#### EXPLORING INFORMATION PROCESSING AND DECISION MAKING FOR SUSTAINABLE SUPPLY MANAGEMENT<sup>1</sup>

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#### ABSTRACT

Since supply networks are highly complex, buying firms face information deficits regarding the actual environmental and social conduct at supplier premises. We investigate sustainable supply management from an information processing perspective to discover (1) how firms reduce sustainability-related information deficits, and (2) how a strategy to achieve that goal is chosen. Building on four in-depth case studies including 20 interviews we found that firms lower their sustainability-related information deficits by (a) reducing their information processing needs using supply chain (re)-design, standardization and supplier development, and (b) by creating information processing capacity using employee management, information exchange, IT support, and supplier evaluation. We hypothesize that decisions on which strategy to pursue are derived from idiosyncratic assessments of costs and benefits associated with the available measures.

Keywords: Sustainable Supply Management; Information Processing Theory; Case Studies

#### **INTRODUCTION**

Since firms have outsourced many value steps [1, 2], most of economic, environmental and social impact of their final products actually stems from suppliers' premises [3, 4]. Therefore, different stakeholder groups frequently criticize firms for environmental and social misconduct not only at their own but also at their suppliers' sites [5, 6]. To protect their corporate reputation firms have started to engage in sustainable operations and supply management [7].

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Our understanding of sustainability follows the notion of the triple bottom line taking economic, ecologic and social criteria simultaneously into consideration [8]. Moreover, we consider a firm to be truly sustainable if it "goes beyond compliance and engages in actions that appear to further some social good, beyond the interests of the firm and that which is required by law" [9, p. 117]. Our research interest focuses on firms' practices to assure that their supply network meets sustainability standards. Therefore, we analyze firms' sustainable supply management (SSM), which "is the consideration of environmental, social, ethical and economic issues in the management of the organization's external resources in such a way that the supply of all goods, services, capabilities and knowledge that are necessary for running, maintaining and managing the organization's primary and support activities provide value not only to the organization but also to society and the economy" [10, p. 489]. SSM includes sustainable supplier evaluation, selection and development [11, 12], sustainable supplier collaboration [13] and sustainable sourcing decisions [14].

To make sound buying decisions when taking sustainable criteria into account, firms must obtain full information and transparency concerning the economic, environmental and social conduct their supplier enforce with their sub-suppliers [15]. Seuring and Müller [16, p. 1705] found that SSM "demands much deeper information flows along the supply chain where suppliers have to gain detailed insights into the subsequent stages". To protect buying firms from reputational and financial damage uprising from their supply network, a structured SSM approach is necessary [17].<sup>2</sup> Hence, it is of utmost importance for the buying firm to evaluate its suppliers taking sustainability criteria into account [18], to select and retain suppliers based on their sustainability performance [19] and to develop the sustainability capabilities of yet selected suppliers [20] by cooperating with them [13].

Our research focuses on the entire supply network, rather than the individual relationship and applies a focal firm's perspective managing its supply network. Choi and Hong [21] have shown that supply networks are characterized by vertical complexity (number of tiers), horizontal complexity (number of suppliers per tier) and spatial complexity (average distance between buying firm and supplier). This structural complexity leads to sustainability-related uncertainty and endangers buying firms to take false or incomplete information regarding their suppliers' sustainability conduct into account [22]. Thus, although firms have integrated green and social criteria in their supply management, decision makers still face information deficits concerning the sustainability of upstream value creation [18]. As information deficits lead to bounded rationality [23-25] decision makers cannot entirely be certain to have a truly sustainable supply network and thereby protect its firm from reputational and financial damage.

Most recently, a call was issued to investigate how sustainability-related uncertainty resulting from supply chain complexity can be reduced and how information deficits within SSM can be diminished [26]. Therefore, our research seeks to answer the following questions:

 $<sup>^2</sup>$  In the early 1990s Nike has been criticized for inhuman working conditions such as long working hours and low payment at some of their Asian suppliers'. As a consequence NIKE was boycotted by many customers and suffered a dropdown in sales. After the turn of the millennium Nike was convicted in the so called sweatshops scandal for unfair and deceptive practices. Nike agreed to pay \$ 1, 5 million to the plaintiff.

In 2010 Nestle, Unilever and Kraft foods complied with public pressure and stopped buying palm oil from their mayor Indonesian supplier, which has been accused by Greenpeace for environmental misconduct supporting the deforestation and thereby endangering the living space of orangutans.

- 1. How do buying firms reduce sustainability-related information deficits?
- 2. How is a strategy to reduce sustainability-related information deficits chosen?

As we are dealing with an information processing problem, we chose to adopt information processing theory (IPT) as the theoretical foundation of our research. The overall notion of the IPT is depicted in Figure 1: Firms face information processing needs (IPN) due to different forms of uncertainty and therefore need a fitting degree of information processing capacity (IPC)<sup>3</sup> to perform effectively [27-29]. Firms, which set out with an IPC that matches its initial IPN and are then confronted with an increase of IPN – for example through the requests of a particularly demanding customer - will then to have to re-adjust its IPN and IPC. Given overall rising sustainability performance expectations, capacity barriers with respect to effective SSM may arise frequently. According to Galbraith [28, p. 6], firms have two means to react to such external impetus and reduce information deficits by achieving a fit between their IPN and IPC with respect to their suppliers' sustainability performance: First, by building up internal capacity to process information and second, by reducing the amount of uncertainty and therefore the information they need to obtain. Both strategies theoretically enable buying firms to process as much information as necessary to make sound sustainability-related decisions concerning their supply network.

To answer the research questions, we first depict an overview on IPT and subsequently integrate extent literature on SSM into our IPT framework. Thereafter, we present our research method – a multiple case study approach within four industries – followed by the results. They comprise detailed within-case and cross-case analyses and lead to testable research propositions. The paper concludes in theoretical and managerial implications and paths for further research.



Figure 1: Research Framework derived from Information Processing Theory

#### LITERATURE REVIEW

## **Information Processing Theory**

<sup>&</sup>lt;sup>3</sup> Information processing capacity includes gathering, interpreting and synthesizing of information (Tushman and Nadler, 1978).

The IPT evolved in the 1970s in response to organizational design problems stemming from sizeinduced complexity. It considers organizations as information-processing networks in which it is not possible for each employee to communicate with all the other employees [28]. Firms operate as open social systems in a changing environment and therefore face internal and external uncertainty that result in IPN [27]. Uncertainty hampers firms' pre-planning and sound decision making. Galbraith [30] found that the greater the uncertainty firms face, the greater the amount of information they have to process for effective decision making. As a consequence firms seek for different ways to reduce the uncertainty they face to make sound decisions: "(...) the organization must adopt a strategy to either (1) reduce the information necessary to coordinate its activities or (2) increase its capacity to process more information" or (3) to do both, simultaneously [28, p. 14].

The IPT is a contingency theory with a strategic fit concept [31] at its core. It posits that a firm's goal must be to achieve a fit between its IPN and its IPC [32] by focusing on strategy (1), (2) or (3). "Instead of modifying its own structure and processes, the organization can attempt to modify its environment" [33, p. 50] by entering cooperation. Firms must adopt at least one of these strategies to either lower IPN or increase IPC, in order not to reduce its performance [28]. Theoretically, firms always choose the strategy associated with the lowest cost and greatest benefit [34].

As outsourcing activities increased and firms had to process information from their upstream supply chain partners, Bensaou and Venkatraman [29] developed a model extending the IPT to an inter-organizational level between buyers and suppliers. In that context, IPN "are defined as the communication requirements for inter-organizational interactions in (...) a supply chain" [35]. Environmental uncertainty is determined by complexity (number of factors) and dynamism (rate of change of those factors) [36], and arises from demand and supply uncertainty, as well as from product complexity [35]. Partnership uncertainty refers to the uncertainty a firm faces regarding its relationship with its supply chain partners. Task uncertainty is determined by the task's analyzability, variety and interdependence [29]. IPC evolves due to inter-organizational coordination activities and is characterized by the quality and quantity of the structure, the process and the information technology of those activities.

Uncertainty, complexity and intra-organizational conflicts do not only result in increased IPN, but also obstruct the creation of IPC, which in turn hinders the simultaneous usage of both means to achieve an informational fit [37]. There appears to be interdependence between the two dimensions.

In this paper, we develop an IPT model that extends the theory further towards the supply network level, in response to uncertainty from the increased supply chain complexity that exists to date. As a starting point, we subsequently review extant literature in the field of SSM.

#### **Sustainable Supply Management**

Recent literature has highlighted the role of internal capabilities [11-13] and best practices [38] for SSM. However, the measures that buying firms can apply to match IPN with IPC have only marginally been addressed in the context of SSM. Business for Social Responsibility [15]

proposed that firms applying supplier information management related to sustainability will gain greater benefits from their relationships and mitigate risks of brand damage.

First contributions to SSCM primarily focused on environmental aspects such as resource reduction, reuse and recycling of packaging material [39-41]. Upstream supply chain management plays an important role in lowering a firm's environmental impact [42, 43] by evaluating and selecting suppliers based on environmental criteria [44-46]. Supply management capabilities are fostered by an attitude of corporate environmental proactivity, which facilitates greening the supply process [47]. Research targeting social aspects such as labor equity, healthcare and safety [17] has commenced after the turn of the millennium [48, 49] and gained importance within the last years.

Carter and Rogers [50] provided a theoretical base towards SSCM developing a framework on how to incorporate economic, environmental and social issues simultaneously. They identified four major supporting aspects to SSCM: Sustainability as part of a corporate strategy, risk management, structurally ingrained ethics, and transparency regarding sustainability performance. Since then a lot of research has been conducted focusing on the triple bottom line within the field of supply chain management. Walker, Di Sisto [51], for instance, have shown that motivational barriers such as high implementation costs, changing political regulation or poor supplier commitment hinder firms from truly integrating sustainability into their supplier management. Subsequent literature has highlighted the role of SSM capabilities [11, 12] and best practices for SSCM [38]. For example, the adoption of supplier codes of conduct enables firms to impose standards on their suppliers' operations and especially their working conditions, yet it does not lead to full control over and transparency on the affected processes at suppliers [5, 52]. To ensure information reliability of a supplier's self-assessment regarding its sustainable performance, focal firms apply multi-step evaluation [53]. Based on that information, multicriteria evaluation helps firms to handle the vastness of information uprising from social and environmental issues [44]. Referring specifically to IPT, we can thus conclude that few contributions exist which focus on the capabilities required to process information related to ecologic and social issues.

Choi and Hong [21] found that due to structural supply chain complexity focal firms often possess false information regarding their suppliers. That is especially the case for working conditions and operational externalities and environmental effects of business conduct [54]. Seuring and Müller [16] found that SSCM has to screen a deeper part of the upstream supply chain as it deals with more than just the economic performance criteria. Consequently, cross-firm communication, information sharing and training of purchasing employees were identified to be crucial factors for SSM. The need to mitigate any possibly present information deficits related to SSM was also underscored by a recent contribution of Hofmann, et al. (2013) who showed how risks emanating from a firm's supply network may go unnoticed by classical supply chain risk management concepts.

While Choi and Krause [55] have shown how supply chain complexity influences a firm's transaction costs, risk and innovation regarding the economic bottom line, contributions on how to handle the uncertainty regarding a supplier's environmental and social performance seem rather sparse, to date. Vertical integration and coordination was investigated in a sustainability context by Carter and Rogers [50] who found that these mechanisms enhance a firm's economic

performance if the firm faces uncertainty regarding a supplier. One notable exception is a recent paper by Wong (2013) which supports the link between environmental information integration among supply chain partners, environmental adaptability and focal firm performance. To our knowledge, no simultaneous investigation into IPN reducing vs. IPC enhancing approaches in SSM has been conducted which is stressed by the recent plea for research concerning the interaction of sustainable supply chain design and capabilities and information deficits in sustainable sourcing decisions [18, 26].

#### METHODOLOGY

We decided to rely on an inductive multiple case study approach for four reasons: (1) Our review of extant literature revealed a limited understanding of how firms process information and make decisions when facing sustainability-related uncertainty. In that context, cases provide better means for exploration and theory development, in particular if constructs and relationships among them are still ambiguously defined [56]. (2) Cases allow the researcher to directly interact with the informant, ask clarification questions and to draw on multiple sources of information. That leads to information-rich cases and gives answers to complex phenomena [57]. (3) Cases are considered to be a strong method for generating managerially relevant knowledge since they usually involve managers operating in real management situations [58]. (4) The use of case studies has recently been encouraged as the method of choice when analyzing SSM [18, 50].

#### **Research design**

We followed a theoretical sampling approach according to Eisenhardt [56] and Yin [57]. Our case selection followed a multilevel process for purposefully maximizing the richness of information, while at the same time minimizing the number of cases necessary to gain comprehensive insights [59]. (1) We concentrated on large firms, which employ more than 1,000 employees, generate annual revenues exceeding € 100 million and operate internationally. Firms like that face sustainability-related uncertainty induced by structural supply chain complexity, and are complex enough to allow a plurality of responses. (2) To make our results more generalizable we opted for firms across the chemical, pharmaceutical, furniture and apparel industry. Firms within the Chemical and Pharmaceutical industry frequently buy raw materials such as Methanol that are toxically for the environment. Firms within the Furniture and Apparel industry have been frequently criticized for environmental and social misconduct within their supply network. By concentrating on these industries we ensure that each case firm has stimuli to take sustainability into account. (3) Within each industry, we focused on firms that are renowned for being sustainable. We based our decisions on what firm to approach on external, valid data such as the Down Jones Sustainability Indexes, the FTSE4 Good Index series and public available newspaper articles.

To leverage our research theoretically and to ensure connectivity to extant research, we grounded it in IPT. Accordingly, we systematically applied a research framework throughout our research process. We inductively evaluated and interpreted the cross case findings in light of the IPT, which provide a good fit between research objective, theory and research method [60]. Moreover, the use of multiple data sources for data triangulation enhances the internal validity by eluding the social-desirability bias inherent in the sustainability topic [61]. To ensure rigor, we applied quality management procedures brought forward by Yin [57] and Gibbert, Ruigrok [58] throughout the research process (see Table 1).

Criteria	Research Phase				
	Case Design Case Selection		Data Gathering	Data Analysis	
Reliability	Case study	Selection criteria	Semi-structured	Inter-rater	
	protocol	well documented	interview	agreement in coding	
			protocol	established	
			All interviews	Discussion of all	
			recorded and	interim results by all	
			transcribed researchers		
Internal	Research	NA	Process tracing	Active search for	
Validity	framework		Multiple alternative		
	derived from		respondents	explanations	
	well-established		Most	Enfolding results	
	related IPT		knowledgeable	into IPT and SSM	
	literature		key informants	literature	
			for SSM		
			interviewed		
External	Multiple case	Theoretical	Gathering case-	Careful cross-case	
Validity	study design	sampling	specific context	analysis	
	within different	regarding end-	data	Pattern matching	
	industries	customer	Comparison of	among cases /	
		proximity to	available	theoretical	
		avoid pro-	secondary data of	replications	
		sustainability bias	nonparticipants		
			with those of		
			participants		
Construct	Questions	NA	Multiple sources:	Data triangulation	
Validity	derived from IPT		semi-structured	based on	
	literature		interviews,	independent sources	
			internal and	Analysis parallel to	
			external reports	interview phase to	
			Tandem	be receptive to new	
			interviews facets appearing		
			whenever the data		
			possible to		
			reduce biases		

# **Table 1: Quality Management Procedures**

# Data collection

We approached potential firms and had initial interviews with primarily executive management representatives such as the CEO or the CPO/CSO. These interviews enabled us to identify

appropriate interview partners, in order to ensure reliable information on the topic. Since our research focuses on information processing and decision making for SSM, we sought to speak with the most knowledgeable informants for SSM. Because SSM is cross-functional and comprises input from numerous corporate functions, we spoke to multiple respondents from the purchasing, production, quality and the corporate sustainability department at each firm. We began by approaching supply management and other functional executives involved in SSM via email and telephone calls to solicit their cooperation. Data was collected between July 2012 and April 2013. We used semi-structured interviews according to Eisenhardt [56] and spoke with informants who were mainly at the senior executive level. Interviews lasted between 45 and 120 minutes and were jointly conducted by two researchers whenever possible. The interviews were recorded and each interviewer individually took minutes of answers. Wherever we were given firm-internal documents, we used that information to triangulate the information obtained from the interviews. We adjusted the interview guide, whenever additional interesting facets were identified and ensured that these aspects were included in subsequent interviews [57]. We continuously kept track of our proceedings in a protocol to ensure reliability. For instance, we noted quoting dates, individual settings of each interview, as well as date and location where archival data was collected. For storing these large amounts of data in a structured way, we established a case database, which incorporates every single observation, such as individual notes, transcripts from the interviews, the questionnaires, content from the firms' websites, observation sheets, as well as sustainability and annual reports [57]. By using multiple data types, respondents, and researchers, we aimed at mitigating social-desirability bias, single-informant bias and the bias of the individual researcher, such as a priori beliefs.

We were able to add each two interviews to a pharmaceutical industry and a chemical industry case study that were already conducted in 2009 on the topic of SSM, yet related to another research project. By reassessing these data, we were able to amend a longitudinal perspective into our cross-sectional setup, which also eased our process tracing [62]. Furthermore, since the data was not collected with an IPT perspective on SSM in mind, it is virtually void of bias from a-priority-belief. An overview of our database is depicted in Table 2.

Firm	Chem	Pharma	Furniture	Apparel	
Employees	>100.000	>100.000	>1.000	>10.000	
Revenues	>€ 70 Bio.	>€ 50 Bio.	>€ 150 Mio.	>€ 3 Bio.	
Main	Chemicals, gas,	Patented- and	Office boards,	Sportswear,	
products	oil and plastics	non-patented	desks and chairs	Fashion wear	
		medicaments			
Informant	1. Manager	1. Head of	1. Chief	1. Chief Sourcing	
job title	Sustainable	Sourcing	Executive Officer	Officer	
	Procurement	2. Head of	2. Head of	2. Head of Project	
	2. Sr. Specialist	Sustainable	Strategic	Management	
	Sustainable	Sourcing	Sourcing Sourcing		
	Procurement	3. Adviser	3. Environmental 3. Global Dire		
	3. Jr. Specialist	Sustainable	Manager	Social	
	Sustainable	Sourcing	4. Project Accountability &		

Table 2: Database

Procurement 4		4. Head of	Manager	Fundamental	
	4. Jr. Specialist	Responsible	Ergonomics	Environmental	
	REACH	Procurement		Standards	
	5. Director Global	5. Head of Third			
	Sourcing	Party Operations			
	6. European				
	Manager				
	Procurement				
	7. Head of				
	Product Safety,				
	Raw Materials				
	8.				
Public	Sustainability	Sustainability	Sustainability	Sustainability	
documents	report	report	brochure	report	
	SCoC	SCoC	Website	ScoC	
	Sustainable SC	Pharmaceutical		Value Chain	
	report	SC Initiative		Report	
	Website	Website		Website	
Internal	Supplier self-	Supplier self-	Supplier self-		
documents	assessment	assessment	assessment		
	Supplier	Supplier	Supplier		
	evaluation sheet	evaluation sheet	evaluation sheet		

#### Coding

First we started with open coding according to the prescriptions of Strauss and Corbin [63] for within case analyses. Analyzing transcripts, internal, and publicly available data, we developed a deep understanding of each case's unique pattern [56]. Having established a consistent coding and classification of each case we elaborated a cross case analysis based on the recommendations of Strauss and Corbin [63]. To identify communalities and differences in patterns of SSM and to relate the categories we found across the studied cases in a causal way, we conducted axial coding by grouping codes into categories and matching patterns among the cases [57]. Thereafter, we pursued selective coding by analyzing those relationships, which reveal the most interesting insights with respect to SSM. In this step, we challenged observations with existing theory and the previously introduced IPT framework to derive testable propositions [27-29].

#### FINDINGS

## Within-Case Analysis

*Chem* is a multinational chemical company headquartered in Germany. In 2011, it had more than 100,000 employees worldwide and generated revenues exceeding EUR 70 billion. It sells its main products such as standard and specialty chemicals, oil, gas and plastics to customers in the pharmaceutical, automotive and fast moving consumer goods industry. In 2011, the firm

purchased about 500,000 different raw materials ranging from safe ones such as Sodium Chloride to toxic ones such as Methanol. To deploy resources in an efficient way when managing its 40,000 tier one suppliers, *Chem* applies a risk mitigation-driven supplier evaluation approach that considers whether the raw material (product) is safe, harmful or toxic and whether the supplier is from an OECD country or not (location). To mitigate risks, Chem focuses its SSM activities on suppliers that come from non-OECD countries and provide harmful raw materials. As sustainability plays a major role in the firm's vision and mission, supplier evaluation includes environmental and social criteria, based on the United Nations Global Compact and the Responsible Care initiative. Five dedicated sustainability expert teams work for *Chem* in different regions around the world to standardize SSM measures when managing suppliers. The firm initially gathers information on suppliers' sustainability performance via self-assessments and later on conducts audits either through own employees or third party auditors at suppliers. If noncompliance with Chem's supplier code of conduct is exposed, corrective action plans are created, assistance is provided and after a few months a re-audit is conducted. If no bettering is realized, purchasing from this supplier will halt until the required adjustments are made. The firm's supply network is highly complex as it includes up to five tiers and is internationally designed with suppliers in Asia, Africa, Europe, North and South America. To reduce this complexity, Chem has partly reintegrated value steps when it could not ensure reliable supplier information on sustainability. Chem is listed in the Dow Jones Sustainability Indexes and the FTSE4Good Index series and has received various awards for its commitment to sustainability.

Pharma is a globally leading pharmaceutical firm from Switzerland with more than 100,000 employees and annual revenues exceeding EUR 50 billion worldwide in 2011. Its portfolio consists of health care products such as patent- and non-patent-registered pharmaceuticals. As sustainability is an integral part of the firm's corporate strategy it founded a foundation for sustainable development more than thirty years ago, which initiates projects to improve working conditions and health. In 2003, Pharma started to manage its suppliers considering the three dimensions of sustainability by launching its first "Corporate Citizenship Guideline for Third Party Management", which were the first in the pharmaceutical industry. All suppliers are required to meet the firm's sustainability standards by frequently providing information regarding their performance via self-assessments and via audits that were either conducted by the firm itself or by experts from independent third party organizations. When non-compliance is identified, Pharma provided assistance by conducting intensive supplier development programs. To concentrate its SSM activities, it installed the cross-functional units "sustainable sourcing" for Pharma and "responsible procurement" for its subsidiaries. In 2012, it launched a second, updated edition of its SCoC that includes stricter criteria for suppliers to be fulfilled. Due to the great number of suppliers and the vastness of information on environmental and social issues, which Pharma could not process, it decided to avoid collecting self-assessments. Instead, a riskbased approach was introduced. By doing so, it could prioritize further action on suppliers that pose an elevated sustainability risk to reduce the number of necessary audits. The classification is based on the product they buy and the country the production is located in. Pharma recently reduced the number of suppliers per product and concentrated on trustful, long-term relationships. It is a founding member of the United Nations Global Compact, has received many awards for its commitment towards sustainability and is listed in the Dow Jones Sustainability Indexes and the FTSE4Good Index series.

*Furniture* is a German firm within the furniture industry specialized in office systems. In 2011, it employed over 1,000 people and generated annual revenues exceeding EUR 150 million. The furniture industry is frequently criticized by Non-Governmental Organizations as many of the key-production-processes have exerted a strong impact on the natural environmental (e.g. coating processes using solvent based paints, solid waste management and zinc plating). Main products like office desks, boards and chairs consist of critical raw material like tropical woods and plastics (Polycyclic Aromatic Hydrocarbons). This has influence on the alignment of the purchasing function as it needs to consider these critical products and its suppliers in detail. Since environmental protection and social responsible business practices play an important part in Furniture's vision, it expects its suppliers to equally engage in sustainable business practices. The firm shows strong commitment to its business and production location in Germany as all its production facilities are based there. Besides that, Furniture has a very high own value added to the end-product and the majority of direct material suppliers (e.g. for steel or flake boards) are nowadays also located in Germany. This proximity allows Furniture to easily conduct supplier audits and supplier development programs if a supplier does not meet its sustainability standards. Furthermore, the value creation within the EU allows them to avoid gathering information according to the REACH regulation (Registration, Evaluation, Authorization and Restriction of Chemicals). Furniture does not import chemical substances into the EU and so their suppliers are not in charge of providing the necessary information. For this reason it has stopped buying from two Asian suppliers as it could not make sure that the information on environmental issues were correct. Furniture has obtained various certificates such as ISO 14001, Leadership in energy and Environmental Design (LEED). In 2010 it initiated a change management process for its purchasing function in consequence of having received a large supply contract that required detailed information regarding the ecologic footprint of their raw materials. Consequently, Furniture hired new employees and provided education courses on environmental protection and recycling. Although environmental criteria play an important role in its SSM, Furniture's purchasing director acknowledged that criteria on social issues will be included this year.

Apparel is a German leading firm for performance and fashion sportswear with a globally known brand. In 2011 they employed more than 10,000 people generating revenues of above EUR 3 billion the same year. Firms within the apparel industry face high stakeholder pressure to engage in sustainability as products are highly visible, advertised on television and sold directly to end customers. NGOs frequently criticize apparel firms for their suppliers' misconduct to environmental or social standards like those of the Internal Labor Organization (ILO). After NIKE's sweatshops scandal in 1993, Apparel installed its first measures to ensure safe working conditions and responsible environmental treatment at suppliers' facilities. In 2010 they launched a new, corporate wide sustainability program spanning the entire value chain and therefore cutting across multiple functions such as purchasing, health and safety, logistics, marketing, etc. Furthermore, the firm introduced an environmental based profit and loss accounting. Apparel has outsourced the majority of its production ranging from tier one (production), tier two (outsourcing), tier three (processing) to tier four (raw material) to suppliers from the Far East. Therefore, it has undertaken a wide set of activities to analyze environmental and social information of its suppliers to improve their performance. That includes commitment of all suppliers to sustainable reporting via the Global Action Network for Transparency in the Supply Chain (GANTSCh) and participation in Greenpeace's Detox campaign to remove all hazardous chemicals from the entire supply chain. Analyzing its entire value chain, the firm identified that the majority of environmental impact takes place at tier four and tier three. Apparel is listed in the Dow Jones Sustainability Indexes and the FTSE4Good Index series and has received various awards such as the "German Sustainability Award 2010" and the "German Image Award 2012" for its commitment to sustainability.

## **Cross-Case Analysis**

Lowering Information Processing Needs. As shown in Fehler! Verweisquelle konnte nicht gefunden werden., we identified three major approaches for buying firms to lower their IPN.

(1) Supply chain (re)-design refers to actions that focal firms undertake to (a) reduce the number of tiers to lower vertical complexity, (b) reduce the number of suppliers per tier, (c) lower horizontal complexity or (d) reduce the average spatial distance between supplier and own production facilities. Neither *Chem, Furniture* or *Apparel* show engagement to reduce the number of suppliers per tier level. This decision is explained by a risk-mitigation approach of all three firms to ensure business continuity in case a supplier causes a disruption in the product flow. In contrast to that we noticed strong pursuits of *Pharma* to reduce the number of direct suppliers. As shown in Table 4, *Pharma*'s Head of Third Party Operations argued that they reduced the number of alternative suppliers per product in order to enable closer long-term collaboration between the remaining suppliers in order to develop a high performing supply base in the economic as well as the green and the social dimension of the triple bottom line.

Instead of reducing the number of alternative suppliers, *Chem* and *Furniture* reduced the number of tiers in their respective supply chain by reintegrating value-added steps into their own organizational boundaries. Yet, these decisions are made on the product level as opposed to a centralized decision to globally reduce the tiers in the upstream supply chain. According to *Chem*'s Sustainable Procurement Manager the firm pursues this strategy when it notices that its suppliers face problems providing certain products in a sustainable manner or when it cannot verify and assure that the sustainability-related information a supplier is providing is in fact true. Although *Furniture* operates at a high degree of own value-added it still analyzes possibilities to integrate further upstream for the same reasons as *Chem. Pharma* and *Apparel* do not pursue this strategy at all, but prefer to invest in measures that enhance their sustainability-related IPC.

In addition, *Furniture* has significantly changed the regional set-up of its suppliers, as it stopped buying from two Asian commodity suppliers due to sustainability related information deficits and relocated the contract with two German suppliers. By doing so they increased the percentage of Europe-based suppliers to almost 100%. *Chem, Pharma* and *Apparel* have not undertaken such actions. Due to cost structures, a more global corporate strategy and their current state of international production, *Chem, Pharma* and *Apparel* show strong commitment to the globalization and therefore continued to buy or even increased their purchasing volume from Asian or South American suppliers for comparable direct supply categories. This is supported by their corresponding statements provided in Table 4.

(2) The Standardizations for sustainable supplier evaluation, selection and development aim at reducing the number of necessary audits and avoiding unnecessary data collection. All firms standardize their evaluation criteria to generate only the amount of information that they actually need. In addition to that, *Chem, Pharma* and *Apparel* use sector- and product group-specific evaluation criteria for the same purpose which further reduces their sustainability-related IPN.



## **Figure 2: Lowering Information Processing Needs**

*Furniture*, which is much more vertically integrated buys far less products and therefore does not apply a standardized approach but and addresses sustainability differently across for each new sourcing project. They are still in the process of developing a homogeneous SSM content that is queried for each sourcing project and across the established supply base.

*Chem, Pharma* and *Apparel* also took the step to cooperate with industry peers and competitors when evaluating suppliers by exchanging the sustainability audit reports. They also founded or joined respective industry alliances that committed to the reduction of information processing requirements by mutually accepting each other's supplier audit. Thereby they reduce the number of audits they need to conduct, which also reduces the administrative burden on their shared direct supply base. E.g. *Pharma* is member of the Pharmaceutical Supply Chain Initiative (PSCI), which has a joined auditing program so that each member has access to audit results of common suppliers (Table 4). *Apparel*'s Chief Sourcing Officer recognized that they must cooperate with competitors in order to achieve its ambitious goals of 100% supplier compliance (Table 4). As a consequence it has co-founded the Detox campaign where audit results of common suppliers are shared among fashion and apparel producers. Merely *Furniture* does not cooperate with competitors when evaluating suppliers regarding sustainable criteria. The reason is the fact that they have significantly less suppliers and that these audits are less resource consuming as their supply base is mainly located in Europe. In addition to that, they have established lasting and trusted supplier relationships, which further reduce the need for continuous re-assessment.

Furthermore, *Chem* and *Pharma* -as well as *Furniture* in a limited manner - apply a risk evaluation to identify suppliers that pose a high risk of environmental of social misconduct. By prioritizing further investigations at suppliers according to their sustainability-related risk profile, they can concentrate on conducting site visits and consecutive supplier development measures at these suppliers that were identified to be critical. Thereby, they and so reduce the amount of necessary assessments resulting in lower IPN. Moreover, *Pharma*, which originally required self-assessments from all its suppliers also adopted this risk-based multi-step supplier evaluation methodology. Their analysis is based on data regarding the product it purchases and the origin of the supplier. These data are purchased from an external data provider, who continuously updates this information. In turn, *Apparel* demands their most risky and most critical suppliers to report on all dimensions of the triple bottom line on a monthly basis. These performance indicators encompass metrics on energy efficiency, water consumption and pollution from all its first-tier suppliers. According to that information it conducts audits at suppliers that show inconstancies.

(3) Supplier Development aims at fostering the supplier's understanding of sustainability as well as building trust and commitment with suppliers. *Chem, Pharma, Furniture* and *Apparel* all create joint solutions with their suppliers on problems regarding environmental or social performance. This action seems to be common and well established when reducing sustainability-related information deficits. While joint solutions are relationship specific they initially increase the sustainability-related information requirements from suppliers. However, the joint initiatives increases the understanding of the buying firm concerning the suppliers production processes, that enable later standardization. *Pharma* and *Apparel* use incentives and rewards to motivate their suppliers to engage in sustainable business practices and thereby build trust and commitment. Both firms use their established supplier evaluation system to approach suppliers that have continuously delivered high performance. So they are able to approach the most trustworthy

# Table 4: Critical Themes within the Cross-Case Analysis

Critical theme	Representative statement		
Supply chain (re)-design	Chem: "We lately rather tend to make products than to buy them when we can't make sure that the supplier meets our requirements regarding safety standards etc."		
	Pharma: "We are emerging towards fewer suppliers and long-term relationships because it is easier to manage 100 suppliers than 1000 suppliers."		
	Furniture: "The percentage of Asian suppliers has even become less. We withdraw from a Chinese supplier because we neither could make sure that the information we received were correct, nor could send someone to control on-site. To play sure, we decided to collaborate more intensive with a German supplier."		
	Apparel: "We think it is the right strategy to develop our suppliers in Asia towards products that are more sustainable than to produce in Germany. You always need to consider the drivers for sustainability."		
Standardization	Chem: "We use external auditing experts, which can provide sector specific questionnaires."		
	Pharma: "Generally health, safety and environment employees conduct audits. Regarding social audits, we collaborate with external experts because we do not have their competences."		
	Pharma: "We are member of the Pharmaceutical Supply Chain Initiative, which conducts joined audits for common suppliers and every firm has access to these supplier evaluations."		
	Pharma: "We came to the conclusion that a self-assessment doesn't provide the information we need. We avoid gathering information that we don't need or that we can't process because the effort is simply too high and the benefit too low."		
	Furniture: "We categorize our suppliers into A, B and C depending on the purchase volume. By doing so we can identify risks and assess these suppliers at first."		
	Apparel: "We know that you can only make big changes in the supply base if you cooperate with other buyers. We accept audits that were conducted by our competitors and even established joint auditing policies. It does not make sense that a competitor conducts and audit today and we approach the same supplier the day after."		
Supplier	Apparel: "Suppliers that consequently deal with that issue (sustainability) and do better than others need to be		

development	awarded with more commitment."
	Apparel: "We updated our supplier evaluation program regarding premium (A+) supplier. To create an incentive our strategic suppliers have the chance to become a premium one if they show great sustainability performance."
	Apparel: "If you want to reduce water usage for example by 25% you need to consider how. We are looking for joint solutions and offer assistance to our suppliers mainly based in developing countries. As they don't know how to make these changes we provide information."
Employee management	Chem: "We started to give trainings on special products and suppliers to make every purchasing employee familiar with the topic of sustainability."
	Pharma: "I am training procurement experts as well as decision makers regarding the program's purpose and our philosophy to work together with our suppliers to achieve continuous improvement."
	Pharma: "We created a department named responsible procurement, hired new employees and will continue to do so in the future."
	Furniture: "It is important that every employee within the sourcing department is concerned about sustainability, because they need to check that topic conducting a supplier audit. Therefore, we sent employees on trainings regarding material science, environmental protection and recycling."
	Furniture: "In 2010 our sourcing department made a change by 180 degrees. There has been a change- management, the majority of the employees left and new employees were acquired."
	Apparel: "To successfully align such an ambitious strategy you need experts. Concerning social aspects we have been engaged since 1993 but when we considered ecologic issues in 2010 we needed experts to build up know how, conduct supplier audits and implement improvements."
Information exchange	Chem: "We have an internal network of global experts who are in each region and permanently interact regarding sustainable procurement."
	Chem: "We have a department that is closely connected to the central communication unit and permanently communicates with NGOs."
	Apparel: "Depending on the supplier's size, we have at least one employee who works at the supplier's site and gives us information if something happens or changes. If the supplier employs 6000 workers there will be an

	inspector and an engineer."
IT support	Chem: "We are moving towards a central database, a one-stop-shop solution, which contains all data we gathered on suppliers including sustainability."
	Furniture: "We had the problem that different departments couldn't access the same information. We moved to a central data base and now everyone has the same information on suppliers and topics like safety and environment."
	Apparel: "Our tier-1-suppliers need to provide us information regarding their waste water and energy consumption every month."
Supplier evaluation	Chem: "Normally we just control our tier-1 suppliers but regarding critical products we control up to tier-n, which can be easily tier-5 or tier-6."
	Chem: "We are going to launch the second edition of our code of conduct. We worked on that for about half a year and I can say that it will be even stricter."
	Pharma: "Normally we just screen our direct business partners. We don't want to make the whole screening process more complicated; we rather want to collaborate more closely with our suppliers in some sectors where it is necessary."
	Furniture: "Normally we just control our direct material suppliers on tier 1. But there are certainly exceptions like for steel. Our suppliers receive and process raw material that has been coated for protection before. We want to know with what matter to estimate the risk."
	Apparel: "To gain more information it is unavoidable to improve the performance of upstream tiers. Our sub- suppliers are mainly known, as we locate them as far as possible. We have a clear view what is going on as we audit our tier-2 and -3 suppliers, nevertheless, yet we do not for tier-4."
	Apparel: "A supplier that was ranked A five years ago would be ranked B today. We have raised the leveling rule to ensure that continuously performance improvement."

suppliers and use the prospect of enhanced joint business in order to push forward sustainability standards. At the same time they apply these continuous supplier evaluations to put pressure on the weak performing suppliers so that they invest in sustainability measures to remain qualified suppliers to *Pharma* and *Apparel* which also reduces the sustainability-related uncertainty and the corresponding IPN in the medium-term. *Apparel* has a ranking system for all its suppliers that reach from A+ to D. The Chief Sourcing officer of *Apparel* explained that they designed their supplier evaluation program so that suppliers with good performance can become a premium supplier. Furthermore he remarked that they provide free supplier development programs and knowledge transfer to achieve the ambitious goals defined in its mission (see Table 4). Based on these cross case finding we formulate our initial proposition:

**Proposition 1:** Information processing needs are primarily reduced based on (a) Supply Chain (Re)-Design, (b) Standardizations of supplier evaluations and (c) Extant Supplier Measures.

*Enhancing Information Processing Capacity.* As depicted in Figure 3, we identified four major approaches applied by our four case companies to enhance their IPT. As in the previous sections the four firms apply each concept with varying intensity.

(1) Employee Management focuses on building up a capacity to process the sustainability-related information. Such a program aims at an adequate large number of employees, which possess high skills regarding SSM. To achieve this capacity, Chem, Pharma, Furniture and Apparel trained its employees on environmental and social issues and hired new additional experts in the field to complement their sustainable sourcing teams. All firms agreed that it is inevitable to create awareness among all purchasing professionals and familiarize them with the topic, especially those specialized employees that evaluate sustainability performance of suppliers and personally conduct sustainability audits required specific training and development. This was particularly the case at Chem, Furniture and Apparel that developed regional experts for sustainability assurance (Chem) as well as own health, safety and environmental management experts into members of the SSM team (Pharma and Apparel). The later experts are even located at the supplier premises and they make decisions based on the supplier's performance and subsequent actions (see Table 4). The trainings were partly product-specific and for products such as palmoil (Chem) or steel (Furniture) as well as region-specific for countries such as China, India or Brazil. In addition to that Chem, Pharma and Apparel founded cross-functional staff units that are in charge of managing new and the existing supplier base regarding sustainable criteria. These teams co-exist with the purchasing department and consist of purchasing, logistics, production and sustainability employees and are headed by a sustainable procurement expert. New experts that were hired work within those units, except for *Pharma*, *Furniture* and *Apparel* where they are part of the purchasing department.

(2) Information Exchange further fosters the focal firm's IPT as the buying firm has more recent and more accurate sustainability –related supplier information at their disposal. Consequently, sustainable supplier selection and development decision are taken under lower levels of uncertainty. We found that our case firms use activities that can be either allocated to internal or to external exchange of sustainability-related information. Internal information exchange refers to information generated by employees within the firm or its supply network whereas external information exchange refers to information generated by employees communicating with NGOs or external experts.



#### **Figure 3: Enhancing Information Processing Capacity**

Regarding the internal exchange, *Chem*, *Pharma* and *Apparel* all have experts who work with the supplier in specific regions of production, which enables a frequent and mutual discussion of new developments around the topic of SSM between suppliers, regional experts and the corporate purchasing function. For instance Chem points out that it has a global network of experts at own production sites (Table 4). In addition to that Apparel and Pharma even located sustainability experts at supplier premises for supplier development and monitoring purposes. As stated by Apparel's Head of Project Management Sourcing, this is an important strategy, but contingent on the relative spend volume with the supplier. Furniture does not conduct any of the above mentioned internal information exchange practices. That is explained by the fact that their own production facilities and their important suppliers are solely located in Germany and the surrounding countries. Regarding the external exchange of sustainability-related information, Furniture shows rather informal activities in that domain as their Environmental Manager is part of the German association for environmental protection. Nevertheless, they do not use external experts to conduct audits as their sustainability critical purchasing volume has become rather low as a result of their supply chain redesign. Their suppliers are based in Europe and they maintain long-term trusted relationships. Thus they perceive to be provided with sufficient information on their green and social business conduct. In contrast to that Chem, Pharma and Apparel show strong engagement to exchange information with NGOs. As stated in Table 4, Chem even operates a so called issue management department that permanently communicates and interacts with NGOs and jointly triggers investigation and rectification of supplier misconduct with their sustainable procurement team. Chem and Pharma use the same external auditing company to conduct environmental and social audits at suppliers' premises. The reason for doing so is twofold: First, they both have a large number of suppliers that are spread all over the world. Therefore, they need assistance to approach all of them. Second, according to its Head Sustainable of Sourcing, Pharma does not fully possess the internal capabilities and resources to conduct social audits by themselves (see Table 4). Additionally, external auditors are perceived to be independent and possess a broader set of comparables. Apparel does contract with external auditing experts even though 90% of its suppliers are located in Asia. Nevertheless, they decided to build up this capability internally within the operations management function. Moreover, since most of their tier one suppliers are located in Asia, this cross-functional auditing unit is also located in Vietnam in order to assure cultural proximity and local responsiveness.

(3) IT Support builds an important technical assistance to further enhance a buying firm's capacity to process sustainability-related supplier information. We observed that *Chem, Pharma, Furniture* and *Apparel* all integrate green and social criteria into a central database and use their electronic data interface to automatically exchange green and social performance criteria with existing suppliers. As exemplarily stated by *Furniture*'s Head of Strategic Sourcing, they configured a central data base that includes supplier information on environmental and social performance indicators besides the traditional economic performance criteria. By doing so, they could assure that everyone within the firm that is interacting with supplier has the same information readily available. *Apparel* demands the shortest standardized reporting interval from their suppliers. They require their suppliers to report monthly to the respective supply category manager who in turn authorizes the received information and disseminates it internally. Moreover, this IT support is needed to extract supplier audit data from the respective cooperative auditing initiatives that *Chem, Pharma* and *Apparel* belong to.

Purpose	Practice	Chem	Pharma	Furniture	Apparel
Reduce IPN	Reduce the spatial distance to suppliers	No	No	Yes	No
	Reduce the number of tiers	Limited	No	Limited	No
	Reduce suppliers per tier	No	Yes	No	No
	Standardize supplier evaluation criteria	Yes	Yes	Yes	Yes
	Use sector specific assessment criteria	Yes	Yes	No	Yes
	Exchange assessment results with competitors	Yes	Yes	No	Yes
	Apply risk evaluation to identify critical supplier	Yes	Yes	Limited	No
	Create joint solutions on problems	Yes	Yes	Yes	Yes
	Create incentives & awards for suppliers	Limited	Yes	No	Yes
	Provide free knowledge on sustainability	Yes	Yes	Limited	Yes
Enhance IPC	Train employees regarding special products and suppliers	Yes	Yes	Yes	Yes
	Hire experts for sustainable procurement	Yes	Yes	Yes	Yes
	Have experts who work at sites within different regions	Yes	Yes	No	Yes
	Have experts who work at supplier sites and process information	No	Limited	No	Yes
	Have experts who interact with NGO's	Yes	Yes	Limited	Yes
	Use external experts to conduct audits	Yes	Yes	No	Limited
	Integrate green and social criteria into a central database	Yes	Yes	Yes	Yes
	Use EDI	Yes	Yes	Yes	Yes
	Apply additional and stricter criteria to fulfill for suppliers	Yes	Yes	No	Yes
	Apply newer and stricter SCoC	Yes	Yes	No	Yes
	Use multi-tier assessment	Limited	Limited	Limited	Yes
	Use multi-step assessment	Yes	Limited	Limited	Yes
	Re-assess supplier periodically	Yes	Yes	Yes	Yes
	Apply additional and stricter criteria to fulfill for suppliers	Yes	Yes	No	Yes

# Table 3: Cross-Case Analysis

In addition to that *Chem* stressed that initially when they first tackled the topic of SSM they developed a standalone solution for the green assessment and development of suppliers. This IT tool coexisted with the social assessment and the supplier relationship management tool, which served as a database to track economic performance such as price developments, quality delivery dependability and security of supply. Only recently the firm merged all these supporting tools into one tool that embraces the entire triple bottom line performance of their suppliers, which also support the risk based step-wise procedures pointed out before. As argued by its Manager for Sustainable Procurement, *Chem* moved from a decentralized database that included merely environmental information to a one-stop-solution embracing social criteria.

(4) Supplier Evaluation constitutes the fourth dimension by which firms seek to enhance their sustainability-related IPC. To gain reliable information each firm that we studied used multi-step evaluation including a self-assessment, audits, site visits and re-audits. *Chem, Furniture* and *Apparel* pursue this approach including all steps whereas *Pharma* changed the process in 2012 and excluded the self-assessments. Its Head of Sustainable Sourcing argued that due to the great number of suppliers they received a vastness of information that they could not process. Instead, they annually buy data from an independent firm regarding products and supplier origin to apply a risk-mitigation approach and to identify where to conduct social or environmental audits and site visits. To ensure recency of information all firms we studied update supplier information by re-assessing their supplier periodically. This finding is in line with the extant literature in the field of SSM [11-13, 38].

By applying newer and stricter evaluation criteria *Chem*, *Pharma* and *Apparel* seek to gradually improve the sustainability performance of their supplier network. *Apparel*'s Chief Sourcing Officer explained us that a supplier that was classified as an A\* (preferred) supplier five years ago would be ranked a B (standard) supplier today due to updated and criteria and stricter evaluation criteria and benchmarking thresholds that are considered to indicate supplier compliance (see Table 4). In addition to that *Chem* and *Pharma* recently launched an updated version of their respective supplier code of conduct specifying new and stricter evaluation criteria than the respective previous version.

We observed that Chem, Pharma, Furniture and Apparel all gained deeper information on its supply network by evaluating indirect suppliers beyond tier one. Apparel applies this approach in an extensive manner including third-tier supplier in their sustainability evaluations. As stated in Table 4, Apparel's Chief Sourcing Officer argues that it is unavoidable to monitor and improve the performance of the upstream tiers in order to reduce sustainability-related uncertainty. Therefore, Apparel locates its sub-suppliers as upstream as possible. In contrast to that, Chem, Pharma and Furniture normally merely assess and monitor their direct business partners and only rarely evaluate their second tier suppliers. Furniture rarely has second-tier suppliers because of their high level of own value-added. The reason for limiting their evaluation processes to the second-tier is resource constraints. Instead they preferred to foster long-term relationships with high performing first-tier suppliers who in turn themselves seek sub-suppliers with high sustainability standards. Chem seeks greater transparency in most of their product supply chains than *Pharma*. Depending on the structure of the respective product supply chain they apply their sustainable supplier evaluation and developing processes down to the last tier (raw material supplier). From our cross case analysis it has become clear that there is a positive correlation between the resources (mainly number internal employees and amount of annual auditing budget) available and the depth of the application of their established sustainable supplier evaluation and development processes. Based on these findings concerning the information processing enhancing attributes we formulate our second proposition:

**Proposition 2:** Information processing capacity is primarily enhanced by (a) Employee Management, (b) Information Exchange, (c) IT Support, (d) Process-related Capabilities

#### CONCLUSION

#### **Summary of Findings**

Drawing on four case studies from the chemical, pharmaceutical, apparel, and furniture industry, we can propose in response to our first research question that firms possess four mechanisms through which they can create IPC for SSM. These are (a) employee management, (b) information exchange, (c) IT support, and (d) process-related capabilities. For each mechanism, we have identified and described multiple variants, which focal firms can choose from or combine to reduce the sustainability-related information deficit.

With respect to our second research question, we have identified three mechanisms, which firms may apply to reduce their IPN. These comprise (a) supply chain (re)-design, (b) standardization and (c) extant supplier-related measures. Again, there are multiple variants for each mechanism. Jointly, the answers to the research questions can be used as a new, formative construct to establish or improve an information-driven SSM capability targeted towards the reduction of sustainability-related uncertainty the sustainability in the upstream supply network.

Our second research question relates to configurations assembled out of the above mechanisms, aiming at the creation (or re-establishment after a trigger incident) of fit between IPN and IPC. We find that at each firm, compelling cost-benefit logic can be identified as to why the firm chose to take their respective measures. However, the respective costs and benefits depend so heavily on the respective firm situation that the cost-benefit logic must, at present, still be regarded as idiosyncratic. For example, supply chain re-design, which can be a powerful IPN reduction instrument, is frequently not applied by firms, which profit so heavily from actual monetary savings through outsourcing to a low-cost country that the benefits stemming from IPN reduction through supply chain re-design towards Western Europe cannot over-compensate this economic benefit. This situation was particularly observed at Pharma and Apparel. Consequently, these firms demonstrated a tendency to build up information processing capacity over reducing IPN. Moreover, the benefits attainable from an enhancement of IPC seemed to be attainable faster than the rather medium- to long-term measures of IPN reduction. On the other hand Furniture was demonstrated the opposite and preferred to redesign their supply chain geographically and also to partially re-integrate value creation in order to lower IPN as opposed to developing a high sustainability-related IPC in the purchasing function. Chem pursued a hybrid solution by means of simultaneous pursuit of IPN reduction and IPC enhancement.

We believe that our research provides highly useful conceptual insights into SSM, in particular into the formation of an informational SSM capability. This capability is also instrumentally relevant. Moreover, it appears to make a useful theoretical contribution towards the extension of IPT to the supply network level, a level which is becoming ever more important in times of highly complex supply chains.

## **Managerial Implications**

This research amends a highly instrumental perspective to extant research on SSM. We build on numerous insightful investigations in a stream of works on the processes of supplier evaluation, selection and development, as well as on another stream on various operational and strategic capabilities for SSM. Moreover, we have described precisely how firms can enable themselves to create or enhance an informational SSM capability. Given the facts that supply chains are still becoming more complex and that sustainability is becoming ever more important, an informational SSM capability can be conjectured to also gain importance, in the future.

## **Limitations and Future Research**

All limitations inherent to theory-generating case studies apply to this work, as well. Moreover, we have not yet reached theoretical saturation so that our results are still preliminary, even for exploratory case study research. Hence, there is ample room for refinement and validation.

Multiple extensions of this research appear worth to be undertaken: It would be interesting to understand in more precisely which benefits and (opportunity) costs are associated with SSM, what these variables depend on and how they evolve, given instrumental drivers. Another line of inquiry relates to paths of informational SSM capability creation; we have some anecdotal evidence that there may be certain path dependencies and therefore firms with particular supply chain characteristics tend to or have to pursue. Those should also be related to urgency of capability creation as an independent variable. At present, it appears plausible that the more urgent a capability creation is, the more firm-internal the respective measures are.

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