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Extending the supply chain visibility boundary

Utilizing stakeholders for identifying supply chain sustainability risks

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Abstract

Purpose – The purpose of this paper is to investigate how buying firms facing low supply chain visibility can utilize their stakeholder network to identify salient supply chain sustainability risks (SCSR).

Design/methodology/approach – The study employs a design science approach to develop a procedural model for identifying SCSR as a new artifact. A small-scale field-testing study in a food supply chain of a Swiss retail firm demonstrates its applicability and pragmatic validity.

Findings – When stakeholder knowledge external to the supply chain is regarded as a valuable resource, a generic understanding of a buying firm's supply chain suffices to identify SCSR hotspots without creating complexity for the SCSR management.

Research limitations/implications – The paper contributes to the study of SCSR by identifying mechanisms buying firms can employ to identify SCSR hotspots and fostering the nascent understanding of responsibility attribution by stakeholders. Moreover, the emerging theory of the supply chain is enriched by paving a way to extend the supply chain visibility boundary. The procedural model is presumably most useful in contexts of elevated stakeholder pressure and low supply chain visibility. Future research should seek to validate and improve the effectiveness of the newly designed artifact.

Practical implications – The procedural model is directly applicable in corporate practice to the identification of SCSR. Moreover, its application fosters the understanding of a firm's supply chain and its stakeholder network.

Originality/value – SCSR is an increasingly important phenomenon in corporate practice that has received only scarce research attention. The design science approach represents a valuable means for generating theoretical insights and emergent solutions to the real-world problem of SCSR identification.

Keywords Sustainability, Risk management, Stakeholder management, Design science, Supply chain visibility

Paper type Research paper

1. Introduction

Today, stakeholders place substantial pressure on firms for sustainable business conduct, thereby requesting that firms pay attention not only to economic concerns but also improve environmental and social conditions (Carter and Easton, 2011; Meixell and Luoma, 2015).

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This attention stretches beyond individual firms' operations in that it also includes their direct (Foerstl *et al.*, 2010) and indirect (Hartmann and Moeller, 2014) suppliers. Stakeholder pressures increase awareness for sustainability in the supply chain, push buying firms to adopt sustainability-related goals, and influence them to implement sustainability in the supply chain (Meixell and Luoma, 2015). When stakeholders' sustainability-related expectations are unfulfilled, irresponsible supplier behavior may be projected onto buying firms, leading to adverse publicity, reputational loss, and costly legal obligations (Bregman *et al.*, 2015). Thus, non-compliance with stakeholders' requests of sustainability poses a risk for buying firms (Hajmohammad and Vachon, 2016), which this study refers to as supply chain sustainability risk (SCSR). Accordingly, SCSR is defined as "a condition or a potentially occurring event" residing "within a focal firm's supply chain" which can "provoke harmful stakeholder reactions" (Hofmann *et al.*, 2014, p. 168). In times of global sourcing and ubiquitous information availability, SCSR poses a major challenge to buying firms (Busse, 2016).

Although many firms have recognized the importance of SCSR, its practical management can be very difficult. Even in simple dyadic buyer-supplier relations, a buying firm does not possess full knowledge about its suppliers. Some suppliers are even reluctant to share information out of fear of being eliminated from the supply chain (Caridi, 2013). Accordingly, "the visibility in either direction [upstream and downstream the supply chain] is invariably going to be limited" (Carter *et al.*, 2015, p. 93). Moreover, many supply chains have developed substantial complexity in their horizontal, vertical, and spatial dimensions (Bode and Wagner, 2015). Often, buying firms are hence not aware of sustainability misconduct lurking in its complex supply network (Meinlschmidt *et al.*, 2016). In consequence, "the supply chain as a system is [...] difficult to predict and control" (Carter *et al.*, 2015, p. 90).

Buying firms often fail in identifying the most salient SCSR, as evidenced by prominent cases in which they have been held responsible for supplier misconduct, resulting in severe reputational or even financial loss. For example, the NGO Amnesty International and the media recently accused Apple, Microsoft, Sony, and Samsung of exploitative behavior because of conflict minerals use and child labor in their upstream cobalt supply chains (Grodon, 2016). However, managing the sourcing of such conflict minerals is difficult, as suppliers are often unknown and the origin of materials is invisible to buying firms (Hofmann *et al.*, in press). Another example is the revelation of the meat adulteration scandal in 2013, when some beef products in Europe were found to have been contaminated by horse meat, leading to consumer boycotts that caused serious reputational and financial loss for the oblivious food retailers (Yamoah and Yawson, 2014). Again, the origin of the problem was invisible to retailers (Czinkota *et al.*, 2014). Similarly, the study at hand was triggered by an enquiry from one of the largest players in the Swiss retail industry which faced a lack of supply chain visibility and asked the authors to offer scientific knowledge to solve this problem, since the firm was very concerned about SCSR surrounding a specific food supply chain.

Previous research suggests that a success factor for sustainable supply chain management (SSCM) in general is that buying firms should "reconceptualize who is in the supply chain. Rather than viewing NGOs and the like as adversaries, sustainable supply chains leverage the skills and abilities of these nontraditional chain members" (Pagell and Wu, 2009, p. 52). Hence, an attentive and cooperative stance toward stakeholders is often advisable for firms (Meixell and Luoma, 2015; Wong *et al.*, 2015). To identify, assess, and manage SCSR, firms must understand stakeholders' differing perspectives, expectations, and values (Wu *et al.*, 2014). Thus, when faced with lacking visibility of the upstream supply chain, attention to stakeholders may be the strategic direction that firms should also pursue for identifying SCSR, seeking to incorporate stakeholders' SCSR knowledge.

Thereby, the aforementioned supply chain complexity and the myriad different stakeholder groups necessitate a prioritization of SCSR to constrain excessive complexity. Not every sustainability-related issue hidden somewhere in the supply chain and every stakeholder can be addressed as buying firms often have to manage a portfolio of thousands of suppliers spread around the globe (Bode and Wagner, 2015). Since research on this important problem is lacking, the paper aims to answer the following research question:

RQ1. How can buying firms who face low levels of supply chain visibility utilize their stakeholder network to identify particularly salient supply chain sustainability risks?

A design science approach was deemed the appropriate method as it represents a valuable means for generating theoretical insights and emergent solutions to the real-world problem of SCSR identification (Denyer *et al.*, 2008; Holmström *et al.*, 2009). The approach will be explained in detail in the methodology section.

The artificial solution designed and proposed by this research is a procedural model that facilitates an identification of SCSR “hotspots” (Geibler *et al.*, 2016) (i.e. those issues which are most likely to trigger punishing stakeholder reactions *vis-à-vis* other SCSR), even when the exact supply network layout and the majority of operational processes therein cannot be determined. The paper contributes to the study of SCSR by identifying the interventions buying firms can employ to identify SCSR hotspots and by fostering the nascent understanding of stakeholders’ responsibility attribution processes. Moreover, it augments the emerging theory of the supply chain (Carter *et al.*, 2015) by showing how the manageability of the supply chain can be augmented by increasing its visibility. In terms of practice, the framework provides a practical tool for managers to identify SCSR, especially in situations of low upstream supply chain visibility. This study is among the first to apply a design science approach in SSCM research.

The following section lays out the conceptual background. The subsequent section justifies and expounds on the design science approach. Section 4 presents the proposed design solution and a simple yet effective field test to show pragmatic validity. The concluding discussion highlights theoretical and practical implications, acknowledges limitations, and suggests future research avenues.

2. Theoretical background

In recent years, several excellent reviews of SSCM research have been published (e.g. Winter and Knemeyer, 2013; Meixell and Luoma, 2015; Touboulic and Walker, 2015; Wong *et al.*, 2015) which are not recapped here. Instead, this section focuses on three specific pillars for this study: first, the emerging theory of the supply chain which illustrates the problem of missing supply chain visibility; second, an overview of SCSR; and third, the fruitful avenue of stakeholder inclusion within SSCM to mitigate SCSR.

2.1 Supply chain visibility

Supply chain visibility can be broadly defined as “traceability and transparency of supply chain process” (Tse and Tan, 2012, p. 51). Buying firms often have low supply chain visibility as they possess little knowledge about indirect suppliers or cannot independently verify information about their components or practices (Lyles *et al.*, 2008; Pagell and Wu, 2009). Especially fast-moving industries such as the retail and fashion sectors often lack supply chain visibility beyond second-tier suppliers (Opata, 2003; Roth *et al.*, 2008).

In their recent article, Carter *et al.* (2015) lament that the discipline’s current perspective on supply chains might be oversimplified. First, scholars and practitioners frequently neglect important supportive actors who do not directly participate in the flow of materials from one stage to another. Second, often a supply chain’s real boundaries remain unclear.

Carter *et al.* (2015) argue that actors in supply chains often lack sufficient knowledge and visibility of their supply chain beyond first-tier suppliers (upstream) and direct customers (downstream), meaning that “what lies beyond the realm of [the] visible range simply emerges” (Carter *et al.*, 2015, p. 90). This visibility boundary poses a severe management problem, since “beyond the visible range the agent has no choice but to accept what happens there” (Carter *et al.*, 2015, p. 90). Prior research has acknowledged the role of missing visibility in supply chains as a critical factor for effective supply chain risk management (e.g. Taylor, 2005; Durach *et al.*, 2015), rendering it a constant concern for practitioners and scholars alike (Taylor, 2005; Yu and Goh, 2014). Lacking visibility may cause knowledge deficits, a loss of control, and distrust, thereby also enhancing risks in the sphere of sustainability and corporate social responsibility (e.g. Spekman and Davis, 2004).

Indirectly, Carter *et al.* (2015) also hint at a potential remedy to the visibility boundary by emphasizing that a supply chain as an entity is relative to certain products and agents, because every agent at any stage sees only select products (components) and partners (Carter *et al.*, 2015). Scanning the environment of firms can help to reduce uncertainty toward sustainability-related problems (Fabbe-Costes *et al.*, 2011). Hence, finding ways to extract, collect, and share individual knowledge from different sources at different production stages in the supply chain might facilitate greater supply chain visibility and better identification and assessment of SCSR for buying firms. This idea has also been referred to with concepts such as chain of custody (e.g. Boyle, 2007), supply chain due diligence (e.g. Hofmann *et al.*, in press), and traceability (e.g. Golan *et al.*, 2004). These perspectives aim at sharing information between different supply chain stages to increase supply chain visibility (i.e. of material flows, products, processes, and actors).

2.2 SCSR

Many stakeholders are aware of the fact that buying firms possess gatekeeper instruments (i.e. supplier code of conducts, contracts) and processes (i.e. supplier selection, evaluation, development) to influence their suppliers' behavior (Klassen and Vereecke, 2012; Busse *et al.*, 2016b). Therefore, they have become attentive to what happens at the sites of these suppliers and may blame buying firms when their environmental or social expectations are unfulfilled (Murillo-Luna *et al.*, 2008). To date, due to the increased transparency and ubiquitous availability of information, stakeholders can often obtain information about firms' misconduct from distant locations within seconds (Meixell and Luoma, 2015), hold buying firms responsible for any grievances, and subsequently reprimand them. Therefore, negative sustainability-related conditions in their upstream supply chains present possible SCSR for buying firms.

SCSR has only been studied for approximately a decade (e.g. Cousins *et al.*, 2004; Foerstl *et al.*, 2010; Klassen and Vereecke, 2012). A SCSR for a buying firm manifests along a four-stage process (Hofmann *et al.*, 2014): there is a negative sustainability-related condition or event within the upstream supply chain, stakeholders become aware of this, stakeholders ascribe to the buying firm a sufficient amount of responsibility to prevent such events or conditions, and stakeholders decide to take punishing action.

Elevated SCSR arise in particular when they are communicated broadly by parties such as the media or NGOs (Hajmohammad and Vachon, 2016; Busse *et al.*, 2016a). Accordingly, the less a buying firm knows about its suppliers and their specific conditions in the upstream supply chain, the relatively more difficult the identification of SCSR sources is (Hajmohammad and Vachon, 2016). Contrarily, if a firm possessed in-depth knowledge about its upstream supply chain, comprising the particular sustainability-related conditions, then it would be better prepared to mitigate SCSR.

Recently, vignette-based experimental research found evidence that stakeholders consider holding buying firms responsible when they perceive misconduct not only at the

direct supplier, but also further upstream (Hartmann and Moeller, 2014). The severity of the misconduct is another driver to such responsibility ascription (Hartmann and Moeller, 2014).

Hence, in order to avoid loss from adverse stakeholder reactions, a firm needs to assess the sustainability conduct in its supply chain also beyond first-tier suppliers (Wilhelm *et al.*, 2016). Importantly, sustainability misconduct in the supply chain cannot be fully determined on the grounds of the end product's quality or physical properties. For example, the use of child labor or environmentally critical production processes (e.g. toxic waste) is not visible in the end product, although this process-related sustainability information is important for the buying firm's stakeholders (Hofmann *et al.*, 2014). It is hence decisive for buying firms to trace products as well as the processes of how these were produced upstream in their supply chains. Yet, doing so requires a fair amount of supply chain visibility, which is often lacking. Missing or inadequate information about indirect (e.g. second- or third-tier) suppliers augments SCSR substantially (Wilhelm *et al.*, 2016). Most of the sustainability-related problems lie beyond the suppliers at the closest tier (Tachizawa and Wong, 2014); hence, the more upstream a supplier, the more SCSR is usually associated with it (Grimm *et al.*, 2014). Moreover, in the context of SCSR, the crucial role stakeholders other than suppliers and buyers might play for improving visibility requires more attention.

2.3 The role of stakeholders in SSCM

Research calls for stronger focus on the incorporation of stakeholders in SSCM research (Noland and Phillips, 2010; Pagell and Shevchenko, 2014). A stakeholder is an entity that "can affect or is affected by the achievement of the organization's objectives" (Freeman, 1984, p. 46). Frequently considered stakeholder groups include owners, managers, employees, suppliers, customers, competitors, local communities, activist groups, the media, governmental actors, and even the natural environment (Donaldson and Preston, 1995).

Firms can adopt various stances toward their stakeholders, ranging from adversarial to welcoming (Pagell and Wu, 2009). Pagell and Wu (2009) observed that leading firms reconceptualize who is in the supply chain, such that they regard not only their direct buyers and suppliers as part of the supply chain, but also other stakeholders. Essentially, they suggest an opening up of the firms toward these stakeholders. Further studies also found that some firms leverage the expertise and skills of stakeholders, resulting in better informed managerial decision making (Roloff, 2008; Sarkis *et al.*, 2010; Gold *et al.*, 2013). In the same vein, Wong *et al.* (2015, p. 56) argued that "feedback from [...] stakeholders represents key resources because (they) sometimes know more about the environmental problems facing part of the supply chains than the focal firm." Stakeholders can provide assistance, develop policies, engage in evaluation and monitoring, and identify improvement potential in the firm's upstream supply chain with regard to sustainability (Gualandris *et al.*, 2015; Wong *et al.*, 2015). The recent literature hence advocates a shift from adversarial to more cooperative firm-stakeholder relationships (Roloff, 2008). In the context of SCSR, leading firms have begun to proactively search for valuable information that helps them to identify their SCSR (or other objectives) by constantly scanning the external environment or by conducting regular stakeholder consultations and round tables (Foerstl *et al.*, 2010; Meinschmidt *et al.*, 2016).

Stakeholders vary in numerous ways, such as their interests and roles (Wu *et al.*, 2014). Different groups of stakeholders can be interested in the economic, environmental, and social dimensions to different degrees (Meixell and Luoma, 2015). Some stakeholders hope for the firm's success (e.g. employees and customers), while others may not mind failure (e.g. competitors and the media) (Hofmann *et al.*, 2014). Therefore, firms should refrain from treating their stakeholders as homogenous aggregates; rather, they should differentiate between them and dedicate specific attention to select stakeholder groups (Gualandris *et al.*, 2015).

One approach to prioritize the different concerns of divergent stakeholder groups was offered by Mitchell *et al.* (1997), who provide a theory of stakeholder salience in which they depict to whom and what managers pay attention in situations of competing stakeholder claims. Three different attributes of stakeholders are presented that influence how salient stakeholders are perceived by managers: a stakeholder's power, the legitimacy of its claim, and the urgency associated with these claims. However, multiple stakeholders can also join forces (Mitchell *et al.*, 1997) such that, for example, powerless stakeholders with urgent claims who reside somewhere in the upstream supply chain (such as exploited workers) are supported by powerful stakeholders without any claims of their own (such as the media or NGOs) (Busse, 2016; Busse *et al.*, 2016a).

Given that SCSR pose a major unresolved problem in corporate practice and that prior SCSR research has mostly ignored stakeholders as a valuable resource for SCSR identification, a more inclusive stance toward these groups will be taken in the current research. Specifically, this study employs a design science approach explained in the next section to develop a procedural model for identifying SCSR.

3. Methodology

This research subscribes to the design science paradigm whose proponents challenge the view of management as a primarily explanatory science, modeled in accordance with the natural sciences (van Aken, 2004; Holmström *et al.*, 2009). In contrast, design scientists regard design-oriented disciplines such as engineering and medicine as additional role models for management. These "sciences of the artificial" (Simon, 1996) revolve around the development of solutions and improvements to real-world problems (Holmström *et al.*, 2009). Design science is relatively more concerned with questions of effectiveness ("works" vs "does not work") than truth ("is true" vs "is false") (Romme, 2003), thereby aiming at the generation of prescriptive knowledge (i.e. how things should be in practice) (Denyer *et al.*, 2008). Design science involves making suggestions for possible or emerging new solutions.

Management scholars have promoted the design science paradigm for slightly more than a decade (Romme, 2003; van Aken, 2004). In the domain of supply chain, logistics, and operations management, the approach has been popularized by Holmström *et al.* (2009), leading to promising initial applications (e.g. Finne and Holmström, 2013; Schleper and Busse, 2013; Tanskanen *et al.*, 2015). For SSCM research, developing new solutions to sustainability-related problems is particularly important, given that "few if any supply chains are truly sustainable" (Pagell and Shevchenko, 2014, p. 49) at present. In light of the difficulty of identifying SCSR, and given that this study was initially invoked by a firm in need of a new solution, the design science approach was applied here.

While explanatory science takes a solution as given, design science commences earlier in the life cycle of a solution; it seeks to develop new solutions (Holmström *et al.*, 2009). These distinctive emphases are methodologically important, because the design of solutions is primarily a creative process relying on abductive reasoning (Kovács and Spens, 2005; Mantere and Ketokivi, 2013), whereas the study of extant solutions employs classical research methods based on deductive and inductive reasoning (Holmström *et al.*, 2009). "Abduction (is) an inference to an explanation" or a solution (Mantere and Ketokivi, 2013, p. 72). Given the subjective nature of abductive reasoning it is impossible to spell out any "mechanistic" (Ketokivi and Mantere, 2010, p. 331) procedure for how exactly a solution to a problem was derived. Accordingly, the basic idea behind the solution proposed by this study cannot be induced from data nor deduced from theory. In essence, the solution recombines elements from the prior literature, as described before, and adapts the general view of stakeholders as valuable resources in SSCM to the specific topic of SCSR.

Although the development of solutions in design science necessitates creativity, design science also generates theory which is called design theory (Gregor and Jones, 2007;

Tanskanen *et al.*, 2015). The essence of design theory is captured in the so-called CIMO logic (Denyer *et al.*, 2008), which refers to the four elements of context, a number of interventions, the generative mechanisms associated with the solution, and the final outcomes. Context denotes the range of applicability of a solution in the same manner that the range of a theory determines its applicability (Denyer *et al.*, 2008; Busse *et al.*, in press). The interventions describe the changes *vis-à-vis* the status quo. Often, multiple interventions are bundled by a single artifact, which is an “artificial thing” (Romme, 2003, p. 562) that serves as “a means to an end” (Holmström *et al.*, 2009, p. 67). The causal effects set in motion by the interventions in the real world are often referred to as generative mechanisms by design scientists (Denyer *et al.*, 2008; Tanskanen *et al.*, 2015). Finally, the generative mechanisms lead to certain outcomes which ought to include the solution (mitigation) of the problem to be solved (Denyer *et al.*, 2008). This study applies the CIMO logic to illustrate the effectiveness of the designed solution.

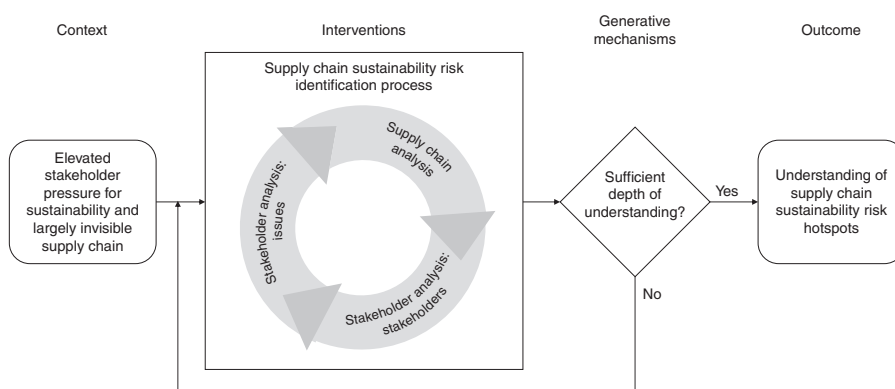
4. Results

Departing from low-visibility supply chains and elevated stakeholder pressure for SSCM as the typical context, this research has developed a procedural model for integrating the stakeholders’ distinct knowledge into a buying firm’s understanding of its own supply chain. Some stakeholders have special interest in sustainability-related issues (e.g. NGOs or activist groups), others represent parties involved in the narrower supply chain (e.g. unions), yet others possess special investigative skills and knowledge (e.g. media). In light of these different interests and roles, stakeholders may see aspects of a buying firm’s supply chain that the firm itself is unaware of, since these aspects are not essential to the firm’s ordinary operations. Thus, by viewing stakeholders as valuable resources for SCSR identification, the procedural model serves as a workaround to the low-visibility problem and facilitates the SCSR identification.

The following description of the procedural model highlights the three interventions aggregated by this artifact (i.e. the procedural model), sheds some lights on the generative mechanisms, and finally argues how and why it leads to the identification of SCSR “hotspots” as the outcome, thereby mitigating the SCSR identification problem and reducing environmental complexity. Thereafter, a second sub-section expounds on the field-testing of the newly designed solution by applying it in the real world and following the request for “pragmatic validity” of design solutions (Denyer *et al.*, 2008, p. 395).

4.1 The procedural model

The basic idea behind the procedural model is to identify SCSR through an iterative process of supply chain and stakeholder analysis while aiming to reduce the environmental complexity with regard to the plethora of involved stakeholders and their expectations. To this aim, the procedural model combines three interventions motivated by three guiding questions, the first of which relates to the supply chain mapping and the other two to the stakeholder analysis (see Figure 1): where should we look? This question will help firms to foster visibility in their supply chains exactly where it is needed the most, based on the stakeholders’ knowledge, attention, and decision-making processes; whom do we need to be concerned about? This question will help firms to filter their stakeholders such that they can focus on the most important ones; and which issues do we need to look for? This question will help firms to ensure that any issues important to their stakeholders are considered. As follows, each question is approached in detail, thereby deriving three context-dependent interventions, which are explained together with their underlying generative mechanisms. The entire process is referred to as iterative because it may have to go through multiple loops in which it uses the answers of the respective other questions as inputs until a satisfactory outcome is reached (see Figure 1).



Supply chain sustainability risks

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Figure 1.
Procedural model

4.1.1 Supply chain analysis – where should we look? Prior literature has suggested that, at least theoretically, the firm's complete supply chain, including relevant stakeholders such as NGOs or local communities (Pagell and Shevchenko, 2014), should be considered to obtain sufficient knowledge for SSCM (Fabbe-Costes *et al.*, 2011). This includes the input-output structure that describes the process of transforming raw materials into final products, the governance structure, and the geographical dimension (Hawkes, 2009). The non-compliance of a single supplier can endanger the focal firm's reputation (Hofmann *et al.*, 2014). However, when visibility is lacking, it is (by definition) extremely difficult and resource-intensive (i.e. costly) for firms to map a supply chain in sufficient detail and to obtain the relevant information, especially for nodes far upstream (Roberts, 2003; Roth *et al.*, 2008).

To approach this problem, pragmatic assumptions can be made about those supply chain stages that need to be considered as potential sources of SCSR, either through observations within similar supply chains or by "reverse engineering." For instance, in the pan-European food crisis caused by the horse meat scandal, a chemical analysis of the end product revealed traces of horse meat DNA in beef products (O'Mahony, 2013). This fraud was thus uncovered by a physical breakdown of the end product, since the supply chain layout could not be determined in detail. While a physical breakdown of the final product may reveal some important insights with respect to, for example, product quality and the type of production processes that were applied, other information cannot be obtained in this manner (e.g. data pertaining to sustainability-related conditions in production facilities). Thus, reverse engineering must be supplemented with other sources of knowledge, such as the firm's internal knowledge (Barney, 1991; Garvin, 1993), expert sources (Meinlschmidt *et al.*, 2016), and, most importantly, the stakeholders' knowledge (Pagell and Wu, 2009; Wong *et al.*, 2015). In this manner, the reconstruction of a generic supply chain (i.e. generative mechanism) for the analyzed product is possible.

By assessing stakeholders' importance (see question 2) and their interests (see question 3), more information concerning expectations in specific channels of a supply chain may be revealed and lead to further iteration of the supply chain mapping process. For example, a component side channel may be included due to an NGO's know-how on critical working conditions in a factory producing this specific part. Conversely, once a process within the supply chain has been identified with sufficient certainty as uncritical, the analysis can be shortened. Considering the fact that stakeholders also have cognitive limits (Barnett, 2014), the prime advantage of integrating stakeholder knowledge in SCSR assessment is that buying firms turn their attention precisely to those supply chain stages that matter most to their stakeholders. The process thus safeguards

that the most important information is considered. Hence, the first intervention (see Denyer *et al.*, 2008, p. 406) is proposed.

I¹: identify all relevant supply chain processes and steps as well as corresponding actors through the use of reverse engineering, firm's internal knowledge, expert sources, and stakeholder knowledge.

4.1.2 Stakeholder analysis – whom do we need to be concerned about? In the process of building a generic supply chain with the required depth of understanding, stakeholders and their interests can be identified along this map. Prior research has identified numerous groups of stakeholders (e.g. Freeman *et al.*, 2010) which also possess somewhat group-specific means of punishing the buying firm (Hofmann *et al.*, 2014; Meixell and Luoma, 2015). Figure 2 highlights some of these means to provide firms with a reference for how SCSR could actually manifest.

Firms face a plethora of stakeholders and hence need to prioritize them to make them manageable (Gualandris *et al.*, 2015). It is impossible to control all stakeholders in a complex supply chain, since the assessment costs would become too high (Mitchell *et al.*, 1997). In practice, managers commonly make the mistake of generating overly long stakeholder lists (Eden and Ackermann, 1998). Hence, what is needed is a way to reduce the complexity in SCSR identification.

Prior research has called for a focus on stakeholders who are perceived as the most likely to cause adverse events in terms of sustainability and those perceived to cause the most damage (Harland *et al.*, 2003). However, we argue that powerful stakeholders with urgent and/or legitimate claims (see Mitchell *et al.*, 1997), such as consumers, are unlikely to be overseen in the process of SCSR identification; they would quite likely already call attention to themselves. Hence, more important is the identification of stakeholders in the upstream supply chain who are powerless but at the same time have urgent and legitimate claims. Such stakeholders may “depend upon others (other stakeholders or the firm's managers) for the power necessary to carry out their will” (Mitchell *et al.*, 1997, p. 877), thereby joining forces with these other stakeholders (Busse, 2016).

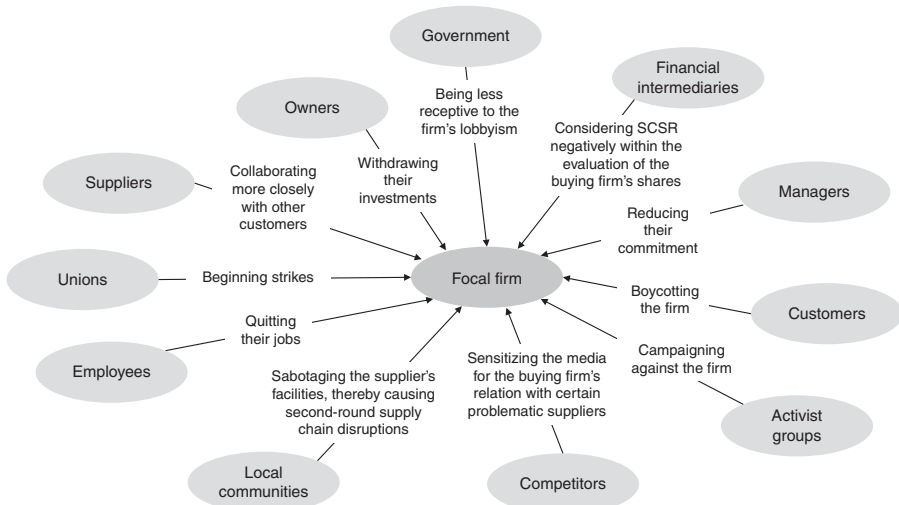


Figure 2.
Illustrative examples
of how stakeholders
can punish
buying firms

Sources: Stakeholder groups adapted from Freeman *et al.* (2010, p. 105); punishments adapted and extended from Hofmann *et al.* (2014) and Meixell and Luoma (2015)

To facilitate SCSR identification in a parsimonious manner, we propose a differentiation between two critical kinds of stakeholders, thereby building on a prior stakeholder classification (Mitchell *et al.*, 1997) and the distinction between a narrow (i.e. material flow related) and a wider, reconceptualized supply chain (Pagell and Wu, 2009; Carter *et al.*, 2015). We label them “deprived” and “advocating” stakeholders. The notion of deprived stakeholders is used to refer to powerless stakeholders with urgent and legitimate claims who also reside within the (narrow) supply chain such that they are involved with or impaired by its material flows. In the aforementioned conflict mineral child labor case, the exploited children represent deprived stakeholders. Complementarily, the term “advocating stakeholders” refers to powerful stakeholders who do not possess any urgent or legitimate claims of their own and whose position is only adjacent to the supply chain such that they are not directly involved in or affected by its material flows (Pagell and Wu, 2009). Again, the conflict mineral child labor case supports these arguments as Amnesty International and the media assume this advocating role. By combining the stakeholder salience classification with the stakeholders’ supply chain related positioning, this study posits a typical correlation between them in SCSR practice which helps to reduce the complexity of the SCSR identification process.

Once confronted with the sustainability problems of deprived stakeholders, advocating stakeholders may support them to have their claims considered. For instance, deprived stakeholders such as oppressed workers who have no voice in a large internationally acting company may be supported by advocating stakeholders such as the media or NGOs, thereby triggering punishing reactions from reciprocal (i.e. fairness-oriented, Bridoux and Stoelhorst, 2014) and dominant stakeholders such as consumers (Busse, 2016; Busse *et al.*, 2016a).

Focusing on deprived stakeholders as a first step in the stakeholder analysis is necessary because buying firms are often deemed responsible for wrongdoings toward these stakeholders. What is going wrong happens within their sphere of influence. Consequently, to identify SCSR in the suggested context, the second intervention is proposed.

I²: identify all relevant stakeholders who are critical to your business by prioritizing them according to their salience; focus particularly on deprived stakeholders.

4.1.3 Stakeholder analysis – which issues do we need to look for? Practitioners (and hence also stakeholders) often have differing understandings of the sustainability concept (Busse *et al.*, 2016b). Some of them regard sustainability more from a longitudinal perspectives, others approach the topic from a cross-sectional perspective. However, at the more specific level of sustainability-related issues, relative consensus appears to exist regarding the question which social-ethical, environmental, and economic governance-related issues are to be subsumed under the sustainability rubrum (Schleper and Busse, 2013). Table I displays these “typical” issues in an overview. Each has been acknowledged by past research as very important. For example, the first issue listed in Table I, scarcity of natural resources, has been at the forefront of the SSCM research agenda for quite a few years (Bell *et al.*, 2012, 2013). Although sustainability performance levels and expectations vary substantially around the globe (e.g. concerning the question which level of resource scarcity or which frequency of occupational hazards is socially acceptable or not) (Busse *et al.*, 2016a), the topics listed in Table I (e.g. use of natural resources or workplace safety and health as such) represent the most widely accepted sustainability-related issues. For the sake of simplicity, buying firms can hence begin their SCSR identification with this list in mind.

As discussed earlier, different stakeholders have slightly distinct interests (Hofmann *et al.*, 2014; Wu *et al.*, 2014). In line with the above considerations, this does generally not mean that their fairness standards are opposed, such that any reciprocal stakeholder would, for example, want scarce natural resources to be wasted. Rather, it highlights that stakeholders focus their attention on specific matters. For example, Amnesty International, an NGO, is particularly concerned with human rights issues, whereas Greenpeace, also an

Issues	Exemplary stakeholder concerns with respect to operations in the supply chain
<i>Environmental</i>	
Use of natural resources	Can the consumption of scarce natural resources be avoided or mitigated?
Disposal and waste reduction	Does the supplier have rules in place that prevent the disposal of waste in the wilderness?
Environmentally friendly products and practices	Do components produced by the supplier have harmful impacts at the end-of-life stage?
Emissions and pollution	Does the supplier pollute water with its emissions?
Environmental risk management	Does the buying firm monitor whether its suppliers have some hazard-protection systems in place?
Energy consumption	Which sources of energy are used by the buying firm's most important supplier?
Biodiversity protection	Does the supplier threaten any endangered species through its operations?
Hazardous substances	Are safety procedures in place that ensure that hazardous substances are kept under control?
Water consumption	How much water is consumed through the production of one unit of the final product?
<i>Social</i>	
Human rights	Are any of the buying firm's suppliers engaged in any form of human rights violation?
Non-discrimination	Are women discriminated within the suppliers?
Child labor	How do the suppliers ensure that underage employees are truly just learning and studying?
Freedom of association and collective bargaining	Are employees at the suppliers allowed to become members of unions?
Forced, compulsory, bonded labor	Are employees provided their attachment for free, or do they have to pay back some loan?
Workplace safety and health	What is the lost time case rate at the respective supplier?
Remuneration, benefits, wages	Do all the workers earn living wages?
Working hours	How many hours per week do employees have to work?
Disciplinary practices, human treatment	Are disciplinary sanctions proportionate and aligned with human rights?
Regular employment	Which share of the workforce is employed on a temporary contract basis?
<i>Miscellaneous</i>	
Compliance with laws and regulations	Does the supplier abide by all local, national, and international law?
Transparency, disclosure, informing stakeholders	How forthcoming is the buying firm in informing stakeholders about its supply chain operations?
Safe processes, products, services	Which quality management processes are in place to ensure product safety at the suppliers?
Stakeholder participation and dialog	How receptive is the firm to engage in dialog with its stakeholders?
Corruption, extortion, bribery	Has any occasion of corruption within the supply chain become publicly known?
Fair business and competition	Does the buying firm foster ethical business conduct at its suppliers?
Sources: Issue list adapted from Schleper and Busse (2013, p. 197); concerns are illustrative	

Table I.
Illustrative examples
of what stakeholders
care about

NGO, focuses on the treatment of the natural environment, most importantly on biodiversity. Hence, once buying firms have identified their most relevant stakeholders, they need to understand their focus of attention. Given that advocating stakeholders ultimately carry out most punishments, the last intervention is proposed.

I³: identify the expectations, issues, and topics to which advocating stakeholders pay particular attention.

By utilizing the suggested procedural model, firms are able to systematically analyze and absorb stakeholder knowledge regarding sustainability conditions in supply chains, thereby fostering SSCM and mitigating SCSR (Meinlschmidt *et al.*, 2016). The term “stakeholder knowledge” is used here to refer to information about stakeholders as well as information from stakeholders. This procedural model acts as a workaround to lacking visibility in supply chains, using a “reverse engineering” approach to reconstruct the supply chain and determine sustainability-related issues of deprived stakeholders that advocating stakeholders might not tolerate. Through greater understanding of activities and stakeholder interests, attention, and attitudes, relevant sustainability-related issues within the supply chain that could depict SCSR can be identified. Thus, the procedural model facilitates SCSR identification and prioritization. Through multiple iterations of this process, relevant stakeholders and their activities and interests can be investigated with the required depth of understanding and provide conceptual insights on sustainability hotspots in supply chains as the final outcome.

4.2 Field-testing study

According to Denyer *et al.* (2008, p. 395), “for validation, design propositions have to be field-tested using pragmatic validity” before implementing the new solution in more complex scenarios. Hence, a field-testing study was conducted with the help of the partner firm that first approached the researchers because it could not identify its SCSR. This firm is one of the largest players in the Swiss retail industry, achieving net revenues in the range of tens of billions of Swiss Francs. With thousands of retail outlets and tens of thousands of employees, it considerably influences the Swiss food market. The company has positioned itself as a market leader in products that are produced in an ecologically and socially sustainable manner, and it has committed itself to fulfilling demanding stakeholder expectations.

The procedural model was field-tested for a specific food supply chain, namely, conventional (i.e. non-organic) canned tomatoes from Italy. The application context matches the ideal context conceived theoretically because, first, stakeholders such as consumers scrutinize food supply chains carefully for sustainability and react very sensitively to any grievances (Beske *et al.*, 2014). Second, lack of supply chain visibility was a major concern raised by the corporate partner. Food supply chains are often based on transactional relationships throughout the supply chain, making them dynamic and non-transparent (Roth *et al.*, 2008). The problem of low visibility is typical in retail (Barratt and Oke, 2007). Another advantage of this first application context is that the supply chain for canned tomatoes is quite simple, compared to other products.

Numerous closely intertwined iterations of the phases one to three in the procedural model occurred (see Figure 1). To foster readability, however, the process is described in a quasi-linear manner, beginning with the mapping of a generic supply chain, in response to the question, “Where should we look?” (also see Figure A1).

The production processes in the supply chain were scrutinized first by analyzing the end product, with the help of firm-internal expertise and (mental) reverse engineering. By utilizing the information provided by the first-tier supplier and expert knowledge from stakeholder reports on canned tomato production, a rough map of the supply chain was derived, including the most important activities at each echelon. In this particular case, intermediary supply chain steps, such as import, trade, or wholesale, were neglected in the further SCSR screening process when it became evident that they presumably did not involve any deprived stakeholders. Agricultural inputs such as fertilizer or seeds could also be excluded, as their production is strongly regulated by law. Moreover, attention was not directed to packaging (e.g. cans) or labeling (e.g. paper wrapping of the cans) material, as

any sustainability-related problems within their production processes would hardly be attributed specifically to this retail firm given that these products are used simultaneously by many buying firms. Hence, the attention could be focused on the specific supply chain channel of tomatoes during the first iteration of the model. This reasoning was supported in the process of investigating stakeholder interests, such that no additional channels were required.

Having mapped the relevant supply chain stages and the most important activities at each echelon (see Figure 3), the different environments in which the main channel is embedded were explored during the stakeholder analysis, including the socio-economic context, the legal and political structure, and the competitive environment. Managers at the partner firm were already well aware of consumers as very powerful stakeholders with legitimate claims (e.g. related to product safety, health, and image). In addition, potential deprived stakeholders were identified, based on the current understanding of the advocating stakeholders' focus of attention. Secondary data sources such as reports from industry experts, NGOs, and unions as well as newspaper articles provided invaluable input thereby. Each iteration of the stakeholder analysis gave way to more information on specific SCSR until the corporate partner was content with the resulting level of detail.

The food industry is often linked to poor social and working conditions in the early supply chain stages (New, 2015) (i.e. farm workers, cooperatives, and farm associations). Hence, it was assumed that deprived stakeholders would be found particularly in the production stage (Wognum *et al.*, 2011; Wiese *et al.*, 2012). NGO reports hinted that social conditions on farms differ substantially within Italy (Amnesty International, 2012; Hough, 2014). The workers' situation in the north seems to be favorable to the south, but underpayment and a lack of social and health benefits were still perceived as very common problems in both regions (Rinaldini *et al.*, 2012).

The poor social status of farm workers partially explains why many are tempted to become involved in criminal activities, such as dumping and burning toxic waste on the fields (e.g. ABC Online, 2014). Farm workers are protected by Italian unions as advocating stakeholders. Unions are actively involved in associations, politics, and public life and possess substantial influence in the Italian food industry. One of these unions is CGIL-Flai, the agricultural section of the general confederation of workers. The union conducts independent research, organizes conferences on agricultural reforms, and frequently publishes reports to attract public attention (Federazione Lavoratori Agroindustria, 2014). Such cumulated stakeholder knowledge is particularly helpful, as it represents dense and easy-to-collect insights.

There was widespread agreement within the retail firm that consumers depict the overall most important stakeholders in the SCSR context. Consumers had a dual role in this study. First, they represent dominant stakeholders who can support advocating stakeholders by exerting their power through boycotts (Beske *et al.*, 2014; Hartmann and Moeller, 2014; Bregman *et al.*, 2015). Second, they can use their power in self-regarding manners (see Bridoux and Stoelhorst, 2014) and protect their personal interests related to food health, safety, and image.

Having identified the most salient advocating stakeholders, the third intervention of the procedural model was applied. The most important issues that the union defends comprise workers' rights for better contracts, minimum wage, less corruption, social security, safety, and integration of illegal immigrants (Federazione Lavoratori Agroindustria, 2014). In addition to these problems, criminality and transparency regarding the origin of produced food were found to matter most for advocating stakeholders. For instance, the study revealed that EU legislation allows the declaration of tomato paste coming from China as "produced in Italy" as long as any minor ingredient such as salt is added in Italy (Kamberaga, 2010; Anesi, 2013). The corporate partner worried that even Mafia

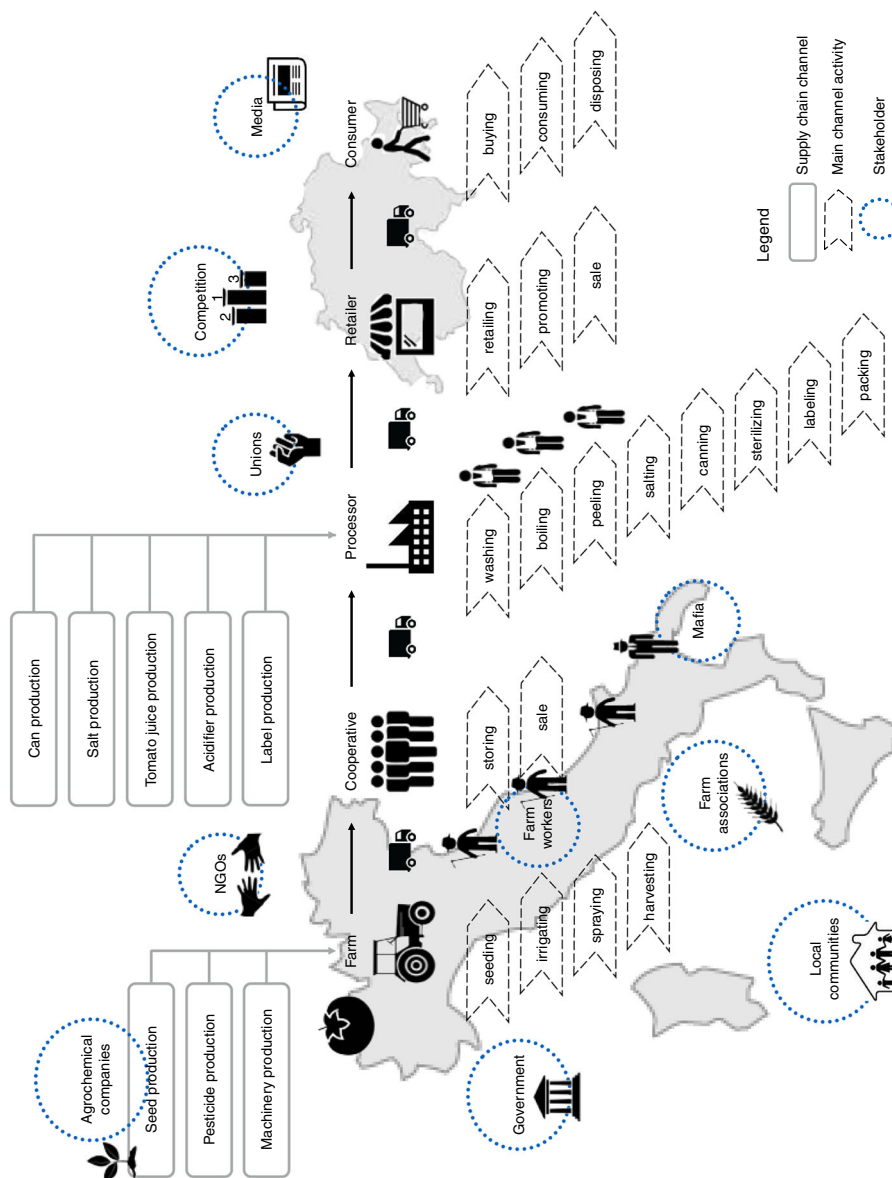


Figure 3.
Field-testing study:
the tomato supply
chain and the
involved stakeholders

organizations might be profiting from such ambiguity. The mafia's involvement in the tomato trade was reported to increase prices for consumers while profits wander into the criminals' pockets (e.g. Bloomberg, 2013; Kington, 2013). Based on this information, the supply chain map was expanded geographically, and the risks stemming from the different locations (north vs south) were examined. Using the procedural model iteratively, the study established a better understanding of the supply chain, the involved actors, and the relevant risk drivers. To a large extent, the supply chain and sustainability-related knowledge was derived from stakeholders adjacent to the supply chain (e.g. industry experts, unions, and NGOs; see Table II). This highlights the importance of collecting information not only about, but also from stakeholders. This approach of using stakeholder knowledge acted as a workaround to the lack of visibility in the specific supply chain.

The procedural model helped to identify three SCSR hotspots which sensitized the partner firm's management for further action, namely, wages and social conditions for farm workers, transparency regarding origin of raw material, and criminal activities related to production processes (e.g. illegal immigration, adulteration of product, burning of toxic waste on agricultural land) (see Table II). The corporate partner can relate all issues to the risk of the end consumer no longer buying the product and switching to competitors. For instance, advocating stakeholders (e.g. unions, NGOs, media) might discover the deployment of poorly paid immigrant workers without work permits on the tomato production farms and might publicize the sustainability problems as they hold the retailer responsible. Sustainability-sensitive consumers would then be inclined to boycott the retailer. This scenario depicts the immediate loss that the firm would face if its most important stakeholders – consumers – were to react to this SCSR hotspot. Moreover, damage to the firm's overall reputation could occur that would affect the remaining business

Hotspots	Specific issues	Involved stakeholders	Knowledge sources
Wage and social conditions for farm workers	No minimum wage, contracts or job safety	NGOs	11 newspaper articles
	Low harvest price	Unions	7 NGO reports
	Unsafe, unfair work and living conditions	Farm workers	3 union reports
	Lack of social and health benefits	End consumer	2 research articles
	High competition between farm workers	Farm associations	5 independent industry experts
	Illegal immigration and no work permission	Cooperatives	Desktop research
Transparency regarding origin of raw material	No integration efforts	Government	
	Ambiguity regarding origin and quality of raw material	End consumer	19 newspaper articles
	Possible contamination with genetically modified produce from China	Processor	3 independent industry experts
	Possible contamination with harmful residues from plant protecting agents	Retailer	Desktop research
	No price transparency	Mafia	Information from first-tier supplier
	Illegal immigration	Government	20 newspaper articles
Criminality	Physical exploitation of farm workers	Local communities	7 NGO reports
	Human trafficking	End consumers	3 union reports
	Corruption, lack of state intervention	Cooperatives	4 research articles
	Toxic waste burning on agricultural land	Farm associations	Desktop research
	Adulteration of product, false labeling	NGOs	
	Artificial price inflation and volatility		

Table II.
Field-testing study:
integration of
stakeholder know-how

of the firm negatively, thereby augmenting financial loss (Hofmann *et al.*, 2014). Relatively, other possible stakeholder punishments are much less severe. To summarize, loss for the retailer can come primarily from the end consumer; however, the root of the problem can be found at multiple stages along the supply chain (in this case, foremost at the production stage).

5. Concluding discussion

Many buying firms face elevated stakeholder pressure for fostering supply chain sustainability but cannot fully comply with these requests due to low supply chain visibility. In consequence, they are left vulnerable to sustainability risks lurking within their supply chains. Against this background, this design science study sought to explore how buying firms can utilize the stakeholder network to identify the most salient SCSR. A procedural model was developed which facilitates identification of such SCSR “hotspots” through an iterative process of supply chain and stakeholder analysis. This section elaborates on the scholarly and practical contributions, acknowledges the limitations of the study, and suggests paths for future research.

5.1 Scholarly contributions

This study is among the first that applies a design science methodology in SSCM and SCSR research. Its contributions to theory building on SCSR are threefold. First, it shows the effectiveness of proactively integrating external knowledge in SCSR management in order to identify SCSR hotspots. In addition to information from first-tier suppliers and other actors within the supply chain, NGOs, unions, the government, the media, or other actors adjacent to the supply chain enable buying firms to identify SCSR hotspots. The procedure described in this study enables buying firms to gain more insights into SCSR by better mapping their supply chains, identifying critical stakeholders, and finding the most pressing issues.

Second, this study contributes to the prioritization process of the plethora of stakeholder expectations buying firms face in globally dispersed supply chain contexts. Although prior research has called for a more positive stance toward stakeholder in general (Roloff, 2008; Pagell and Wu, 2009), the ubiquitously used term “stakeholder” needs to be contextualized in individual firms’ environments since not all stakeholders can be treated equally (Gualandris *et al.*, 2015). The study follows the call to integrate specific stakeholder groups and to prioritize them according to their role in SCSR identification processes. More precisely, based on the supply chain reconceptualization of Pagell and Wu (2009), Mitchell *et al.*’s (1997) initial categorization of stakeholders, as well as Busse’s (2016) finding that chains of stakeholders often join forces in SCSR, this study introduced a parsimonious dichotomy of “deprived” and “advocating” stakeholders, which fosters the conceptual understanding of SCSR manifestation and simplifies SCSR identification in corporate practice. Deprived stakeholders possess urgent and legitimate claims but no power; they reside within the supply chain. In enforcing their claims, deprived stakeholders are dependent on advocating stakeholders, who are powerful actors adjacent to the direct supply chain. Their voice and power helps to magnify the public attention paid to the perpetrators and to the buying firm held co-responsible for the misconduct.

Third, this study contributes to an amended understanding of responsibility ascription in SCSR. A crucial step in SCSR manifestation is that stakeholders ascribe to the buying firm a sufficient amount of responsibility for preventing unsustainable actions or events in their upstream supply chains and, based on this action, decide to take punishing action (Amaeshi *et al.*, 2008; Hartmann and Moeller, 2014). The results from the field study suggest that responsibility ascription is unlikely when the power of the buying firm over the supplier is low (also see Touboulic *et al.*, 2014) and when numerous buying firms potentially

share the blame. Investigating responsibility ascription in more detail is an interesting avenue for future research.

Additionally, the study contributes to the emerging theory of the supply chain as proposed by Carter *et al.* (2015). Our theory surrounding the procedural model developed in this study paves the way to extend the supply chain visibility boundary, which represents a severe problem in corporate practice as it constrains the manageability of a supply chain (Taylor, 2005; Carter *et al.*, 2015; Durach *et al.*, 2015). This research has illustrated how the visibility problem can be mitigated with the help of stakeholder knowledge, a quasi-inexhaustible source of valuable knowledge (Pagell and Wu, 2009; Wong *et al.*, 2015).

5.2 Practical contributions

Identifying SCSR is very difficult, especially when supply chain visibility is low, as numerous well-known cases illustrate. Firms hence require new SCSR management instruments and concepts (Pagell and Shevchenko, 2014), such as the involvement of stakeholders who do not directly participate in material flow activities (Carter *et al.*, 2015).

In terms of practice, the procedural model represents a practical tool for managers to identify SCSR without creating unnecessary management complexity, especially in situations of low upstream supply chain visibility. We conducted a limited field-testing study in a food supply chain in retail to demonstrate its pragmatic validity (Denyer *et al.*, 2008). Thereby, we have shown that a generic supply chain understanding suffices for conducting an analysis of the most pressing sustainability hotspots, as long as relevant stakeholders can be identified and their interests and knowledge can be extracted. The corporate partner firm can use the information on sustainability hotspots to identify SCSR. Equally important, from the perspective of the partner firm, the iterative process of the systems analysis also generated a better understanding of the entire supply chain and the involved stakeholders. The implementation partner was thus sensitized for the processes in the tomato production system considered most important among its stakeholders. The firm also indicated that it would be possible to transfer the procedural model easily to other contexts to facilitate a structured analysis of SCSR.

We conjecture that applications of the procedural model are scalable, ranging from a quick preliminary screening for a first overview of sustainability hotspots to an in-depth analysis of SCSR, providing more elaborate information on a specific supply chain. The degree of detail and the number of iterations can also be adapted to each firm's needs and resources, rendering the tool adaptable and versatile.

5.3 Limitations and future research

The procedural model developed in this study is context dependent; the proposed interventions are particularly suitable in situations of low supply chain visibility and high stakeholder pressure toward SSCM. Consequently, the higher the visibility and the lower the stakeholder pressure, the less effective the proposed solution is expected to be. However, we assume that the basic logic of the procedural model is also applicable in moderate- to high-visibility contexts. The procedural model was so far applied only once for a food supply chain at a Swiss retail firm. Accordingly, its applicability to other industries with the same contextual prerequisites needs to be validated in future studies. Further, it should be mentioned that the pragmatic assumptions about those supply chain stages that need to be considered as potential sources of SCSR are particularly context-dependent. The omission of intermediary steps occurred due to idiosyncrasies of this specific field-testing study. Intermediary steps cannot and should not be excluded from the analysis *per se* but doing so was deemed appropriate in this particular study.

Interesting avenues for future research emerge from these findings. First, as mentioned above, scholars still lack adequate knowledge of how, why, and when stakeholders decide to

take punishing actions against buying firms. This study calls for taking a closer look at the mechanisms of responsibility ascription. Second, it remains unclear how buying firms manage (e.g. mitigate, hedge, or accept) any SCSR that they have identified. It remains to be seen how this new information obtained will be used and tied to existing risk management systems in corporate practice. As this is an integral part in the overall SCSR management, future research should investigate systematically how firms identify, assess, and manage their SCSR, which may vary greatly across industries. We hereby support the call of Hajmohammad and Vachon (2016) for more empirical research in the field of SCSR. Third and subsequently, the supply chain analysis within the procedural model resembles the renowned research stream of value chain analysis which identifies and maps firms and processes first from a strategic value chain (supply chain) perspective and then breaks the information down to a more detailed facility perspective (e.g. Hines and Rich, 1997; Taylor, 2005). As the resulting value chain maps contain key performance indicators (e.g. demand, stock, defect numbers, etc.), integrating SCSR relevant data could lead to more comprehensive and thus improved value chain maps. Balancing performance and risk data has become a common process and thus combining SCSR and value chain mapping could provide a means to develop an integrated supply chain risk management system. Last, with respect to the emerging theory of the supply chain, this study showed that the visibility boundary can be influenced, although this may be difficult and costly. A worthwhile amendment for future research is to investigate both the usefulness of extending the supply chain visibility boundary in terms of a cost-benefit analysis and the means for doing so. A long-term goal might lie in the definition of optimal degrees of supply chain visibility contingent upon the firms' backgrounds (i.e. supply chain strategy, size, internationalization, etc.).

The proposed procedural model with its three interventions is intended to help buying firms to extend the visibility boundary in their supply chains, thereby revealing hotspot SCSR. Doing so capacitates firms to mitigate the impact of SCSR and to develop more sustainable supply chains.

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Appendix

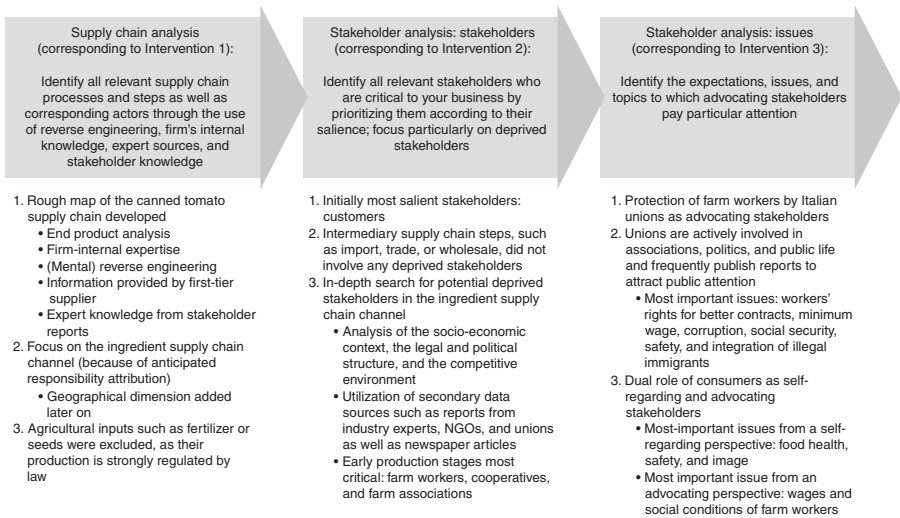


Figure A1.
Utilization of the
procedural model in
the field-testing study

Note: The process is depicted in a quasi-linear manner to foster readability

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