From sustainability commitment to performance: The role of intra-and inter-firm collaborative capabilities in the upstream supply chain

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Abstract

Organisations increasingly see sustainability as an important element of their business strategies, and the role of purchasing and supply functions is critical in translating sustainability commitment into performance. Yet, the impact of sustainability commitment on purchasing processes and routines, as well as the effect of such capabilities on performance, remains empirically under-explored. From a Resource-Based perspective, we argue that commitment to sustainability leads purchasing and supply functions to develop intra- and inter-firm collaborative capabilities, and that in turn these capabilities deliver improved performance. Based on survey data from 383 procurement executives in ten European and North American countries, we use structural equation modelling to empirically test our hypotheses. Our results provide strong support for the hypothesised links between sustainability commitment and both intra- and inter-firm collaborative capabilities; and between inter-firm collaborative capabilities and environmental and social, and cost performance. Conversely, our data do not support the hypothesised links between intra-firm collaborative capabilities and both aspects of performance. In our discussion, we reflect on both confirmatory and conflicting findings in relation to theory and practice, before examining the study's limitations and opportunities for future research.

Keywords: Sustainability; purchasing and supply management; intra-firm collaborative capabilities; inter-firm collaborative capabilities

1. Introduction

The last two decades have seen an increasing number of organisations committing to sustainability as an integral part of their business strategy (Gimenez *et al*., 2012; Gunasekaran & Spalanzani, 2012; Kleindorfer *et al.*, 2005; Makower & Pike, 2008; Schoenherr, 2011). However, the relationship between commitment to sustainability and performance is still under investigation (Harwood & Humby, 2008; Schrettle *et al*., 2013). This is largely because in order for sustainability commitment to lead to

performance improvement, it must be operationalised effectively within firms and across their supply networks (Sarkis, 2012; Wu *et al*., 2013). In this regard, purchasing and supply functions play a critical role for a number of reasons (Ageron *et al*., 2011). Firstly, the overall environmental, social, and financial performance of organisations is strongly influenced by the approaches taken towards the purchasing of products and services. As competition has shifted to the level of supply chains, it is clear that an organisation is no more sustainable than its supply base (Krause *et al.*, 2009). Secondly, firms are increasingly held responsible for the environmental and ethical behaviour of their suppliers (Bacallan, 2000; Seuring *et al.*, 2008). As such, purchasing and supply functions need to support sustainability commitments within the procurement process and the on-going management of suppliers (Brammer & Walker, 2011; Preuss, 2009).

Sustainability can only be achieved with buy-in across the entire supply chain (Paulraj, 2011). Some recent studies investigate the role of specific purchasing and supply chain management practices to achieve sustainability, focusing on specific countries (e.g. García-Rodríguez *et al.*, 2013; González-Benito *et al.,* 2010; Zailani *et al*., 2012) or sectors (e.g. Debrito *et al.*, 2008; Gopalakrishnan *et al.*, 2012; Walker & Brammer, 2012). However, there remains a relative paucity of research exploring the ways in which firms pursuing sustainability approach purchasing practice and how this in turn influences performance (Leire & Mont, 2010). Of particular interest to our research are the impact of sustainability commitment on collaborative processes and routines, and the influence of such capabilities on performance (Giunipero & Vogt, 1997; Shi *et al*., 2012). Intra-firm collaborative capabilities consider the level of cross-functional and departmental integration in decision-making around supplier selection, sourcing strategy and supplier evaluation (Bowen *et al.*, 2001; Trent & Monczka, 1998). Inter-firm collaborative capabilities consider the extent of integration with suppliers in relation to supplier development and new product development (Sharfman *et al.*, 2009; Vachon & Klassen, 2006a).

In our study, we examine the impact that commitment to sustainability has on the development of intra- and inter-firm collaborative capabilities within purchasing and supply functions, and how such capabilities impact on environmental and social performance, as well as cost performance. From a Resource Based Perspective, we argue that purchasing and supply functions increase their level of intra- and inter-firm collaboration when faced with firm-level sustainability commitments, and that these

capabilities lead to higher levels of both environmental and social, and cost performance. In carrying out this research, we make two important contributions to theory and practice. Firstly, our study is, to our knowledge, the only one to examine empirically the impact of sustainability commitments on the development of both intra- and inter-firm collaborative capabilities, and of the impact that such capabilities have on performance. As such, we answer the call of sustainability research to explore *how* commitment to sustainability can be translated into improved performance (Barney, 2012). Secondly, our work provides a rare example of work that incorporates environmental and social performance, and financial performance dimensions in theory-testing sustainability research. In doing so, it provides much-needed empirical support for the argument that different facets of sustainability can be improved simultaneously (Rao & Holt, 2005; Zhu & Sarkis, 2004).

The remainder of this paper is structured as follows. In section 2, we review the literature that acts as the foundation of our model. We then develop the logic of relationships between key constructs and state hypotheses. In section 3, we describe our research design, including survey instrument, measures, data collection, and preparation. In section 4, we present the results of hypothesis testing based on survey data from 383 procurement executives. In section 5, we discuss the theoretical and managerial implications of our findings. Finally, we draw conclusions, highlight study limitations, and consider opportunities for future research.

2. Conceptual framework and hypotheses

2.1. Sustainable purchasing and supply management from a Resource-Based perspective

Sustainability is increasingly perceived as providing opportunities for organisations to create competitive advantage through "capabilities that facilitate […] sustainable economic activity" (Hart, 1995, p991). Within the context of purchasing and supply management, the literature examines the activities needed to improve sustainability performance, including supplier selection and evaluation (Bai & Sarkis, 2010; Handfield *et al*., 2002; Vachon, 2007;), collaboration with suppliers (Rao, 2002; Vachon, 2007; Vachon & Klassen, 2006a, 2008), supplier integration (Walton *et al*., 1998), and supply management (Foerstl *et al*., 2010; Koplin *et al*., 2007). These activities require high levels of interaction, within a firm and across organisational

boundaries, and such intra- and inter-firm collaborative capabilities may positively affect both environment and social, and cost performance (Ageron *et al*., 2011).

This reinforces the perspective that organisations gain competitive advantage through the creation of bundles of strategic resources or capabilities that are difficult to replicate, as espoused in Resource-Based Theory (Barney, 1991). In the context of purchasing and supply management, path dependency, causal ambiguity, social complexity, and the way in which intangible resources are bundled together in complex ways, allows purchasing and supply functions to act as sources of competitive advantage (Barney, 2012; Priem & Swink, 2012). As such, rather than asking *if* purchasing and supply management can translate sustainability commitments into performance, the more critical question is *how* they can do so (Bai & Sarkis, 2010).

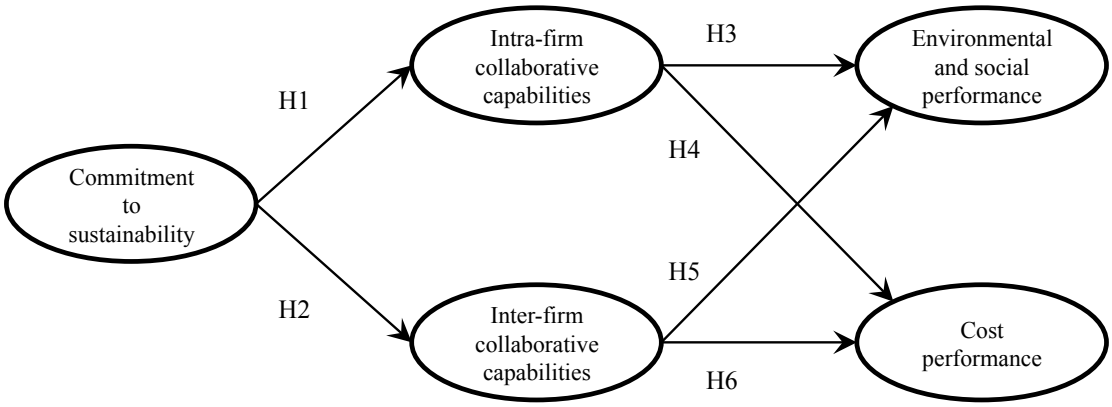
Whilst RBT remains a popular theoretical perspective within management research, it is limited by ill-defined conceptual boundaries and the fact that many researchers tautologically equate the existence of capabilities with organisational success and vice versa post hoc (Cepeda & Vera, 2007). Consequently, some authors suggest that it is more appropriate to examine identifiable processes and routines, unique relationships, and specialised knowledge that embody advantage-bearing capabilities (Teece *et al*., 1997). Previous studies within Sustainable Supply Chain Management have examined antecedents, practices or capabilities and performance (Paulraj, 2011). However, there is still a paucity of research in this area. In this study, we are particularly interested in how internal commitment to sustainability leads to intra- and inter-firm collaborative capabilities, and in turn, how they impact performance. Commitment to sustainability relates to an organisation's level of engagement with social or environmental initiatives in order to diminish negative impact (De Burgos Jiménez & Lorente, 2001; Krause *et al.,* 2009). This strategic intent influences the development of specific capabilities. Intra-firm collaborative capabilities refer to the level of cross-functional and departmental integration in decision-making around supplier selection, sourcing strategy and supplier evaluation (Bowen *et al.*, 2001; Trent & Monczka, 1998). Inter-firm collaborative capabilities extend the traditional RBT to explore how advantage-bearing resources are also built beyond the boundary of the firm (Ageron *et al*., 2011; Barney, 2012; Zhu *et al*., 2010). Such capabilities consider the extent of integration with suppliers in relation to supplier development and new product development (Sharfman *et al.*, 2009; Vachon

& Klassen, 2006a). The existence of these capabilities may lead to improved environmental and ethical, or cost, performance. Next, we develop our hypotheses and conceptual model.

2.2. Conceptual model and hypotheses

Figure I illustrates our conceptual model linking sustainability commitment, intra- and inter-firm collaborative capabilities, and environmental and social, and cost, performance. Our model is based on the premise that in order to translate a commitment to sustainability into performance, a purchasing and supply function must consider sustainability across its entire internal and external supply network, and the development of intra- and inter-firm collaborative capabilities appear to be crucial in achieving this (Shi *et al*., 2012). Collaborative capabilities focus less on the outcome of sustainability efforts (for example, compliance with regulations), and more on the means by which sustainability efforts may be successfully coordinated within and across organisations. As such, the unidirectional and control-oriented activities such as site audits, questionnaires, and other buyers' requirements that are often blended in the conceptualisation of sustainable procurement (Zhu & Sarkis, 2004) are not included within this study. We now explore these broad propositions in further detail and develop six hypotheses relating to our model.

Figure I. Proposed model of sustainability commitment, collaborative capabilities, and performance



2.3.1. Effect of commitment to sustainability on intra-firm collaboration

Firstly, we consider the relationship between an organisation's commitment to sustainability and intra-firm collaborative capabilities. Commitment to sustainability relates to the extent to which an organisation engages with environmental or social initiatives in order to reduce negative impacts (cf. Bansal & Roth, 2000; Krause *et al.*, 1995), and may act as an antecedent to capability development. According to Hoffman (2001, p3), "environmental and social considerations [have begun] to be pushed back down into the line operations and integrated into both process and product decisions" suggesting that intra-firm collaborative practices are likely to be critical in translating commitment to sustainability into performance (Bowen *et al.*, 2001). Intra-firm collaborative capabilities refer to cross-functional strategic purchasing activities (Bowen *et al.,* 2001; Lamming & Hampson, 1996). Building on traditional organisational studies (Williams *et al.*, 1994), the use of cross-functional teams has been examined in purchasing and supply management (Trent & Monczka, 1998). Typically, sourcing teams incorporate people from different business units with different functional backgrounds and therefore provide a substantial range of ideas, learning and improvements that can be applied to the organisation (DeBoer *et al.,* 2001). Thus, firms can use cross-functional teams to support the implementation of sustainability, with the aim of drawing together ideas, learning, knowledge, expertise and innovation. This means that the concept of sustainability adopted within an organisation is managed more coherently across different departments and therefore priorities may be more consistent.

In the context of sustainability, Bowen *et al.* (2001) argue that environmental strategies can be realised through regular contact between purchasing and other departments involved in the supply process, for example the Operations function and Logistics function. Lamming and Hampson (1996) also highlight the value of intra-firm collaborative capabilities such as supplier selection, contracting, and evaluation. They argue that such practices can be useful in clarifying objectives enshrined in the purchasing policy; characterising the supply base and setting criteria for supplier selection; developing methods for collecting supplier information; setting minimum standards; and then externally communicating these to all suppliers. From a RBT perspective, a commitment to sustainability may act as an antecedent to the development of this capability. Thus,

H1: Commitment to sustainability is positively related to intra-firm collaborative capabilities

2.3.2. Effect of commitment to sustainability on inter-firm collaboration

Next, we consider the relationship between organisational commitment to sustainability and inter-firm collaborative capabilities. Inter-firm collaborative capabilities refer to mentoring and collaboration with suppliers (Cheng *et al*., 2008; Frohlich & Westbrook, 2001; Krause *et al.*, 2009) For improved performance based on commitment to sustainability, firms must work effectively with other organisations in their supply networks (Fu *et al*., 2012; Klassen & Vereecke, 2012; Lee & Kim, 2009; Sharfman *et al.*, 2009). This is because increasingly supply chains, rather then individual organisations, are seen to compete (Seuring & Gold, 2013) and the boundary of responsibility is increasingly extended beyond the individual firm (Gimenez & Tachizawa, 2012). Therefore, firms need to be able to conceive, create and sustain a wide variety of relationships with suppliers and partners over time (Barratt, 2004; Squire *et al.*, 2009). Supplier development programs are noted as a particularly important inter-firm collaborative practice that can support sustainability (Simpson & Power, 2005), whilst other inter-firm collaborative capabilities are less directed at routine operational tasks, but instead occur around particular projects such as new product and process development (Vachon & Klassen, 2006b). For example, the purchasing and supply function may contribute to sustainability objectives, such as design for reuse, recycling, and disassembly, by involving suppliers during the early stages of the design process (Carter & Carter, 1998).

Within the literature, it is evident that inter-firm collaborative capabilities may support the implementation of changes towards sustainability (Bowen *et al.*, 2001; Lee & Kim, 2009; Vachon & Klassen, 2006a) within the supply chain. To be effective, inter-firm collaborative capabilities require buyer and supplier organisations to devote specific resources to cooperative activities addressing environmental and social issues (Vachon & Klassen, 2008) such as supplier monitoring or supplier development (Leire and Mont, 2010). Inter-firm collaborative capabilities are particularly likely to occur when the buying company is strongly committed to sustainability as a competitive priority (Leire &Mont, 2010; Bowen *et al*., 2001; Carter & Carter, 1998; Vachon & Klassen, 2006a), because this tends to involve a more strategic approach (Leire & Mont, 2010). Therefore, as with hypothesis 1, RBT

suggests that commitment acts as an antecedent to inter-firm collaborative capabilities. Thus,

> *H2: Commitment to sustainability is positively related to inter-firm collaborative capabilities*

2.3.3. Effect of collaborative capabilities on performance

According to RBT, the development of capabilities may lead to performance outcomes (Peteraf, 199; Teece *et al*., 1997). Environmental and social performance relates to the extent to which organisations have met targets relating to these two dimensions of sustainability (Kauppi *et al.*, 2013); whilst cost performance is concerned with purchasing price and process price (Croom & Brandon-Jones, 2007; Croom & Johnston, 2003; Zsidisin & Ellram, 2001) and is focused on the financial dimension of sustainability. Considering the impact of intra-firm collaborative capabilities on environmental and social performance, and cost performance, Bowen *et al.* (2001) argue that collaboration between the purchasing function and other departments is critical in maximising performance. Cross-functional supplier selection and evaluation are important intra-firm collaborative capabilities that can lead to higher levels of purchasing performance (Giunipero & Vogt, 1997; Trent & Monczka, 1998). Such teams can aid the implementation of different strategies by sharing knowledge, expertise and ideas across business function boundaries (DeBoer *et al.,* 2001). Whilst some studies indicate a trade-off between environmental and social, and economic performance (Corbett & Klassen, 2006), we argue that both dimensions of performance can be improved simultaneously (Rao & Holt, 2005; Zhu & Sarkis, 2004). Thus,

> *H3: Intra-firm collaborative capabilities are positively related to environmental and social performance*

> *H4: Intra-firm collaborative capabilities are positively related to cost performance*

In relation to inter-firm collaborative capabilities, the benefits of information sharing and collaboration with suppliers have been shown to positively impact performance (Barratt, 2004; Lee & Kim, 2009; Singh & Power, 2009). The use of

collaborative capabilities can lead to new insights and improved processes thereby improving the environmental and social compliance of the existing suppliers (Paulraj *et al*., 2008). In addition, studies indicate that supplier development efforts can result in improved supplier capability performance that ultimately drives cost reduction (Carter, 2005). Studies have shown the benefits of collaboration for environmental performance (e.g. Bala *et al*., 2008; Vachon and Klassen, 2006b) as well as the potential positive impact for both the focal organisation and suppliers (e.g. Rao, 2005). We argue that the use of inter-firm collaborative capabilities help drive enhanced environmental and social performance, as well as cost performance. Again, we argue that both dimensions of performance can be improved simultaneously (Zhu & Sarkis, 2004). Thus,

> *H5: Inter-firm collaborative capabilities are positively related to environmental and social performance*
>
> *H6: Inter-firm collaborative capabilities are positively related to cost performance*

3. Research design

3.1. Survey instrument

The data used to examine our hypotheses were collected in ten countries in Europe and North America (Canada, Finland, France, Germany, Italy, the Netherlands, Spain, Sweden, United Kingdom, and the United States of America) through an online survey questionnaire about purchasing priorities, purchasing practices, and purchasing performance, using constructs derived from the literature. The survey was developed iteratively through a number of phases. Initially, an English language draft was discussed with academics within and outside of the group. The refined survey was then translated into different languages following the TRAPD (Translation, Review, Adjudication, Pre-testing and Documentation) procedure to maximise construct and measurement equivalence (Bensaou *et al.*, 1999; Hult *et al.*, 2008). Local testing of the survey was carried out with a number of practitioners with suggested modifications centrally coordinated to ensure consistency across translated versions prior to data collection.

Before and during the pre-testing phase a special emphasis was laid on the quality of the construction of questions in order to reduce potential bias resulting from respondents' misleading cognition (Poggie, 1972; Schwarz & Oyserman, 2001). In particular, we tried to concentrate our questions on observable data and 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. Internet surveys offer higher levels of accuracy and reduces missing values due to either the respondent or some data entry mistakes than paper based surveys (Boyer *et al.*, 2002). Firms were sampled from the membership lists of national purchasing associations and alumni networks. Sampling criteria were pre-agreed among the participating researchers. Firms were first contacted and asked to participate, with reminder e-mails and telephone calls conducted after four weeks to those who had not responded. Following other similar key informant-based research studies (Cini *et al*., 1993; Cousins, 2005), the goal was to find the right person within the organisation who was able to respond to all of the questions about the purchasing strategy, the buyer-supplier relationship, purchasing practices and performance. For this reason, mostly Chief Purchasing Officers, Vice Presidents of Purchasing, Purchasing Directors and Purchasing Managers were involved. The respondents consisted of highly qualified purchasing professionals who had played important roles in the purchasing functions of their firms. After the data collection process, each country cleaned its own data in accordance with a common agreement to build a shared international database.

The core part of the survey focuses on a single purchasing category, autonomously selected by the respondent. This choice is due to the fact that companies frequently buy differently by category (i.e., a specific group of items, also known as a "purchasing group" or "commodity"). As such, strategies are never truly 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 & Van Weele, 2005). For instance, differences are noted between direct and indirect goods and among categories that are positioned differently within the Kraljic matrix. However, to date few studies have investigated purchasing practices at the category level (González Benito, 2007). Taking this 'commodity perspective' for sustainability research is supported by Krause *et al.* (2009, p21), "All of these commodity categories will need to be revisited by companies that are serious about

achieving significant results in raising sustainability as a competitive objective. This necessity reflects the fact that sustainability is not one-dimensional, as managerial actions should be adapted to the context or, in the case of purchasing, to the type of input supplied".

3.2. Measures

To examine our hypotheses, five constructs were operationalised – *commitment to sustainability, intra-firm collaborative capabilities*, *inter-firm collaborative capabilities*, *environmental and social performance*, and *cost performance*. All questions and items used to measure these constructs are shown in our appendix. Furthermore, each construct used in our conceptual model is described below. These constructs were measured from the perspective of the senior procurement executives and as such do not capture the perceptions of other functions (in relation to intra-firm collaborative capabilities) and suppliers (in relation to inter-firm collaborative capabilities). Whilst it was decided that running the project at the supply network level was impractical, the lack of dyadic data is clearly a limitation of our work.

3.2.1. Commitment to sustainability

One way to assess the commitment to sustainability is to examine a firm's competitive objectives (Hayes &Wheelwright, 1984). The literature on strategic management highlights the importance of alignment between competitive objectives and overall corporate strategy in driving functional and business performance (Baier *et al.*, 2008; González Benito, 2007). As such, organisational commitment to sustainability should be translated into functional commitment to sustainability through competitive priorities (De Burgos Jiménez & Cespedes Lorente, 2001; Krause *et al.*, 2009). Respondents were asked to consider "To what extent has management emphasised the reduction of environmental impact for the chosen category over the past two years" and "To what extent has management emphasised compliance with social (ethical) guidelines for the chosen category over the past two years". As such, the *commitment to sustainability* construct incorporates both environmental and social dimensions of sustainability (Bansal & Roth, 2000; Hart 1995). Items used a Likert scale ranging from 1 (Not at all) to 6 (Completely).

3.2.2. Collaborative capability constructs

The *intra-firm collaborative capabilities* construct considers the extent to which strategic purchasing activities (such as supply market analysis, sourcing strategy, supplier selection and evaluation processes) are carried out in a cross-functional manner (Bowen *et al.*, 2001; Lamming & Hampson, 1996). The extent of cross functionality was evaluated for items using a Likert scale ranging from 1 (Always performed by one function) to 6 (Always cross-functional). The *inter-firm collaborative capabilities* construct incorporates both mentoring and collaboration elements identified within the literature. The mentoring role of buyer organisations is operationalised as the proficiency level in conducting supplier development, involvement and integration programs (Cheng *et al.*, 2008). Technological collaboration is included as the proficiency in engaging suppliers in new product development, while logistical collaboration is the ability to integrate suppliers in order fulfilment activities (Krause *et al.*, 2009). Items used a Likert scale ranging from 1 (Extremely low) to 6 (Extremely high).

3.2.3 Performance constructs

The *environmental and social performance* construct incorporates two dimensions of sustainability. Respondents were asked to consider the extent to which they had met targets to offer "products/services with less impact on the environment" and "products/services which comply with social norms on safety, child labour, and bonded labour" for their chosen purchase category. The *cost performance* construct focuses on the financial dimension of sustainability and includes the purchasing price and the cost of managing the procurement process (Neely *et al*., 1994). Respondents were asked to consider the extent to which they had met targets for "the purchasing price for the chosen category" and "the cost of managing the procurement process for the chosen category". All performance construct items used a Likert scale ranging from 1 (Much worse than target) to 6 (Much better than target).

3.2.4 Control variables

In addition to the hypotheses explained above we added some control variables to further ensure the reliability of results. The first control variable we took into account the *size* of the firm, measured in terms of Full Time Equivalents (FTEs). Secondly, we introduced several dummy variables to distinguish among four different *geographical areas*: Southern Europe (Italy and Spain), Central Europe (France, Germany, The

Netherlands), Northern Europe (Finland and Sweden), United Kingdom, United States and Canada. Finally, we controlled for the *industry sector*. We introduced a dummy distinguishing between Manufacturing (1) and Non Manufacturing (0) sector for possible differences in performance according to the nature of the firm.

3.3. Data collection

Data collection and consolidation was completed in 2010. Sampling followed centrally established guidelines in terms of company size and ISIC codes to ensure comparability across countries (Lynn *et al.*, 2007). To maximise equivalence we focused on those respondents answering questions on strategic direct and indirect purchasing categories (excluding capital expenditure) with a *strategic importance* value equal or greater than 4 on a 1-6 Likert scale. Table I provides an overview of the 383 firms in our sample.

Table I. Sample descriptives

Descriptive	Frequency	%	Descriptive	Frequency	%
Country			***Sector***		
Italy	36	9.4	Manufacturing	263	68.7
Netherlands	31	8.1	Transportation, storage and communication	23	6.0
United Kingdom	43	11.2	Wholesale and retail trade	18	4.7
Germany	36	9.4	Construction	16	4.2
Spain	37	9.7	Professional and administrative services	9	2.3
Sweden	89	23.2	Financial services	8	2.1
Finland	25	6.5	Human health and social work activities	8	2.1
United States	38	9.9	Agriculture, forestry, fishing, and mining	5	1.3
Canada	22	5.7	Hotels and restaurants	5	1.3
France	26	6.8	Public administration and defence	4	1.0
			Electricity, gas, and water supply	3	0.8
			Arts, entertainment and recreation	3	0.8
			Other	15	3.9
			Missing	3	0.8
Sales (million €)			***Respondent position***		
<= 50	124	32.4	CPO, VP of purchasing	50	13.1
51-250	105	27.4	Purchasing director	94	24.5
251-500	48	12.5	Purchasing manager	173	45.2
501-750	20	5.2	Senior, Project buyer	30	7.8
751-1000	11	2.9	Buyer, Purchasing agent	13	3.4
> 1000	68	17.8	Other	22	5.7
Missing	7	1.8	Missing	1	0.3
Total	**383**	**100**		**383**	**100**

3.4. Data preparation

Prior to hypothesis testing, a number of data preparation procedures were undertaken, namely: missing value analysis; examination of outliers; and assessment of bias. Missing value analysis indicated that missing data were relatively low (Average <5.9%) suggesting item deletion was not required prior to hypothesis testing. In addition, an overall test of randomness was performed, indicating no significant differences between patterns of missing and non-missing data, so missing data are classified as missing completely at random. Excluding missing values when running structural equation modelling is appropriate for this study because the valid sample for statistical tests remains high (Sekaran, 2003).

Examination of outliers initially involved looking at variable histograms to check how the tails of distribution fall away at the extremes. We then examined box-plots to check for identified outliers for each variable. Unless it is evident that an outlier is unrepresentative of any observation within a population, it should remain in the data set as the improvement in multivariate analysis may come at the cost of generalisability (Hair *et al.* 2009). Given the low level of outlier scores for our respondents, all data were retained prior to further analysis.

Non-respondent bias was tested by comparing early and later respondents using two tailed *t*-statistics across survey items (Armstrong & Overton, 1977). No statistically significant differences among the variables were identified between the two groups. We controlled for common method bias through both the survey design and statistical assessment. Regarding survey design, the project was labelled as a broad overview of purchasing and supply management, with no explicit reference to the intention to examine sustainability commitment, execution, or performance. As such, respondents' attention was not drawn to the relationships being targeted in this study. Proximal separation of construct variables relating to commitment to sustainability, collaborative capabilities, and performance was used to prevent respondents from developing their own theories about possible relationships (Podsakoff *et al*., 2003). In addition, respondents were able to answer questions on commitment to sustainability, collaborative capabilities, and performance in relation to a specific category with which they were familiar. Statistical assessment of common method bias employed Harman's one-factor test. This revealed the presence of five factors rather than a single general factor, indicating that common method bias is unlikely to be a major concern for our data (Podsakoff *et al.*, 2003). In addition, the

ten country-specific subsamples were proven to be appropriate in terms of pooling (Knoppen *et al*., 2011).

4. Results

Structural equation modelling (SEM), using STATA version 12, was used to estimate both the measurement model and the structural model. The maximum likelihood (ML) algorithm was used to obtain the paths, loadings, weights, and quality criteria. The hypothesised model was tested statistically in a simultaneous analysis of the entire system of variables to determine the extent to which it is 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.

Table II reports the results of the confirmatory factor analysis (CFA). Item loadings on factors range from 0.645 to 0.936, which exceeds most absolute cut-offs found in the methods literature (Hair *et al*., 2009) and in OM empirical work (cf. Lin *et al.*, 2005; Ramanathan & Gunesekaran, 2014; Roh *et* al., 2014; Yang, 2014). To check for internal consistency reliability, the Cronbach alpha has been obtained for all the constructs in the model. All measured constructs showed a Cronbach alpha of above 0.6. Moreover, reliability measured by the Composite Reliability (Fornell and Larcker, 1981) was also satisfactory (Nunnally, 1994). To assess convergent validity, Fornell and Larcker (1981) suggest using the average variance extracted (AVE) scores. These scores measure the variance captured by a latent construct, that is, the explained variance. None of the constructs violates the Fornell-Larcker criterion. To further test for discriminant validity, we compared the squared correlation (Table III) between two latent constructs and their average variance extracted estimates (Fornell & Larcker, 1981). These constructs meet the validity condition of the average variance extracted estimates exceeding the squared correlation between each pair of constructs.

Table II. Measurement model

Construct	Reflective indicators	λ	CR	AVE
Commitment to sustainability	Management emphasis on the reduction of the environmental impact	0.816	0.815	0.69
	Management emphasis on the compliance with social (ethical) guidelines	0.842		
Intra-firm collaborative capabilities	Cross-functionality of decision-making for supply market analysis	0.645	0.824	0.54
	Cross-functionality of decision-making for sourcing strategy	0.867		
	Cross-functionality of decision-making for supplier selection and contracting	0.647		

	Cross-functionality of decision-making for supplier evaluation	0.764		
Inter-firm collaborative capabilities	Proficiency of supplier development for the chosen category	0.785	0.831	0.62
	Proficiency of supplier involvement into NPD for the chosen category	0.833		
	Proficiency of supplier integration in order fulfilment for the chosen category	0.745		
Environmental and social performance	Environmental compliance from suppliers for the chosen category	0.936	0.883	0.79
	Social compliance from suppliers for the chosen category	0.840		
Cost performance	Purchasing price for the chosen category	0.646	0.670	0.51
	Cost of managing the procurement process for the chosen category	0.771		

Chi-square=62.874, p-value=0.166, chi/df=1.186, CFI=0.994, RMSEA=0.022

λ = Factor loading

Table III. Correlation matrix

Variables	1	2	3	4	5
1. Commitment to sustainability	1				
2. Intra-firm collaborative practices	0.155**	1			
3. Inter-firma collaborative practices	.236***	0.148**	1		
4. Environmental and social performance	0.348***	0.083ns	0.289***	1	
5. Cost performance	0.072ns	-0.078ns	0.365***	0.307***	1

***p < .001, **p<.01, *p<.05

Two possible ways of evaluating model fit are the use of the chi-square goodness-of-fit statistic and the use of other absolute or relative fit indices (Hu & Bentler, 1999). It is quite common in management literature to avoid using the chi-square p-value as this measure is particularly sensitive to sample size and assumptions of normality (Hu and Bentler, 1995). As a consequence other fit indices are preferred to the p-value. Some authors suggest checking for the ratio between the chi-square value and degrees of freedom in the model, where cut-off values range from <2 to <5 depending on the investigator (Kelloway, 1998). Another way to evaluate the fit of a model is to use fit indices, with values closer to 1 (on a 0 to 1 scale) indicating good fit. Hu and Bentler (1999) 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). An acceptable threshold for CFI is > 0.95 whereas RMSEA should be < 0.05.

The CFA reveals a good model fit attested through multiple fit indices from multiple families of fit criteria (Shah & Goldstein, 2006). Having established reliable and valid measurement models, the structural model has been assessed (Table IV). T-values of path coefficients (2-tailed tests at a significance level of 99%) were used to examine hypotheses. As such, a hypothesis related to an effect with a t-value lower

than 2.58 will be rejected. Results of this study show that four of the six hypotheses are accepted, whilst two are rejected (Table IV). The overall validity of the conceptual model was tested using multiple-fit criteria. The chi-squared value for the model is 242.42 for a chi/d.f. ratio of 1.20. The presented research model yielded a CFI value of 0.977, which exceeds the minimum criterion of 0.95, and a RMSEA value of 0.023, which is lower than the maximum criterion of 0.05 (Hu & Bentler, 1999). When these fit statistics are considered together, the above results lend support to the overall validity of the conceptual model. Control variables are not significant, except for the size of the firm, which slightly affects environmental and social performance, i.e. larger firms have better performance relatively to smaller firms.

Table IV. Structural model

Path	Standardized effect	t-value	Implication
Commitment to environmental and social sustainability → Intra-firm collaborative capabilities	0.154**	2.60	**Accept H1**
Commitment to environmental and social sustainability → Inter-firm collaborative capabilities	0.261***	4.48	**Accept H2**
Intra-firm collaborative capabilities → Environmental and Social performance	ns	0.39	**Reject H3**
Intra-firm collaborative capabilities → Cost performance	-0.130*	-2.17	**Reject H4**
Inter-firm collaborative capabilities → Environmental and Social performance	0.315***	5.72	**Accept H5**
Inter-firm collaborative capabilities → Cost performance	0.383***	6.06	**Accept H6**
Controls			
Country dummy South Europe → Environmental and Social performance	ns	0.87	
Country dummy Central Europe → Environmental and Social performance	ns	0.70	
Country dummy Northern Europe → Environmental and Social performance	ns	0.86	
Country dummy United Kingdom → Environmental and Social performance	ns	-0.57	
Size (FTEs) → Environmental and Social performance	0.111*	2.05	
Sector → Environmental and Social performance	ns	-1.07	
Country dummy South Europe → Cost performance	ns	-0.07	
Country dummy Central Europe → Cost performance	ns	-1.14	
Country dummy Northern Europe → Cost performance	ns	0.55	
Country dummy United Kingdom → Cost performance	ns	-0.47	
Size (FTEs) → Cost performance	ns	1.16	
Sector → Cost performance	ns	0.07	

***p<0.001, **p<0.01, *p<0.05
Chi-square=242.42, p-value=0.0272, chi/df=1.20, CFI=0.977, RMSEA=0.023

5. Discussion

The aims of this study were to examine the extent to which commitment to sustainability leads to increased intra- and inter-firm collaborative capabilities for purchasing and supply functions, and to examine the extent to which these collaborative practices positively affect environmental and social, and cost

performance. In light of our analysis, we can now reflect on our hypotheses and draw a number of implications for theory and practice.

5.1. The relationship between commitment to sustainability and collaborative capabilities

Our analysis provides strong support for the positive relationship between commitment to sustainability and intra-firm collaborative capabilities. As such, our work strengthens the argument that collaboration between the purchasing function and other departments involved in the supply process (Such as Operations or Logistics) is important when approaching sustainability (Bowen *et al.*, 2001; Hoffman, 2001). Our data show that purchasing and supply functions often seek to address sustainability concerns through increased cross-functional supplier selection and evaluation. Such practices can be crucial in the implementation of sustainability strategies, with the aim of sharing knowledge, ideas, and expertise (De Boer *et al.,* 2001), especially since these practices may need to become boundary-spanning to become truly impactful.

Our analysis also indicates a positive relationship between commitment to sustainability and inter-firm collaborative capabilities. Purchasing and supply functions committed to sustainability exhibit higher levels of inter-firm collaborative capabilities in the form of supplier development, supplier involvement in new product development, and supplier integration in order fulfilment. These findings provide empirical support for the view that inter-firm collaboration takes on strategic importance in implementing sustainability strategies (Roberts, 2001; Sharfman *et al.*, 2009). Firms committed to sustainability should understand the crucial role of their supply base and encourage suppliers to cooperate by highlighting and sharing the benefits of sustainability initiatives. The sustainability of the supply chain is becoming increasingly important to the focal firm (Krause *et al.,* 2009), in regards to both reputation and performance. As such, the sharing of knowledge relating to the reduction of carbon emissions, ethical sourcing, or water and material efficiency, for example, may benefit different actors across the supply chain, enabling improved performance for the focal firm but also their suppliers (Rao, 2005).

Interestingly, our analysis suggests that purchasing and supply functions are more active in establishing stronger collaborative arrangements with external partners than with other internal functions (Effect 0.261 compared with 0.154). This may partly be

explained by the nature of environmental and social initiatives being enacted by firms, which are often focused heavily on improving working conditions within key suppliers and greening inputs provided by these suppliers. The added emphasis on inter-firm collaboration may also be an indication that the outward-facing attitude of many procurement functions more generally has reached a point where they consider it easier to overcome inter-firm collaborative challenges than intra-firm ones. From a positive perspective, this may support the apparent shift towards more collaborative relationships with key suppliers (Brandon-Jones *et al.*, 2010), who are after all critical in the dissemination of sustainability beyond the boundaries of the firm. However, more worryingly, it suggests that purchasing and supply functions may either not recognise the need to collaborate internally when looking to enact sustainability priorities or find it difficult to do so. One possible reason is that functional silos act as barriers to intra-firm collaborative capability development (Walker & Jones, 2012). As such, firms committed to sustainability should understand the importance of knowledge-sharing practices across their business functions and find ways to encourage such activities. One practical approach may be to focus on 'easy wins' for internal collaboration and then highlight the success of initiatives that have involved a number of functional partners (Croom & Brandon-Jones, 2007). The existence of internal sustainability champions, who work horizontally across different departments, may also help to disseminate knowledge about sustainability and gain commitment to new projects (Gattiker & Carter, 2010).

5.2. The relationship between collaborative capabilities and performance

Contrary to our hypotheses and a number of studies arguing that intra-firm collaborative capabilities are important in achieving higher levels of performance (Bowen *et al.*, 2001; Giunipero & Vogt, 1997; Trent & Monczka, 1998), our analysis indicates that whilst commitment to sustainability leads to higher levels of intra-firm collaborative capabilities, these do not lead to improved environmental and social performance (H3) or cost performance (H4). In fact, our results suggest that such practices might even be counterproductive in terms of cost performance. There are two possible explanations for this. The first is that intra-firm collaborative capabilities do not in themselves drive performance. Whilst the resource-based perspective remains central to the strategic literature (Mahoney & Pandian, 1992; Peteraf, 1993), the assumption that only bounded resources can drive performance appears

increasingly untenable (Das & Teng, 2000; Lewis *et al.*, 2010). In fact, in the case of environmental and social performance, the potential for competitive advantage is more likely to be found across organisational boundaries (Arya & Lin, 2007; Lavie, 2006). For example, through the use of innovative shared technologies or improved ethical performance influenced by the focal firm but enacted by suppliers.

The second explanation for the insignificant relationship is that intra-firm collaborative practices may currently be carried out in a relatively shallow or transactional manner, through networks of 'weak ties' (i.e. those lacking reciprocity and emotional intensity). Such collaborative practices may have limited potential to create differential performance (Granovetter, 1973). Even though the t-test is not strongly significant, our results suggest that such practices might even be counterproductive in terms of cost performance: investing in weak cross-functional procedures that do not reflect the employees' commitment might represent a cost that is not followed up by corresponding benefits. To have a more positive impact on performance, it is argued that intra-firm collaborative practices require networks of 'strong ties' where richer knowledge is exchanged between partners (Szulanski, 2000) and benefits are obtained from shared values, mutual dependence, and high levels of communication (Hingley *et al.*, 2011). As such, the focus may shift to identifying internal connections that have the potential to add real value to sustainability efforts, possibly by identifying other departments who are already positively predisposed to sustainability initiatives.

Finally, analysis provides strong support for the positive relationship between inter-firm collaborative capabilities and both environmental and social performance (H5) and cost performance (H6). These findings provide empirical support for the argument that buyer-supplier collaboration has an instrumental role in delivering improved environmental and social performance, and cost reduction (Carter, 2005; Lamming & Hampson, 1996; Singh & Power, 2009; Vachon & Klassen, 2008). Inter-firm collaborative capabilities allow the buying company to share sustainability related risks with its supply base and to exploit suppliers' knowledge and expertise, leading to significant improvements in performance.

The process of capability development through a supply network is often seen as an extension of the resource-based perspective (Dyer & Singh, 1998) and suggests that competitive advantage may emerge partly from resources/capabilities held beyond the boundary of the firm (Lavie, 2006; Squire *et al.*, 2009). Our study

indicates that commitment to sustainability may also span firm boundaries and be embedded in inter-firm routines and processes (Teece, 2007). Furthermore, the fact that inter-firm collaborative capabilities are at present driving improved performance whilst intra-firm collaborative capabilities are not may partly be a consequence of the external orientation of modern procurement functions. Interestingly, purchasing and supply managers may find it easier to incorporate sustainability through existing relationships with key suppliers than to do so by working more closely with other functions within their own firm. Finally our analysis runs contrary to the view that there is a trade-off between environmental and social, and economic performance (Corbett & Klassen, 2006). Instead, we provide empirical support for the view that it is possible to improve these simultaneously (Rao & Holt, 2005; Zhu & Sarkis, 2004).

5.3. Managerial implications

Having examined the academic implications of our analysis above, we now consider the implications of our study for practitioners. Purchasing and supply functions are increasingly expected to support sustainability commitments within the procurement process and in the on-going management of suppliers. Our analysis indicates that it is the inter-firm collaborative capabilities, as opposed to intra-firm collaborative capabilities, that currently deliver significant performance improvements. Practitioners increasingly accept that collaboration with key suppliers is vital for success. Our study provides additional empirical support for this view and points to the fact that sustainability can only be achieved fully with the support of supply partners, further highlighting the importance of supply chain management for sustainability. In addition, although purchasing and supply professionals may not always naturally associate economic benefits with sustainability, our findings prove that it is possible to improve environmental and social, and economic performance simultaneously.

At present, increased intra-firm collaborative practices in relation to sustainability commitments do not appear to deliver improved performance. To contribute to performance, we argue that there is a need to develop richer intra-firm collaborative capabilities that involve internal partners more fully in the total procurement cycle. As such, we look to move beyond a perspective that implies a focus on either intra-firm collaborative capabilities *or* inter-firm collaborative capabilities towards one highlighting the complementarity of the two areas (Barratt, 2004; Defee *et al.*, 2009;

Shi *et al.*, 2012). A number of strategies may be employed by purchasing practitioners and their organisations to achieve this. Firstly, environmental and social champions may be used to share knowledge across departments to ensure consistency of sustainability objectives, as well as in relation to suppliers. Secondly, ICT platforms are currently employed by organisation such as Marks & Spencer to benchmark and share best practices between suppliers. These could be adopted both cross-functionally and inter-organisationally to disseminate successful sustainability practices. Finally, the inclusion of sustainability performance measures within employee performance reviews could encourage internal practices and awareness, and may also positively influence behaviours and expectations of suppliers. These strategies could enhance the perceived importance within a firm and encourage the development of intra- and inter-organisational collaborative capabilities.

6. Conclusions

It is evident that sustainability is an increasingly integral part of many organisations' business strategy (Gimenez *et al*., 2012; Gunasekaran & Spalanzani, 2012; Kleindorfer *et al.*, 2005; Schoenherr, 2011). For firms looking to improve environmental and social performance, whilst maintaining their financial bottom line, the question now appears to be less about whether or not to pursue sustainability, but rather how (Bai & Sarkis, 2010; Vachon, 2007;). Focusing on purchasing and supply management, we examine the extent to which a commitment to sustainability leads to higher levels of intra- and inter-firm collaborative capabilities, and the effects of these capabilities on different facets of performance. Based on survey data from 383 procurement executives in ten countries, we find strong evidence that commitment to sustainability leads to increased intra- and inter-firm collaborative capabilities. Our analysis also indicates that increased inter-firm collaborative capabilities lead to improved performance. Importantly, we show that environmental and social, and cost performance do not necessarily have to be traded off against one another, but can both be improved simultaneously. Finally, our data indicates that at present, increased intra-firm collaborative capabilities arising from sustainability commitment does not positively affect performance. Our research makes two important contributions to sustainable operations and supply management literature. Our study is one of the first to empirically examine the impact of sustainability commitments on both the development of intra- *and* inter-firm collaborative capabilities, as well as assessing

the impact of such capabilities on performance. In addition, by examining the impact of such capabilities on both environmental and social, and financial performance, we are able to provide a robust empirical assessment of to the extent to which different facets of performance can be improved simultaneously.

6.1. Limitations and future research

Whilst we believe that our study provides a number of valuable insights for Operations and Supply Management, there are a number of limitations that should be considered when reflecting on its findings and that give rise to potential avenues for future research. Firstly, research is clearly an iterative process (Sanders, 2007) and we would therefore encourage studies that replicate our model and expand the empirical base to other settings (Kaynak & Hartley, 2006). Only then can we with any degree of certainty establish which of the relationships modelled in this study apply to all firms and which are context-dependent. In line with the majority of other studies, data used to test hypotheses come from the perspective of the senior procurement executives and therefore do not capture the perspective of other functions (in relation to intra-firm collaborative capabilities) nor of suppliers (in relation to inter-firm collaborative capabilities). As such, we believe that the replication work we have suggested would benefit from data gathered from these alternative sources and would increase confidence in the conclusions drawn here.

Secondly, data used for hypothesis testing is reported rather than objective and is therefore open to interpretation. As noted earlier, our survey was labelled as a broad overview of Purchasing and Supply Management, and made no explicit reference to sustainability. This may have helped reduce social acceptability bias, which is a particular concern when perceived consensus can encourage inaccurate reporting of organisational behaviour (Randall *et al.*, 1993). However, future studies may combat this problem further by collecting additional secondary data, particularly on strategy and various performance indicators.

Thirdly, the model clearly does not capture all possible variables and is naturally limited by the ex-ante variables. As such, the aim of selection has been to balance comprehensiveness and parsimony to ensure sufficient responses from purchasing professionals who were unlikely to complete a more time-consuming survey. Despite exhibiting sufficient measurement properties, our performance constructs (environmental and social performance, and cost performance) are both reflected by

just two items. Therefore, future research may benefit from more comprehensive measures of performance incorporating a wider variety of environmental, social, and financial indicators. Huang *et al* (2005), for example, consider cost of goods sold, total supply chain management cost, value added employee productivity, and warranty/return processing costs as alternative indicators of cost performance. By broadening performance measures, future research has the opportunity to examine potential synergies and trade-offs in a far more detailed manner than was possible in our study.

Fourthly, in our study, we controlled for the potential effects of sample heterogeneity with regards to region, industry, and size (Golicic & Smith, 2013). Our analysis suggests that these contingencies are not generally significant in impacting on the nature of relationships in our model. However, whilst outside the scope of this particular study, we believe that future research would benefit from a more detailed exploration of these, and other, contingencies using larger sub-samples and thus enabling multi-group analysis.

Finally, the study bases its conclusions on data collected in a single time period. As such, we are not able to comment on the diffusion of collaborative capabilities within organisations and across their supply network over time. This is something we intend to explore with further rounds of data collection in the future.

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Appendix 1. Survey items

Construct	Reflective indicators	References
Commitment to sustainability	**Please indicate to what extent management has emphasized the following priorities for the chosen category over the past 2 years. (Note that the objectives for this category may have been different from those emphasized for the company as a whole).** *Six points Likert scale from "Not at all" to "Completely".* Reducing ecological impact for this category Improving compliance with social and ethical guidelines for this category	De Burgos Jiménez and Lorente, 2001; Krause *et al*., 2009; Hart, 1995; Bansal and Roth, 2000
Intra-firm collaborative capabilities	**Please indicate for the chosen category whether decision-making in these processes is done in a cross-functional way (i.e. more than one function is involved) or by one function only**. *Four points Likert scale from "Always cross-functional" to "Always performed by one function".* Supply market analysis Sourcing strategy Supplier selection and contracting Supplier evaluation	Lamming and Hampson, 1996; Bowen *et al*., 2001; Monczka *et al*., 2000; Johnsen, 2009; Petersen *et al*., 2005; Chen *et al*. 2004
Inter-firm collaborative capabilities	**Please indicate the level of proficiency of these processes (i.e. the level of quality in executing each process) for the chosen category** *Six points Likert scale from "Extremely low" to "Extremely high".* Proficiency of supplier development for the chosen category Proficiency of supplier involvement into NPD for the chosen category Proficiency of supplier integration in order fulfilment for the chosen category	Cheng *et al.*, 2008; Krause *et al*., 2009; Prahinski & Benton, 2004; van Echtelt *et al*., 2008; Frohlich and Westbrook, 2001
Environmental and social performance	**Please consider current category performance – compared to management targets – for the following objectives** *Seven points Likert scale from "Much worse than target" to "Much better than target".* Environmental compliance from suppliers for the chosen category Social compliance from suppliers for the chosen category	Karjalainen and Salmi, 2013; Kauppi *et al*. 2013; Luzzini *et al*. 2012
Cost performance	**Please consider current category performance – compared to management targets – for the following objectives** *Seven points Likert scale from "Much worse than target" to "Much better than target".* Purchasing price for the chosen category Cost of managing the procurement process for the chosen category	Croom and Brandon-Jones, 2007; Kauppi *et al*. 2013; Luzzini *et al*. 2012; Zsidisin and Ellram, 2001