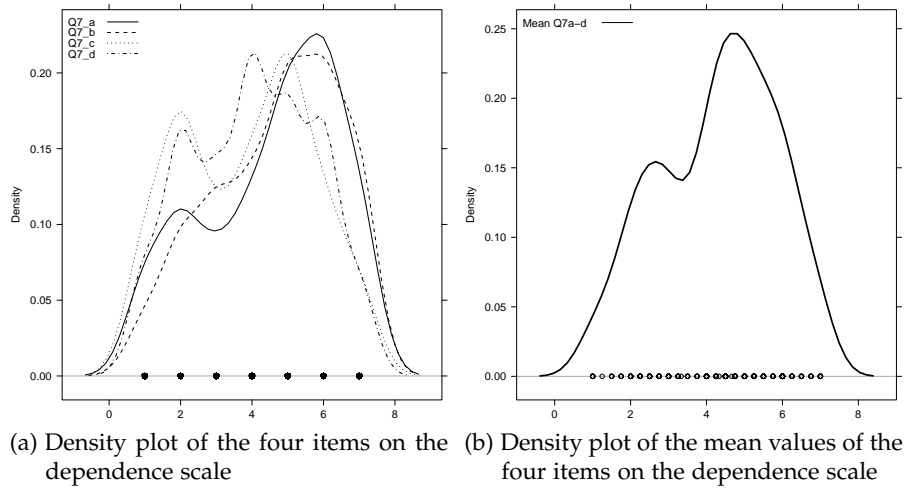
Figure 5.7.: Density plots of the *dependence* scale

5.2.3 *Bases of power*

The bases of power are determined through the statements 9a–ar. In order to get an overview, the same descriptive statistics as for the dependence questions are reported for the 44 statements measuring the bases of the existing power. The descriptives can be found in table 5.5. Most of the items are slightly negatively skewed. In this set of questions, this indicates that the distribution is bent towards agreement with the statements.
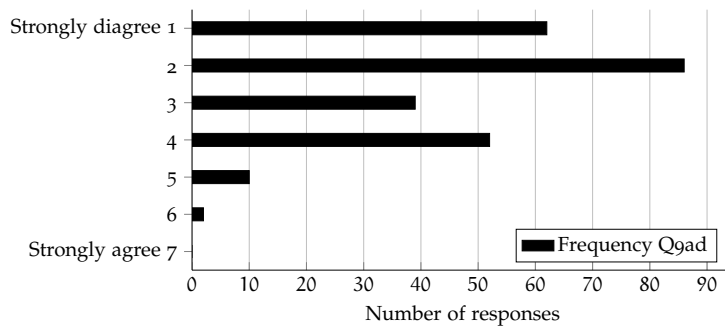
Figure 5.8.: Frequency distribution to question 9ad

Table 5.5.: Descriptive statistics for the bases of power questions

BASE	ITEM	N	MEAN	SD	MEDIAN	TRIMMED	MAD	MIN	MAX	RANGE	SKEW	KURTOSIS	SE
EX	Q9_c	251	3.84	1.59	4	3.85	1.48	1	7	6	0.02	−0.98	0.10
	Q9_s	251	2.78	1.47	2	2.67	1.48	1	7	6	0.52	−0.51	0.09
	Q9_z	251	4.23	1.41	4	4.30	1.48	1	7	6	−0.37	−0.66	0.09
	Q9_al	251	3.21	1.61	3	3.12	1.48	1	7	6	0.32	−0.84	0.10
REF	Q9_e	251	4.53	1.40	4	4.56	1.48	1	7	6	−0.19	−0.41	0.09
	Q9_o	251	4.45	1.35	4	4.57	1.48	1	7	6	−0.53	0.02	0.09
	Q9_aa	251	4.77	1.54	5	4.87	1.48	1	7	6	−0.54	−0.37	0.10
	Q9_ai	251	3.58	1.41	4	3.59	1.48	1	7	6	−0.06	−0.56	0.09
INP	Q9_d	251	4.69	1.56	5	4.81	1.48	1	7	6	−0.60	−0.61	0.10
	Q9_q	251	4.85	1.48	5	5.00	1.48	1	7	6	−0.80	−0.22	0.09
	Q9_x	251	4.68	1.47	5	4.80	1.48	1	7	6	−0.66	−0.18	0.09
	Q9_ap	251	4.94	1.54	5	5.12	1.48	1	7	6	−0.99	0.24	0.10

BASE	ITEM	N	MEAN	SD	MEDIAN	TRIMMED	MAD	MIN	MAX	RANGE	SKEW	KURTOSIS	SE
LED	Q9_i	251	4.43	1.61	5	4.52	1.48	1	7	6	−0.40	−0.75	0.10
	Q9_p	251	4.55	1.39	5	4.66	1.48	1	7	6	−0.52	−0.36	0.09
	Q9_y	251	4.57	1.53	5	4.67	1.48	1	7	6	−0.52	−0.43	0.10
	Q9_an	251	5.27	1.18	5	5.35	1.48	1	7	6	−1.10	1.98	0.07
PRE	Q9_h	251	4.49	1.35	4	4.57	1.48	1	7	6	−0.42	0.10	0.09
	Q9_n	251	4.27	1.36	4	4.36	1.48	1	7	6	−0.50	0.10	0.09
	Q9_ac	251	4.16	1.39	4	4.22	1.48	1	7	6	−0.34	−0.42	0.09
	Q9_ag	251	3.80	1.36	4	3.84	1.48	1	7	6	−0.34	−0.37	0.09
LER	Q9_g	251	3.65	1.41	4	3.66	1.48	1	7	6	−0.15	−0.41	0.09
	Q9_l	251	3.68	1.49	4	3.72	1.48	1	7	6	−0.27	−0.71	0.09
	Q9_af	251	3.25	1.36	4	3.25	1.48	1	7	6	−0.05	−0.70	0.09
	Q9_aq	251	2.67	1.25	2	2.64	1.48	1	7	6	0.35	−0.62	0.08
ICO	Q9_f	251	4.78	1.61	5	4.89	1.48	1	7	6	−0.59	−0.60	0.10
	Q9_m	251	3.69	1.72	4	3.68	1.48	1	7	6	0.01	−0.94	0.11
	Q9_ae	251	3.63	1.65	4	3.63	1.48	1	7	6	0.07	−1.04	0.10
	Q9_am	251	4.10	1.64	4	4.15	1.48	1	7	6	−0.21	−0.74	0.10

BASE	ITEM	N	MEAN	SD	MEDIAN	TRIMMED	MAD	MIN	MAX	RANGE	SKEW	KURTOSIS	SE
	Q9_k	251	2.76	1.44	2	2.63	1.48	1	7	6	0.63	−0.32	0.09
LEQ	Q9_u	251	2.71	1.43	2	2.58	1.48	1	7	6	0.57	−0.44	0.09
	Q9_ad	251	2.47	1.22	2	2.40	1.48	1	6	5	0.50	−0.70	0.08
	Q9_aj	251	2.79	1.28	3	2.73	1.48	1	7	6	0.44	−0.42	0.08
	Q9_a	251	3.68	1.57	4	3.65	1.48	1	7	6	0.06	−1.03	0.10
IRE	Q9_v	251	4.92	1.46	5	5.05	1.48	1	7	6	−0.76	0.11	0.09
	Q9_ak	251	4.56	1.47	5	4.68	1.48	1	7	6	−0.64	−0.10	0.09
	Q9_ao	251	4.33	1.46	4	4.45	1.48	1	7	6	−0.58	−0.26	0.09
	Q9_j	251	4.35	1.47	4	4.42	1.48	1	7	6	−0.35	−0.21	0.09
PCO	Q9_r	251	4.52	1.43	5	4.61	1.48	1	7	6	−0.46	−0.09	0.09
	Q9_w	251	3.99	1.44	4	4.03	1.48	1	7	6	−0.27	−0.38	0.09
	Q9_ar	251	3.54	1.52	4	3.54	1.48	1	7	6	−0.07	−0.90	0.10
	Q9_b	251	4.90	1.40	5	4.97	1.48	1	7	6	−0.52	−0.28	0.09
LEP	Q9_t	251	2.73	1.50	2	2.58	1.48	1	7	6	0.76	−0.14	0.09
	Q9_ab	251	4.69	1.46	5	4.81	1.48	1	7	6	−0.66	−0.09	0.09
	Q9_ah	251	4.33	1.57	5	4.40	1.48	1	7	6	−0.37	−0.69	0.10

It stands out that only in question 9ad have the participants not used the full range of possible answers. The frequency distribution of the question is displayed in figure 5.8. The statement in question 9ad reads:

We had made some mistakes and therefore felt that we owed our buyer to adapt to the requested change.

strongly ○ ○ ○ ○ ○ ○ ○ *strongly*
disagree   *agree*

It is understood from this result that none of the participants has adapted to the sustainability related initiative on the basis of *making up for a mistake*. Moreover, the low mean values of all Legitimate Power of Equity (LEQ) statements indicate that the legitimate power of *equity* plays no major role in the decision process of interorganizational adaptations regarding sustainability.

Question 9t delivers a distinctively different mean value from the other questions measuring Legitimate Power of Position (LEP). This is also reflected by the skewness towards disagreement. The statement in question 9t reads:

It was their job to tell us how to produce the products they buy from us.

strongly ○ ○ ○ ○ ○ ○ ○ *strongly*
disagree   *agree*

Particularly because the LEP statements in 9ab and 9ah deliver very similar results, it is understood that the phrasing of the statement 9t is suboptimal. The differing results between the buyer being allowed *to tell the supplier how to do the job* and the supplier being *obliged to do as the buyer says* must be due to the perception of the statement, rather than its content.

Amongst the statements determining Impersonal Coercive Power (ICO), question 9f stands out with a higher mean value and more negatively skewed results than the other questions in the group:

The buyer could reduce its volume of orders.

strongly disagree ◯ ◯ ◯ ◯ ◯ ◯ ◯ *strongly agree*

The reason why the results differ from the other ICO questions 9m, 9ae and 9am could be explained through the slight distinction in its context, compared with the other statements in the group. Statement 9f mentions an action executed by a buyer as a penalty, whereas the other statements in the group do not refer to a specific action as punishment.

The set of statements measuring Impersonal Reward Power (IRE) has a general tendency towards agreement. Statement 9a alone has a distinctively lower mean value and no negative skewness:

A good evaluation from our buyer could lead to an increase in selling price.

strongly disagree ◯ ◯ ◯ ◯ ◯ ◯ ◯ *strongly agree*

Feedback from practitioners confirms that the situation described is just very untypical. Once the dealing parties have agreed on a price for their goods, it is rather unlikely for the buyer to offer a higher price—even if sustainability initiatives need to be implemented on the supplier's side. The other statements in the IRE group (9v, 9ak, 9ao) refer to better positions on the market, or increase in sales ($\neq$ selling price per product unit).

Question 9aq stands out in the Legitimate Power of Reciprocity (LER) group with a relatively low mean and median value compared to the other items in this group: 9g, 9l and 9af. This also leads to a

positive skewness, meaning a tendency of the distribution towards disagreement.

> **Our buyer had let us have our way earlier so we felt obliged to comply now.**
>
> *strongly*   ○ ○ ○ ○ ○ ○ ○   *strongly*
> *disagree*   *agree*

The statement in question 9aq differs from the rest of the LER group in the *feeling obliged* part. The other statements in this group only mention the buyer's consideration of the supplier in the past—not the consequence of that.

An overview of all the descriptive statistics (of which only the most distinctive results are discussed in the above summary) is given in table 5.5. The abnormalities detected whilst going through the descriptives (questions 9a, 9f, 9t, 9ad, 9aq) are kept in mind and compared to the later findings of more complex statistical methods.

5.2.4 *Sample adequacy: sectors, regions and company sizes*

To find out how the sample compares to the distribution of sectors and regions of the firms from the *Fame* database, a comparison between the sample and the population was conducted. The results of the comparison between the respondents' and the database entries' regions, sectors and employees is visualized in figures 5.9 to 5.12. The respective underlying figures can be found in the appendix in tables B.5 to B.8.

Figure 5.9 shows some minor deviations in the regions between the sample and the companies under consideration from the *Fame* database. The first difference, the surplus in responding firms located in the East Midlands, can be explained by the researcher's affiliation to a local university. A considerably higher percentage of firms from the North East and North West of England has responded than the distribution of the firms in the *Fame* database would suggest. However, considerably fewer respondents are located in the adjacent regions Yorkshire and The Humber. Hence, the total of responding firms from the North is in accordance with the expected responses. The difference between the 6.8 per cent of respondents from the East of England and the 11.5 per cent of firms from the East of England in the *Fame* database cannot be explained. However, since the gap between sample and database is just 4.7 per cent, it does not endanger the sample adequacy.

The spread across the sectors as displayed in the graph in figure 5.10 reveals some differences between the respondents and the contacted firms. Firms listed under the NACE codes 27xx, 17xx and 16xx (respectively *manufacture of electrical equipment, manufacture of pa-*
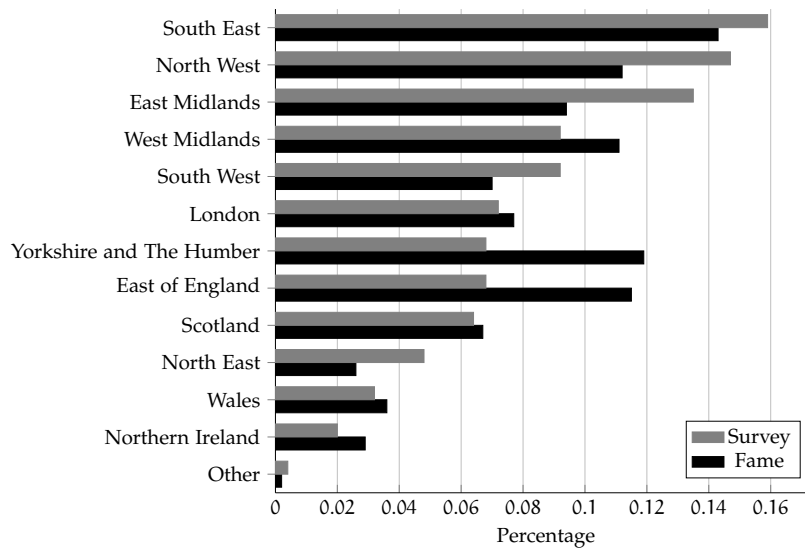
Figure 5.9.: Regions of respondents vs. regions of all database entries ($n_{survey} = 251$, $n_{fame} = 22,577$)

per and paper products and *manufacture of wood and products of wood and cork, except furniture*) are over-represented amongst the respondents. It is understood that it was easier for the firms in these sectors to find an example of a sustainability initiative they were asked to implement. Particularly in these sectors, the *initiatives* are often compliant with certification on the environmental bottom line, such as the Forest Stewardship Council (FSC) for NACE codes 16xx and 17xx, and RoHS or even more stringent certifications for NACE codes 27xx. The discrepancy between the data in the sectors *Land Transport* and *Postal/Courier* is explained because the respondent chose to which sector his or her firm belongs, and by the overlap between the two sectors. The same goes for the rather open categories *Manufacturing other* and *Wholesale*. All other sectors are very similar in their relative occurrence (density).

Only one out of the 259 respondents considered for the graph in figure 5.11 declared that their company employs >300 employees. Another seven participants claimed to be amongst the 250–299 employ-
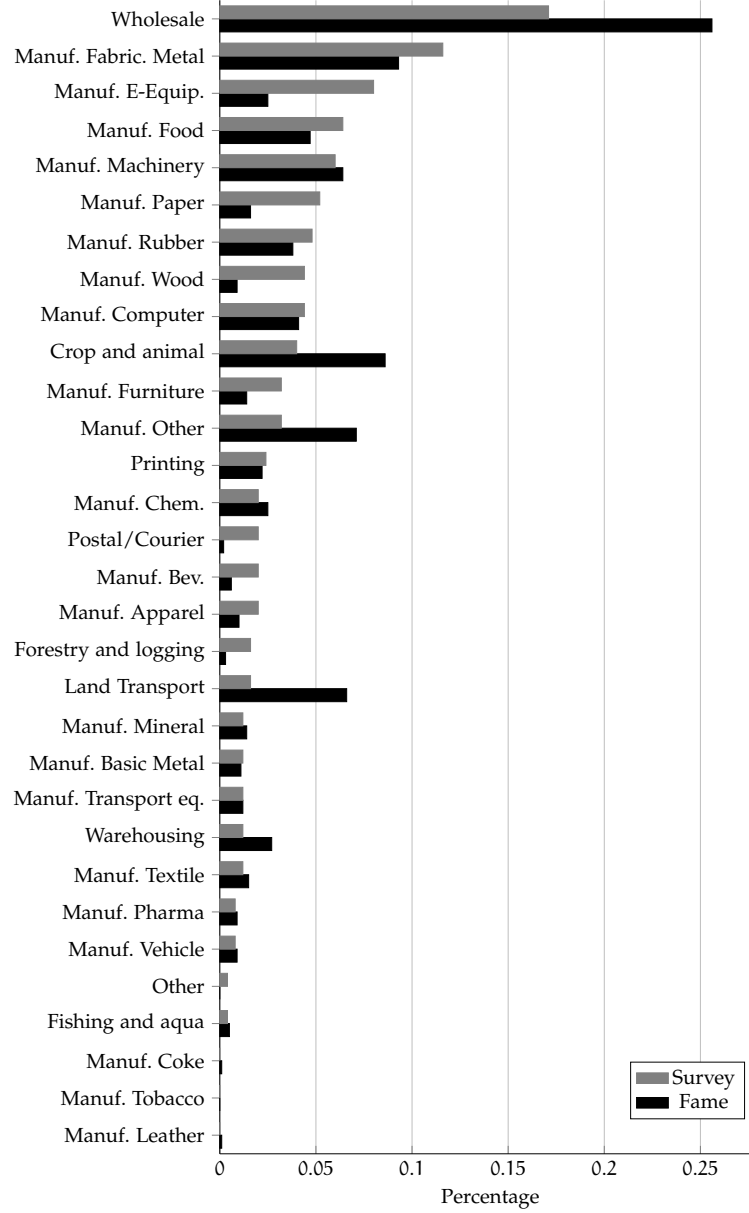
Figure 5.10.: Sectors of respondents vs. sectors of all database entries (n_{survey} = 251, n_{fame} = 22,577)

ees of their firm. This deviation from the definition of SMEs as presen-
ted in table 4.3 might arise from the respondents' considering their
whole (global) company, whereas the sampling in the *Fame* database
(table 4.4) considered only the number of employees at a certain sub-
sidiary. Apart from these two upper values differing from the expec-
ted distribution, the result of the sampling appears very similar to
the *Fame* database's distribution of firms across their number of em-
ployees. The cases with >250 employees have been removed from the
dataset.
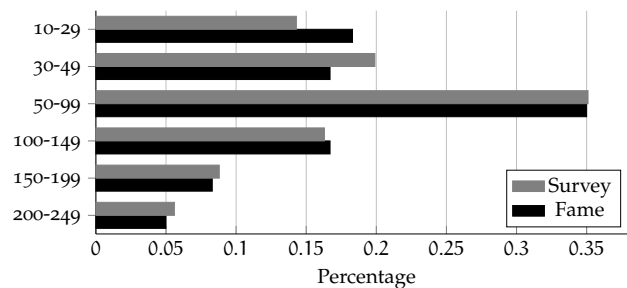
Figure 5.11.: Number of employees of respondents' firms vs. number of em-
ployees of all database entries ($n_{survey} = 251$, $n_{fame} = 14{,}239$)

The job descriptions of the respondents fitted with some exceptions
the distribution of job descriptions of the data as derived from the
Fame database. It stands out that less company secretaries answered
the questionnaire (−6.5%), however more operations managers than
the database would suggest responded to the survey (+5.1%). The
figures of *Managing Director* and *Director* are best interpreted as one
group, as it is suspected that a distinction is often not made by the
participants who were allowed to enter free text for their job descrip-
tion. In total there is still a 9.6% lower participation of directors as
the data from the database would suggest. The reason for that, as it
was communicated via email by some directors, is that often other
employees in the company were more suitable to fill in the question-

naire, based on their responsibilities and knowledge regarding sustainability. Particularly sales people, who deal with the buyers, and employees from the quality assurance departments hence contributed to the questionnaire. The data underlying the graph can be found in table B.8 (page 396).
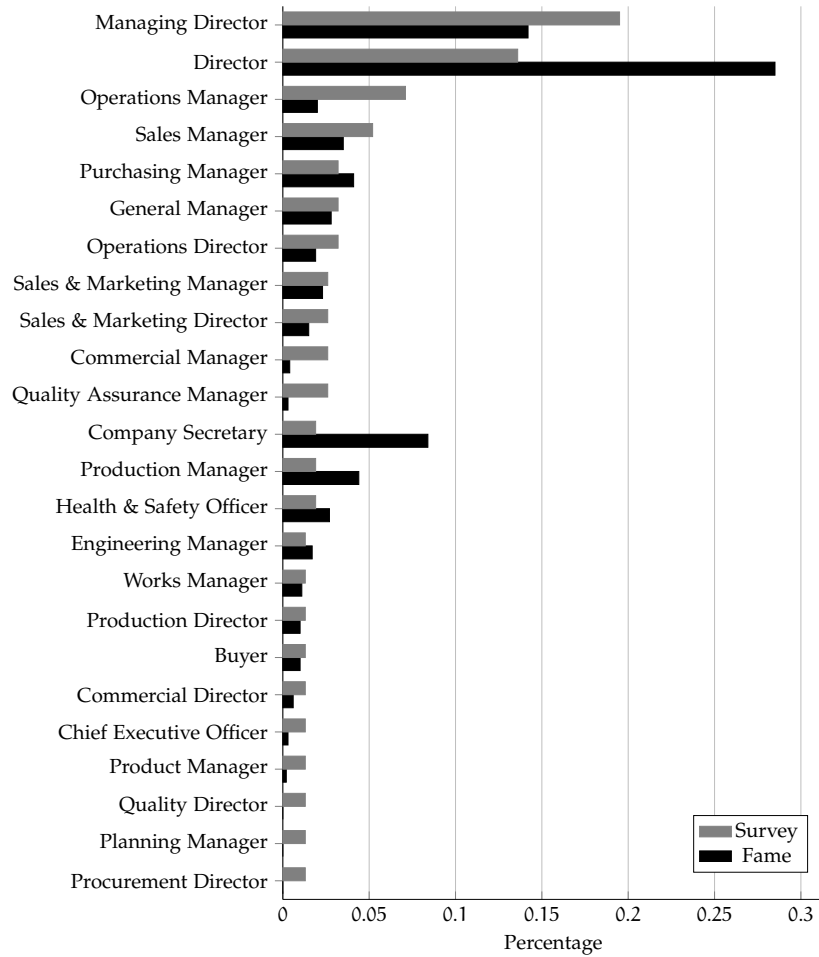
Figure 5.12.: Job description of respondents vs. job description of all database entries (n_{survey} = 154, n_{fame} = 29,021)

Summary 27: Representativeness of sample

The sample represents the considered population to a sufficient extent. Eight cases, which contain answers from larger companies, are excluded. The sample size is 251 observations.

5.3 NORMALITY OF DISTRIBUTION

Normality tests are conducted to find whether there is statistical support for the assumption that the data deviate from the Gaussian distribution. The common tests for normality (e.g. Shapiro-Wilks and Anderson-Darling test) however are susceptible to sample size and are likely to reject the normal assumption with an increasing number of observations. The results of the Shapiro-Wilks and Anderson-Darling test are reported in table B.9 (Appendix B.4.2). The normality tests return significant results for all questions. This means that the null hypothesis (that the data are normally distributed) is rejected. However, in large samples minor outliers already lead to this result in the Anderson-Darling and Shapiro-Wilks test. The Anderson-Darling test "is sensitive to discrepancies at the tails of the distribution" (Anderson and Darling, 1954, p. 765), whereas the Shapiro-Wilks test was created to detect deviations from the normal distribution for sample sizes <50 observations (Royston, 1982).

On the other hand, statistical analysis which requires normally distributed data, such as Analysis of Variance (ANOVA) or linear regression, become more robust against violation of the "normal assumption" with increasing numbers of observations. Hence it is found as most useful to graphically observe the QQ-plots of the related data to see whether there is a worrying non-normal distribution in any of the variables. No concerns regarding the distribution of the data for the further analysis were raised from the interpretation of the QQ-Plots (see appendix C.3).

Furthermore the kurtosis and skewness of the questions about dependence (7a–d) and power (8), as well as the statements measuring

the bases of power (9a–ar), are reported in tables 5.3 and 5.5. Abnormalities of exogenous variables have already been reported and explained in section 5.2.1.

5.4 EMERSON'S POWER-DEPENDENCE RELATION

To find statistical evidence of whether Emerson's (1962) power-dependence relation, which states that one's perceived power is inversely proportional to its dependence, holds, the questions 7a–d (dependence) will be associated with question 8 (power). An overview of the responses recorded for question 8 is given in figure 5.13.
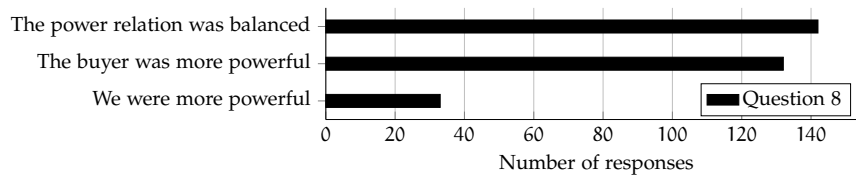
Figure 5.13.: Distribution of the responses to question 8

A graphical representation (figure 5.14) of the means of the questions 7a–d, grouped by the answers to question 8, will give some first indication for the suitability of Emerson's theory of the power-dependence relation in this application.

Figure 5.14 demonstrates clear distinctions between the three groups as derived from Question 8 (*We were more powerful*, *The power relation was balanced* and *The buyer was more powerful*). The respondents who found themselves more powerful than their buyer also rated their dependence fairly low. At the opposite end of the scale, the respondents finding their buyer powerful rated their dependence rather high. In between these two groups lies the group with the balanced power in the buyer-supplier relation. This last mentioned group also rated
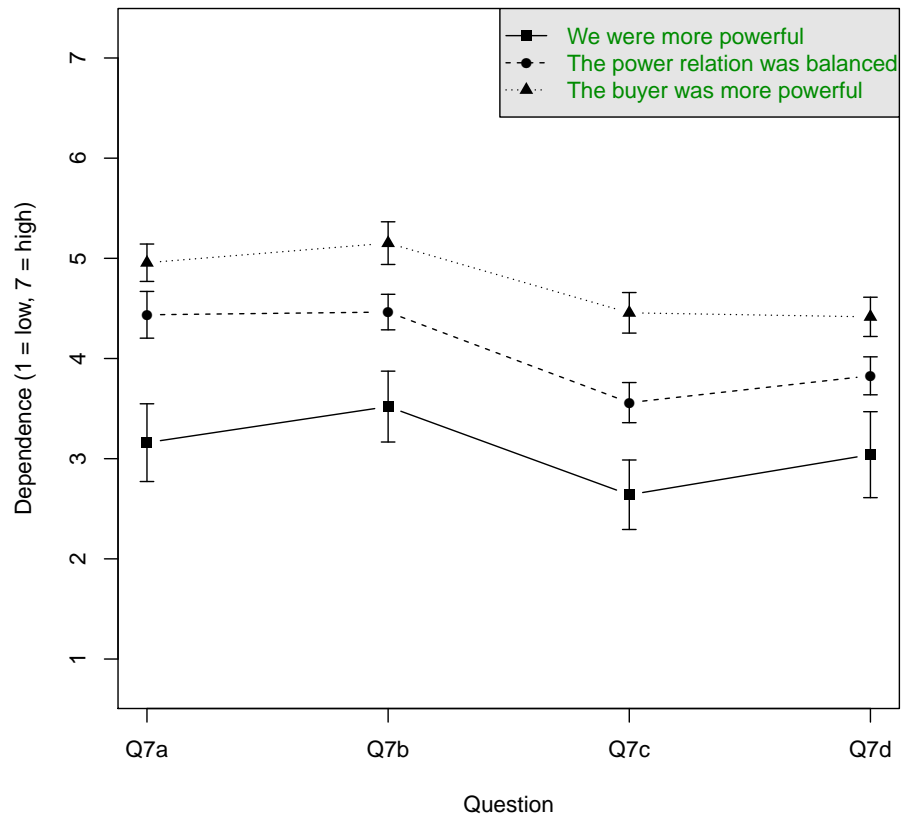
Figure 5.14.: Dependence questions grouped by perceived power. The whiskers represent the 95% confidence interval region (following Revelle (2013b, error.bars.by()-function)). The number of observations per question varies (n_{Q7a} = 249, n_{Q7b} = 247, n_{Q7c} = 248, n_{Q7d} = 248, n_{Q8} = 251).

their dependence as lying between the two other groups. As a result it is concluded that this graphical analysis *does* represent Emerson's power-dependence relation. As a further step, the non-parametric Kruskall-Wallis test will be conducted to test for statistically significant differences among the three groups.

Table 5.6.: Cronbach's α for Questions 7a–d, dependence

	RAW α	STANDARDIZED α	G6(SMC)	AVERAGE r
Dependence	0.89	0.89	0.88	0.68

Table 5.7.: Increase of Cronbach's α for dependence if any of the questions 7a–d is dropped

QUESTION	RAW α	STANDARDIZED α	G6(SMC)	AVERAGE r
7a	0.87	0.87	0.82	0.69
7b	0.85	0.85	0.80	0.66
7c	0.86	0.86	0.82	0.68
7d	0.87	0.87	0.82	0.69

The Kruskall-Wallis test compares the variances of two variables (Kruskal and Wallis, 1952). Therefore one variable for dependence will be created and compared to the ordinal variable *power*. Before creating one variable for question 7 (dependence), the internal reliability of questions 7a–d is determined (table 5.6). A sensitivity analysis (table 5.7) suggests that all exogenous variables should be kept, since no improvement in α can be achieved by dropping any of the variables. The recommendation of Cooksey and Soutar (2006) and Revelle and Zinbarg (2009) is followed: a cluster analysis with the ICLUST algorithm is carried out. The advantage of this method is the test for internal homogeneity (Revelle's β) as well as internal consistency (Cronbach's α). Internal homogeneity measures whether the

cluster under scrutiny (here: dependence) has an "underlying general factor", which is an often neglected precondition for the calculation of Cronbach's α (Cooksey and Soutar, 2006, p. 80). The value for β should be above 0.5 (Revelle, 1979; Rossiter, 2002) before considering the calculation of the internal reliability.
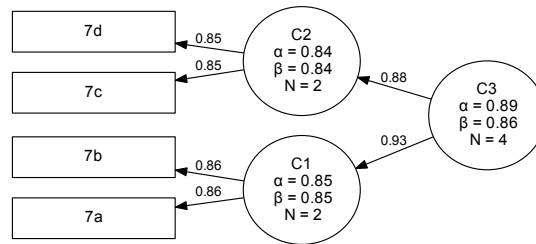
Figure 5.15.: Cluster analysis with the ICLUST algorithm for the four dependence questions

Figure 5.15 shows the intercorrelations between the clusters (ellipsis C1–C3) next to the arrows, and the α and β coefficients of the clusters in the ellipsis. The results show one cluster (C3) out of the four variables (7a–7d) as appropriate, considering α and β. This finding allows the formation of a new variable: *Dependence* (X). The descriptives for the dependence variable are listed in table 5.4.

The newly created variable X, which represents the dependence of the supplier, is then related to the question 8, the power of the supplier. As a graphical representation of this relation, boxplots for each subgroup are plotted. When looking at the boxplots of the subgroups according to answer in question 8, an inverse association as suggested by Emerson (1962) can be observed (figure 5.16). This confirms the result as found in figure 5.14.

Statistical support for the inverse proportionality of power and dependence as it is proposed by Emerson (1962) is delivered by the Kruskal-Wallis test. The Kruskal-Wallis test is chosen instead of a one-way ANOVA due to possible violation of the normality assump-
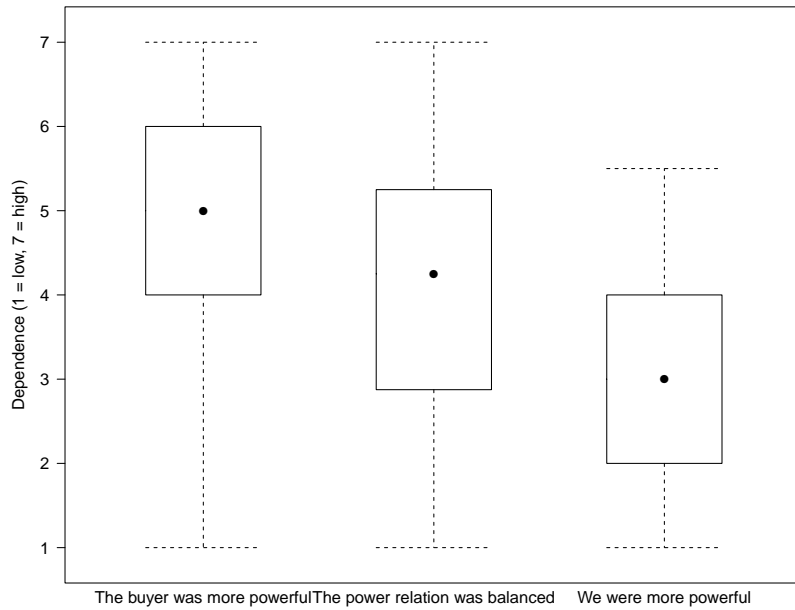
Figure 5.16.: Boxplots of the subgroups according to question 8, power. The number of respondents in each group is, respectively, 114, 112 and 25.

tion. The non-parametric Kruskal-Wallis test is a viable option to test whether the different populations, respondents who find themselves in the three different power categories (powerful, equal, not powerful), are identical. The null hypothesis states that the different answers in question 8, which asks for the perceived power of the respondent, are unrelated to the respondent's answers in questions 7a–d (dependence). The result of the Kruskal-Wallis test is reported in table 5.8. The results indicate a p-value of $p < 0.001$; therefore the null hypotheses is rejected and an association of perceived power to dependence is established. The characteristic of this association can be obtained from figures 5.14 and 5.16.

Table 5.8.: Kruskal-Wallis test for Emerson's power-dependence relation

χ^2	DF	P-VALUE
28.320	2	< 0.001

Considering the significant result of the Kruskal-Wallis test, as well as the graphical representations of the data regarding the relationship between power and dependence, it is concluded that power and dependence are inversely related in the case at hand—following Emerson's (1962) power-dependence relation.

Summary 28: Emerson's theory

Statistical support for an inverse association between a supplier's perceived dependence and power towards its buyer is found.

5.5   SCALE VALIDITY AND RELIABILITY

Figure 4.3b suggests a dichotomization between hard and soft power bases. Different techniques will be applied to test *a*) whether the adapted questionnaire allows the construction of eleven bases of power and *b*) whether the eleven bases of power can be fitted to two second order factors, namely hard and soft. Therefore the subscales for each of the eleven bases of power are tested regarding their internal homogenity and reliability, and new factors are created from these findings. The same process as for the scale measuring *dependence* is applied (page 242). In the next step, the eleven bases are fitted to two latent variables with a Confirmatory Factor Analysis (CFA) model.

As a first step the αs for the sets of statements are reported in table 5.9.

Table 5.9.: Cronbach's α for each subscale with the original four predictors per factor

FACTOR	RAW α	STANDARDIZED α	G6(SMC)	AVERAGE r	MEAN	SD
EX	0.78	0.78	0.74	0.47	3.51	1.18
REF	0.55	0.56	0.51	0.24	4.34	0.93
INP	0.81	0.81	0.77	0.52	4.81	1.21
LED	0.72	0.71	0.68	0.38	4.72	1.06
PRE	0.78	0.78	0.74	0.47	4.19	1.05
LER	0.73	0.73	0.69	0.40	3.32	1.02
ICO	0.71	0.71	0.67	0.38	4.06	1.22
LEQ	0.79	0.79	0.75	0.48	2.69	1.05
IRE	0.60	0.61	0.57	0.28	4.36	1.01
PCO	0.68	0.68	0.63	0.35	4.10	1.05
LEP	0.60	0.60	0.55	0.27	4.19	1.00

Based on the sensitivity analysis of the internal consistency (appendix B.4.4, table B.10), the following statements are marked for pos-

sible exclusion due to an increase in either standardized α or average inter-item correlation:

REF—Q9AA Excluding statement 9aa from Referent Power (REF) increases the internal reliability of the scale by 0.05 (α = 0.55 → 0.60).

ICO—Q9F The exclusion of statement 9f increases not only the α of ICO by 0.05 up to 0.76, but also the average inter-item correlation from 0.38 to 0.51.

IRE—Q9A Removing statement 9a from IRE improves the α (0.61 → 0.67) and the average inter-item correlation of the scale from 0.28 to 0.4.

PCO—Q9W Excluding statement 9w from Personal Coercive Power (PCO) improves the α from 0.68 to 0.73, and the average inter-item correlation from 0.35 to 0.47.

LER—Q9AQ Even though the α is only improved by 0.01 when excluding statement 9aq from the scale for LER, it could be a sensible decision, since the average inter-item correlation increases from 0.4 to 0.48 by doing so.

LEP—Q9T Similarly to the case above, the analysis of the αs and average inter-item correlation for the scale to measure LER suggests that statement 9f should be dropped. By doing so, the α value drops by 0.01; however, the average inter-item correlation improves from 0.27 to 0.39.

To form the eleven variables for the bases of power, not only the α and β values are considered, but also the inter-item correlation of the scales. The statements 9a, 9f, 9t and 9aq were found to have

abnormalities in their descriptive statistics (see section 5.2.3), which are now confirmed through this further test.

The outcome of the `iclust` analysis is displayed in figure 5.17. For a further overview of how the statements compare within each group (base of power), boxplots were printed. The 44 boxplots grouped into eleven bases of power can be found in appendix C.1, page 406.

(a) Expert power

(b) Referent power

(c) Informational power

(d) Legitimate power of dependence

(e) Personal reward power

(f) Legitimate power of reciprocity

(g) Impersonal coercive power

(h) Legitimate power of equity

(i) Impersonal reward power

(j) Personal coercive power

(k) Legitimate power of position
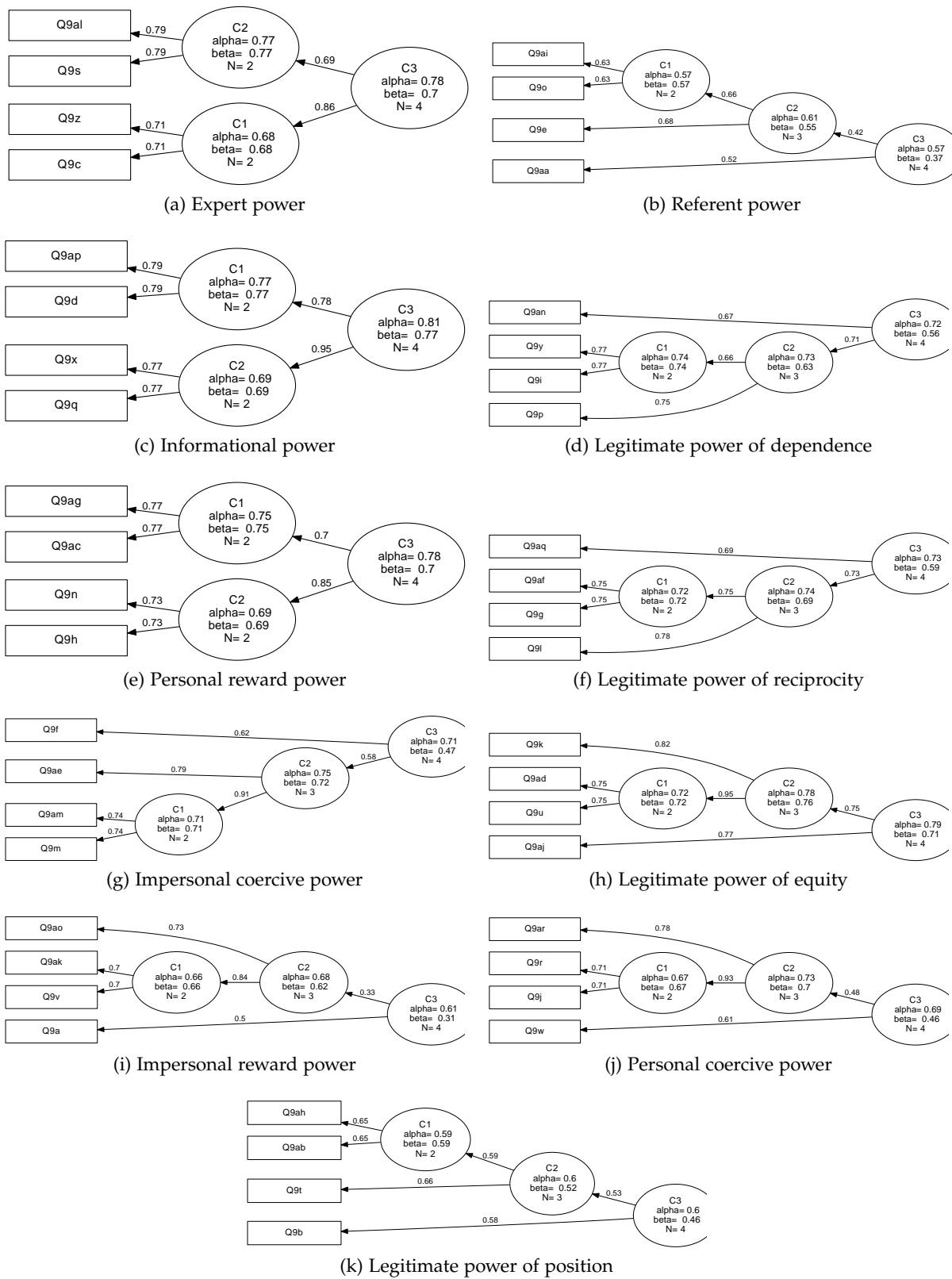
Figure 5.17.: ICLUST analysis to test the reliability of the scale for the determination of the eleven power bases.

The `iclust` analysis suggests removing even more statements whilst considering Revelle's (1979) β for internal homogeneity as well as Cronbach's (1951) α for internal reliability. An overview of which scale items were suggested for removal by this method follows. The items with an asterisk are in accordance with the above analysis of α and average inter-item correlation.

REF—Q9AA* Exclusion of statement 9aa increases α (0.56 → 0.6) and β (0.35 → 0.55).

LED—Q9AN, Q9P Exclusion of statement 9an increases α (0.71 → 0.72) and β (0.56 → 0.62), further dropping statement 9p increases α (0.72 → 0.74) and β (0.62 → 0.74). The dropping of items on this scale was not considered in the analysis before, due to the small gain of Cronbach's α. The decision is made to keep Q9p due to a acceptable α with three predictors.

LER—Q9AQ* Exclusion of statement 9aq increases α (0.73 → 0.74) and β (0.59 → 0.68).

ICO—Q9F* Exclusion of statement 9f increases α (0.71 → 0.76) and β (0.46 → 0.73).

LEQ—Q9AJ Exclusion of statement 9aj decreases α slightly (0.79 → 0.78) and increases β (0.7 → 0.76). Also the average inter-item correlation increases slightly from 0.48 to 0.53 (see table B.10).

IRE—Q9A* Exclusion of statement 9a increases α (0.61 → 0.67) and β (0.33 → 0.6).

PCO—Q9W* Exclusion of statement 9w increases α (0.68 → 0.73) and β (0.44 → 0.71).

LEP—Q9T*, Q9B Exclusion of statement 9b decreases α slightly (0.6 → 0.59) whilst β increases (0.47 → 0.51). Further, the exclusion

of statement 9t would increase α back to its initial value (0.59 $\rightarrow$ 0.6) while increasing β once again (0.51 $\rightarrow$ 0.6). However, since it was intended to keep at least three predictors, the last transformation (excluding Q9b) was not considered.

The application of the criteria as defined above yields the factors with the reliability and number of predictors as described in table 5.10 (page 254). In recent publications, Cronbach's α alone was found to be an inappropriate measure to determine the internal scale consistency and unidimensionality (Sijtsma, 2008); therefore further analysis of the measurement instrument needs to be undertaken. An overview of the distribution of the remaining 36 statements grouped by the base of power is available as a boxplot in figure C.2 (appendix C.2, page 408).

Since the questionnaire had been altered – and even the original publication of Raven et al. (1998) reduced the dimension of the power bases – a further test was conducted to detect whether a, 11-factor solution was the best option. The statistical method of choice was EFA (Norris and Lecavalier, 2010). As discussed by several authors, defining the number of factors in an EFA can be done in various ways (Cattell, 1966; Fabrigar et al., 1999; Kaiser, 1960; Velicer, 1976). Following the procedure as proposed in section 4.10.4, the number of factors was gauged by a parallel factor analysis (Horn, 1965)[6] and a

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6 "Parallel Analysis is a Monte Carlo simulation technique that aids researchers in determining the number of factors to retain in Principal Component and Exploratory Factor Analysis. This method provides a superior alternative to other techniques that are commonly used for the same purpose, such as the Scree test or the Kaiser's eigenvalue-greater-than-one rule. Nevertheless, Parallel Analysis is not well known among researchers, in part because it is not included as an analysis option in the most popular statistical packages."   Ledesma and Valero-Mora (2007, p. 1)

Listing 5.1: Result of the VSS analysis

```
Very Simple Structure
Call: VSS(x = total1, n = 11, rotate = "promax", diagonal =
    TRUE, fm = "mle")
VSS complexity 1 achieves a maximimum of 0.81  with  1  factors
VSS complexity 2 achieves a maximimum of 0.71  with  2  factors

The Velicer MAP criterion achieves a minimum of 0.01  with  6
    factors

Velicer MAP
 [1] 0.03 0.02 0.02 0.01 0.01 0.01 0.01 0.02 0.02 0.02 0.02

Very Simple Structure Complexity 1
 [1] 0.81 0.60 0.50 0.51 0.42 0.32 0.31 0.16 0.30 0.23 0.23

Very Simple Structure Complexity 2
 [1] 0.00 0.71 0.63 0.59 0.53 0.52 0.51 0.09 0.30 0.26 0.29
```

VSS analysis[7] whilst making sure that the detected structure remains sound with the underlying theory.

The VSS analysis suggests one or two factors. Both results can be interpreted. The one-factor solution can be understood as the common factor being power, whereas the two-factor solution can be understood as the dichotomization between soft and hard. However, since a further distinction between the different bases of power is desired, other criteria for the determination of the number of factors are looked at as well. The Velicer Minimum Average Partial (MAP) criterion (Velicer, 1976) suggests splitting the data into six factors, even though the result is not very clear. The results in listing 5.1 demonstrate that the MAP is very low between four and seven factors; similarly, the VSS structure leaves room for interpretation (see also listing 5.1 and graphical in figure 5.18).

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7 "The number of factors which maximizes the VSS criterion is taken as being the optimal number of factors to extract."   Revelle and Rocklin (1979, p. 403)
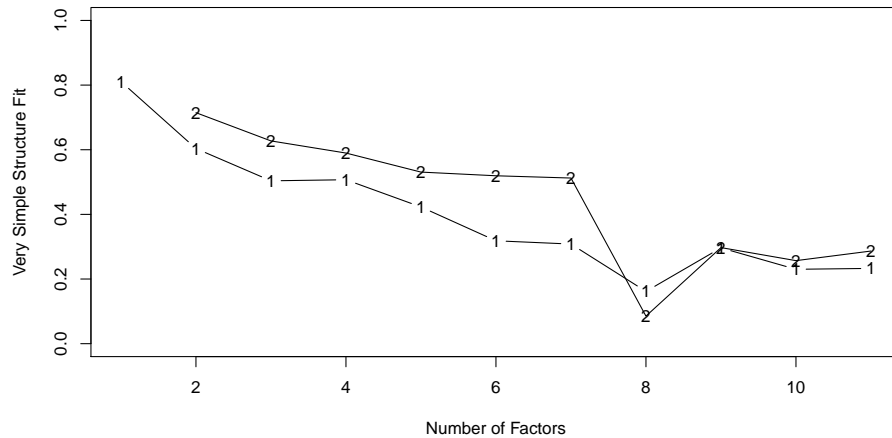
Figure 5.18.: VSS plot of the 36 remaining statements determining the bases of power

The polychoric parallel factor analysis (Holgado-Tello et al., 2010), which compares the eigenvalues of the correlation matrix of the supplied data to random data, suggests seven factors or five components. As a further test, the Bayesian Information Criterion (BIC) of EFAs from two to thirteen factors is compared and found to be lowest at a five-factor solution. A factor analysis is then run for a seven- and a five-factor solution, to determine which results remains interpretable within the underlying context. Only the five-factor solution returned an understandable solution. The cumulative variance explained by the five factors is 46% (a seven-factor solution achieved 52% and an eleven-factor solution achieved 59%).

The newly derived factors are:

COLLABORATIVE POWER (CP) Informational power, legitimate power of dependence and impersonal rewards power

PERSONAL SANCTIONS (PS) Referent power, personal reward power and personal coercion

EQUALIZING POWER (EQ) Legitimate power of equity and legitimate power of reciprocity

Listing 5.2: Result of the factor analysis

```
Factor analysis with Call: fa(r = total1, nfactors = 5, rotate =
    "oblimin", scores = "regression",
    fm = "ml")


Test of the hypothesis that 5 factors are sufficient.
The degrees of freedom for the model is 460  and the objective
    function was  4.05
The number of observations was  251  with Chi Square =  947.53
    with prob <  5.1e-36


The root mean square of the residuals (RMSA) is  0.05
The df corrected root mean square of the residuals is  0.07


Tucker Lewis Index of factoring reliability =  0.815
RMSEA index =  0.069  and the 90 % confidence intervals are
    0.059 0.071
BIC =  -1594.17
 With factor correlations of
     ML1  ML3  ML2  ML4  ML5
ML1 1.00 0.39 0.06 0.00 0.38
ML3 0.39 1.00 0.25 0.21 0.25
ML2 0.06 0.25 1.00 0.20 0.15
ML4 0.00 0.21 0.20 1.00 0.16
ML5 0.38 0.25 0.15 0.16 1.00
```

IMPERSONAL SANCTIONS (IS) Impersonal coercion and legitimate
power of position

EXPERT POWER (EX) Expert power

The newly determined categorization can still be dichotomized into hard and soft power bases. This hard and soft dichotomization (considering all eleven underlying power bases individually) remains as declared in table 5.10. The summary of the factor analysis is presented in listing 5.2.

A CFA with the lavaan package in R (Rosseel, 2012) comparing the three models was conducted to observe whether the method of improving the scale reliability as described above had an impact on the overall measurement model. The three models are: *a*) 44 predictors for

Table 5.10.: Factor loadings for power base items. The dichotomization of the the factors stands for hard or soft (respectively H and S). Hard or soft in brackets indicates that the dichotomization was changed from the original group (in brackets) to the other group. Only factors on which the literature disagrees, as regards the groups, were changed.

FACTOR	CONTENT	DICHOTOMIZATION	INDI-VIDUAL α	ITEM	LOADINGS	COM-BINED α
	INP	S	0.81	Q9d	0.75	
				Q9q	0.68	
				Q9x	0.73	
				Q9ap	0.74	
CP	LED	S	0.73	Q9i	0.50	0.86
				Q9p	0.49	
				Q9y	0.69	
	IRE	(H) S	0.68	Q9v	0.38	
				Q9ak	0.41	
				Q9ao	0.44	
	REF	(S) H	0.61	Q9e	< 0.30	
				Q9o	0.62	
				Q9ai	0.39	
PS	PRE	(S) H	0.78	Q9h	0.65	0.87
				Q9n	0.79	
				Q9ac	0.32	
				Q9ag	0.39	
	PCO	H	0.73	Q9j	0.72	
				Q9r	0.58	
				Q9ar	0.51	
	LEQ	H	0.78	Q9k	0.74	
				Q9u	0.63	
EQ				Q9ad	0.65	0.81
	LER	H	0.74	Q9g	0.49	
				Q9l	0.46	
				Q9af	0.57	
	ICO	H	0.75	Q9m	0.66	
				Q9ae	0.67	
IS				Q9am	0.62	0.72
	LEP	H	0.58	Q9b	0.49	
				Q9ab	< 0.30	
				Q9ah	0.33	
				Q9c	0.38	
EX	EX	S	0.78	Q9s	0.67	0.78
				Q9z	0.38	
				Q9al	0.72	

11 factors (*Model 44-11*), *b*) 36 predictors for 11 factors (*Model 36-11*) and *c*) 36 predictors for 5 factors (*Model 36-5*). Table 5.11 indicates in the column ΔBIC a distinct improvement in the model when omitting the eight statements as determined above. A further improvement can be observed in *Model 36-5*, which uses five bases of power as suggested by the EFA, instead of eleven bases as suggested by the literature.

Table 5.11.: Goodness-of-fit indices for model 1 (four predictors for each of the eleven bases of power), model 2 (three bases predicted by four predictors, eight bases predicted by three predictors) and model 3 (5 latent variables as suggested by EFA)

| MODEL | χ^2 | P | DF | CFI | TLI | RMSEA | 90%CI | | SRMR | BIC | ΔBIC |
							LOWER	UPPER			
44-11	2029	< 0.000	854	0.677	0.642	0.074	0.070	0.078	0.146	37341	0
36-11	1357	< 0.000	546	0.730	0.688	0.077	0.072	0.081	0.154	30465	6876
36-5	1136	< 0.000	567	0.811	0.789	0.063	0.058	0.068	0.092	30075	7266

5.6   DICHOTOMIZATION

To deliver results comparable to past research based on French Jr. and Raven's (1959) work, the categorization of the eleven bases of power was kept, and two variables for hard and soft power were built from those. In order to build the two mediators as suggested in figure 4.3b, the mean values of the eleven bases of power used to predict the latent factors hard and soft according to the dichotomization in table 5.10 were taken. The fit of this model is reported in table 5.12. A graphical representation of the model and its estimates can be found in figure 5.19.

Table 5.12.: Goodness-of-fit indices for the latent factor model including hard and soft dichotomization

MODEL	χ^2	P	D.F.	CFI	TLI	RMSEA	90%CI LOWER	UPPER	SRMR
Dichotomization	79	< 0.000	35	0.947	0.917	0.071	0.052	0.089	0.053

5.7   MEDIATION MODEL

The CFA model for the hard and soft dichotomization allows prediction for the variables *soft* and *hard*. The remaining variables in the mediation model as presented in figure 4.3b—*dependence* and *adaptation*—are exogenous. The descriptives for the four variables in the mediation model are reported in table 5.15.

The CFA is based on the recommendation of Brown (2006) that an underlying theory precedes the analysis, rather than just following regression coefficients. This theory is the hard and soft dichotomiz-

(a) Latent factor model   (b) Standardized path estimates
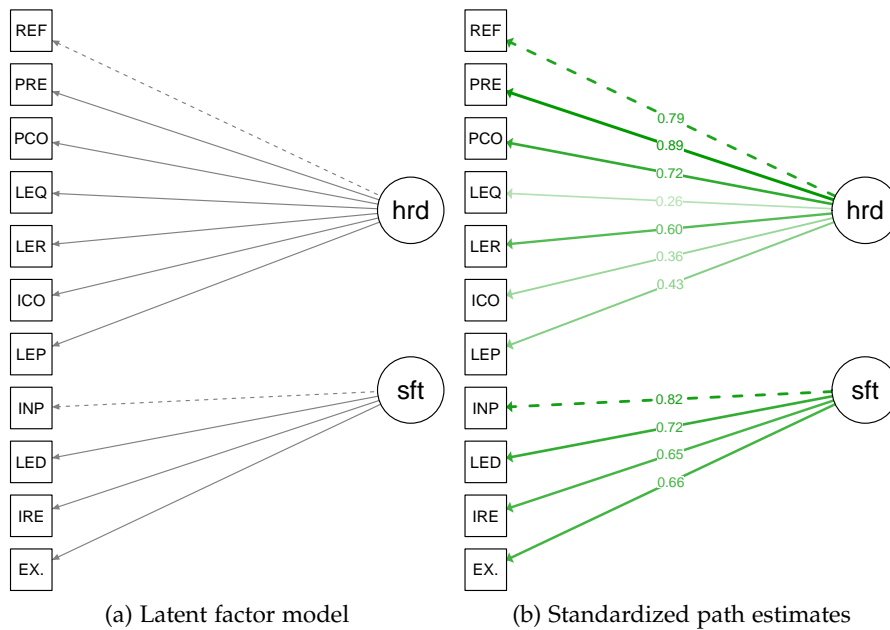
Figure 5.19.: Latent factor model and standardized estimates for the dichotomization and subsequent mediating variables

ation of the bases of power as introduced by French Jr. and Raven (1959) and applied in most research thereafter.

To ensure discriminant validity of the eleven factors, the factor correlations are printed in table 5.13 and the estimates of the factors on the latent variables in table 5.14. Following Brown's (2006) recommendations for discriminant validity, all factors are retained for the subsequent CFA.[8]

In the context of the social sciences, different approaches to mediation analysis are debated. In order to triangulate the results, four different approaches to measure mediation are attempted: *a*) the 3/4 step solution as suggested by David Kenny (Kenny, 2012); *b*) a SEM approach as recommended by Yves Roseel (Rosseel, 2012, 2013); *c*) Hayes and Preacher's method with their proprietary SPSS macro (Preacher

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8 "In applied research, a factor correlation that exceeds .80 or .85 is often used as the criterion to define poor discriminant validity."   Brown (2006, p. 131)

Table 5.13.: Factor correlations of the eleven bases of power as used for the prediction of variables *soft* and *hard*

	MEAN	SD	INP.P	LED.P	IRE.P	REF.P	PRE.P	PCO.P	LEQ.P	LER.P	ICO.P	LEP.P
INP.p	4.79	1.21										
LED.p	4.52	1.21	0.64***									
IRE.p	4.60	1.14	0.53***	0.38***								
REF.p	4.19	1.04	0.48***	0.43***	0.46***							
PRE.p	4.18	1.06	0.45***	0.48***	0.52***	0.69***						
PCO.p	4.14	1.19	0.24***	0.29***	0.34***	0.56***	0.66***					
LEQ.p	2.65	1.14	−0.02	0.11	0.08	0.11	0.22***	0.16*				
LER.p	3.53	1.15	0.24***	0.25***	0.32***	0.42***	0.57***	0.40***	0.51***			
ICO.p	3.81	1.37	0.04	0.11	0.31***	0.19**	0.25***	0.43***	0.39***	0.32***		
LEP.p	4.64	1.09	0.31***	0.28***	0.31***	0.45***	0.31***	0.35***	0.06	0.09	0.37***	
EX.p	3.52	1.18	0.54***	0.43***	0.41***	0.52***	0.45***	0.30***	0.15*	0.28***	0.07	0.27***

*$p < .05$, **$p < .01$, ***$p < .001$ (two-tailed)

Table 5.14.: Convergent and discriminant validity for hard and soft power

BASE	SOFT	HARD
INP.p	−0.02	**0.903**
LED.p	0.143	**0.628**
IRE.p	0.347	**0.418**
EX.p	0.23	**0.502**
REF.p	**0.595**	0.298
PRE.p	**0.761**	0.183
PCO.p	**0.792**	−0.07
LEQ.p	**0.458**	−0.239
LER.p	**0.667**	−0.064
ICO.p	**0.56**	−0.211
LEP.p	**0.304**	0.242

Note: Convergent validities are printed in bold type.

Table 5.15.: Descriptive statistics for the all variables used in the mediation
model (n=251)

	MEAN	SD	MEDIAN	TRIMMED	MAD	MIN	MAX	SKEW	KURTOSIS	SE
Dependence	4.29	1.55	4.50	4.33	1.85	1.00	7.00	−0.26	−0.85	0.10
Soft	3.70	0.91	3.79	3.74	0.86	0.61	6.01	−0.50	0.15	0.06
Hard	3.20	0.76	3.25	3.22	0.70	0.63	5.02	−0.35	0.20	0.05
Adapt	0.77	0.42	1.00	0.84	0.00	0.00	1.00	−1.27	−0.39	0.03

and Hayes, 2004); and *d*) the counterfactual method of Tingley et al.

(2013), which allows nonlinear and nonparametric relationships (Imai

et al., 2010, 2011).

5.7.1   *The Baron and Kenny method*

Baron and Kenny suggest four steps to follow in order to establish mediation.

STEP 1:   The independent variable (*dependence*) and the outcome variable (*adapt*) will be correlated. In the case at hand, this correlation is tested with a logistic regression since the outcome variable is dichotomous, that is, yes or no (1/0). This estimate is understood as *total effect*, or path c.

STEP 2:   A correlation between the input variable and the mediators is tested. Therefore a linear regression between the independent variable and both mediators is computed separately. These paths are named respectively a_1 and a_2 and represent the first part of the two *indirect effects* (respectively $a_1 \cdot b_1$ and $a_2 \cdot b_2$).

STEP 3:   The correlations between either mediator and the outcome variable is tested. Similar to the first step, this is done with a logistic regression. The results of this test represent the paths b_1 and b_2 and stand for the second part of the two *indirect effects*.

STEP 4:   The last step is to establish complete mediation as opposed to partial mediation. Complete mediation is found when the *direct effect* (path c') is zero. Partial mediation is found if the direct effect still exists whilst controlling for the indirect effects. However, its estimate is lower than the estimate of the total effect.

Table 5.16.: Mediation analysis according to Baron and Kenny

PARAMETER	ESTIMATE	STD. ERROR	t VALUE	$Pr(>|t|)$
Path a_1	0.142	0.037	3.895	< 0.000
Path a_2	0.159	0.038	4.231	< 0.000
Path b_1	1.975	0.362	5.452	< 0.000
Path b_2	−0.908	0.339	−2.680	0.007
Path c (total effect)	0.170	0.097	1.757	0.079
Path c' (direct effect)	0.065	0.112	0.575	0.565
Indirect soft[*]	0.281	0.089	3.172	0.002
Indirect hard[*]	−0.144	0.062	−2.311	0.021

[*] Test statistic, standard error and p-value calculated with Sobel test (Sobel, 1982) as recommended by Kenny (2012).

The results of the Baron and Kenny method are listed in table 5.16. The total effect c exists; however, it is not significant at $p \leqslant 0.05$. This does not affect the analysis for two reasons:

a) David Kenny[9] suggests focusing on the effect size rather than the significance:

> Note that the steps are stated in terms of zero and nonzero coefficients, not in terms of statistical significance, as they were in Baron and Kenny (1986). Because trivially small coefficients can be statistically significant with large sample sizes and very large coefficients can be nonsignificant with small sample sizes, the steps should not be defined in terms of statistical significance.

b) Further recent discussions have led to the idea that the first step of Baron and Kenny's method is not necessary to establish mediation (e.g. Hayes, 2009; Zhao et al., 2010).

The R code presented in listing B.1 (page 400) is used to determine mediation according to Baron and Kenny's (1986) method.

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9 `http://davidakenny.net/cm/mediate.htm`

The results from table 5.16 show a decrease in path c' compared to c (direct effect < total effect), which means that some of the effect of the independent variable on the output variable is mediated. The coefficients *and* statistical significance of mediating paths $a_1 \cdot b_1$ and $a_2 \cdot b_2$ show a mediation of the effect in both pathways. The indirect effect of *hard* on *adapt*, represented through path $a_2 \cdot b_2$, is negative whereas the indirect of *soft* on *adapt* is positive.

Summary 29: Baron and Kenny Analysis

The mediation analysis according to Baron and Kenny's method delivers statistical support to suggest that the adaptive behaviour towards sustainability of a supplier not only depends on its dependence on its buyer, but is promoted through the existence of soft power bases. Hard power bases suppress adaptive behaviour towards sustainability initiatives under the same conditions.

5.7.2 *The SEM method*

The same model as in section 5.7.1 was tested with the path modelling library `lavaan` (Rosseel, 2012) for `R` (R Core Team, 2013). The code presented in listing B.2 (page 400) serves as a construction for the mediation model.

The path model as proposed in listing B.2 delivers the results as described in table 5.17. These results are in line with the Baron and Kenny method (see table 5.16).

Table 5.17.: Mediation analysis with path analysis package Lavaan

PARAMETER	ESTIMATE	STD. ERROR	Z-VALUE	P(>|z|)
Path a_1	0.158	0.041	3.828	< 0.001
Path a_2	0.218	0.036	6.133	< 0.001
Path b_1	0.957	0.174	5.509	< 0.001
Path b_2	−0.345	0.170	−2.029	0.042
Path c (total effect)	0.099	0.056	1.760	0.078
Path c′ (direct effect)	0.023	0.055	0.419	0.676
Indirect Soft	0.151	0.046	3.306	0.001
Indirect Hard	−0.075	0.038	−1.969	0.049

Table 5.17 suggests mediation through the pathway of the mediator *soft*. This derives from the positive estimates *and* significant p-values for the paths a_1 and b_1, as well as the significant positive score of the parameter *Indirect Soft*. Whilst a supplier's dependence is still positively correlated to experiencing hard power bases (even more than soft power bases, resp. 0.267 vs. 0.184), only a negative relation between adaptive behaviour and hard power bases is observed (path b2). Hence due to the opposite impact of the two indirect paths, the total effect appeared not significant.

Summary 30: Pathmodel analysis

The mediation analysis according with the path model method delivers statistical support that the adaptive behaviour towards sustainability of a supplier does not directly depend on its dependence on its buyer, but is promoted through the existence of soft power bases. Hard power bases are found to have a significant negative impact on adaptive behaviour towards sustainability initiatives under the same conditions.

5.7.3 Hayes' PROCESS

Despite the development of SEM path modelling for mediation models, a method as proposed by Preacher and Hayes (2004) has gained popularity due to its simplicity. Preacher and Hayes offer a SPSS plugin called PROCESS which calculates total effects, direct effects and bootstrapped indirect effects for a mediation model with a certain structure. For validation purposes, the data for the four variables were fed into the software and the outcome is presented in table 5.18.

Table 5.18.: Mediation analysis with Hayes' SPSS plugin PROCESS

PARAMETER	ESTIMATE	STD. ERROR	t/Z	P
Path a_1	0.141	0.036	3.898^t	0.001
Path a_2	0.127	0.030	4.231^t	< 0.001
Path b_1	1.990	0.365	5.452^Z	< 0.001
Path b_2	−1.131	0.422	-2.680^Z	0.007
Path c (total effect)	0.170	0.097	1.757^Z	0.079
Path c' (direct effect)	0.065	0.112	0.575^Z	0.565
Indirect Soft	0.281	0.103		< 0.05
Indirect Hard	−0.144	0.072		< 0.05

^{t} t-statistics ^{Z} Z-statistics

Table 5.18 replicates the findings from the path analysis (table 5.17) and the Baron and Kenny method (table 5.16), even though the magnitudes of the estimates differ. However, the implications remain the same, in that the indirect path via the mediator *soft* is significant and positive (0.281, 95% Confidence Interval (CI) 0.118, 0.518) and hence experiencing soft power bases contributes to the adaptive behaviour of a supplier towards sustainability initiatives. The effects via the mediator *hard* are significant at a 95 percent confidence interval (−0.144, 95% CI −0.322, −0.040) and hinder the adaptive behaviour of a sup-

plier towards the implementation of a buyer-requested sustainability initiative.

> **Summary 31: Hayes's SPSS macro**
>
> The mediation analysis with the proprietary macro `PROCESS` delivers results which support the path analysis and the four-step Baron & Kenny approach.

5.7.4   *The counterfactual method*

Since mediation, in particular with binary outcome variables and more than one mediator, is still an active research topic amongst statisticians (Imai and Yamamoto, 2013; Imai et al., 2011), a further analysis as recommended in conversations with specialists in the field was conducted.[10] This analysis was conducted with the help of the `mediation` library as introduced by Imai et al. (2010). This method gives further insight into whether the observed effects are significant. Both indirect effects (via mediator *soft* and *hard*) were calculated separately by feeding a linear model regressing the mediators on the input variable (called *treat* in this method) and a probit model for the binary outcome variable to the `mediate()` algorithm. The results of the analysis are presented in tables 5.19 and 5.20.

Table 5.19.: Results for counterfactual mediation analysis for the mediator *soft*

	ESTIMATE	90%CI		P-VALUE
		LOWER	UPPER	
ACME (treated)	0.042	0.017	0.065	< 0.00
ADE (treated)	0.008	−0.020	0.042	0.55
Total Effect	0.051	0.009	0.087	0.01
Prop. Mediated (treated)	0.840	0.407	2.672	0.01
ACME (average)	0.042	0.017	0.065	< 0.00
ADE (average)	0.008	−0.021	0.042	0.55
Prop. Mediated (average)	0.840	0.406	2.646	0.01

Tables 5.19 and 5.20 represent the estimates of the mediation analysis and the respective confidence intervals based on nonparamet-

---

10 Dr. Phillip Parker, Centre for Positive Psychology and Education, University of Western Sydney; Dr. Jeremy N. V. Miles, RAND Corporation; Prof. Dr. Yves Rosseel, Department of Data Analysis, Ghent University

Table 5.20.: Results for counterfactual mediation analysis for the mediator *hard*

	ESTIMATE	90%CI		P-VALUE
		LOWER	UPPER	
ACME (treated)	−0.015	−0.026	−0.004	0.01
ADE (treated)	0.006	−0.013	0.035	0.61
Total Effect	−0.009	−0.026	0.020	0.51
Prop. Mediated (treated)	1.613	−11.196	11.189	0.51
ACME (average)	−0.015	−0.027	−0.004	0.01
ADE (average)	0.006	−0.012	0.034	0.61
Prop. Mediated (average)	1.627	−11.397	11.352	0.51

ric bootstrap with 5000 simulations. The Average Causal Mediated Effects (ACMEs), which stands for the indirect effects, are significant for both mediators, since the confidence intervals do not include 0. The ACME for the mediator *hard* is significant with a negative estimate. This points towards a causal mediation not only via soft power bases, which are found to promote adaptive behaviour towards sustainability, but also through the pathway of hard power bases which are found to have a negative impact on the same adaptive behaviour. Similar to the other methods of analysis, statistical evidence for a causal mediation through both pathways was found. The Average Direct Effect (ADE) is almost similar for both mediators, since whilst conducting the analysis for mediator *soft* the algorithm controls for *hard*, and the other way around. ADE is not significant, which is in line with the findings from all other previous analysis.

The graphical output of the `mediation` library (figure 5.20) replicates the findings from tables 5.19 and 5.20 in a condensed format. Figure 5.20a shows a positive and statistically significant estimate for the ACME with *soft* power bases as a mediator figure 5.20b displays

a negative, statistically significant estimate for the ACME with *hard* power bases as a mediator. The ADE is not significant and is similar for both models. This direct effect is also known as c' in the path model analysis or in the Baron and Kenny method. The total effect, which is the sum of the direct effect and the indirect effect, is significant when considering soft power bases as a mediator; however, it is not significant when considering hard power bases as a mediator. This finding is in line with the former analysis.

(a) Mediation effects for mediator *soft*

(b) Mediation effects for mediator *hard*
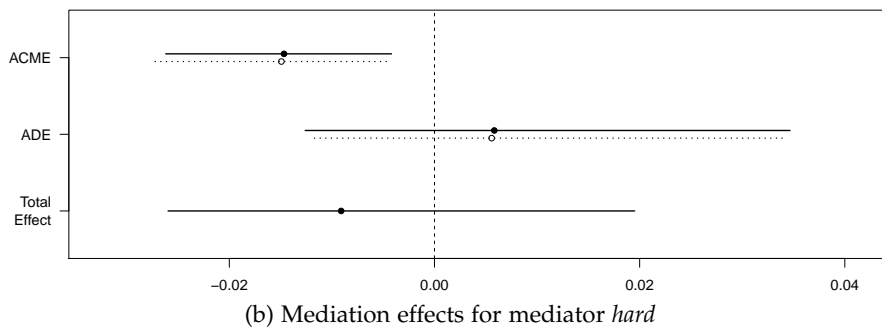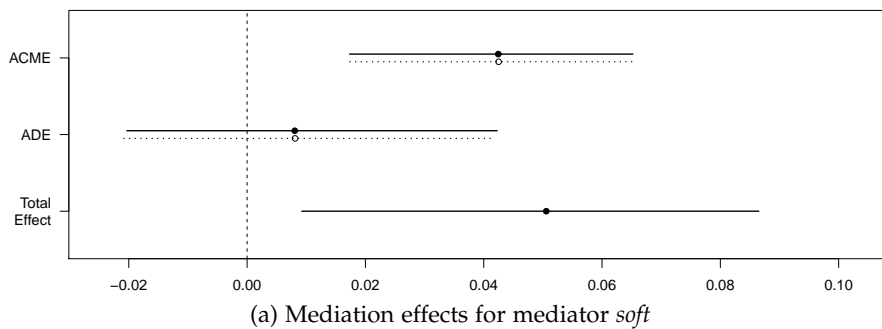
Figure 5.20.: Mediation effects with bootstrapped confidence intervals for each mediator as derived by the `mediation` library in R.

The R code presented in listing B.3 (page 401) is used to determine mediation according to Imai et al.'s (2011) method.

Summary 32: Counterfactual Analysis

The mediation analysis according to Imai et al.'s (2011) method delivers statistical support that the adaptive behaviour towards sustainability of a supplier not only depends on the dependence on its buyer, but is mediated through the existence of soft power bases. Hard power bases suppress adaptive behaviour towards sustainability initiatives under the same conditions.

5.7.5   *Summary and comparison of the mediation results*

The different available approaches to mediation analysis deliver inconsistent estimation coefficients. This is mainly due to the binary outcome of the model, since mediation models with ordinary or binary outcomes are an active research area and various approaches for the estimators are used.

In table 5.21 a comparison of all modelling approaches is displayed. One can observe that the estimates vary; however, the interpretation of the estimates leads to very similar results. The column **+/-/0** indicates whether the estimates for the indirect paths have a positive, negative or non-significant effect on the outcome variable. To determine whether mediation happens, the indirect effects need to be significant and the estimate of the direct effect must be lower than the total effect. A direct effect of 0 would indicate an ideal case of full mediation.

The first three modelling approaches return only one total effect $(c + (a_1 \cdot b_1) + (a_2 \cdot b_2))$, which is computed including both indirect effects as well as the direct effect ($a_1 \cdot b_1$ and $a_2 \cdot b_2$ based on MacKinnon et al., 2007). The newest method as introduced by Imai

et al. (2010) returns a total effect for a mediation model with *soft* as a mediator and a total effect for a mediation model with *hard* as a mediator. Table 5.21 shows that all approaches agree on mediation through the proposed mediators. To summarize the findings, the following key points are taken away from the analysis:

- All modelling approaches agree that the indirect effect via mediator *soft* is *positive* and significant.

- All modelling approaches agree that the indirect effect via mediator *hard* is *negative* and significant.

- All modelling approaches agree that the total effect of the mediation model is larger than the direct effect of dependence on adaptation.

- The modelling approaches from sections 5.7.1 to 5.7.3 and the soft model of section 5.7.4 find the total effect (mediated model) statistically significant at $p < 0.05$, whereas the direct effect of dependence on adaptation is found not significant.

Figure 5.21 provides a graphical overview of the findings. The estimates and the standardized estimates are taken from the path model analysis as described in section 5.7.2.

Summary 33: Mediation

Statistical support for positive mediation of the effect of a supplier's dependence on its adaptive behaviour towards a buyer-requested sustainability initiative through the mediator *soft power bases* is found. Furthermore, the mediator *hard power bases* is found to have a significant negative impact on the adaptive behaviour of a supplier in the same situation.
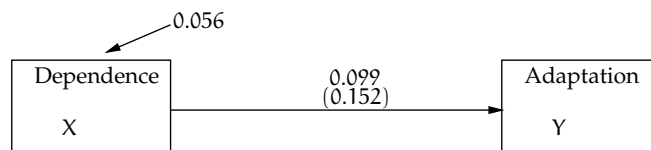
(a) Total effect model: estimates non-significant.
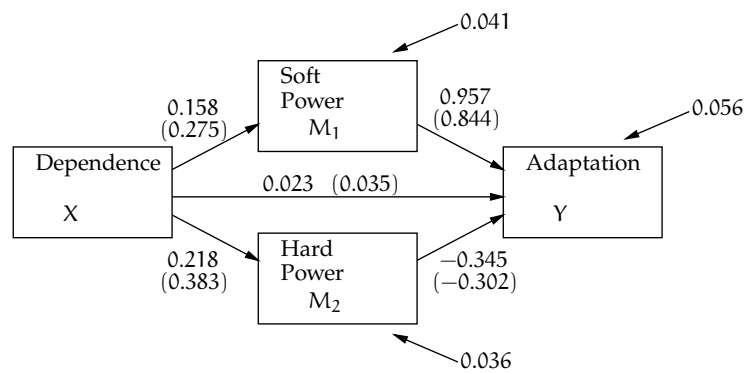
(b) Mediation model for soft and hard power bases: all estimates significant at p < 0.05

Figure 5.21.: Mediation model with estimates and standardized estimates.

Table 5.21.: Summary of the mediation model and comparison of the results with different methods. The standardized estimates are in brackets.

| | | BARON AND KENNY | | PATH MODEL | | PREACHER AND HAYES | | IMAI ET AL. | |
		Estimate	+/-/o	Estimate	+/-/o	Estimate[†]	+/-/o	Estimate (Soft/Hard)[‡]	+/-/o
Indirect effects	Soft	0.281[*]	+	0.151 (0.232)	+	0.281	+	0.042	+
	Hard	-0.144[*]	-	-0.075 (-0.116)	-	-0.144	-	-0.015	-
Direct effect		0.065[*]	+	0.023 (0.035)	+	0.065	+	0.007	+
Total effect		0.170 (0.624)		0.099 (0.152)		0.170		0.051/-0.009	

[*] Estimates are log odds of paths b_1 and b_2 and c'. Hence no standardized β coefficients.
[†] The PROCESS macro does not calculate standardized coefficients.
[‡] The estimates of the mediate package stand for a percentage increase in the probability that the firm will adapt to/refuse the suggested sustainability initiative.suggested sustainability initiative.

sustainability of a supplier, and the *indirect hard* path, which works counter productive.

Table 5.22.: Hypothesis and results of the statistical analysis

HYPOTHESES	ACCEPTED	REJECTED
H_1 A supplier's dependence on its buyer is positively related to its adaptive behaviour towards sustainability.	✓	

5.8 FOLLOW-UP STUDY: INDIVIDUAL BASES OF POWER AND AD-APTATION

As introduced in section 4.12 a follow up study, expanding on the dichotomization of the bases of power shall be conducted with the same dataset, in order to find out which bases of power are having the biggest impact amongst the hard and soft power bases. Initially a logistic regression model with all eleven bases of power is therefore used to predict the response variable *adapt* (*RegMod1*). The log odds estimates of all predictors, as well as their p-values are printed in table 5.23.

After an algorithm for stepwise model selection by AIC was applied to *RegMod1* a new solution with an improved AIC is found (AIC of *RegMod1* was 208.11, AIC of the new model *RegMod2* is 199.97). The log odds estimates of all considered predictors, as well as their p-values are printed in table 5.24.

It is found that INP and LEP have a significant positive impact on a supplier's adaptation of buyer requested sustainability initiatives, whereas LEQ and ICO have a negative impact on adaptation. The estimates in tables 5.23 and 5.23 are log odds. An easier to interpret trans-

Table 5.23.: Log odds regression coefficients and p-values for model *Reg-Mod1*

BASE OF POWER	ESTIMATE	STD. ERROR	Z VALUE	PR(>│Z│)
(Intercept)	−5.207	1.211	−4.300	0.000
INP.p	0.720	0.239	3.009	0.003
LED.p	0.343	0.231	1.485	0.138
IRE.p	0.211	0.227	0.929	0.353
REF.p	−0.047	0.325	−0.145	0.885
PRE.p	−0.196	0.361	−0.544	0.587
PCO.p	−0.082	0.267	−0.308	0.758
LEQ.p	−0.307	0.220	−1.394	0.163
LER.p	−0.208	0.258	−0.808	0.419
ICO.p	−0.312	0.206	−1.520	0.129
LEP.p	0.932	0.233	4.000	0.000
EX.p	0.249	0.237	1.052	0.293

Table 5.24.: Log odds regression coefficients and p-values for model *Reg-Mod2*

BASE OF POWER	ESTIMATE	STD. ERROR	Z VALUE	PR(>│Z│)
(Intercept)	−5.052	1.140	−4.432	0.000
INP.p	0.957	0.171	5.584	0.000
LEQ.p	−0.341	0.180	−1.897	0.058
ICO.p	−0.312	0.180	−1.736	0.083
LEP.p	0.935	0.218	4.290	0.000

formation of the estimates from table 5.24 as well as the confidence intervals are given in table 5.25. The estimates printed in table 5.25 stand for the increase of the odds of adaptation with every increase of 1 unit on the respective scale of the bases of power.

The ROC plots of both models can be found in figure 5.22. The AUC of *RegMod1* is 0.877 and *RegMod2* delivers an AUC of 0.871. Model *RegMod2* performs similar to *RegMod1* with five variables less, which were of little significance.

Table 5.25.: Estimates of *RegMod2* converted into odds, including 95% confidence interval

BASE OF POWER	ESTIMATE	LOWER CI	UPPER CI
(Intercept)	0.006	0.001	0.052
INP.p	2.605	1.888	3.714
LEQ.p	0.711	0.495	1.004
ICO.p	0.732	0.511	1.039
LEP.p	2.547	1.695	4.005
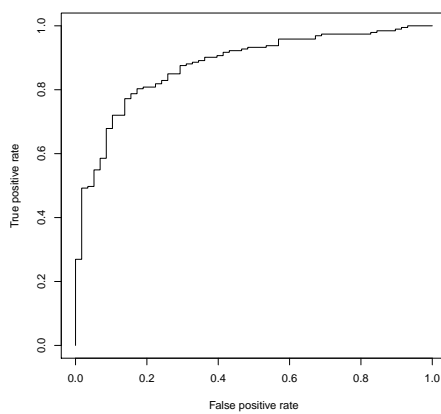
(a) ROC for *RegMod1* (AUC=0.877).   (b) ROC for *RegMod2* (AUC=0.871).
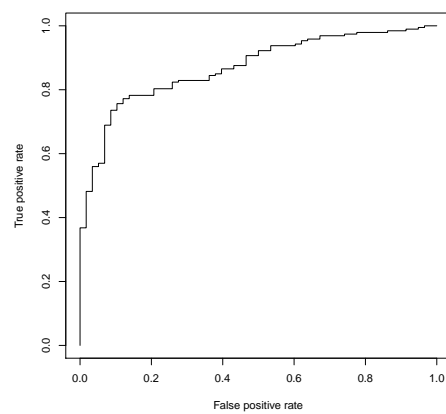
Figure 5.22.: ROC for the two regression models *RegMod1* and *RegMod2*

Part III

CONTRIBUTION

6

DISCUSSION

6.1 SUMMARY OF THE FINDINGS

6.1.1 *Usage of the terminology SSCM*

While knowledge is orderly and cumulative, information is random and miscellaneous.
— Boorstin (1980, p. 3)

The fact that the importance of SSCM is increasing amongst retailers leads to the conclusion that the suppliers in their SC face increasing pressure to implement sustainability initiatives as requested by the retailers. This finding was established after analysing the world's leading retailers websites and CSR reports, as well as talking to experts.

Increasing importance of SSCM for companies in the public eye, such as retailers, means also that their suppliers will experience requests to change their behaviour regarding the impact on the TBL. This pressure to change comes from different sources, as it was found in section 3.1 (details in table 3.1 on page 77), but one of the main driver is found to be the buyer. The increasing numbers of mentioning of SSCM on supermarkets corporate websites over the years 2012, 2013 and 2014 support the idea that retailers, as a powerful buyers within complex supply chains, could qualify as a driver of SSCM.

6.1.2   *SSCM in practice*

The results from the analysis of the exploratory questionnaire in section 5.1.3 confirm what was mentioned in an informal interview with a Tesco climate change manager. In the interview it was stated that most of the work regarding SSCM is currently *outsourced* to specialists from consultancy firms. The analysis confirmed that in a way by flagging up that a lot of practitioners are not familiar with the TBL approach, even though they claim to be involved in sustainability and supply chain management.

The results from the plot in figure 5.5 (page 213) show some indications of what (in the perception of the involved practitioners) is currently more or less implemented in sustainable supply chain management in the industry. It was expected to find the plots further right aligned, which would represent a high standard of implementation of SSCM principles in the industry. Moreover it is found that not all the principles as they are suggested by the literature about SSCM are of equal importance in practice.

What stands out is, for instance, the implementation of product quality control. The importance of product quality in procurement is an obvious issue and did not just come with the idea of SSCM; hence an above average integration does not surprise. Ten practitioners had the perception that LCA is not integrated in their SSCM at all, whereas more than the half of the questioned respondents found LCA at least somewhat integrated in their SC. This example of an inconclusive results could be investigated further. On the other hand this doesn't come as a surprise. The exploratory study of addressing the practitioners perspective on SSCM found that it is particularly diffi-

cult to conduct a LCA wit the necessary transparency needed to get reliable data. This issue is also raised in the academic literature (see section 2.2.9.2 on page 54). The idea of LCA is somewhat unclear up to date, as the boundaries of the life-cycle system can be chosen by each assessor is it fits. New standards will bring more clarity in this field and enable practitioners to say with certainty whether a valid LCA on a product level is being conducted or not.

Further, the practitioners clearly take up a point when giving their perception about how many changes in the SC under their responsibility were made in consequence of legal regulations. The SCOR framework seems not to gain acceptance for SSCM purposes, even though authors in the field of SSCM suggest its application for more environmental supply chain operations (Blanchard, 2008; Piotrowicz, 2011).

Following the statements of the practitioners regarding risk management in supply chains in the context of sustainability, it can be said that risk control depends on the structure of each particular SC and hence the importance of SCRM is perceived differently. What can be noted is that the well-established mechanisms to reduce risk are as prevalent as quality management systems.

The findings about the respondents occupation and their knowledge about sustainability as presented in figure 5.4 (page 211) allow two conclusions:

1. supply chain managers and sustainability managers have different perspectives on their SC/SSC; and

2. at least half of the participating supply chain managers do not follow academic models in order to achieve sustainability in their supply chain.

At this point, it should be emphasized that only supply chain managers with an expertise in sustainability (according to their own job description) are surveyed. This discrepancy between the academic literature and the actual practice reflects the early stage of the SSCM principle. It also shows that even though supply chain managers adorn themselves with the term sustainability, most of the work regarding implementation is either dictated by powerful supply chain entities or sustainability consultants. The first mentioned pathway, which was also suggested by the drivers of SSCM (see section 3.1) was scrutinized in the process of this research and shall be discussed in chapter 6.

6.1.3 *Summary*

After shedding light on the comprehension of SSCM in academia and its growing importance in practice,[1] the aim of this research was to find out how sustainability can be permeated through a supply chain. In particular, buyer-driven sustainability initiatives are scrutinized in this research, as buyers are found to be significantly more often the initiators of SSCM efforts than suppliers (see also table 3.1 on page 77). From the in-depth analysis of SSCM as a concept, the practical problem of how sustainability initiatives can be permeated through a supply chain, starting at a dyadic exchange relation, remained unclear and was further developed into research objective 2 (page 119):

Research Objective 2 *To test whether a buyer's power impacts the adaptive behaviour towards sustainability of a supplier.*

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1 Research question 1 (page 4) and findings from the exploratory studies (summary 25 on page 210)

The test was executed by using a questionnaire tool and collecting data from suppliers who had been asked by a buyer to adapt to a sustainability initiative. Thus, each supplier's perceived dependence, base of power and the result of the adaptation request were the major points assessed.

The analysis of the collected data reveals findings to be summarized briefly in the next paragraphs, before the meaning and value of these findings will be discussed in chapter 6, and the theoretical contribution of this research is elucidated in section 6.5.

The results of the survey show that most SMEs perceive the power relation between themselves and their buyer (the buyer wanting them to adapt to its sustainability agenda) as balanced, or find the buyer more powerful (table 6.1). Further, the mediation model shows that an organization's dependence on its buyer is correlated to the adaptive behaviour towards a sustainability agenda as requested by this buyer. However this correlation is only positive *if* the relationship is based on soft power. Hard power, such as coercion (ICO, PCO) or relying on the supplier experiencing something similar to guilt (LEQ, LER) and acting on those bases, does not correlate to adaptive behaviour towards the buyer-requested sustainability agenda. The empirical evidence suggests the opposite: a higher likelihood of rejection of the suggested sustainability initiative. The rates of acceptance as presented in table 6.1 might therefore be misleading, as they do not highlight that the power–adaptation relationship is conditional on the type of power.

On the journey to SSCM, these findings can be used to permeate one's sustainability ideology through a supply chain.

Nothing has been falsified—except the impression that it gives.
— Huff (1954, p. 62)

Table 6.1.: Acceptance rate per power perception

RESPONSE Q8	N	% ACCEPTANCE
The buyer was more powerful	114	79.8
The power relation was balanced	112	80.4
We were more powerful	25	48.0

6.1.4 *Specific relevance of single bases of power*

A new insight into the bases of power by undoing the dichotomization and looking at each base in particular reveals, that as expected the hard power bases LEQ and ICO impact the adaptive behaviour of a supplier particularly negative and the soft power base INP significantly positive to a great extent. However, opposed to the categorization between soft and hard, it is found that LEP actually promotes adaptive behaviour.

The finding that LEP promotes adaptive behaviour even though it is a hard power base appears surprising at first. However going back to the literature in SCM and considering the cases of lean management principles such as TQM or JIT reveals that the perceived power based on a firms position has also played a role back then.

It appears like a more subtle power such as an appearance of a market leader, a form of power which is there without pointing it out, works well in combination with informational power. Informational power can be related to the often discussed supplier collaboration which has proven successful in other supplier development scenarios.

This finding goes hand in hand with what was introduced section 3.2.5, built on Cox's theories about power in exchange relations.

6.1.5   *Answers to the research questions*

Two research questions were asked in this thesis. Research question 1 (page 4) was answered with secondary data analysis such as searching retailers' websites for the terminology (page 380), primary data such as conducting informal telephone interviews with industry representatives (section 5.1.2), as well as an exploratory survey (see summary 26 on page 219). It was found that not only do FMCG retailers use the terminology SSCM widely and increasingly, but also other industries, such as manufacturing, the textile industry and construction, are on board. The understanding of SSCM is found to differ between academics and practitioners in the prioritization of the sustainability issues (TBL ranking).

Research question 2 (page 4) represents the main focus of this thesis. The simple answer to the research question would be: Yes, according to the findings in this thesis, it can be concluded that a buyer's power does have an impact on its supplier's adaptive behaviour towards sustainability. However, the more interesting finding lies in the mechanism behind this influence. Depending on the type of power on which a buyer bases its relationship, the results are significantly promotive or obstructive regarding the goal of permeating sustainability through the upstream supply chain.

Even though several drivers for SSCM are known in the existing literature, the mechanism behind one of the most frequently mentioned drivers (buyer) remained unclear so far (see also table 3.1 on page 77). During the course of this research, it became clear that different forms of power, represented through bases of power, significantly affect a supplier's adaptive behaviour in this particular context. With

the findings from this research, the theoretical knowledge is extended from *who* drives SSCM to *how* SSCM is driven by one of the major influencers.

6.1.6 *Anomalies in the results*

The adapted questionnaire did not reproduce the eleven factors as introduced by Raven et al. (1998). Since even the original questionnaire, which is well established in the literature after Raven et al.'s (1998) introduction, had not produced the desired number of factors in the flagship study, this anomaly is not considered as a major concern. The factors extracted from the results are in accordance with the existing literature about the *bases of power* framework (see table 5.10). Even though for future research a focus on a five-category solution is recommended, the hard and soft dichotomization still holds.

6.1.7 *Emerson's power-dependence relation in interorganizational relations*

In section 3.2.2, the idea of Emerson's power-dependence relation is introduced. Emerson (1962) found that in dyadic interpersonal relationships a person's power and dependence are inversely related. This study shows that not only interpersonal relationships follow this rule, but also interorganizational relationships. It can be argued that the dependence and power as they are determined in this study are *perceptions* by a person who represents a firm. However, in practice this is where the boundaries between interpersonal and interorganizational research blur. Even though the results represent the perception of one person, this person is likely to be equipped with responsib-

ilities to make decisions in the organisation's name, and hence will be acting *as* the organization (Frazier and Summers, 1986). In earlier chapters, the transition of theories and principles from the interpersonal to the interorganizational level is discussed (section 3.2.1.2) and elaborated to the widespread RDT by Pfeffer and Salancik (1978). Building on this reasoning, Emerson's theory of power-dependence relations is applied to interorganizational relations before the findings (see section 5.4) deliver statistical support for this reasoning.

6.1.8 *Causality*

Often the causal chain of path models remains somewhat unclear and debatable. In this research, a causal chain as described in equation 6.1 is suggested:

$$
\begin{gathered}
\text{Perceived Dependence} \\
\downarrow \\
\text{Perceived Experienced Power} \\
\downarrow \\
\text{Adaptation of Sustainability Agenda}
\end{gathered}
\tag{6.1}
$$

Dependence causes a supplier to experience a form of power. The opportunity for a buyer to exercise power in relation to a supplier is only given if a certain dependence exists. The results of the analysis suggest that power (even if it is exercised only in a certain manner) leads to a significant increase in a supplier's adaptive behaviour towards a buyer-requested sustainability initiative.

It was also found that hard and soft power bases and a supplier's dependence are correlated. Even though this might appear contradictory at first, the result confirms the suggested causation that an increase in dependence causes an increase in experienced power. Thus, the type of power which is later exerted by a buyer, whether soft or hard, is negligible. The buyer is left with a choice. Following the results of this study, a buyer is advised to base its power on its expertise (EX) and information (INP), as well as rewarding the supply chain partner's firm (IRE) and being conscious of the supplier's weaker position (LED).

Causation however can not be established in a single uncontrolled study as it has been conducted in this research, a controlled experiment would be necessary to achieve certainty. Kenny (1979, p. 3) suggest to establish the following three points before claiming causation:

> Three commonly accepted conditions must hold for a scientist
> to claim that X causes Y:
>
> 1. time precedence
>
> 2. relationship
>
> 3. nonspuriousness

Item 1 in the case of this research means that the power relation between the buyer and the supplier must have prevailed before or at the time of the buyer's request for sustainability. It cannot be assured that this is the case; however the questionnaire particularly asked the the responding supplier how likely each base of power have influenced its decision regarding the requested change (see also page 188):

> On the second page of this questionnaire are a number of reas-
> ons why you may have decided as you did. Read each descript-
> ive statement carefully, thinking of the situation in which your

firm was asked to alter its operative behaviour. Decide how likely every statement on the following pages may have influenced your firm's decision.

Regarding the time precedence of the bases of power and the power relationship between the buyer and supplier no claim shall be made though, because no controlled experiment study was conducted and it cannot be said with certainty whether the change has influenced the power relationship within the dyad.

Item 2 suggests that there must be a "functional relationship between cause and effect" (Kenny, 1979, p. 4). The functional relationship is generally inferred by statistical methods, such as those used in this research. If a change in variable X is significantly correlated to a change in variable Y a functional relationship is established. This is found to be valid for a supplier's dependence and soft and hard power bases, as well as soft power bases and a supplier's likelihood of adapting a buyer requested change (positive); and hard power bases and adapting to a buyer requested change (negative).

The most interesting condition for this research lays in item 3. Kenny (1979, p. 4) suggests:

For a relationship between X and Y to be nonspurious, there must not be a Z that causes both X and Y such that the relationship between X and Y vanishes once Z is controlled.

. . .

Controlling for either a spurious variable or an intervening variable makes the relationship between X and Y vanish; but while a spurious variable explains *away* a causal relationship, an intervening or mediating variable *elaborates* the causal chain.

However in this research the implementation of the mediators *hard* and *soft* make the relationship between *X* and *Y* vanish. Since *hard* and *soft* are identified as mediators and not spurious variables, the suggested causal chain remains in a working order. The difficulty in this research for establishing causality lays in the relationship between a supplier's dependence and the bases of power. Item 2 from the above list can be fulfilled, as shown in e.g. table 5.16 (page 261). The underlying reasoning of this relationship is that the perceived dependence of a supplier on its buyer is causes an increase of the buyer's power—on every possible pathway. The causality cannot be established with certainty, however well established research such as from Blau (1964), Emerson (1962, 1976), Pfeffer (1981) and Pfeffer and Salancik (1978) support the idea that a target's perception of dependence on an agent increases the agent's power. Only a controlled experiment could establish causation for this relationship in the case of sustainability adaptation in a dyadic exchange relationship, by controlling for time precedence of perceived dependence and attempting a set up which eliminates spurious variables as good as possible.

6.1.9 *Mediation*

The types of exerted power—or more precisely the bases of power—have an impact on the change of behaviour of a supplier. The mediation analysis in section 5.7 statistically supports the proposed model built on this hypothesis (figure 4.3 on page 199). In this case of mediation it means that, without considering the mediators, no significant impact of the input variable on the output can be observed. Hence, at first it appears as if a supplier's perceived dependence does not signi-

ficantly influence its adaptive behaviour towards the implementation of a sustainability initiative as suggested by a buyer (figure 5.21a on page 272). The reason why no correlation between these two variables can be observed appears after replacing the black box between these two variables with a mechanism. The suggested mechanism is the framework of the bases of power as initially introduced by French Jr. and Raven (1959) on an interpersonal level. Simplifying this framework and creating two categories, namely hard and soft power bases, allows the researcher to explain the mechanisms of the black box. Only one pathway—soft power bases—significantly influences the impact of a supplier's perceived dependence towards its adaptation to a sustainability initiative (figure 5.21b on page 272). Distinguishing between these two categories of power explains the *black box*. Hard power bases have a negative impact on a supplier's adaptive behaviour. Hence, looking at the black box, which from the outside only shows the overall result of all the mechanics inside, delivers no useful result. The two mechanisms cancel each other out.

A possible explanation for the finding that only soft power bases significantly change a supplier's attitude and behaviour with regard to adaptation to buyer-requested sustainability initiatives can be found in the *Theory of Planned Behaviour* (TPB) by Ajzen (1991). The theory suggests that a supplier would have a higher motivation towards a change in behaviour (sustainability adaptation) if highly respected buyers made the request and if the suggested behaviour is understood as a change for the good. Informational power explains the latter condition of the TPB. A highly respected buyer, which is needed to fulfil the condition Ajzen (1991) calls *subjective norm*, is likely to cause a supplier's perception of expert power to be high. These two

bases of power make up half of the soft power bases, which are found to significantly improve the likelihood that a supplier will adapt to a sustainability agenda as suggested by a buyer—and therefore undergo a change in behaviour.

Going back to the literature review and comparing the findings of this research with what was found from the available literature in the academic domain, some valuable additions to the current state of research can be made. As it was pointed out in section 2.2.12.1 the literature suggested that it is most important to select a supplier with sustainability capabilities which fit one's needs (Amindoust et al., 2012; Bai and Sarkis, 2010; Büyüközkan and Çifçi, 2011; Tuzkaya et al., 2009). The findings from this research show that working together with suppliers, and communicating the need for adaptation to a certain sustainability initiative via the right channel, can change a suppliers' behaviour towards more sustainability. This confirms the idea of Hall and Matos (2010) who found that environmental collaboration and education of suppliers can lead to more understanding and hence more effort regarding environmental practices in farming.

Understanding the mechanisms that lead to an improved adaptation of sustainability in dyadic exchange relations also contribute to the theory around SSCM where Al Zaabi et al. (2013) raised concerns about how interorganizational implementation of sustainability may work (see section 2.2.12.3). Simpson et al. (2007) suggested for the case of automotive supply chains, that mainly an increase of the monetary effort in interorganizational relations would lead to an improved responsiveness towards buyer requested environmental initiatives. Looking at the results from this research it can be said, that without offering economic incentives to a supplier, a certain way of

approaching the exchange relationship is also significantly beneficial to achieve the goal of implementing sustainability initiatives. In particular soft bases of power, and of those informational power (INP), contribute to an adaptive behaviour of a supplier (section 5.8).

6.2 MEANING OF THESE FINDINGS

It is better to debate a question without settling it than to settle a question without debating it.
— Joubert (1883)

Even though this whole study is conducted from the perspective of a supplier—a supplier at the receiving end of a buyer's power—the findings are most valuable for a buyer. A firm whose idea it is to increase the sustainability of its supply chain, or implement the SSCM principle, can benefit from the results gained in the quantitative analysis of this research. Knowing how a supplier reacts to different perceived forms of power can be used as a powerful tool to manipulate suppliers on the journey towards a more sustainable supply chain. This journey is expected to start with a dyadic exchange relation before the idea can be permeated further upstream in the SC. Hence, knowledge about how to achieve a successful start at the first link is valuable.

The importance of supplier selection when striving for a sustainable supply chain is thoroughly discussed in the existing literature (Amindoust et al., 2012; Büyüközkan and Çifçi, 2011; Roberts, 2003; Tuzkaya et al., 2009). However, a firm with the desire to become more sustainable in its SC is rarely going to find itself in a situation where all suppliers can be chosen from scratch. And even if they can be, it would be surprising if a supplier network could be built containing solely suppliers with exactly the sustainability agenda in place that is required by the buying firm. Therefore, the more likely case is a

firm, striving for sustainability as a holistic concept, trying to implement the SSCM ideology in its existing supply chain. Apart from those firms who have a strong management commitment to sustainability and therefore an intrinsic motivation to become sustainable, the most likely candidates are organizations which are under the observation of the public.

6.3 VALUE OF THESE FINDINGS

Those firms willing to change the behaviour of their existing suppliers will face resistance if the right strategy is not applied. The findings of this research suggest that the *wrong* strategy is to force supply chain partners without informing them or offering a good example. Not only can the initiator of the SSCM concept in a supply chain use the findings of this research as a tool to strike the right note, the idea about soft power bases and their beneficial role in interorganizational change and adaptation can be passed on to the first tier suppliers. This knowledge transfer can result in a systemic effect and enable the permeation of sustainability ideas through a farther-reaching supplier network.

Moreover evidence for the focus on the dyadic exchange relation with suppliers whilst aiming to implement SSCM is delivered from global leaders in different industries. As an example for consumer pressure on the sustainability efforts of a large company stands the US fast food chain McDonald's (Gunther, 2013). McDonalds's (2013) emphasize their engagement with their *direct* suppliers as an effort to achieve a more sustainable supply chain:

> We continue to work with our direct suppliers, advisors and relevant industries to make sure our suppliers are aware of the importance of sustainability.

In the automotive industry, sustainable supply chains are necessary for reasons similar to those of any other organisation in the focus of the media and public (Barnish, 2013). Even though around 80 per cent of the environmental footprint of a car occurs during use (Arratia, 2012), the automotive industry is keen on tackling the remaining environmental issues as well as social issues in their supply chains (Chynoweth, 2013). The findings of this research are derived from firms in a variety of manufacturing sectors, of which several are likely to be a link in an automotive supply chain. Jaguar Land Rover (2013, p. 18) explain their strategy for dealing with suppliers in order to align them to their sustainability agenda, as follows:

> We partner closely with suppliers to help us achieve improvements in our products and encourage them to tackle their environmental footprint through the supply chain.

Partnering closely might be understood as basing the unmistakeable power of the car manufacturer on soft power bases, as suggested by this research, in order to achieve a smooth transition of the supplier to greater TBL sustainability. The need for collaboration is highlighted by Jaguar Land Rover (2013, p. 41) by further stating that:

> We expect suppliers to uphold the same high standards on sustainability as we set ourselves, and we work closely with them to reduce the environmental and social impacts of the products and services we buy.

In order to achieve a sustainable supply chain, Jaguar Land Rover (2013, p. 42) rely on their suppliers to permeate the sustainability values further upstream the supply chain to n-tier suppliers:

> We expect suppliers to convey our requirements to their own suppliers.

It is easier for the first-tier suppliers to comply with this request if the right tools are given to them, e. g. in the form of a workshop. The information shared with a first-tier supplier on how to convince second-tier suppliers to follow the sustainability requirements should include the findings of this research, which explains the method currently practised at Jaguar Land Rover: collaboration and information instead of coercion. That this collaboration derives from an exchange relationship with underlying soft power bases can be used as a further strategic tool or guideline on how to approach a supplier to achieve the desired change in its sustainability behaviour.

The finding that the likelihood of sustainability adaptation can be mediated by just basing one's power on the right foundation should be acknowledged and used by all applicable industries. The dependence of a supplier is not alone sufficient to spread the buyer's sustainability agenda efficiently through a supplier network.

6.4 DIFFERENCE FROM OTHERS' FINDINGS

No piece of research was found where authors used the framework of the bases of power or any other solid theoretical framework to investigate the mechanisms of sustainability permeation in supply chains. Only Boons et al. (2012) mention that different bases of power

might have an influence on sustainability adaptation, without going into further detail.

Recent work has looked at drivers of sustainability and identified the buyer as one of the most important drivers. However, an explanation of this mechanism for the particular case of sustainability permeation through the upstream supply chain has now been attempted. The main difference from the studies explaining the drivers of SSCM is the focus on the most important driver: the buyer. The mechanism behind this driver is particularly illuminated in this study, which distinguishes this work from the sustainability driver studies as introduced in section 3.1.

In a series of papers Vachon and Klassen discuss the impact of collaboration and supply chain integration on the extension of green practices along supply chains (Vachon and Klassen, 2007; Vachon and Klassen, 2006, 2008; Vachon and Mao, 2008). Thereby it is found that environmental collaboration with a supplier increases the supplier's environmental performance (Vachon and Klassen, 2006, 2008). The authors did not countercheck whether there are other pathways of increasing a supplier's environmental performance however, such as coercive measures. The findings of this research suggest that coercive measures lead to the opposite effect at a supplier. In an earlier study Vachon and Klassen (2007) found that pollution control increases when suppliers become integrated; whereas investment in pollution prevention, such as through product innovation, goes up when customers become integrated. This is another indication for customers driving sustainability initiatives, such as changes in one's organization, upstream. Related to the research at hand this confirms the idea

of the sustainability principle being permeated upstream the supply chain, from a buyer to a supplier.

Equations (3.4) to (3.8) illustrate the causal chain from a supplier's dependence to its change in behaviour. As the quantitative analysis of this study has demonstrated, a supplier's dependence alone is not sufficient to explain its change in behaviour when it comes to the adaptation to buyer-requested sustainability initiatives. The causal chain in equations (3.4) to (3.8) is manifested in the literature and each step has been proven by numerous peer-reviewed studies. At first glance, it appears as if this causation has failed in this study, since dependence (and with it power) did not deliver a clear result on whether the adaptive behaviour improves or not. However, after closer scrutiny one may recognise that equation 3.7, in particular, is significant regarding the results of this study: a change of attitude towards the buyer-requested sustainability initiative must have happened amongst the suppliers in different ways, depending on whether they were approached via hard or soft power bases. The resulting contradictory attitudes are then expressed as adaptation or rejection of the buyer-requested sustainability initiative.

6.5   CONTRIBUTION

The final test of a theory is its capacity to solve the problems which originated it.
— Dantzig (1998, p. vii)

This PhD thesis contributes to knowledge from different angles. The main contributions will be outlined in the following subsections sections 6.5.1 to 6.5.3.

6.5.1 *Sample*

Before the survey of this study, it was unknown how many SMEs in a supplier role were asked to adapt to a buyer's requested sustainability initiative. The sample of this study shows that the occurrence of such a situation is evenly spread throughout the manufacturing sector in the UK. Furthermore, the sampling method allowed a database to be built with volunteers who had encountered such a situation and were willing to participate in a follow-up study.

6.5.2 *Questionnaire tool*

In order to measure which base of power underlies a dyadic exchange relation, the questionnaire tool (developed for interpersonal relations by Raven et al. (1998)) was adapted for the interorganizational situation. The questionnaire tool attempts to measure eleven different bases of power as they were determined by Raven (1993). The closest tool found is that deployed by Maloni and Benton (2000) which measures six bases of power in an interorganizational context. No tool tailored to determine eleven bases of power could be found in the literature; hence its development and successful application is understood as a significant contribution to knowledge and methodology.

6.5.3 *Results from the mediation model*

The results from the mediation model contribute to knowledge, since the mechanism behind adaptation of sustainability initiatives in dyadic exchange relations remained unexplored up to this date. As poin-

ted out by Boons et al. (2012, p. 140) the following points were unclear:

> How are sustainability practices diffused through global product chains?

and

> Power relationships in product chains: who is driving the sustainability agenda?

The results of this PhD thesis give some further insight into these issues. In section 3.1, the current literature concerning drivers of sustainability is analysed and a ranking created for who or what drives sustainability. Parts of the second issue raised by Boons et al. (2012) are then addressed with the quantitative analysis in Part II. In particular, it is the finding that it is not sheer power (or dependence) that drives the permeation of sustainability, but rather how this supremacy is utilized, that contributes to the current state of knowledge.

The main findings that power does influence the adaptive behaviour of a SME in a supplier role, when it comes to sustainability initiatives as requested by a powerful buyer, extends the knowledge about drivers of SSCM. The literature-suggested mechanism (section 3.2) behind this power influence, which is confirmed by empirical analysis, contributes further to the academic and practical knowledge about power in interorganizational relationships. Brennan and Turnbull's (1999) idea that power has an impact on adaptive behaviour across organizational borders (although insufficient as a single predictor) is confirmed by the findings from this study (cf. page 99).

Finding that it matters how the request for sustainability implementation is communicated to a supplier, and particularly finding

that soft power bases (in particular INP) work significantly better, contributes to the theory of SSCM. Up to this stage research by Vachon and Klassen (2006) was available dealing with collaboration in environmental issues between suppliers and buyers and the impact of this collaboration on the performance of the environmental initiative. However these studies did not deliver a clear guidance to practitioners on how to act in such a situation in order to achieve the best possible result regarding adaptive behaviour on the supplier's side.

The empirical analysis with a causal mediation model is not often used in the field of SSCM. Zhu et al. (2011) apply Baron and Kenny's (1986) approach in a study about GSCM, which is now considered to be outdated by many researchers (Hayes, 2009; Imai et al., 2010). A recent publication about collaborative behaviour and performance in dyadic exchange relations delivers similar results from a mediation model as this study (Nyaga et al., 2013). However Nyaga et al.'s study is set up with a different goal and hence the model differs from figure 4.3, in that adaptive behaviour is a mediator between the bases of power and organizational performance. The regression from the bases of power to adaptive behaviour reproduces the results of this study.

At the beginning of this research a model representing the contents of SSCM was presented (figure 2.5 on page 62). The model is based on the current state of the art from the academic literature and includes all topics which are investigated, discussed and researched under the umbrella of SSCM. Many of those topics have been extensively debated in published material and are rather well understood. However as the literature review revealed, the dyadic exchange relation and inter-organizational power as it comes with this topic, has

not been well researched so far. No quantitative data for the influence of power and dependence on the permeation of sustainability through supply chains was found—even though the issue was understood as important by experts in the field (e.g. Boons et al., 2012). This research delivers some first insights and data into UK manufacturing supply chains and elaborates which conditions allow sustainability initiatives to permeate upstream, and thereby contributes to the theory of SSCM.

7

CONCLUSION

As a concluding remark, the structure of this thesis will be presented in a graphic (figure 7.1). After exploring and understanding the principles of sustainability (section 2.1), the integration of the sustainability principle in supply chains was laid out (section 2.2). The importance of the sustainability issues from a systems perspective became clear whilst elaborating on SSCM.

Chapter 3 focuses on the permeation of sustainability through the supply chain. After systematically reviewing the drivers of the SSCM principle as they are found in the literature (section 3.1), the most important driver—the buyer—was further scrutinized in the abstract form of a dyadic exchange relation. Theories applied in interpersonal relations, which have been successfully transferred to an interorganizational context, were explored and modelled to the problem of sustainability permeation in supply chains (section 3.2). The proposed causal inference model in figure 3.6 represents adaptive behaviour in an excerpt of a supply chain, a dyadic exchange relation. Finally, based on the findings from the literature review about power and interorganizational change, it was hypothesized that power (based on dependence) will have an impact on a supplier's adaptive behaviour
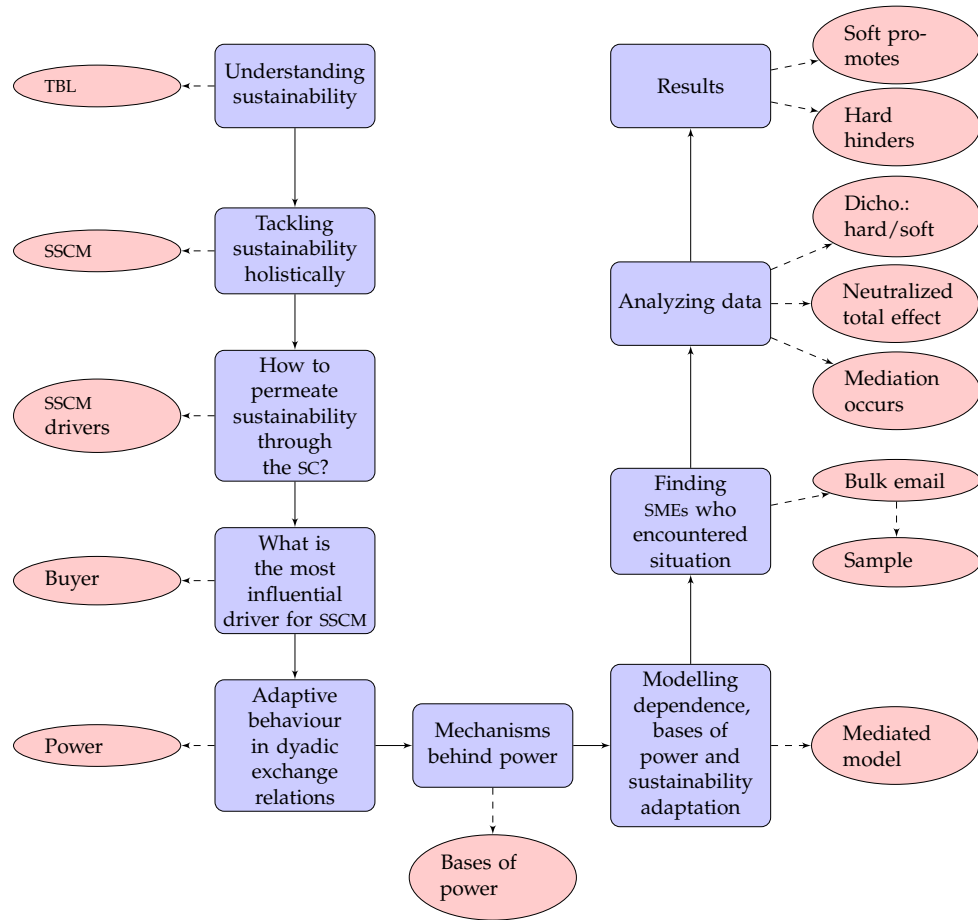
Figure 7.1.: Structure of this PhD thesis

towards a buyer-requested implementation of a sustainability initiative (hypothesis H_1).

To test the eventually proposed mediated model (figure 3.9b), a research strategy was systematically created (chapter 4). Due to an unknown population,[1] a large number of UK based SMEs were contacted and asked to participate in the survey (summary 23). The online survey was based on a modification of a questionnaire tool which has been established in high impact academic literature for over a decade (section 4.9 and for the modifications table 4.6). Since the question-

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1 The population comprises UK based SMEs who have encountered a situation where a buyer asked them to implement a certain initiative to improve their social or environmental bottom line.

naire had to be migrated from an interpersonal to an interorganizational context, pilot studies and discussions with experts preceded the data collection (page 182). In total, 263 wholly completed questionnaires were returned, of which 259 fitted the sample criteria as determined beforehand (sampling statistics in figure 4.2 and participant criteria in table 4.4 and equation 4.1).

Following a descriptive statistical procedure, the obtained data were analysed to support the following circumstances:

- The applicability of Emerson's power-dependence relation in an interorganizational context.

- The performance of the newly developed questionnaire tool.

- The effect of a supplier's dependence on its adaptive behaviour towards a buyer-requested sustainability initiative.

The findings from the quantitative analysis showed that Emerson's power-dependence relation, an inverse relation between perceived dependence and perceived power, works in an interorganizational context as well as in an interpersonal situation. The reliability measures of the questionnaire did not match the expectations. However, following the methodology as applied in the introductory study of the questionnaire by Raven et al. (1998) delivered interpretable results. A total effect of power $\left(\approx \frac{1}{\text{dependence}} \right)$ could not be observed. Following the suggested mediation model, and thereby implementing the mechanism behind perceived power in the causal chain, yielded the outcome as previously hypothesized in hypothesis H_1 (for total effect see figure 5.21a and mediated effects figure 5.21b). The total effect appears to be non-significant since the effect via the mediator *soft* is positive, whereas the effect via the mediator *hard* is negative, which yields a

neutralized total effect. In conclusion, the useful result appears only after disassembling power into hard and soft bases of power.

The finding that soft power bases promote a supplier's adaptive behaviour towards sustainability is not only a contribution to academic knowledge in the field of SSCM, but also a valuable tool for practitioners on their journey to a sustainable supply chain.

7.1   LIMITATIONS

The limitations of this study are mainly due to new methodological approaches and an unknown population. An overview of the main limitations is given in the following subsections.

7.1.1   *Questionnaire tool*

The findings of this study need further verification by quantitative and qualitative evidence. In addition, since the Raven et al.'s (1998) original questionnaire was modified, further alterations in order to achieve better fit to the path model are necessary. The model fits as presented in table 5.11 (page 255) are not sufficient to accept any of the latent factor models as a good fit. However, since Raven et al. (1998) never tested their original questionnaire in such a rigorous manner, it is difficult to say whether the modifications of the questionnaire (interpersonal $\rightarrow$ interorganizational) influenced the latent model fit. In order to improve the questionnaire tool further studies and pilot studies need to be conducted.

7.1.2   *Mediation model*

The mediation model itself reveals some limitations by not regarding possible suppressors. Following the description in section 4.10 on page 196, all other drivers of SSCM could act as suppressors in the model (see also figure 3.8). Due to the already considerable length of the questionnaire deployed in this study, it was understood not to be possible to collect even more data per participant. Follow-up studies with a similar sample could be used to feed some further data into a larger model that considers suppressors such as other SSCM drivers. The questionnaire could also be shortened by removing those statements that did not perform well, which could make some space for the operationalization of further variables.

7.1.3   *Sampling*

The sampling and data collection process revealed itself as challenging, since the population was unknown. It was not possible to specifically target firms who have encountered a situation in which a buyer asked them to implement a sustainability initiative. Hence a rather large number of firms was contacted and the number of firms who did not encounter this situation was estimated. The estimation is based on participants who aborted the questionnaire after they read the pre-condition that they must have been asked by a buyer to adapt to a sustainability initiative. As a post-hoc test as to whether the sample represents the database, descriptive statistics about the participants' company size, location and industry were compared.

The study on hand focusses solely on manufacturing SMEs as suppliers, without having knowledge of the buying firm.

7.2   FUTURE RESEARCH

This research opens the door for various follow up research projects. As a first step the results derived from this mainly quantitative study should be validated through interviews or case studies. This would give the outcome of this study more prominence. In addition, as mentioned in section 3.2.6, a study with Cox et al.'s (2001) power regimes as an underlying framework could be conducted, in order to find out whether this mechanism explains the adaptive behaviour of suppliers towards sustainability to a similar or even better degree as the bases of power framework.

During the course of this study new research questions also arose, which could lead to further research projects.

Research Question 3 *Would the results of this research differ if a buyer perspective had been used?*

Research Question 4 *What other factors contribute to sustainability permeation through a supply chain?*

Research Question 5 *How far does the power of the focal firm – the SSCM initiator – reach upstream the supply chain?*

Research Question 6 *How does sustainability permeation in supply chains work* downstream*?*

In particular, research question 4 needs to be addressed since the model used in this research only considers *the* most influential driver

of SSCM according to the literature analysis. Nevertheless, other factors such as government regulations, cost reductions, and norms and standards, appear quite frequently in the literature about SSCM drivers too and should be tested for their impact (see also table 3.1). To measure these factors, new questionnaire tools need to be developed.

Another research project, building on this study, should focus on improving the questionnaire tool which is used to determine the power relationship between firms in an exchange relation. The tool as used in this PhD thesis is laid out to measure eleven bases of power, each operationalized by four items. The reliability of the questionnaire was good after reducing the number of factors; however, the reliability to measure the proposed eleven factors was rather mediocre. This questionnaire could be shortened by the number of items per factor, as well as possibly the number of factors in interorganizational exchange relations. Along with improved operationalization, this effort could lead to a more reliable and shorter questionnaire tool.

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Part IV

APPENDIX

A

ENCLOSURES

A.1 ABBREVIATIONS

ABS   Association of Business Schools

ACME   Average Causal Mediated Effect

ADE   Average Direct Effect

AIC   Akaike Information Criterion

AHP   Analytical Hierarchy Process

AMJ   Academy of Management Journal

ANOVA   Analysis of Variance

AUC   Area Under the Curve

B   Buyer

BES   BRE Environmental & Sustainability Standard

BIC   Bayesian Information Criterion

BPR   Business Process Reengineering

BRP   Boundary Role Person

BS   British Standard

CFA   Confirmatory Factor Analysis

CFI   Comparative Fit Index

CI   Confidence Interval

CIP	Continuous Improvement Process
CO	Coercive Power
CP	Collaborative Power
CSR	Corporate Social Responsibility
DEFRA	Department for Environment, Food and Rural Affairs
DETR	Department of the Environment, Transport and the Regions
DV	Dependent Variable
EFA	Exploratory Factor Analysis
EMS	Environmental Management System
EOL	End-Of-Life
EQ	Equalizing Power
ERP	Enterprise Resource Planning
ESER	Energy Saving and Emission Reduction
ETS	Environmental Trading Scheme
EU	European Union
EX	Expert Power
FMCG	Fast Moving Consumer Goods
FSC	Forest Stewardship Council
GHG	Greenhouse Gas
GM	General Motors
GOE	Gram of Oil Equivalent
GRI	Global Reporting Initiative
GSCM	Green Supply Chain Management
ICLUST	Item Cluster
ICO	Impersonal Coercive Power
IJPE	International Journal of Production Economics
IJPR	International Journal of Production Research

IMSS	International Manufacturing Strategy Survey
INP	Informational Power
IOIS	Interorganizational Information System
IQ	Intelligence Quotient
IRE	Impersonal Reward Power
IS	Impersonal Sanctions
ISO	International Organization for Standardization
ISSN	International Standard Serial Number
IT	Information Technology
IV	Independent Variable
JCR	Journal Citation Reports
JIT	Just in Time
JOM	Journal of Operations Management
KPI	Key Performance Indicator
LCA	Life-cycle Assessement
LCAA	Life-cycle Attribute Assessment
LCI	Life Cycle Inventory
LCSA	Life-cycle Sustainability Assessment
LE	Legitimate Power
LED	Legitimate Power of Dependence
LEED	Leadership in Energy and Environmental Design
LEP	Legitimate Power of Position
LEQ	Legitimate Power of Equity
LER	Legitimate Power of Reciprocity
LSR	Logistics Social Responsibility
MAD	Median Absolute Deviation
MAP	Minimum Average Partial
MAPA	Modified Atmosphere Packaging

MSC	Marine Stewardship Council
NACE	Statistical Classification of Economic Activities in the European Community
NGO	Non-governmental Organization
OEM	Original Equipment Manufacturer
OHSAS	Occupational Health and Safety Advisory Services
OM	Operations Management
PCA	Principal Component Analysis
PCO	Personal Coercive Power
PDCA	Plan Do Check Act
PhD	Doctorate of Philosophy
POM	Polyoxymethylene
PRE	Personal Reward Power
PS	Personal Sanctions
QAP	Quadratic Assignment Problem
RDT	Resource Dependence Theory
REF	Referent Power
REW	Reward Power
RMSEA	Root Mean Square Error of Approximation
ROC	Receiver Operating Characteristic
RoHS	Restriction of Hazardous Substances Directive
RSPO	Roundtable on Sustainable Palm Oil
S	Supplier
SA	Social Accountability
SC	Supply Chain
SCOR	Supply Chain Operations Reference
SCM	Supply Chain Management
SCRM	Supply Chain Risk Management

SEM   Structural Equation Model

SME   Small and Medium-sized Enterprise

SRMR   Standardized Root Mean Square Residual

SSC   Sustainable Supply Chain

SSCM   Sustainable Supply Chain Management

TBL   Triple Bottom Line

TLI   Tucker Lewis Index

THD   The Home Depot, Inc.

TPB   Theory of Planned Behaviour

TQM   Total Quality Management

UK   United Kingdom

UN   United Nations

UNCED   United Nations Conference on Environment and

         Development

URL   Uniform Resource Locator

US   United States

USP   Unique Selling Proposition

VSS   Very Simple Structure

WCED   World Commission on Environment and Development

WEEE   Waste Electrical and Electronic Equipment Directive

WLSMV   Weighted Least Squares Means and Variance Adjusted

WRAP   Waste & Resources Action Programme

A.2 SCOPUS SEARCH STRINGS

Listing A.1: Search string for publications regarding sustainability

```
(TITLE-ABS-KEY(sustainability) OR TITLE-ABS-KEY(sustainable))
    AND DOCTYPE(ar OR re)
```

Listing A.2: Search string for publications regarding sustainability in high
    quality journals

```
TITLE-ABS-KEY(sustainability) AND ISSN(1474-0346) OR
    ISSN(0167-8809) OR ISSN(0889-048x) OR ISSN(0308-521x) OR
    ISSN(0167-4366) OR ISSN(0001-1541) OR ISSN(0044-7447) OR
    ISSN(0962-7286) OR ISSN(1751-7311) OR ISSN(1367-5788) OR
    ISSN(0306-2619) OR ISSN(1568-4946) OR ISSN(1939-1234) OR
    ISSN(1932-104x) OR ISSN(0961-9534) OR ISSN(0960-8524) OR
    ISSN(1537-5110) OR ISSN(0961-3218) OR ISSN(1618-954x) OR
    ISSN(0098-1354) OR ISSN(0166-3615) OR ISSN(0167-9236) OR
    ISSN(0921-8009) OR ISSN(1754-5692) OR ISSN(0301-4215) OR
    ISSN(0360-5442) OR ISSN(1618-0240) OR ISSN(1748-9326) OR
    ISSN(1462-9011) OR ISSN(0013-936x) OR ISSN(0377-2217) OR
    ISSN(0957-4174) OR ISSN(1467-2960) OR ISSN(0306-9192) OR
    ISSN(0963-9969) OR ISSN(0165-0114) OR ISSN(0959-3780) OR
    ISSN(0888-5885) OR ISSN(0268-3768) OR ISSN(1473-5903) OR
    ISSN(0951-192x) OR ISSN(1735-1472) OR ISSN(0948-3349) OR
    ISSN(0925-5273) OR ISSN(0020-7543) OR ISSN(1187-7863) OR
    ISSN(0959-6526) OR ISSN(0301-4797) OR ISSN(1088-1980) OR
    ISSN(1050-0472) OR ISSN(0272-6963) OR ISSN(0737-6782) OR
    ISSN(1047-4838) OR ISSN(0025-1909) OR ISSN(0276-7783) OR
    ISSN(0028-0836) OR ISSN(0027-8424) OR ISSN(0962-8452) OR
    ISSN(0894-3214) OR ISSN(1059-1478) OR ISSN(1364-0321) OR
    ISSN(0964-4563) OR ISSN(0361-3682) OR ISSN(0008-1256) OR
    ISSN(0011-7315) OR ISSN(0964-4016) OR ISSN(0017-8012) OR
    ISSN(0019-8501) OR ISSN(0969-5931) OR ISSN(0278-4319) OR
    ISSN(0144-3577) OR ISSN(0960-0035) OR ISSN(0092-0703) OR
    ISSN(0167-4544) OR ISSN(0735-3766)
```

Listing A.3: Search string for publications regarding SSCM in high quality
    journals

```
TITLE-ABS-KEY(sustain* AND ("supply chain" OR "supply-chain" OR
    "supply chains" OR "supply-chains")) AND ISSN(1474-0346) OR
    ISSN(0167-8809) OR ISSN(0889-048x) OR ISSN(0308-521x) OR
    ISSN(0167-4366) OR ISSN(0001-1541) OR ISSN(0044-7447) OR
    ISSN(0962-7286) OR ISSN(1751-7311) OR ISSN(1367-5788) OR
    ISSN(0306-2619) OR ISSN(1568-4946) OR ISSN(1939-1234) OR
    ISSN(1932-104x) OR ISSN(0961-9534) OR ISSN(0960-8524) OR
    ISSN(1537-5110) OR ISSN(0961-3218) OR ISSN(1618-954x) OR
    ISSN(0098-1354) OR ISSN(0166-3615) OR ISSN(0167-9236) OR
    ISSN(0921-8009) OR ISSN(1754-5692) OR ISSN(0301-4215) OR
    ISSN(0360-5442) OR ISSN(1618-0240) OR ISSN(1748-9326) OR
    ISSN(1462-9011) OR ISSN(0013-936x) OR ISSN(0377-2217) OR
    ISSN(0957-4174) OR ISSN(1467-2960) OR ISSN(0306-9192) OR
    ISSN(0963-9969) OR ISSN(0165-0114) OR ISSN(0959-3780) OR
    ISSN(0888-5885) OR ISSN(0268-3768) OR ISSN(1473-5903) OR
    ISSN(0951-192x) OR ISSN(1735-1472) OR ISSN(0948-3349) OR
    ISSN(0925-5273) OR ISSN(0020-7543) OR ISSN(1187-7863) OR
    ISSN(0959-6526) OR ISSN(0301-4797) OR ISSN(1088-1980) OR
    ISSN(1050-0472) OR ISSN(0272-6963) OR ISSN(0737-6782) OR
    ISSN(1047-4838) OR ISSN(0025-1909) OR ISSN(0276-7783) OR
    ISSN(0028-0836) OR ISSN(0027-8424) OR ISSN(0962-8452) OR
    ISSN(0894-3214) OR ISSN(1059-1478) OR ISSN(1364-0321) OR
    ISSN(0964-4563) OR ISSN(0361-3682) OR ISSN(0008-1256) OR
    ISSN(0011-7315) OR ISSN(0964-4016) OR ISSN(0017-8012) OR
    ISSN(0019-8501) OR ISSN(0969-5931) OR ISSN(0278-4319) OR
    ISSN(0144-3577) OR ISSN(0960-0035) OR ISSN(0092-0703) OR
    ISSN(0167-4544) OR ISSN(0735-3766)
```

A.3   ETHICAL CLEARANCE

**Ethics Approvals (Human
Participants) Sub-Committee**

Loughborough University

Ethical Clearance Checklist

Has the Investigator read the 'Guidance for completion of Ethical Clearance Checklist' before starting this form?	Yes

Project Details

1. Project Title: PhD project: Suppliers' adaptive behaviour to buyer requested sustainability related changes in their operations.

Applicant(s) Details

2. Name of Applicant 1: Roman Buck	10. Name of Applicant 2: Samir Dani
3. Status: PGR student	11. Status: Staff
4. School/Department: SBE	12. School/Department: SBE
5. Programme (if applicable):	13. Programme (if applicable):
6. Email address: R.Buck@lboro.ac.uk	14. Email address: S.Dani@lboro.ac.uk
7a. Contact address: 18 Blake Drive, LE11 5JG Loughborough	15a. Contact address: Click here to enter text.
7b. Telephone number: 07906 03 96 69	15b. Telephone number: 01509 228830
8. Supervisor: No	16. Supervisor: Yes
9. Responsible Investigator: Yes	17. Responsible Investigator: No

Participants

Positions of Authority

18. Are researchers in a position of direct authority with regard to participants (e.g. academic staff using student participants, sports coaches using his/her athletes in training)?	No

1

Ethical Clearance Checklist January 2013

Vulnerable groups

19. Will participants be knowingly recruited from one or more of the following vulnerable groups?	
Children under 18 years of age	No
Persons incapable of making an informed decision for themselves	No
Pregnant women	No
Prisoners/Detained persons	No
Other vulnerable group Please specify:	No
If you have selected No to all of Question 19, please go to Question 23.	
20. Will participants be chaperoned by more than one investigator at all times?	Choose an item
21. Will at least one investigator of the same sex as the participant(s) be present throughout the investigation?	Choose an item
22. Will participants be visited at home?	Choose an item

Researcher Safety

23. Will the researcher be alone with participants at any time?	No
If Yes, please answer the following questions:	
23a. Will the researcher inform anyone else of when they will be alone with participants?	Choose an item
23b. Has the researcher read the 'guidelines for lone working' and will abide by the recommendations within?	Choose an item

Methodology and Procedures

24. Please indicate whether the proposed study:

Involves taking bodily samples (please refer to published guidelines)	No
Involves using samples previously collected with consent for further research	No
Involves procedures which are likely to cause physical, psychological, social or emotional distress to participants	No
Is designed to be challenging physically or psychologically in any way (includes any study involving physical exercise)	No
Exposes participants to risks or distress greater than those encountered in their normal lifestyle	No
Involves collection of body secretions by invasive methods	No
Prescribes intake of compounds additional to daily diet or other dietary manipulation/supplementation	No

2

Involves pharmaceutical drugs	No
Involves use of radiation	No
Involves use of hazardous materials	No
Assists/alters the process of conception in any way	No
Involves methods of contraception	No
Involves genetic engineering	No

Involves testing new equipment	No

Observation/Recording

25a. Does the study involve observation and/or recording of participants?	No
If **Yes**:	
25b. Will those being observed and/or recorded be informed that the observation and/or recording will take place?	Choose an item

Consent and Deception

26. Will participants give informed consent freely?	Yes

Informed consent

27. Will participants be fully informed of the objectives of the study and all details disclosed (preferably at the start of the study but, where this would interfere with the study, at the end)?	Yes
28. Will participants be fully informed of the use of the data collected (including, where applicable, any intellectual property arising from the research)?	Yes

29. For children under the age of 18 or participants who are incapable of making an informed decision for themselves:	
a. Will consent be obtained (either in writing or by some other means)?	N/A
b. Will consent be obtained from parents or other suitable person?	N/A
c. Will they be informed that they have the right to withdraw regardless of parental/guardian consent?	N/A
d. For studies conducted in schools, will approval be gained in advance from the Head-teacher and/or the Director of Education of the appropriate Local Education Authority?	N/A
e. For detained persons, members of the armed forces, employees, students and other persons judged to be under duress, will care be taken over gaining freely informed consent?	N/A

3

Deception

30. Does the study involve deception of participants (i.e. withholding of information or the misleading of participants) which could potentially harm or exploit participants?	No
If **Yes:**	
31. Is deception an unavoidable part of the study?	Choose an item
32. Will participants be de-briefed and the true object of the research revealed at the earliest stage upon completion of the study?	Choose an item
33. Has consideration been given on the way that participants will react to the withholding of information or deliberate deception?	Choose an item

Withdrawal

34. Will participants be informed of their right to withdraw from the investigation at any time and to require their own data to be destroyed?	Yes

Storage of Data and Confidentiality

35. Will all information on participants be treated as confidential and not identifiable unless agreed otherwise in advance, and subject to the requirements of law?	Yes
36. Will storage of data comply with the Data Protection Act 1998?	Yes
37. Will any video/audio recording of participants be kept in a secure place and not released for any use by third parties?	Yes
38. Will video/audio recordings be destroyed within ten years of the completion of the investigation?	Yes
39. Will full details regarding the storage and disposal of any human tissue samples be communicated to the participants?	N/A
40. Will research involve the sharing of data or confidential information beyond the initial consent given?	No
41. Will the research involve administrative or secure data that requires permission from the appropriate authorities before use?	No

Incentives

42. Will incentives be offered to the investigator to conduct the study?	No
43. Will incentives by offered to potential participants as an inducement to participate in the study?	No

Work Outside of the United Kingdom

44. Is your research being conducted outside of the United Kingdom?	No
If **Yes**:	
45. Has a risk assessment been carried out to ensure the safety of the researcher whilst working outside of the United Kingdom?	Choose an item
46. Have you considered the appropriateness of your research in the country you are travelling to?	Choose an item
47. Is there an increased risk to yourself or the participants in your research study?	Choose an item
48. Have you obtained any necessary ethical permission needed in the country you are travelling to?	Choose an item

Information and Declarations

Checklist Application Only:
If you have completed the checklist to the best of your knowledge, and not selected any answers marked with an * or †, your investigation is deemed to conform with the ethical checkpoints. Please sign the declaration and lodge the completed checklist with your Head of Department/School or his/her nominee.

Checklist with Additional Information to the Secretary:
If you have completed the checklist and have only selected answers which require additional information to be submitted with the checklist (indicated by a †), please ensure that all the information is provided in detail below and send this signed checklist to the Secretary of the Sub-Committee.

Checklist with Generic Protocols Included:
If you have completed the checklist and you have selected one or more answers in which you wish to use a Generic Protocol (indicated by #), please include the Generic Protocol reference number in the space below, along with a brief summary of how it will be used. Please ensure you are on the list of approved investigators for the Generic Protocol before including it on the checklist. The completed checklist should be lodged with your Head of Department/School or his/her nominee.

Full Application needed:
If on completion of the checklist you have selected one or more answers which require the submission of a full proposal (indicated by a *), please download the relevant form from the Sub-Committee's web page. **A signed copy of this Checklist should accompany the full submission to the Sub-Committee.**
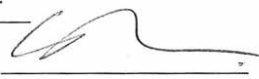
Space for Information on Generic Proposals and/or Additional Information as requested:

For completion by Supervisor

Please tick the appropriate boxes. The study should not begin until all boxes are ticked.

☒ The student has read the University's Code of Practice on investigations involving human participants

☒ The topic merits further research

☒ The student has the skills to carry out the research or are being trained in the requires skills by the Supervisor

☒ The participant information sheet or leaflet is appropriate

☒ The procedures for recruitment and obtaining informed consent are appropriate

Comments from supervisor:

Signature of Applicant: _____

Signature of Supervisor (if applicable): _____

Signature of Head of School/Department or his/her nominee: _____

Date: 16/05/2013

A.4   CERTIFICATE OF ORIGINALITY

This is to certify that I am responsible for the work submitted in this thesis, that the original work is my own except as specified in acknowledgements or in footnotes, and that neither the thesis, nor the original work contained therein, has been submitted to this or any other institution for a higher degree.

_____   _____

(Signature)   (Date)

B

TABLES

B.1 RESULTS OF CONTENT ANALYSIS: RETAIL

Table B.1.: Results from Google Search Query—Usage of the terminology SSCM in practice

	QUERY 1	QUERY 2	QUERY 3
	Wal-Mart		
Search String	"sustainable supply chain" site:http://walmartstores.com/	sustainable supply chain site:http://walmartstores.com/	"sustainable supply chain" Walmart
Results 2012[*]	15	512	565,000
Results 2013[†]	0	170	282,000
Results 2014[‡]	0	193	246,000
	Carrefour		
Search String	"sustainable supply chain" site:http://www.carrefour.com/	sustainable supply chain site:http://www.carrefour.com/	"sustainable supply chain" Carrefour
Results 2012	0	167	42,200
Results 2013	0	31	190,000
Results 2014	2	31	218,000

	QUERY 1	QUERY 2	QUERY 3
		Metro	
Search String	"sustainable supply chain" site:http: //www.metro24.de/ OR "nachhaltige supply chain" site:http://www.metro24.de/	sustainable supply chain site:http: //www.metro24.de/ OR nachhaltige supply chain site:http://www.metro24.de/	"sustainable supply chain" Metro -vancouver[§] OR "nachhaltige supply chain" Metro
Results 2012	0	0	276,170
Results 2013	0	0	1,420,000
Results 2014	0	0	2,200,000
		Tesco	
Search String	"sustainable supply chain" site:http: //www.tescoplc.com/	sustainable supply chain site:http: //www.tescoplc.com/	"sustainable supply chain" Tesco
Results 2012	0	57	264,000
Results 2013	1	365	87,900
Results 2014	3	173	70,900

	QUERY 1	QUERY 2	QUERY 3
		Schwarz Unternehmensgruppe (Lidl & Kaufland)	
Search String	"nachhaltige supply chain" site:http: //www.lidl.de/ OR "sustainable supply chain" site:http://www.lidl.co.uk/ OR "nachhaltige supply chain" site:http: //www.kaufland.de/	nachhaltige supply chain site:http: //www.lidl.de/ OR sustainable supply chain site:http://www.lidl.co.uk/ OR nachhaltige supply chain site:http: //www.kaufland.de/	"sustainable supply chain" Lidl OR "nachhaltige supply chain" Lidl OR "sustainable supply chain" Kaufland OR "nachhaltige supply chain" Kaufland
Results 2012	0	2	11,137
Results 2013	0	4	238
Results 2014	0	0	82
		Kroger	
Search String	"sustainable supply chain" site:http: //sustainability.kroger.com/	sustainable supply chain site:http: //sustainability.kroger.com/	"sustainable supply chain" Kroger
Results 2012	0	0	24,500
Results 2013	0	1	208,000
Results 2014	0	1	173,000

	QUERY 1	QUERY 2	QUERY 3
		Costco	
Search String	costco "sustainable supply chain" site:http://phx.corporate-ir.net/¶	costco sustainable supply chain site:http://phx.corporate-ir.net/	"sustainable supply chain" costco
Results 2012	0	127	225,000
Results 2013	0	203	193,000
Results 2014	1	89	191,000
		Aldi	
Search String	"sustainable supply chain" site:http://www.aldi.co.uk/ OR "sustainable supply chain" site:http://uk.aldi.com/ OR "sustainable supply chain" site:https://corporate.aldi.co.uk/	sustainable supply chain site:http://www.aldi.co.uk/ OR sustainable supply chain site:http://uk.aldi.com/ OR sustainable supply chain site:site:https://corporate.aldi.co.uk/	"sustainable supply chain" Aldi
Results 2012	0	5	17,000
Results 2013	0	4	158,000
Results 2014	0	4	115,000

	QUERY 1	QUERY 2	QUERY 3
	Home Depot		
Search String	"sustainable supply chain" site:https://corporate.homedepot.com/	sustainable supply chain site:https://corporate.homedepot.com/	"sustainable supply chain" Home-Depot
Results 2012	0	8	244,000
Results 2013	0	9	198,000
Results 2014	0	7	258,000
	Target		
Search String	"sustainable supply chain" site:http://corporate.target.com/	sustainable supply chain site:http://corporate.target.com/	"sustainable supply chain" Target[‖]
Results 2012	0	20	—,—
Results 2013	0	22	—,—
Results 2014	0	24	—,—

[*] January 2012

[†] June 2013

[‡] February 2014

[§] Misleading results due to the usage of the term Metro under other circumstances than the actual retailer. In particular, a project with the name "metro vancouver" was responsible for a high count of misleading results. The exclusion of the term "vancouver" reduced the search result by 186,000 hits.

[¶] Costco has outsourced its corporate website to an external service provider who is hosting several corporate websites. Hence, the search string had to be slightly changed in order to restrict the results to Costco only.

[‖] The search results were misleading because of the meaning of the term "target". Hence, they could not be used (738,000 hits in 2012 / 740,000 hits in 2013).

B.2   DATA FOR GRAPHS

Table B.2.: Data for figure 3.5

AUTHOR (YEAR)	EX	REF	INP	LE	REW	CO
Yukl and Falbe (1991)	1	0	0	1	0	0
Cox (1999)	0	0	0	0	0	1
Brennan and Turnbull (1999)	0	0	0	0	0	1
Raven et al. (1998)	1	0	1	1	0	0
Raven et al. (1998)	1	0	1	1	0	0
Pierro et al. (2008)	0	0	0	1	1	1
Pierro et al. (2008)	1	1	0	1	0	0
Pierro et al. (2008)	1	1	0	1	0	0
Hinkin and Schriesheim (1989)	1	1	0	0	0	0
Frost and Stahelski (1988)	0	0	0	1	0	1
Carson et al. (1993)	1	0	0	0	1	0
Swasy (1979)	0	0	0	0	0	0
Cobb (1980)	0	0	0	1	0	0
Comer (1984)	1	1	0	0	0	0
Greene and Podsakoff (1981)	0	0	0	0	0	0
Martin and Hunt (1980)	1	1	0	0	0	0
Martin and Hunt (1980)	1	0	0	0	0	0
McDaniel et al. (1985)	1	1	0	1	1	0
Ragins (1988)	1	1	0	1	1	0
Rahim (1989)	1	1	0	1	0	0
Spekman (1979)	1	0	0	0	0	0
Student (1968)	1	1	0	0	0	0
Sembi (2012)	0	0	0	0	0	0
Lines (2007)	1	0	0	0	0	0
Hunt and Nevin (1974)	1	1	0	1	1	0
Hunt et al. (1987)	1	1	0	1	0	0
TOTAL	18	11	2	13	5	4

B.3   COMPLETE LIST OF SSCM DRIVERS

Table B.3.: Drivers for SSCM

AUTHOR	GOVERNMENTAL REGULATION	ORGA. COMMITMENT	MANAGERIAL COMMITMENT	COST REDUCTION	CUSTOMER- /BUYER	COMPETITIVE ADVANTAGE
Caniato et al. (2012)[a]	x	x	x	x	x	x
Chkanikova and Mont (2012)[b]	x			x	x	
Giunipero et al. (2012)[a]	x		x	x		
Gopalakrishnan et al. (2012)[c]	x	x			x	
Isaksson et al. (2010)[c]	x				x	x
Liu et al. (2012)[a]	x				x	x
Meehan and Bryde (2011)	x	x		x	x	
Millard (2011)[a]						
Santolaria et al. (2011)[a]	x			x	x	
Zhu and Geng (2013)[b]					x	
Birkin et al. (2009)	x			x	x	x
Cambra-Fierro and Ruiz-Benítez (2011)	x					x
Fava (2006)[a]				x	x	
Holt and Ghobadian (2009)[a]	x	x			x	x
Hong et al. (2012)[c]	x				x	
Mollenkopf et al. (2010)[a]		x		x	x	
Nikoloyuk et al. (2010)[a]						
Shi et al. (2012)[a]	x				x	
Stuart (2011)[c]	x	x			x	x
Tachizawa et al. (2012)[a]	x	x			x	
Walker et al. (2008)[a]	x	x		x	x	x
Zhu et al. (2005)[a]	x			x	x	
Zhu et al. (2007)[a]	x	x			x	
Diabat and Govindan (2011)[a]	x			x	x	

AUTHOR	FOCAL FIRM'S REPUTATION	INDUSTRIAL NORM/STANDARD	NGOS	TRANSPARENCY/RISK MITIGATION	SECURING SUPPLY	FOLLOWING COMPETITORS	LABOUR ORGANIZATIONS
Caniato et al. (2012)[a]							
Chkanikova and Mont (2012)[b]	x	x	x	x	x		
Giunipero et al. (2012)[a]		x				x	
Gopalakrishnan et al. (2012)[c]		x				x	
Isaksson et al. (2010)[c]			x				x
Liu et al. (2012)[a]							
Meehan and Bryde (2011)	x			x		x	
Millard (2011)[a]		x					
Santolaria et al. (2011)[a]	x						
Zhu and Geng (2013)[b]	x	x				x	
Birkin et al. (2009)		x					
Cambra-Fierro and Ruiz-Benítez (2011)	x						
Fava (2006)[a]		x					
Holt and Ghobadian (2009)[a]							
Hong et al. (2012)[c]							
Mollenkopf et al. (2010)[a]	x	x	x	x		x	
Nikoloyuk et al. (2010)[a]	x	x	x				
Shi et al. (2012)[a]						x	
Stuart (2011)[c]							
Tachizawa et al. (2012)[a]						x	
Walker et al. (2008)[a]							
Zhu et al. (2005)[a]							
Zhu et al. (2007)[a]							
Diabat and Govindan (2011)[a]		x					

AUTHOR	COMMUNITY/SOCIETY	SUBSIDIZED	INCREASE IN PRODUCTIVITY	ATTRACT INVESTORS	STAKEHOLDER CONCERNCS	SUPPLIER
Caniato et al. (2012)[a]						
Chkanikova and Mont (2012)[b]						
Giunipero et al. (2012)[a]						
Gopalakrishnan et al. (2012)[c]						
Isaksson et al. (2010)[c]						
Liu et al. (2012)[a]	x					
Meehan and Bryde (2011)						
Millard (2011)[a]						
Santolaria et al. (2011)[a]		x				
Zhu and Geng (2013)[b]						
Birkin et al. (2009)			x			
Cambra-Fierro and Ruiz-Benítez (2011)			x			
Fava (2006)[a]						
Holt and Ghobadian (2009)[a]						x
Hong et al. (2012)[c]	x					
Mollenkopf et al. (2010)[a]						
Nikoloyuk et al. (2010)[a]						
Shi et al. (2012)[a]				x		
Stuart (2011)[c]					x	x
Tachizawa et al. (2012)[a]	x					
Walker et al. (2008)[a]						
Zhu et al. (2005)[a]						x
Zhu et al. (2007)[a]						x
Diabat and Govindan (2011)[a]						x

[a] The article focuses on environmental issues
[b] The authors explore what promotes sustainability upstream and downstream as well
[c] Based on literature review

AUTHOR	DRIVER 1	DRIVER 2	DRIVER 3	DRIVER 4	DRIVER 5	DRIVER 6	DRIVER 7	DRIVER 8
Caniato et al. (2012)[*]	Governmental regulation	Corporate values of owner	New market niche	Cost reduction	Understanding	Customer		
Chkanikova and Mont (2012)[†]	Securing long-term product supply	Transparency (Risk mitigation)	Cost reduction	Customer	Industrial norm	Reputation	NGOs	Law
Giunipero et al. (2012)[*]	Top management commitment	Governmental regulation	Cost reduction	Following competitors	Industrial norm			
Gopalakrishnan et al. (2012)[‡]	Governmental regulation	Organizational commitment	Customer	Competitor	Industrial norm			
Isaksson et al. (2010)[‡]	Labour organizations	Governmental regulation	Customer	Competition	NGOs			
Liu et al. (2012)[*]	Customer	Marketing	Governmental regulation	Competition	Community expectation			
Meehan and Bryde (2011)	Governmental regulation (proactive/reactive)	Competition (best practice)	Risk mitigation	Organizational commitment	Reputation	Cost savings	Customer pressure	
Millard (2011)[*]	Industrial norm and standards							

Continued on next page

AUTHOR	DRIVER 1	DRIVER 2	DRIVER 3	DRIVER 4	DRIVER 5	DRIVER 6	DRIVER 7	DRIVER 8
Santolaria et al. (2011)[*]	Governmental regulation	Cost reduction	Reputation (Brand value)	Client demand	Subsidized			
Zhu and Geng (2013)[†]	Following competitor	Industry norm	Reputation (Brand value)	Client demand				
Birkin et al. (2009)	Governmental regulation	Industry standard	Increase in productivity	Customer requirement	Cost savings	Competitive advantage		
Cambra-Fierro and Ruiz-Benítez (2011)	Entering new markets	Legislation	Production efficiency	Competitive advantage	Brand image			
Fava (2006)[*‡]	Consumer demand	Industrial norms	Reduced costs					
Holt and Ghobadian (2009)[*]	Pressure from supply chain	Internal drivers (orga. commitment)	Competitive advantage	Legislation				
Hong et al. (2012)[‡]	Governmental regulation	Societal expectations	Market requirements					
Mollenkopf et al. (2010)[*‡]	Global environmental standards	Organizational commitment	Reputation	Cost reduction	Competitors	Transparency	Customer	NGOs
Nikoloyuk et al. (2010)[*]	Reputation	NGOs	Industry norms (RSPO)					
Shi et al. (2012)[*‡]	Governmental policies	Customer pressure	Competitors	Attract investors				

Continued on next page

AUTHOR	DRIVER 1	DRIVER 2	DRIVER 3	DRIVER 4	DRIVER 5	DRIVER 6	DRIVER 7	DRIVER 8
Stuart (2011)[‡]	Powerful supply chain partners	Governmental regulation	Stakeholder concerns	Organizational commitment	Competitive advantage			
Tachizawa et al. (2012)[*]	Governmental regulation	Competitors	Society	Customers	Organizational commitment			
Walker et al. (2008)[*]	Customer requirement/pressure	Organizational commitment	Governmental regulation	Cost reduction	Competitive advantage			
Zhu et al. (2005)[*]	Supply chain pressure	Cost related pressure	Marketing	Governmental regulations				
Zhu et al. (2007)[*]	Governmental regulation	Supplier pressure	Market demand	Organizational commitment				
Diabat and Govindan (2011)[*‡]	Supply chain pressure	Governmental regulation	Industry norms	Cost reduction				

* The article focuses on environmental issues
† The authors explore what promotes sustainability upstream and downstream as well
‡ The article is based on literature review

B.4   STATISTICS

B.4.1   *Sampling*

REGION	FAME (%)	SURVEY (%)
East Midlands	9.4	13.5
Wales	3.6	3.2
West Midlands	11.1	9.2
Yorkshire and The Humber	11.9	6.8
Other	0.2	0.4
East of England	11.5	6.8
London	7.7	7.2
North East	2.6	4.8
North West	11.2	14.7
Northern Ireland	2.9	2.0
Scotland	6.7	6.4
South East	14.3	15.9
South West	7.0	9.2

Table B.5.: Comparison of sample and population: industrial regions

Table B.6.: Comparison of sample and population: industrial sectors

SECTOR	FAME (%)	SURVEY (%)
Other	0.0	0.4
Crop and animal	8.6	4.0
Manuf. Wood	0.9	4.4
Manuf. Paper	1.6	5.2
Printing	2.2	2.4
Manuf. Coke	0.1	0.0
Manuf. Chem.	2.5	2.0
Manuf. Pharma	0.9	0.8
Manuf. Rubber	3.8	4.8
Manuf. Mineral	1.4	1.2

Continued on next page

SECTOR	FAME (%)	SURVEY (%)
Manuf. Basic Metal	1.1	1.2
Manuf. Fabric. Metal	9.3	11.6
Forestry and logging	0.3	1.6
Manuf. Computer	4.1	4.4
Manuf. E-Equip.	2.5	8.0
Manuf. Machinery	6.4	6.0
Manuf. Vehicle	0.9	0.8
Manuf. Transport eq.	1.2	1.2
Manuf. Furniture	1.4	3.2
Manuf. Other	7.1	3.2
Wholesale	25.6	17.1
Land Transport	6.6	1.6
Warehousing	2.7	1.2
Fishing and aqua	0.5	0.4
Postal/Courier	0.2	2.0
Manuf. Food	4.7	6.4
Manuf. Bev.	0.6	2.0
Manuf. Tobacco	0.0	0.0
Manuf. Textile	1.5	1.2
Manuf. Apparel	1.0	2.0
Manuf. Leather	0.1	0.0

EMPLOYEES	FAME (%)	SURVEY (%)
10-29	18.3	14.3
30-49	16.7	19.9
50-99	35.0	35.1
100-149	16.7	16.3
150-199	8.3	8.8
200-249	5.0	5.6

Table B.7.: Comparison of sample and population: number of employees

Table B.8.: Comparison of sample and population: job description (top 25)

JOB DESCRIPTION	FAME (%)	SURVEY (%)
Managing Director	14.2	19.5
Director	28.5	13.6
Operations Manager	2.0	7.1
Sales Manager	3.5	5.2
Purchasing Manager	4.1	3.2
General Manager	2.8	3.2
Operations Director	1.9	3.2
Sales & Marketing Manager	2.3	2.6
Sales & Marketing Director	1.5	2.6
Commercial Manager	0.4	2.6
Quality Assurance Manager	0.3	2.6
Sales Director	1.8	0.6
Company Secretary	8.4	1.9
Joint Managing Director	1.6	0.6
Production Manager	4.4	1.9
Health & Safety Officer	2.7	1.9
Engineering Manager	1.7	1.3
Works Manager	1.1	1.3
Health & Safety Manager	0.6	0.6
Production Director	1.0	1.3
Business Development Manager	0.6	0.6
Buyer	1.0	1.3
Commercial Director	0.6	1.3
Manufacturing Manager	0.3	0.6
Chief Executive Officer	0.3	1.3
Customer Services Officer	0.3	0.6
Product Manager	0.2	1.3
Service Manager	0.2	0.6
Manufacturing Director	0.2	0.6
Purchasing Director	0.1	0.6
Business Development Director	0.1	0.6
Vice President	0.1	0.6
Health & Safety Director	0.1	0.6

Continued on next page

JOB DESCRIPTION	FAME (%)	SURVEY (%)
Group Managing Director	0.1	0.6
Quality Director	0.0	1.3
International Sales Manager	0.0	0.6
Technical Sales Manager	0.0	0.6
Design Director	0.0	0.6
Buying Director	0.0	0.6
Executive Chairman	0.0	0.6
Planning Manager	0.0	1.3
Procurement Director	0.0	1.3
Purchasing Supervisor	0.0	0.6
Chief Financial Officer & Company Secretary	0.0	0.6
Engineering Director	0.0	0.6

B.4.2   *Test of normality*

Table B.9.: Statistical tests for normality of the exogenous variables

VARIABLE	W (Shapiro-Wilks)	P-VALUE	A (Anderson-Darling)	P-VALUE
Q9_c	0.940	0.000	5.310	0.000
Q9_s	0.903	0.000	8.309	0.000
Q9_z	0.922	0.000	7.503	0.000
Q9_al	0.925	0.000	6.147	0.000
Q9_e	0.944	0.000	5.612	0.000
Q9_o	0.918	0.000	8.045	0.000
Q9_aa	0.925	0.000	6.356	0.000
Q9_ai	0.934	0.000	7.148	0.000
Q9_d	0.903	0.000	9.338	0.000
Q9_q	0.879	0.000	12.017	0.000
Q9_x	0.912	0.000	8.331	0.000
Q9_ap	0.861	0.000	13.150	0.000
Q9_i	0.931	0.000	6.208	0.000
Q9_p	0.925	0.000	7.440	0.000
Q9_y	0.925	0.000	6.695	0.000
Q9_an	0.868	0.000	10.859	0.000
Q9_h	0.931	0.000	6.829	0.000
Q9_n	0.919	0.000	8.329	0.000
Q9_ac	0.925	0.000	7.589	0.000
Q9_ag	0.919	0.000	9.092	0.000
Q9_g	0.910	0.000	10.807	0.000
Q9_l	0.921	0.000	7.968	0.000
Q9_af	0.914	0.000	9.455	0.000
Q9_aq	0.881	0.000	12.011	0.000
Q9_f	0.907	0.000	8.497	0.000
Q9_m	0.933	0.000	5.669	0.000
Q9_ae	0.931	0.000	6.197	0.000
Q9_am	0.944	0.000	4.657	0.000
Q9_k	0.895	0.000	9.505	0.000
Q9_u	0.894	0.000	9.353	0.000

Continued on next page

VARIABLE	W	P-VALUE	A	P-VALUE
	(Shapiro-Wilks)		(Anderson-Darling)	
Q9_ad	0.880	0.000	11.436	0.000
Q9_aj	0.906	0.000	9.167	0.000
Q9_a	0.926	0.000	7.294	0.000
Q9_v	0.902	0.000	8.521	0.000
Q9_ak	0.911	0.000	8.541	0.000
Q9_ao	0.912	0.000	8.170	0.000
Q9_j	0.933	0.000	6.390	0.000
Q9_r	0.933	0.000	6.356	0.000
Q9_w	0.930	0.000	7.606	0.000
Q9_ar	0.931	0.000	6.663	0.000
Q9_b	0.925	0.000	6.853	0.000
Q9_t	0.892	0.000	9.063	0.000
Q9_ab	0.920	0.000	7.310	0.000
Q9_ah	0.933	0.000	6.225	0.000
Q4	0.487	0.000	64.940	0.000
Q7_a	0.904	0.000	7.965	0.000
Q7_b	0.919	0.000	6.353	0.000
Q7_c	0.926	0.000	6.233	0.000
Q7_d	0.939	0.000	4.972	0.000
Q8	0.763	0.000	25.363	0.000

B.4.3   *R code*

Listing B.1: Baron and Kenny method: code for mediation model

```
Y<-ordered(mediation.df$adapt)

M1<-mediation.df$soft

M2<-mediation.df$hard

#<<<<<< Baron and Kenny - Step 1 >>>>>># Compute path c - total
    effect

Baron_c.mod <- glm(Y ~ X, family = binomial(link = "logit"))

#<<<<<< Baron and Kenny - Step 2 >>>>>># Compute path a1 and a2

Baron_a1.mod <- lm(M1 ~ X); Baron_a2.mod <- lm(M2 ~ X)

#<<<<<< Baron and Kenny - Step 3 and 4 >>>>>># Compute paths b1
    and b2 (whilst controlling for c') and path c' (direct
    effect)

Baron_b.mod <- glm(Y ~ X + M1 + M2, family = binomial(link =
    "logit"))

# Baron and Kenny Summary:

Path_a1 <- summary(Baron_a1.mod)$coefficients[2,]

Path_a2 <- summary(Baron_a2.mod)$coefficients[2,]

Path_b1 <- summary(Baron_b.mod)$coefficients[3,]

Path_b2 <- summary(Baron_b.mod)$coefficients[4,]

Path_c <- summary(Baron_c.mod)$coefficients[2,]

Path_c_ <- summary(Baron_b.mod)$coefficients[2,]

Baron <- rbind(Path_a1, Path_a2, Path_b1, Path_b2, Path_c,
    Path_c_)

print(Baron, digits=3)
```

Listing B.2: Lavaan code for mediation model

```
library(lavaan)

mediation <- '

hard =~ REF.p + PRE.p + PCO.p + LEQ.p + LER.p + ICO.p + LEP.p
```

```
soft =~ INP.p + LED.p + IRE.p + EX.p
soft ~ a1*dependence
hard ~ a2*dependence
adapt ~ b1*soft + b2*hard + c*dependence
indirect_soft := a1*b1
indirect_hard := a2*b2
total := c + (a1*b1) + (a2*b2)
direct:= c
'

mediation.fit <- sem(mediation, ordered = "adapt",
    data=MeanEleven.df, estimator='WLSMV')
parameterEstimates(mediation.fit, boot.ci.type = "perc")
```

Listing B.3: R code for mediation model with the package mediation

```
require(mediation)
adapt.y <- glm(adapt ~ soft + hard + dependence, family =
    binomial(link = "probit"))
soft.m <- lm(soft ~ dependence)
hard.m <- lm(hard ~ dependence)
soft.out <- mediate(soft.m, adapt.y, treat = "dependence",
    mediator = "soft", covariates = "hard.m", sims = 5000, boot
    = TRUE)
hard.out <- mediate(hard.m, adapt.y, treat = "dependence",
    mediator = "hard", covariates = "soft.m", sims = 5000, boot
    = TRUE)
summary(soft.out);
summary(hard.out)
par(mfrow=c(2,1))
plot(soft.out, main="soft power bases")
plot(hard.out, main="hard power bases")
```

B.4.4   *Cronbach's α for the 11 bases of power*

Table B.10.: Sensitivity analysis of Cronbach's (1951) α. The figures represent the value for α if the respective item is removed from the group.

BASE	ITEM	RAW α	STD α	G6(SMC)	AVERAGE r
EX	EX	0.78	0.78	0.74	0.47
	Q9c	0.75	0.75	0.68	0.50
	Q9s	0.69	0.70	0.61	0.44
	Q9z	0.73	0.73	0.67	0.48
	Q9al	0.72	0.73	0.64	0.47
REF	REF	0.55	0.56	0.51	0.24
	Q9e	0.50	0.50	0.42	0.25
	Q9o	0.39	0.40	0.32	0.18
	Q9aa	0.60	0.60	0.50	0.33
	Q9ai	0.43	0.44	0.36	0.21
INP	INP	0.81	0.81	0.77	0.52
	Q9d	0.74	0.74	0.66	0.49
	Q9q	0.79	0.79	0.72	0.56
	Q9x	0.76	0.76	0.69	0.52
	Q9ap	0.76	0.76	0.68	0.52
LED	LED	0.72	0.71	0.68	0.38
	Q9i	0.61	0.61	0.53	0.34
	Q9p	0.71	0.70	0.64	0.44
	Q9y	0.55	0.55	0.46	0.29
	Q9an	0.72	0.72	0.65	0.46
PRE	PRE	0.78	0.78	0.74	0.47
	Q9h	0.75	0.75	0.67	0.50
	Q9n	0.72	0.72	0.65	0.46
	Q9ac	0.71	0.71	0.63	0.45
	Q9ag	0.72	0.72	0.64	0.46
	LER	0.73	0.73	0.69	0.40

LER

base	item	raw α	std α	g6(smc)	average r
	Q9g	0.64	0.64	0.56	0.38
	Q9l	0.70	0.69	0.63	0.43
	Q9af	0.60	0.59	0.51	0.33
	Q9aq	0.73	0.74	0.66	0.48
ICO	ICO	0.71	0.71	0.67	0.38
	Q9f	0.76	0.76	0.68	0.51
	Q9m	0.56	0.56	0.48	0.30
	Q9ae	0.62	0.62	0.56	0.35
	Q9am	0.62	0.62	0.54	0.35
LEQ	LEQ	0.79	0.79	0.75	0.48
	Q9k	0.72	0.72	0.65	0.46
	Q9u	0.73	0.73	0.65	0.48
	Q9ad	0.72	0.72	0.64	0.46
	Q9aj	0.77	0.78	0.70	0.53
IRE	IRE	0.60	0.61	0.57	0.28
	Q9a	0.67	0.67	0.59	0.40
	Q9v	0.49	0.50	0.42	0.25
	Q9ak	0.44	0.45	0.36	0.21
	Q9ao	0.49	0.50	0.45	0.25
PCO	PCO	0.68	0.68	0.63	0.35
	Q9j	0.58	0.57	0.49	0.31
	Q9r	0.56	0.56	0.48	0.29
	Q9w	0.73	0.73	0.64	0.47
	Q9ar	0.58	0.58	0.51	0.31
LEP	LEP	0.60	0.60	0.55	0.27
	Q9b	0.59	0.59	0.50	0.33
	Q9t	0.60	0.59	0.50	0.33
	Q9ab	0.47	0.47	0.39	0.23
	Q9ah	0.43	0.43	0.35	0.20

C

GRAPHICS

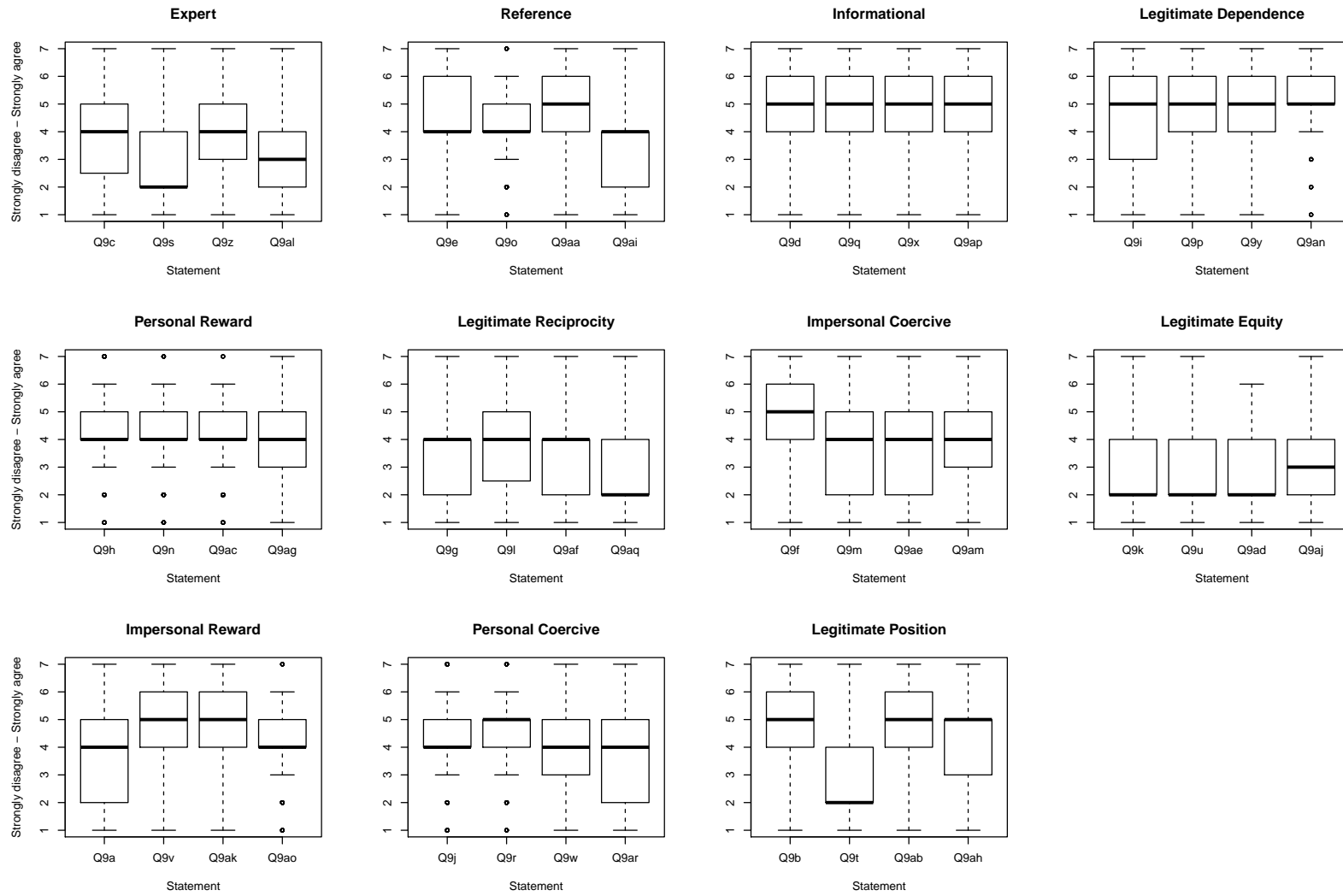## C.1 BOXPLOTS FOR THE 44 STATEMENTS MEASURING 11 POWER BASES

Figure C.1.: Boxplots of the 44 statements measuring 11 bases of power. Grouped by power bases.

C.2 BOXPLOTS FOR THE 36 STATEMENTS MEASURING 11 POWER BASES
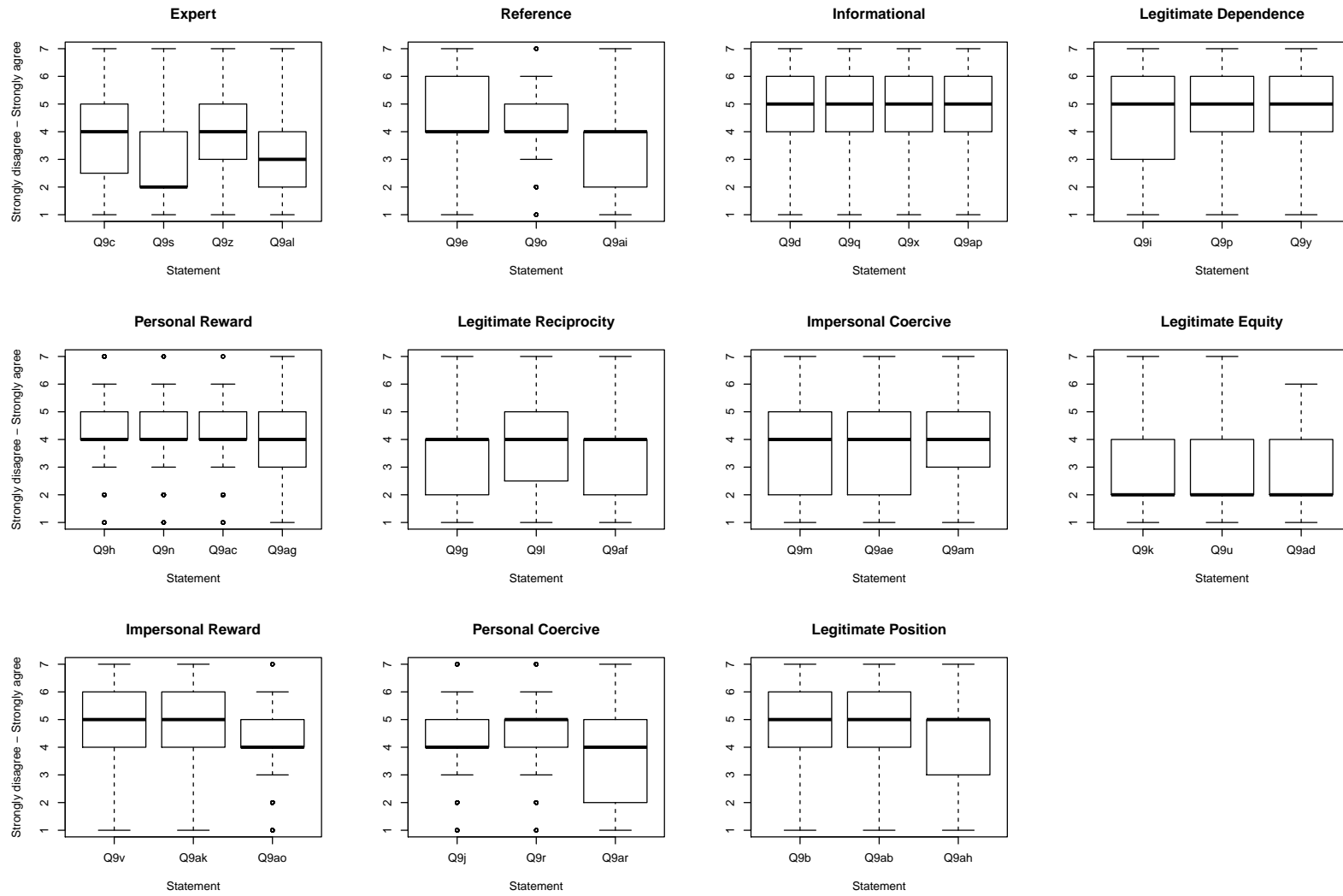
Figure C.2.: Boxplots of the remaining 36 statements measuring 11 bases of power. Grouped by power bases.

C.3   NORMALITY PLOTS

Normal Q–Q Plot for Q9_an

Normal Q–Q Plot for Q9_i

Normal Q–Q Plot for Q9_p

Normal Q–Q Plot for Q9_y

Normal Q–Q Plot for Q9_ag

Normal Q–Q Plot for Q9_h

Normal Q–Q Plot for Q9_n

Normal Q–Q Plot for Q9_ac

Normal Q–Q Plot for Q9_aq

Normal Q–Q Plot for Q9_g

Normal Q–Q Plot for Q9_l

Normal Q–Q Plot for Q9_af

Normal Q–Q Plot for Q9_ar

Normal Q–Q Plot for Q9_j

Normal Q–Q Plot for Q9_r

Normal Q–Q Plot for Q9_w

Normal Q–Q Plot for Q9_ah

Normal Q–Q Plot for Q9_b

Normal Q–Q Plot for Q9_t

Normal Q–Q Plot for Q9_ab

Normal Q–Q Plot for Q7_d

Normal Q–Q Plot for Q7_a

Normal Q–Q Plot for Q7_b

Normal Q–Q Plot for Q7_c