Received 11 June 2017
Revised 24 December 2017
18 April 2018
9 August 2018
7 September 2018
12 September 2018
Accepted 12 September 2018

Achieving triple bottom line sustainability in supply chains

The role of environmental, social and risk assessment practices

Joe Miemczyk
ESCP Europe Business School, London, UK, and
Davide Luzzini
EADA Business School, Barcelona, Spain

Abstract

Purpose – Companies are increasingly challenged by sustainability-related supply chain risks. Research has developed linking supply chain sustainability priorities, practices and triple bottom line performance; however, risk is rarely included in these models. The purpose of this paper is to understand the link between sustainable supply chain strategies, practices and performance, and to test the importance of risk management practices in this relationship focusing on the product category level.

Design/methodology/approach – The paper includes a survey of supply managers in four countries with 305 responses, with a focus on upstream supply chain strategies at the product category level.

Findings – The environmental and social sustainability strategies lead to sustainable supply sustainable performance, through focused practices in either area, but the effect on operational and cost performance is not significant. Social supply chain strategies positively impact environmental and cost performance when mediated by risk assessment practices.

Originality/value – This paper shows a more nuanced view of the impact of supply chain practices on the strategy–performance link. It is one of the first papers to empirically test the role of risk practices in sustainable supply chain management and emphasize the importance of alignment across the main dimensions of sustainability to achieve positive sustainable performance outcomes, but not necessarily cost and operational performance. Unlike other studies, social sustainability priorities may positively impact environmental and social performance and is linked to cost advantage when implemented with risk assessment practices.

Keywords Sustainability, Survey, Supply chain management, Supply risk

Paper type Research paper

Introduction

The purpose of this research is to investigate how supply chain sustainability orientation influences triple bottom line (TBL) outcomes, and how supply chain practices related to sustainability and risk assessment impact on this relationship. There are numerous examples of how companies have reacted to risks in their supply chain whether from environmental disasters such as oil spills and industrial accidents or from labor standards violations ranging from child exploitation to unsafe working practices (e.g. Locke *et al.*, 2013). From the early 1980s, companies including Gap, Nike, BP and Nestlé are well-known cases of reacting to supply chain problems, apparently surprised by the extent of sustainability-related risks in their supply chains (Lee and Vachon, 2016). However, companies are still being caught out today by not identifying and acting on issues such as slavery in seafood supply chains (The Guardian, 2017). Hence, there appears to be a gap in practice, especially in the area of risk assessment, and the sustainability intentions of companies and their supply chains. Research, while somewhat limited, has reinforced the view that sustainability actions are influenced by risks in the supply chain (Cousins *et al.*, 2004; Foerstl *et al.*, 2010; Klassen and Vereecke, 2012) and that a focus on risk management practices may improve sustainability-related performance (Hofmann *et al.*, 2014). Supply chain risk management is

International Journal of Operations & Production Management
Vol. 39 No. 2, 2019
pp. 238-259

0144-3577
DOI 10.1108/IJOPM-06-2017-0334

deemed important and seen as "the ability of a firm to understand and manage its economic, environmental, and social risks in the supply chain" (Carter and Rogers, 2008, p. 366), yet few studies have explicitly examined how risk management helps achieve supply chain sustainability objectives as well as other aspects of business performance through the avoidance of negative risk impacts. Supply chain risk practices typically comprise risk assessment and management dimensions which can lead to improved supply chain performance by focusing management attention in the right areas and minimizing disruptions (Wieland and Wallenburg, 2012). Thus, we ask whether risk assessment practices influence the link between sustainability strategies and TBL performance.

Sustainability performance is often defined in terms of the TBL, by going beyond economic performance and including environmental sustainability and social equity (Brandon-Jones, 2015). This view of performance has been adopted in research on sustainable operations (Gimenez *et al.*, 2012) as well as sustainability in supply chains (Carter and Rogers, 2008; Gimenez and Sierra, 2013; Hollos *et al.*, 2012). Historically, research has focused on environmental supply chain sustainability (Touboulic and Walker, 2015), while there is also increasing interest in social issues leading to non-compliance to codes of conduct and social standards (Klassen and Vereecke, 2012; Marshall *et al.*, 2015). It is therefore crucial to understand how these different aspects of sustainability impact on the alignment of strategy, practices and TBL performance. Research on both aspects has provided a deep understanding of the drivers of sustainable supply chains (Carter and Jennings, 2004; Walker *et al.*, 2008; Paulraj *et al.*, 2017); however, the link between sustainability priorities, practices and performance, is an important and continuing research stream (Gimenez and Sierra, 2013; Paulraj *et al.*, 2014). Broadly, sustainable supply chain practices have been shown to have a positive impact on performance, with this link being made most commonly through the impact of environmental practices on environmental and economic performance (Golicic and Smith, 2013). The effects of both environmental and social practices in supply chains on TBL performance is still subject to some disagreement especially in the domain of social practices (Hollos *et al.*, 2012; Sancha *et al.*, 2015). Thus, an open question exists on how environmental and social strategy and practices might have an influence the TBL performance and whether risk assessment practices play a role in this relationship. This paper aims to contribute to sustainable supply chain management (SSCM) research by: testing the link between supply chain sustainability strategy, practices and TBL performance in upstream supply chains, to add to the debate on the alignment highlighted in recent reviews (e.g. Busse and Mollenkopf, 2017); and developing an understanding of how risk assessment practices, a recent and under-researched topic in the context of sustainability (Roy *et al.*, 2018), might be part of this aforementioned link. Two guiding research questions emerge:

RQ1. Does a focus on environmental and social priorities lead to TBL improvements through supply chain environmental and social sustainability practices?

RQ2. How, in combination with these aforementioned practices, does supply chain risk assessment impact on the relationship between sustainable strategy and the TBL?

Aligning sustainability strategy, practices and performance

From a theoretical point of view this paper draws on the resource-based view of the firm, with specific relation to the natural resource-based view (NRBV), the relational view (RV) and the extended resource-based view (ERBV) of the firm. Notably, the concept of alignment between strategy, practice and performance can be traced back to the original resource-based view of the firm (Wernerfelt, 1984), exemplified by Gonzalez-Benito (2007) in the

supply chain sphere. Research shows that companies can align their supply chain sustainability strategy and resources and obtain positive outcomes – a sustainable supply chain capability – although the exact resources required are not always clear (Sarkis *et al.*, 2011). Previous studies have interpreted these resources as supply chain practices at the functional level (Luzzini *et al.*, 2015).

The recognition that a company is no more sustainable than its suppliers links to the need for supply chain actions to capitalize on resources outside the company boundaries. Both the RV (Dyer and Singh, 1998) and the ERBV (Mathews, 2003) highlight the need to invest in relationships and actions that leverage external resources. As sustainability issues can pervade any part of the supply chain, the ERBV appears especially relevant where positive or negative impacts may be felt through both strong direct ties but also weak indirect ties (in the case of distant suppliers).

Hart (1995) emphasizes internal–external boundary spanning resources that positively impact competitive advantage, thus extending NRBV to SCM. From this, researchers have highlighted the interplay between internally and externally focused capabilities for sustainable SCM (Lee and Klassen, 2008; Luzzini *et al.*, 2015), inter-organizational resources stimulating supplier engagement (e.g. Foerstl *et al.*, 2010) and the effects of integration (Vachon and Klassen, 2006). Sarkis *et al.*'s (2011) review of theory in SSCM highlights the need for further development of NRBV by focusing on the inter-organizational elements, motivating studies linking sustainable supply chain practices and performance (Golicic and Smith, 2013; Paulraj *et al.*, 2017). While some of these studies do provide a focus on both environmental and social aspects of supply chain sustainability (Luzzini *et al.*, 2015; Paulraj *et al.*, 2017), there is still uncertainty about the impacts of sustainability strategy and practice on performance overall (Hollos *et al.*, 2012). A particular challenge is finding a link to benefits from social supply chain sustainability (Sancha *et al.*, 2015; Mani *et al.*, 2018; Croom *et al.*, 2018).

The role of risk assessment in sustainable supply chains

A second research opportunity is driven by the observation that companies often discuss the impacts of environmentally and socially irresponsible behaviors in their supply chains in terms of risks. While some research has discussed the potential role of risk in sustainable supply chains by adapting risk frameworks to sustainability (Giannakis and Papadopoulos, 2016), or the impact of sustainability practices on financial risk reduction (Lam, 2018), the role of risk management in this context has barely been empirically tested (Miemczyk *et al.*, 2012; Roehrich *et al.*, 2014). Such risks may be driven by either environmental or socially-related concerns. On the environmental side, this includes disruptions due to industrial accidents leading to major spills or air/water pollution or suppliers who fall foul of pollution regulations restricting their license to operate (Cousins *et al.*, 2004), for example, oil supply disruption due to the Deepwater Horizon disaster attributed to lack of contractor controls. On the social side, compliance to labor standards are often cited as common risks (Klassen and Vereecke, 2012), with examples including the modern slavery scandals in seafood supply chains (*The Guardian*, 2017) or Adidas suppliers losing contracts due to non-compliance issues (CIPS, 2015). Both types of risks may lead to reputational damage or supply disruption which can affect company performance in terms of sustainability metrics as well as operational and cost indicators (Roehrich *et al.*, 2014; Hofmann *et al.*, 2014). It is expected that companies prioritizing sustainability will assess risks in their supply chains to avoid non-compliance as well as economic and reputational damage, hence, costs (to find new suppliers), delivery (delays due to disruptions), quality (non-conformance to material regulations such as RoHS or REACH), sustainability objectives and reputation (Hofmann *et al.*, 2014).

Development of the research model

Building on the arguments raised in the previous sections, we develop a testable conceptual model of sustainability strategy, practices, including risk assessment and the impact on performance in supply chains. For the purposes of this research, supply chain strategy is viewed as the competitive priorities put in place at a functional level to focus action and resource allocation and which reflect the competitive positioning of the focal company (Gonzalez-Benito, 2007). Hence, sustainable supply chain strategy is conceptualized as environmental and social supply chain priorities.

Environmental and social supply chain priorities, practices and performance

Much previous research has assumed that a sustainable supply chain priority including environmental and social elements is implemented homogeneously and that, regardless of the focus, will have broad sustainability outcomes (Carter and Easton, 2011). Research suggests that specific actions are needed depending on the desired outcome and that actions need to be balanced according to the specific priorities put in place at the supply chain level (Wu and Pagell, 2011). Focus on environmental priorities is likely to lead to practices that emphasize working with suppliers to create innovations and efficiency through product redesign, waste reduction or recycling and other ways of reducing resource usage which can save costs and create greener products (Blome *et al.*, 2014; Tachizawa and Wong, 2015). Social priorities likely arise due to concerns over non-compliance to codes of conduct, mandates and social standards, and therefore social supply chain practices are likely to focus on ensuring suppliers meeting social and ethical standards expected through auditing and working with stakeholders (Klassen and Vereecke, 2012; Shafiq *et al.*, 2014). Hence, we may argue that these different priorities may be supported by specific supply chain practices.

Most research looking at sustainable supply practices has concentrated on green or environmental outcomes relating buying products which are greener and avoid hazardous materials (Lee, 2015; Rauer and Kaufmann, 2015; Wong *et al.*, 2015). Research focuses on green or environmental practices in general which may involve selection and evaluation, but also working directly with suppliers and ensuring the supply chain function is focusing on the right issues for a specific set of supplied products (Sarkis *et al.*, 2011).

As for achieving social sustainability in supply chains, companies will select suppliers using social performance-oriented criteria and may ask suppliers to meet specific social standards such as ISO26000 or Fairtrade-type arrangements, or rules such as working time limits or safety targets. Buying companies may need to go further to demonstrate that their main suppliers actually adhere to these standards (Mani *et al.*, 2018), for example, using codes of conduct and carrying out audits to ensure compliance (Marshall *et al.*, 2015; Sancha *et al.*, 2015). Complying with rules may not be enough to convince stakeholders that practices are sustainable, so suppliers may be involved in stakeholder dialogue with NGOs or other interest groups targeting improved social conditions (Shafiq *et al.*, 2014).

Research has looked at the impact of sustainable supply chains on performance and broadly found a positive link between the investment in sustainable supply chains and numerous outcomes which include sustainability metrics as well as operational performance (Carter and Easton, 2011), although with some mixed results (Hollos *et al.*, 2012). The majority of research has focused on environmental/green sustainability issues (Golicic and Smith, 2013) and a positive link has been found between environmental/green supply chain practices and performance such as operational costs (Vachon and Klassen, 2006; Zhu and Sarkis, 2004; Paulraj *et al.*, 2017). Studies showing the effect of supply chain social practices on performance is still developing and results are less convincing (Sancha *et al.*, 2015; Mani *et al.*, 2018). Yet, it might be expected that not only environmental practices but also social-related supply chain practices might have positive effects on performance by

addressing potential costs (replacement of non-compliant suppliers) and operational (labor problems causing delivery delays) issues at suppliers (Klassen and Vereecke, 2012; Croom *et al.*, 2018; Mani *et al.*, 2018).

In order to address these mixed results, it is important to examine impacts on TBL performance, going beyond green or social impacts and including cost and other operational priorities. While several studies have tested the impact of sustainability practice on plant- or company-level TBL performance (Gimenez *et al.*, 2012), measuring TBL performance in a supply chain context needs to consider the metrics used by supply managers notably cost, and operational issues such as delivery and quality, alongside specific aspects of environmental and social sustainability (Hollos *et al.*, 2012).

In summary, previous research has shown positive links between sustainable supply chain priorities and overall performance through the adoption of dedicated practices, especially in the area of environmental sustainability. However, further research is needed to understand whether focused practices on environmental or social have an equivalent impact on the relationship between focused strategies and TBL performance or whether a more nuanced picture actually emerges from practice. The following hypotheses are developed from these arguments:

H1. Environmental supply chain priorities have an indirect positive impact on TBL performance and are mediated by environmental practices.

H2. Social supply chain priorities have an indirect positive impact on the TBL performance and are mediated by social supply chain practices.

Linking sustainable supply chains and risk

Research on sustainability-related risks in supply chain management is a relatively neglected area (Hofmann *et al.*, 2014). This is rather surprising, given the frequently cited anecdotal evidence of supply risks related to environmental or social non-compliance (Hajmohammad and Vachon, 2016). Managing supply risks in general have been identified as important for firm performance overall (Ritchie and Brindley, 2007). The first phases in risk management, namely, identification and assessment (Zsidisin *et al.*, 2000), are key to supply management's role in protecting the firm from negative impacts such as supply disruptions (Jüttner, 2005). Research has shown that risk assessment practices should go alongside other supply management practices such as selection and assessment in order to reduce risks and their impacts such as supply disruptions (Craighead *et al.*, 2007).

Examining the role of risk practices enacted by purchasing functions and their role in facilitating strategies to improve the TBL is relatively new in supply chain management research. Foerstl *et al.* (2010) suggest that the integration of risk assessment into supply chain practices can lead to enhanced performance outcomes related to both reputational effects and operational performance, by enabling risk mitigation strategies where they will be most effective (the selection and development of suppliers related to sustainability). Building on this, other researchers have found that supply risk damage to the focal firm can occur due to disruptions and also stakeholder reactions when considering sustainability risk sources (Hofmann *et al.*, 2014). To counter these risks, supply managers may adopt monitoring or collaborative approaches with suppliers (Hajmohammad and Vachon, 2016) and even create alliances (Canzaniello *et al.*, 2017), depending on the level of risk and dependence. Further, more recent research reinforces the argument that sustainable supply chain practices are mutually supportive to supply risk practices (Kähkönen *et al.*, 2016).

Despite these contributions, there still exists a lack of evidence on the impact of supply risk assessment on the ability of SSCM strategies to have impact on TBL performance, especially at the supply level (rather than broad company-level reputational benefits). This is important because it is the supply function that needs to justify and invest in the

necessary resources to assess risk. Risk assessment can help focus supplier practices on the right suppliers and the right issues (Canzaniello *et al.*, 2017), optimizing the focus of environmental and social supply chain priorities. Therefore, we expect risk assessment practices to have a positive influence in the link between sustainable supply chain priorities and TBL performance. Not only might risk assessment positively impact environmental and social performance, but other aspects of performance might also be influenced. For example extra costs might be avoided if possible supply disruptions are identified from environmental or social compliance issues such as downtime due to environmental accidents or safety issues affecting supplier productivity, which would also impact operational metrics on supply delivery. At the same time, we might expect that ensuring priorities are focused in right areas, the costs of supply chain might also be optimized (Canzaniello *et al.*, 2017). Hence, we hypothesize the following:

H3. Environmental supply chain priorities have an indirect positive impact on TBL performance and are mediated by supply chain risk assessment practices.

H4. Social supply chain priorities have an indirect positive impact on TBL performance and are mediated by supply chain risk assessment practices.

These hypotheses can be summarized in the path model in Figure 1 testing the influence of supply chain sustainable priorities, sustainable and risk assessment practices and TBL performance.

Methodology

Survey development and data collection

The hypotheses were tested using data collected in the second half of 2014 through a second wave of the International Purchasing Survey, involving supply management researchers in four European countries (Finland, Germany, Italy and Ireland). The choice of countries was made to cover different European countries and also by pragmatic considerations, such as the presence of research partners and the complexity of data collection. The research project utilized an online survey questionnaire about purchasing/SC priorities, practices and performance using constructs derived from the literature. Since the survey design and data collection involved multiple countries, a common methodological toolkit was developed to provide guidance to partner institutions throughout the project. The survey was developed in English using the main theoretical frameworks that inspired the study. Given the diverse interests of each research partner, a method team selected a few grand theories after a review of the most important and promising theories in purchasing and supply management. The constructs were defined in a construct book, reporting construct name and typology, definitions, survey items, scales,

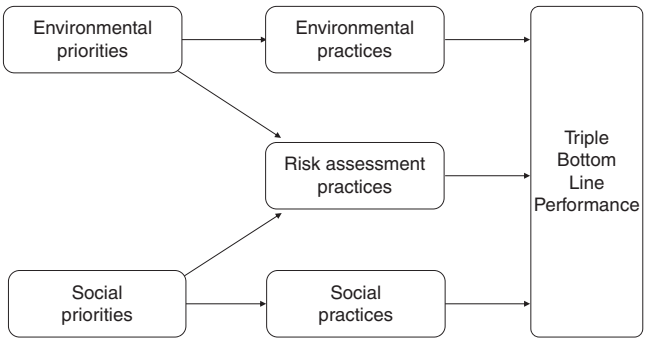


Figure 1.
Conceptual model

underlying theory and corresponding references. A particular aspect of the survey is that it benefits from the adoption of a category-level perspective. In fact, strategies are never fully implemented until they are integrated at the category or product family level (Handfield *et al.*, 2005), and these different categories often adopt different managerial approaches (Gelderman and Van Weele, 2005).

The English version of the questionnaire was translated into different languages using the Translation, Review, Adjudication, Pre-testing and Documentation procedure (Harkness *et al.*, 2004), and tested by two purchasing executives in each country to check the clarity of the questions. Before and during the pre-testing phase, emphasis was placed on quality of the question formulation to reduce potential bias resulting from respondents' misleading cognition (Poggie, 1972; Schwarz and Oyserman, 2001). We concentrated questions on observable data to exclude every possible scope of interpretation. The final version of the survey tool was uploaded onto the project website and made visible only to respondents selected in the sampling procedure. The internet survey offers higher levels of accuracy and reduces missing values due to either the respondent or data entry mistakes (Boyer *et al.*, 2002).

In each country, firms were randomly sampled from a national, publicly available database. Sampling criteria were pre-agreed among the participating researchers: only firms with more than 50 employees from the manufacturing (ISIC codes from 10 to 33) and professional service firms (ISIC codes from 62 to 66, and from 69 to 75) were included in the sample. Next, each country worked to recover contacts of key informants at the sampled firms. The paper authors were in charge of the data collection in Italy.

Respondents were contacted over the phone to determine their availability to give answers and to provide guidance for the survey completion. A script for the telephone call with respondents was provided within the method toolkit as well as a draft text of subsequent e-mails. After a respondent agreed to participate, he or she was contacted via a customized e-mail including the survey link. Reminder e-mails and telephone calls were made to those who had not responded. Following similar key-informant-based research studies (Cini *et al.*, 1993; Cousins, 2005), the goal was to find the right person within the organization who was able to respond to all the questions about the purchasing/SC strategy, the buyer–supplier relation, purchasing practices and performance. Mostly CPOs, VPs of purchasing/SC, purchasing/SC directors and purchasing/SC managers were involved. The respondents consisted of highly qualified purchasing/SC professionals who had played important roles in the purchasing functions of their firms.

The databases across all four countries included a total of 20,515 companies that fit our sampling criteria. Of these, 3,068 were selected through random sampling, and out of these, 3,059 were contacted (some companies were noticed after sampling to not fit the criteria, e.g. the company moved abroad, was no longer in the industry specified, or no longer fit the criterion for at least 50 people). Out of these, 1,059 were contacted via phone (for those not reached, either a suitable respondent was never located in the company or the suitable respondent never answered our calls, despite multiple attempts). A total of 656 companies agreed to participate, and out of these, 305 useable responses were received. Thus, the response rate considering companies that received the link for the questionnaire was relatively high at 46 percent. Considering all the companies reached, the resulting response rate was 28.8 percent.

After the data collection process, each country cleaned its own data in accordance with a common agreement and conducted tests regarding non-response bias. Non-respondent bias was tested by ruling out the differences in terms of size and sector distributions between respondents and non-respondents (Scott and Overton, 1977).

As we relied on a single respondent design, we controlled for common method bias in two ways: through the design of the study and through statistical control (Podsakoff *et al.*, 2003;

Chang *et al.*, 2010; MacKenzie and Podsakoff, 2012). Regarding the survey, the research project was labeled as a broad overview of purchasing/SC management: no explicit reference to the intention to test antecedents of supplier performance was evident. The respondents' attention was not drawn to the relationships being targeted in this study. Questions including items and constructs related to each other in the general model were separated in the questionnaire to prevent respondents from developing their own theories about possible cause–effect relationships. Furthermore, the questionnaire was carefully created and pre-tested and respondents were assured of strict confidentiality. Finally, we used different scales and formats for the independent and criterion measures (Podsakoff *et al.*, 2003). As a second means to ensure against common method bias, we examined the unrotated factor solution for the constructs included in our model (Podsakoff and Organ, 1986), checking that neither a single nor a general factor was likely to account for the majority of the covariance among the measures (Table I).

Measures

The operationalization of the constructs was based on existing measures. All the items used to measure the latent variables we target are shown in Table II.

The buyer's strategic purchasing competitive priorities and the supplier's performance were assessed following the production competence framework adopted by Gonzalez-Benito (2007). Respondents were asked – on the one hand – to what extent the purchasing management has emphasized the priorities over the past two years on a Likert-like scale from 1 ("Not at all") to 6 ("To a great extent"). On the other hand, respondents were asked to what extent the supplier's performance has met management's expectations from 1 ("Far below expectations") to 6 ("Far above expectations"). The emphasis on environmental and social sustainability practices was mainly measured following Hofer *et al.* (2012), with some items added from ElTayeb *et al.* (2010) and Pagell and Wu (2009). Respondents were asked on a Likert-like scale ranging from 1 ("Totally disagree") to 6 ("Totally agree") to what extent they agree or disagree on a series of statements regarding both environmental and social practices, for example, "To what extent do you agree or

Descriptive	Freq.	%	Descriptive	Freq.	%
Country			*Industry sector*		
Italy	99	32.5	Manufacturing	234	76.7
Germany	70	23	Information and comm.	23	7.6
Finland	84	27.5	Finance and insurance	19	6.2
Ireland	52	17	Professional, scientific and technical activities	29	9.5
Purchasing categories			*Respondent position*		
Raw materials	125	41	Purchasing director	53	17.4
Components and supplies	90	29.5	Purchasing manager	153	50.2
IT services	28	9.2	Senior, project buyer	34	11.1
Logistics services	16	5.2	Buyer, purchasing agent	28	9.2
Office equipment and supplies	19	6.2	Other	32	10.5
Maintenance and cleaning	27	8.9	Missing	5	1.6
Employees					
Medium (50–249)	150	49.1			
Large (250–1,000)	78	25.6			
Very large (> 1,000)	75	24.6			
Missing	2	0.7			
Total	305	100		305	100

Table I.
Sample descriptive statistics

First-order construct	Indicator	Loading	Mean	SD	CR	AVE
Environmental strategy	Supplier ability to meet agreed environmental performance goals	0.8956	3.71	1.37	0.882	0.717
	Ensuring that purchased products or services contain green attributes	0.9363				
	Ensuring that purchased products or services do not contain environmentally undesirable substance	0.6871				
Social strategy	Enforcement of a code of conduct for suppliers	0.8390	3.16	1.47	0.865	0.683
	Independent audits of ethical performance of suppliers	0.8194				
	More stringent ethical and social mandates than required in host countries	0.8202				
Environmental practices	Major suppliers are selected using criteria that include environmental dimensions	0.8627	3.04	1.36	0.905	0.618
	Major suppliers are required to adhere to certain environmental standards	0.8584				
	We audit major suppliers on environmental dimensions	0.8180				
	Purchased products and services are being designed to meet environmental objectives	0.8330				
	Major suppliers are involved in environmental research and development	0.6910				
	We provide environmental training and information to major suppliers	0.6209				
Social practices	Major suppliers are selected using criteria that include ethical and/or social dimensions	0.8790	2.92	1.44	0.924	0.674
	Major suppliers are required to adhere to certain ethical and/or social standards	0.8863				
	We audit suppliers on ethical and/or social dimensions	0.8045				
	We provide training and information to major suppliers on ethics/social responsibility	0.6384				
	Major suppliers' processes are required to meet ethical and social objectives	0.9139				
	Major suppliers are involved in stakeholder dialogue and/or engagement in ethical or social issues	0.7707				
Risk assessment practices	Systematic identification of sources for such disruptions	0.7131	3.83	1.21	0.902	0.700
	Assessment of both our own risks and risks of major suppliers	0.8679				
	Assigned individuals responsible for the management of such risks	0.8145				
	Continuous monitoring of developments that might promote such disruptions	0.9359				
Environmental performance	Supplier ability to meet agreed environmental performance goals	0.9079	3.93	0.95	0.879	0.714
	Ensuring that purchased products/services contain green attributes	0.9567				
	Ensuring that purchased products/services do not contain environmentally undesirable substance	0.6338				
Social performance	Enforcement of a code of conduct for suppliers	0.8532	3.70	1.07	0.934	0.825
	Independent audits of ethical performance of suppliers	0.9103				
	More stringent ethical and social mandates than required in host countries	0.9588				
Cost performance	Labor productivity in the purchasing department	0.6389	4.29	0.86	0.701	0.438
	Productivity of purchasing resources	0.6594				
	Low cost of purchases (e.g. purchasing price, transportation)	0.6874				

Table II.
CFA results

(*continued*)

First-order construct	Indicator	Loading	Mean	SD	CR	AVE
Quality performance	Features and functionality of purchased products or services	0.6304	4.31	0.69	0.866	0.622
	Durability of purchased products or services	0.8931				
	Reliability of purchased products or services	0.8720				
	Fit between purchasing specifications and purchased products or services	0.7301				
Delivery performance	Short internal order processing times	0.7063	4.06	0.85	0.773	0.531
	Short delivery times by suppliers	0.7153				
	Fulfilment of agreed schedules by suppliers	0.7639				

Notes: Fit indexes: $\chi^2 = 870.9$; p-value $= 0.000$; $\chi^2/\text{df} = 1.46$; CFI $= 0.961$; RMSEA $= 0.045$

Table II.

disagree with the following statements about environmental sustainability practices for this category?," "Major suppliers are selected using criteria that include environmental dimensions" or "We audit suppliers on ethical and/or social dimensions." Finally, risk assessment practices were adapted from Wieland and Wallenburg (2012), Respondents were asked which measures are taken in order to counter unexpected disruptions of the material or service flow on a Likert-like scale from 1 ("Totally disagree") to 6 ("Totally agree"), for example, asking "In order to counter unexpected disruptions of the material or service flow for this category along our inbound supply chain, the following actions are taken," "Assessment of both our own risks and risks of major suppliers."

Findings

Hypotheses were tested using structural equation modeling (SEM) with the maximum likelihood (ML) estimation method. Most SEM applications described in the literature are analyzed with this methodology. The hypothesized model was tested statistically in a simultaneous analysis of the entire system of variables to determine the extent to which it was consistent with the data. Where goodness-of-fit is adequate, the model can be seen as a plausible explanation of postulated interactions between constructs. The research model is analyzed and interpreted sequentially: first, the assessment of the reliability and validity of the measurement model and, second, the assessment of the structural model (Hulland *et al.*, 1996). The R software (https://cran.r-project.org) was used to estimate both the measurement model and the structural model. The ML algorithm was used to obtain the paths, the loadings, the weights and the quality criteria.

Measurement model

The measurement model consists of ten multi-item constructs with a total of 38 indicators. We used several tests to determine the convergent and discriminant validity of the six reflective constructs. We controlled through a confirmatory factor analysis (CFA) that all item loadings between an indicator and its posited underlying latent variable were greater than 0.7 – with no relevant cross-loadings. Table II shows the measurement scales of the reflective constructs investigated by our research model. We verified the measures by assessing reliability and unidimensionality of each of the nine constructs, i.e. item-to-total correlations within each construct were examined (Churchill, 1979). Our measurement model is able to provide to a great extent discriminant validity and convergent validity (Bagozzi and Yi, 1988; Anderson and Gerbin, 1988; Fornell and Larcker, 1981): both composite reliability and average variance extracted (AVE) were above the recommended threshold of 0.7 and 0.5, respectively (Fornell and Larcker, 1981; Nunnally, 1994). Only the cost

performance AVE is slightly below the threshold, none of the constructs violates the Fornell–Larcker criterion. To further test for discriminant validity, we compared the squared correlation between two latent constructs and their AVE estimates (Fornell and Larcker, 1981). These constructs meet the validity condition of the AVE estimates exceeding the squared correlation between each pair of constructs, with the only exception of a higher correlation between the cost and delivery performance (see Table III).

Finally, we can evaluate the overall model fit in two ways (Hu and Bentler, 1998): with the χ^2 goodness-of-fit statistic and with other absolute or relative fit indices. It is quite common in management literature to avoid using the χ^2 p-value as this measure is particularly sensitive to sample size and assumptions of normality (Hu and Bentler, 1998). As a consequence, other fit indices are preferred to the p-value. Some authors suggest checking the ratio between χ^2 value and degrees of freedom in the model, where cut-off values range from < 2 to < 5 depending on the investigator (e.g. Byrne, 1989; Kelloway, 1998). Another way to evaluate the fit of a model is to use fit indices that have been offered to supplement the χ^2. Fit indices range from 0 to 1, with values closer to 1 indicating good fit. Hu and Bentler (1998) recommend MLE-based fit indices and also suggest a two-index presentation strategy with, among others, the comparative fit index (CFI), and Gamma hat or root mean square error of approximation (RMSEA). The CFA reveals a sufficient model fit attested through such fit indices for the measurement model (Bollen, 1989; Shah and Goldstein, 2006): $\chi^2 = 870.9$; $\chi^2/\text{df} = 1.46$; RMSEA $= 0.045$; CFI $= 0.961$. Following the recommendations of Bagozzi and Yi (1988) as well as Bagozzi and Baumgartner (1994), the quality of our model can be judged as sufficient.

Structural model

The postulated path model produced a sufficient fit to the data ($\chi^2 = 1{,}020.6$; $\chi^2/\text{df} = 1.64$; RMSEA $= 0.053$; CFI $= 0.943$). Figure 2 shows the results of the hypotheses testing.

According to *H1*, higher emphasis on environmental priorities has a positive effect on the TBL through the implementation of environmental practices. However, we find a significant and positive relationship only with the environmental performance. Cost, operational and social performance are not affected (i.e. neither increased nor diminished).

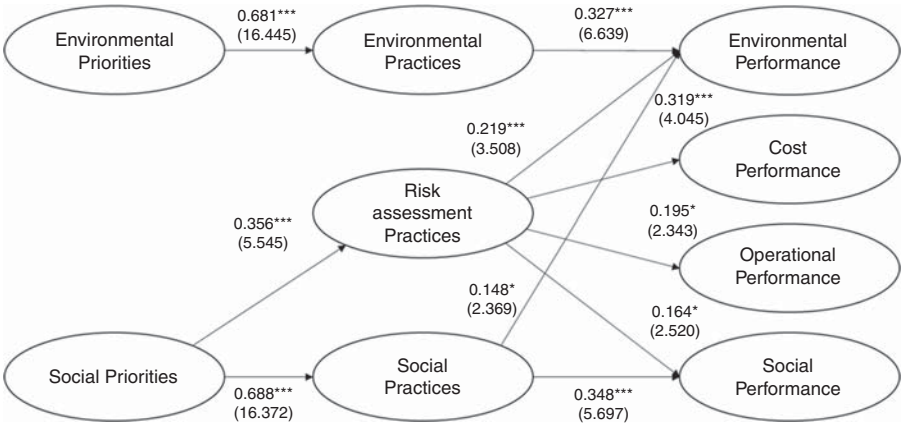
Similarly, as stated by *H2*, we find that higher emphasis on social priorities does improve both environmental and social performance, thanks to the adoption of social practices. Like for environmental practices, social practices neither significantly affect cost nor operational performance.

Our third hypothesis states that risk assessment practices mediate the relationship between environmental priorities and the TBL. We cannot confirm this hypothesis,

Variables	1	2	3	4	5	6	7	8	9	10
1. Environmental strategy	*0.847*									
2. Environmental practices	0.661	*0.786*								
3. Social strategy	0.759	0.551	*0.826*							
4. Social practices	0.460	0.722	0.688	*0.821*						
5. Risk management practices	0.280	0.347	0.339	0.270	*0.834*					
6. Environmental performance	0.370	0.548	0.303	0.451	0.348	*0.845*				
7. Social performance	0.230	0.367	0.370	0.416	0.252	0.756	*0.908*			
8. Cost performance	0.185	0.223	0.223	0.225	0.307	0.449	0.344	*0.662*		
9. Quality performance	0.185	0.124	0.183	0.104	0.128	0.330	0.272	0.581	*0.789*	
10. Delivery performance	0.316	0.258	0.266	0.293	0.146	0.347	0.228	0.800	0.544	*0.729*

Table III.
Correlation matrix

Notes: The square root of the average variance extracted (AVE) is shown in italic on the diagonal. Correlations are in the lower triangle of the matrix



Notes: Fit indexes: χ^2=1,020.6; p-value=0.000; χ^2/df=1.64; CFI=0.943; RMSEA=0.053. The value of the test statistic is in brackets. *$p<0.05$; ***$p<0.001$

Figure 2.
SEM results

given that the link between environmental priorities and risk assessment practices is not significant in first place.

Our final hypothesis states that risk assessment practices mediate the relationship between social priorities and the TBL. Our results support this hypothesis in that higher emphasis on social priorities translates into higher adoption of risk assessment practices, which, in turn, positively affect all performance.

To further test the mediation effect, we followed some of the most recent recommendations (Rungtusanatham *et al.*, 2014; Preacher, 2015). Since some of the individual paths in the priority–practice–performance relationship were not significant, we did not perform further specific mediation tests. For example, since environmental priorities do not significantly affect risk assessment practices (cf. Figure 2), we did not follow this up. Instead, we tested for all the others mediation effects assumed in our hypotheses.

Although different testing methods usually provide similar results, each method has its advantages and disadvantages. Therefore, we assessed the reliability of our results through multiple criteria (see Table IV). First, we applied the classical Baron and Kenny's (1986) method. We checked the following: the direct effect of environmental and social priorities without mediator (c) and with mediator (c'); (ii) the direct effect of environmental and social priorities on the mediator (a); the effect of the mediator on performance (b); and the total effect of environmental and social priorities ($(a \times b)+c'$). Second, we tested the indirect effect through bootstrapping analyses by considering bias-corrected and accelerated confidence intervals (95%) for indirect effects. Mediation is said to occur if the derived confidence interval does not contain zero.

We could clearly confirm four mediation effects. Indeed, environmental practices significantly mediate the environmental priorities–performance relationship. Similarly, social practices significantly mediate the social priorities–performance relationship and the social priorities-environmental performance relationship. Finally, risk assessment practices significantly mediate the effect of social priorities on environmental and cost performance.

Despite the individual path coefficients in the priority–practice–performance relationship were mostly significant, we could not confirm some of the hypothesized mediation effects. In particular, risk assessment practices neither significantly mediate the relationship between social priorities and operational nor social performance.

Table IV.
Test for mediation

Path analyzed	Direct effect coefficients (β)				Indirect effect (mediation)		Total effect
	c	c'	a	b	ab	Bootstrapping confidence intervals	$(a \times b)+c'$
Environmental priorities→environmental practices→environmental performance	0.386*** (5.668)	0.009^{ns} (0.103)	0.678*** (10.552)	0.542*** (5.771)	0.367*** (5.228)	(0.158; 0.346)	0.377*** (5.516)
Social priorities→social practices→environmental performance	0.441*** (6.215)	0.248* (2.339)	0.730*** (10.357)	0.266** (2.600)	0.194** (2.526)	(0.031; 0.230)	0.443** (6.115)
Social priorities→risk assessment practices→environmental performance		0.355*** (4.844)	0.369*** (4.960)	0.214** (3.078)	0.079** (2.746)	(0.015; 0.090)	0.434*** (6.114)
Social priorities→social practices→social performance	0.382*** (5.403)	0.170^{ns} (1.644)	0.714*** (10.262)	0.304** (3.023)	0.218** (2.946)	(0.051; 0.253)	0.387*** (5.384)
Social priorities→risk assessment practices→social performance		0.339*** (4.548)	0.359*** (4.830)	0.140* (2.058)	0.048^{ns} (1.813)	(-0.003; 0.068)	0.387*** (5.465)
Social priorities→risk assessment practices→cost performance	0.249* (2.091)	0.107^{ns} (1.225)	0.353*** (4.759)	0.289*** (3.213)	0.102** (2.755)	(0.014; 0.086)	0.209* (2.473)
Social priorities→risk assessment practices→operational performance	0.334** (2.605)	0.292* (2.306)	0.354*** (4.678)	0.035^{ns} (0.405)	0.012^{ns} (0.405)	(−0.009; 0.014)	0.305* (2.445)

Notes: The value of the test statistic is in parentheses. *$p < 0.05$; **$p < 0.01$; ***$p < 0.001$

Discussion

Our study links a focus on SSCM, the adoption of practices and the positive impact on TBL performance (Carter and Jennings, 2004). Companies that prioritize environmental or social sustainability tend to adopt corresponding environmental and social practices which, in turn, positively impact on the target performance dimension. Considering this strategy-practice link it at first appears that companies deploy their strategy into silos, in the sense that an environmental strategy is followed up by specific environmental practices. However, our results also show that social practices do also mediate the effect on environmental performance. Considering the way SSCM have been operationalized in this study we may comment about the maturity of adopted practices. Social supply chain practices – as opposed to environmental supply chain practices – are relatively newly deployed in many companies, possibly indicating where companies are becoming more advanced and that practice investment can spill over into other areas. Another explanation may be considering that social standards (such as the Global Compact) also include environmental criteria, whereas environmental standards tend to be more specific, so that companies focusing on the social side have a more holistic view of supply chain sustainability.

We do not find support for environmental and social supply chain practices having a positive effect on operational and cost performance, at this level of analysis, i.e. the purchasing category level. In a sense, this disaggregated view provides a more granular view on the performance effects, i.e. these practices appear to be neutral from a cost or operational impact perspective. This is only partially in line with previous studies that found positive links between green practices and cost and operational performance, but no similar effects with social practices (Hollos *et al.*, 2012; Sancha *et al.*, 2015). In one sense, this is reassuring as such practices are producing the expected results without harming classical supply chain performance. This result may also depend on the way operational and cost performance are measured, focusing on relatively short-term targets. Both environmental and social improvements may only have long-term impacts on performance due to the longer return on investment for green technologies or longer term effects on reputational gains from improved social compliance, as suggested by Croom *et al.* (2018). However, this view is somewhat contingent on the use of other practices, especially risk assessment.

All in all, the empirical evidence supports the following answer to our first research question: environmental and social practices do mediate the strategy–performance link in their respective domain, with social practices also showing positive effects on environmental performance. At the same time, these SSCM practices do not harm classic cost and operational performance, though not producing significant positive effects in the short term.

As for the second research question, the role of risk assessment in the relationship between sustainability priorities and performance is rather more nuanced. It appears that a focus on environmental supply chain aspects is not related to risk assessment practices and does not then impact on performance, while social priorities are linked to risk assessment which, in turn, impacts the TBL. This may be partly explained as social issues being more inherently risk-based, i.e. where companies are focusing on supplier compliance to various labor related issues such as working time agreements, minimum wage and age requirements (Mani *et al.*, 2018). However, the mediation effect of risk assessment practices is only significant for environmental and cost performance. This might be explained through social practices already having an element of a risk view point, being often based on minimizing non-compliance (Klassen and Vereecke, 2012). We do find a mediating effect on the social priorities and environmental performance relationship, which might indicate a reinforcing of efforts when operational risks are taken into account in assessments of suppliers, perhaps again linking to the broader remit of social standards.

Another interesting outcome is that risk assessment practice effects the social priorities-cost performance relationship. While social priorities and practices have a neutral

effect on cost supporting other studies (Sancha *et al.*, 2015), the addition of risk assessment practice appears to be associated with reduction of costs. This is perhaps related to reduced need of dealing with opportunistic behavior of suppliers (Carter and Rogers, 2008), hence related to the focus of efforts that risk assessment requires, saving managerial efforts in the supply function. Therefore, it seems it is not enough to invest only in social supply chain practices to gain financial benefits, but risk assessment is also required to allow social priorities to have a broader impact than just compliance to standards. This supports other research which has concluded that buyer commitment and investments might be needed in addition to social supply chain actions (Mani *et al.*, 2018), but adds risk assessment as an additional practice. This finding expands the view that the benefits of a social sustainability focus are linked to long-term reputation, given that our research supports a more direct impact on supply costs of identifying risks in the context of social issues in the supply chain.

We believe these results allow at least two important observations compared to extant literature. First, while SSCM practices are sometimes meant to be a panacea for any type of performance when studied in isolation, they actually lose some power when studied in conjunction with other practices, which seems more realistic. Second, we put existing risk management research (Narasimhan and Talluri, 2009; Foerstl *et al.*, 2010; Hofmann *et al.*, 2014) in the context of SSCM and open avenues for further research on how in combination sustainability and risk management supply chain practices can lead to overall performance benefits.

Conclusions

Our first conclusion is that, indeed, there are differences between the influence of social, environmental, risk-based practices and TBL performance outcomes depending on which type of sustainability priority is targeted. Environmental and social priorities relate to sustainability practices which, in turn, relate to improved sustainability performance as expected. However, neither environmental nor social practices influence cost and operational performance at the purchasing category level, which provides a more nuanced and disaggregated view of the strategy-practice-performance link. This can be a sign that companies have moved beyond sustainability being a significant cost of operating and that both environmental and social performance can be improved without compromising on costs or other performance dimensions. However, this also shows that supply managers may still find it difficult to justify additional resources to SSCM when direct supply chain benefits are limited, unless combined with other practices.

Second, evidence shows that social supply chain priorities are linked to risk assessment practices (where environmental supply chain priorities are not), which have a broad impact on TBL performance. This adds evidence to previous research emphasizing the link between social sustainability issues in supply chains and risk issues (Klassen and Vereecke, 2012). Hence, companies that identify a need to address social issues in their supply chains will also provide more focus on risk assessment activities, which emerges as an important component in achieving benefits from a focus on social supply chain sustainability (Hofmann *et al.*, 2014; Roehrich *et al.*, 2014).

Building on the previous point, the third conclusion is that while environmental and social supply chain practices have a neutral mediating impact on operational and cost performance, risk assessment practices do have a positive mediating effect on the link of social priorities with cost and environmental performance. This adds to the growing literature on which contingent factors and practices impact on socially sustainable supply chain outcomes (Sancha *et al.*, 2015; Mani *et al.*, 2018; Croom *et al.*, 2018). While environmental and social practices on their own may not be seen as competitively valuable, their combination with risk assessment practices provides a positive effect on performance.

These contributions can be linked to the main theoretical underpinnings of this research namely NRBV (Hart, 1995), RV (Dyer and Singh, 1998) and ERBV (Matthews, 2003). From the point of view of NRBV, this research expands upon Hart and Dowell's (2011) suggestions on how companies develop capabilities in response to external risks, and that the NRBV reasoning can apply beyond the natural environment to include social aspects. This research highlights the importance of combining practices across environmental and social sustainability, alongside other practices (i.e. risk assessment) to obtain the most benefits, and perhaps hints at the development of capabilities in this area. Hence, we can partially answer the call by Sarkis *et al.* (2011) to identify competitively valuable resources in the application of the NRBV and could support the inclusion of risk assessment as part of these resources particularly when focusing on social sustainability.

From a relational advantage perspective, it appears that companies that place an importance in collaborative practices alongside risk assessment can also do well, although this study focuses categories rather than individual supplier relationships. This research reflects on the upstream ERBV as a response to the criticism of the "internally focused" RBV and by extension NRBV. As sustainability-related risks may pervade a company's supply base, bridging both strong and weak ties, this research could support the ERBV position that capabilities require resources not just at an individual firm level, but also supplier network levels (Arya and Lin, 2007), and thus, combining of supply practices, including risk assessment, might support an extended resource-based advantage (Mathews, 2003; Lewis *et al.*, 2010).

Managerial implications include the need to argue for sustainability practices to improve sustainability performance both on environmental and social fronts and that this need does not add cost or operational compromises. However, the lack of cost and operational benefits in the short term might lead to managers question additional investment in beyond-compliance sustainable practices. Many companies invest to provide at least minimum compliance to industry specific regulation or customer requirements, yet going much beyond compliance to obtain broad TBL benefits may still be limited. Therefore managers might need to find less direct measures of performance, such as reputational benefits or longer term effects related to reducing risks. Hence, we can state that it is worthwhile for individual companies to put in place risk assessment in order to address sustainability issues, especially those with social implications, and these actions can continue to provide broad performance benefits. From a broader point of view, implementing sustainable supply chain practices comes at a cost, which might be balanced by cost and operational benefits, but no net benefit unless effectively focused. Recent development in information systems and horizontal collaboration platforms such as Sedex and EcoVadis might allow companies to gain further performance benefits by sharing the burden of selecting and monitoring sustainable suppliers and identifying where the most significant risks might be in their supply chains in order to focus their efforts.

Limitations and further research

There are a number of limitations to this research that might be addressed in further research studies. The purchasing category level of analysis limits the findings to links between priorities, practices and performance. Analysis of the sample suggests that respondents chose significant spend areas that could have an impact on the overall supply chain and business is general, with 70 percent of the sample choosing raw materials or parts and components as their chosen category. Constructs for environmental and social priorities and performance were necessarily generic to ensure relevance to different industry sectors. However, this may be improved by having sector-specific measures to more closely reflect the issues in a particular sector such as apparel or food and beverage. On the other hand, sector differences could also be tested, for example, between manufacturing and service-based industries.

Differences in category approaches were not part of our analysis and therefore future research could look at which categories allow the most opportunities in performance improvement with investment in sustainable practices and also a risk assessment approach. Different categories might show nuanced results in the same company, or same categories can differ across companies in the same sector. In this way, different types of risks might be explored according to the category or the industrial sector.

The research also focuses on the direct suppliers of a specific category, but risks might stem from further upstream in the supply chain and therefore a risk assessment approach that can help detect these more distant risks might also provide interesting findings. Further area for development is the approach in many commodity supply chains to work together to identify and manage supply chain sustainability risk, such as the case of alliances (Canzaniello *et al.*, 2017), and therefore the supply chain risk assessment construct could be further expanded to empirically test the influence of such methods.

The research is cross-sectional in nature and captures a snapshot of company practice and performance; therefore, any causality related to priorities, practices and performance cannot be fully demonstrated. Data collected from different sources and different points in time might provide further evidence about the target relationships. Other methods such as event studies might elucidate the link between sustainability risks, disruptions and impacts on performance.

Finally, researchers might explore the adoption of SSCM practices in conjunction with other practices than risk management to extend our view that TBL outcomes can be driven by a wise combination of a specific set of practices. This may depend on the company's strategic orientation and possibly some relevant contingent factors.

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Corresponding author
Joe Miemczyk can be contacted at: jmiemczyk@escpeurope.eu