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Sustainable supply chains: a framework for environmental scanning practices

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Structured Abstract:

Purpose – The purpose of this paper is to explore the empirical reality of environmental scanning practices in sustainable supply chain management contexts. In particular it tests and extends a conceptual framework proposed by Fabbe-Costes *et al.* (2011).

Design and methodology – The empirical data for this research were obtained from 45 semi-structured interviews with key informants, combined with a discussion of the main results with a focus group of supply chain experts. These data are compared with the literature and brought to bear on the framework.

Findings - The research finds both breadth and depth in the scope of sustainability scanning practices of the respondents and provides evidence of multi-level scanning, with all respondents describing scanning activity at the societal level. It further demonstrates the adoption of multiple and diverse scanning targets at all levels in the conceptual framework. The articulation and ranking of scanning targets for sustainable SCM at all levels informs the development of priorities for practice. The paper also makes some observations about the boundaries of the scanning process.

Practical implications – The results provide managers with guidance about what to scan in sustainable supply chain contexts. The validated framework can serve as a practical tool to assist managers with the organization and prioritization of their environmental scanning activities.

Originality/Value – The paper is among the first to address the role of environmental scanning in sustainable supply chain contexts. It highlights the need for a multi-level framework for such scanning activities and opens up a debate about their implementation.

Keywords: Supply chain management, Sustainable development, Environmental scanning, Environmental scanning scope, Qualitative research.

Article Classification: Research paper

Sustainable supply chains: a framework for environmental scanning practices

1. Introduction

In the current business environment, in which firms are increasingly subject to pressures deriving from both legislation and public opinion (Jayaraman *et al.*, 2007), the pursuit of sustainable development is an imperative. This paper considers sustainable supply chain management (SSCM) and examines the empirical reality of environmental scanning (ES) practices within this. Environmental scanning is a strategic activity which assumes greater importance in the face of today's complex and uncertain trading environments. We argue that it has an important role in SSCM, especially since not enough is yet known about how to create sustainable supply chains (Pagell and Wu, 2009; Carter and Easton, 2011). The extant literature largely fails to address environmental scanning in the context of sustainable development (Fabbe-Costes *et al.*, 2011). Consequently firms lack the knowledge they need in order to design and re-design their supply chains to address the challenges posed by needing to adhere to principles of sustainable development. Further, effective ES can improve performance by minimizing supply chain disruption due to unanticipated changes in the environment (Closs *et al.*, 2008; Fleming, 2008).

The sustainable development agenda encourages firms to take a much wider view of their supply base, to encompass activities along the entire chain (Seuring and Müller, 2008). This in turn argues for optimizing the complete chain, based on total cost and maximum value creation, rather than on sub-optimization at the firm level (Linton *et al.*, 2007; Ferguson and Souza, 2010). There is some evidence that SSCM can bring strategic benefits in terms of enhanced corporate reputation (Roberts, 2003) and in relation to improved operational and financial performance (Rao and Holt, 2005; Carter and Rogers, 2008). However, even if these benefits were not evident, the drive towards sustainable supply chains (SSCs) is inescapable: *"Research into the operational implications of various policies and how business can integrate sustainability is critical, since current legal trends will force many of these changes whether or not academe and practice is prepared"* (Linton *et al.*, 2007, p. 1080).

Building on a conceptual framework which suggests the scope of, and targets for, environmental scanning (Fabbe-Costes *et al.*, 2011), the research presented in this paper has two key purposes. Firstly, it aims to address a gap in the literature regarding the need for new approaches to ES in the context of sustainable supply chains. Secondly, it aims to provide firms with knowledge to help them properly face the challenges of sustainability in the design / re-design of their supply chains (SCs). The paper extends the framework by exposing it to the realities of practice through 45 semi-structured interviews with practitioners together with a confirmatory focus group of SC experts. Through this comparison with firms' actual sustainable scanning practices, the paper sheds new light on the conceptual framework and allows us to propose a validated set of targets for ES which are organized into six inter-related levels. The result is a tool to assist practitioners with the prioritization of their ES efforts. As stated above, such efforts are mandated by the increasing pressures to perform effectively whilst adhering to the global sustainability agenda.

The remainder of the paper is as follows: in the next section we review the literature on environmental scanning and its relevance for SSCM. There is also a brief introduction to the conceptual framework which is the subject of this investigation. This is followed by a description of the research design and methodology, after which our results are presented. Finally, the

significance of the findings is discussed before we conclude with some remarks about contributions, limitations and opportunities for further research.

2. Literature review

2.1. Sustainability in Supply Chain Management

The importance of sustainability in operations continues to grow, to the extent that many now regard it as a mainstream concern for both researchers and practitioners (Kleindorfer *et al.*, 2005; Corbett and Klassen 2006). Supply chain managers, in particular, are in a strong position to impact environmental and social performance (Carter and Easton, 2011). As firms encounter external pressures about sustainability from, for example, regulators, consumers, lobby groups and citizens, they need to reconfigure their supply chains to combine economic prosperity, social equity and environmental quality (Seuring and Müller, 2008) – the so-called “triple bottom line” (Elkington, 1997). Sustainable development will impact on operations and SCM, modifying product design, sourcing, production, transportation models, stock policies, distribution and waste networks, and partners’ relationships (Vachon and Mao, 2008; Awaysheh and Klassen, 2010). However, an organisation’s environmental management orientation should not simply be reactive, aiming primarily to comply with legal requirements; more desirable is a proactive orientation which is “*associated with the development of product design capabilities that employ design-for-the-environment principles and life cycle analysis*” (Vachon and Klassen, 2010, p. 224).

Many companies have embraced their responsibility to address environmental issues, often through certification to ISO 14001 or other ‘green’ initiatives (Zhu *et al.*, 2008). However, a response to social issues (e.g. human safety and welfare, community development, and protection from harm), particularly in the supply chain, is not as evident (Beske *et al.*, 2008; Klassen and Vereecke, 2012). This could to some extent be linked to equivocality about the meaning of social issues in operations contexts (Sarkis, 2012). In contrast, a study which examined how best to embed social and environmental practices in global SCs (Jørgensen *et al.*, 2003) showed that environmental issues went largely ignored. Consequently, despite charges that the triple bottom line might be somewhat oxymoronic and that the quest for profitability will generally militate against sustainability, there remains a need for more widespread adoption of its underlying concepts within SCM (Bai and Sarkis, 2010; Bai *et al.*, 2012; Walker and Jones, 2012).

More generally, despite the increasing body of literature on SSCs there remain “*numerous opportunities for further advancing theory, methodology, and the managerial relevance of future inquiries*” (Carter and Easton, 2011, p. 46) such that “*there are still fundamental issues researchers need to address in order to offer managers prescriptive models of how to create sustainable supply chains*” (Pagell and Wu, 2009, p. 37). These issues include the needs for a more balanced approach to sustainability; for better frameworks and methods to understand and anticipate future trends requiring SC design or redesign (Fabbe-Costes *et al.*, 2011); and for a more holistic perspective on complete supply chains (Zhu *et al.*, 2008; Wolf, 2011) rather than on individual firms, since a firm can be no more sustainable than its supply chain (Krause *et al.*, 2009).

The adoption of a holistic perspective is widely emphasized (e.g. Mentzer *et al.*, 2001; Chen and Paulraj, 2004; Larson *et al.*, 2007), with the “*ultimate supply chain*” (Mentzer *et al.*, 2001, p. 4) encompassing all organizations associated with upstream and downstream flows of products, services, finance and information from initial suppliers to final customers, and embracing activities beyond the core such as disposal, recycling and recovery processes at end-of-life (Linton *et al.*, 2007; Vachon and Klassen, 2010). As firms tackle the challenges of integrating sustainable development into their supply chains they uncover the strategic benefits which may accrue (Keating *et al.*, 2008; Flint and Golobic, 2009). These include improved financial performance (Rao

and Holt, 2005; Handfield *et al.*, 2005; Carter and Rogers, 2008), enhanced corporate reputation (Roberts, 2003) and increased competitive advantage (Markley and Davis, 2007). However, these are only attainable if firms are prepared to take a broader environmental and social perspective (Kleindorfer *et al.*, 2005; Kovács, 2008), to look *“at a longer part of the supply chain”* (Seuring and Müller, 2008, p. 1705), to ensure that they consider a wider range of issues (Ibid: 1705) and to acknowledge the crucial role of inter-organisational relationships (Gold *et al.*, 2010). Consequently, firms who are embedded within SSCs must renew the way they delineate their supply chains and scan their environments (Fabbe-Costes *et al.*, 2011), i.e. they must revisit and revise their methods of SC environmental scanning.

2.2. Environmental Scanning

Environmental scanning is a search activity which aims to anticipate and understand events and relationships in a firm's external environment (Hambrick, 1982; Lesca *et al.*, 2012) in order to reduce uncertainty (Lewis and Harvey, 2001). It can *“assist top management in its task of charting the company's future course of action”* (Aguilar, 1967, p. 1), but differs from focused search where managers, already engaged in decision-making, seek information to understand a problem and available choices (Walters *et al.*, 2003; Day and Shoemaker, 2004). ES is pre-attentive monitoring with no specific decision guiding the process: *“the objective is to be vigilant to discrepant signs/signals that might manifest in the peripheral vision and could eventually help identify, discover or anticipate plausible changes in the environment”* (Lesca *et al.*, 2012, p.132). After detection, the scanning process entails interpretation of signal strength and meaning, to inform managerial action.

Environmental scanning has a long history (e.g. Etzioni, 1967; Aguilar, 1967) and the associated literature has evolved in phases, first focusing on systems employed by large firms, then examining relationships between scanning and strategic management before shifting towards study of scanning practices in various contexts, and to the impact of scanning on firm performance (Wong and Hung, 2012). Some scanning papers recommend using a broad scanning scope because *“under conditions of uncertainty a complete and accurate scanning of the external environment is critical”* (Srinivasan *et al.*, 2011, p. 263) – while, somewhat contradictorily, also suggesting that scanning operations should be focused. They propose the use of lists of macro-environmental components (Aaker, 1983; Jain, 1984; Prescott and Smith, 1989; Ahituv *et al.*, 1998), to include individual and collective cognitive perspectives (Slaughter, 1999; Voros, 2001a, 2001b, 2003) and to define micro-environment forces in line with Porter's model. Brockoff (1991) proposes combining both 'general' and 'task' (Bourgeois, 1980) environment, to identify 'interest zones' and 'interest groups'.

Others emphasize the need to operationalize such environmental frameworks through the use of checklists (Mendonça *et al.*, 2004; Oreja-Rodriguez and Yanes-Estevez, 2007) or causal diagrams (Narchal *et al.*, 1987), or by road-mapping technology processes (Phaal *et al.*, 2004; Camponovo and Pigneur, 2004). Some advocate the prioritization of scanning targets through expert interviews (Calori, 1989) or by focusing on their importance and likelihood (Stoffels, 1982; Aaker, 1983; Bates, 1985). To sum up, the limited empirical research into environmental scanning has found that firms focus on economic and technological zones (Jain, 1984; Subramanian *et al.*, 1993) with enlargement of the scanning scope over time. It seems that *“there is often a 'local search' problem in firms' environmental scanning”* (Holmberg and Cummings, 2009: 177) although *“executives in high performing companies tend to scan environmental information more broadly than their counterparts in low performing companies”* (Xu *et al.*, 2003: 382).

2.2.1. Environmental scanning in supply chain management

Despite the increasing imperative to undertake environmental scanning, few SCM papers consider this as a core topic (Paiva *et al.*, 2008). Those that do, indicate a range of benefits. By monitoring competitors' product lines, quality and costs, scanning enables firms to stay ahead of the competition (Badri *et al.*, 2000) and provides insights into sales trends and customer preferences, supply network innovations and new distribution channels (March and Hevner, 2007; Kristal *et al.*, 2010). It can trigger the reconfiguration of firms' SCs to respond quickly to marketplace changes and manage disruption risks (Harland *et al.*, 2003) and to safeguard uninterrupted customer service (Braunscheidel and Suresh, 2009). Scanning can mitigate the impact of environmental uncertainty on SC performance (Srinivasan *et al.*, 2011), and support the creation of powerful value propositions for other chain members (Walters, 2008). Scanning of suppliers and their extended networks can improve supplier selection for long-term relationships and provide access to other companies with technological and innovative resources (Choi and Kim, 2008; Koufteros *et al.*, 2012).

In practice, organizations tend to adopt a fragmented and somewhat isolated focus on the individual firm (Håkansson and Snehota, 2006b), despite encouragement to 'widen their sweep', especially in inter-organizational networks (Eisingerich and Bell, 2008; Neto *et al.*, 2008; Peters *et al.*, 2011). Moreover, due to increased environmental complexity and uncertainty, and a greater volume and range of external information sources (Bengisu and Nekhili, 2006), new scanning methods are called for, especially since "*a review of the state-of-the-art in environmental scanning does not reveal any major changes in its basic methods since the 1970's*" (Tonn, 2008:596). Although firms are beginning to use the Internet and social media to undertake SCM scanning (Abrahams *et al.*, 2012), the changes being advocated are much broader in scope. Thus, "*a framework of multiple perspectives for environmental scanning*" (Neugarten, 2006, p. 903) is needed, such that the peripheral environment is taken into account for the detection of weak signals (Brown, 2004; Rossel, 2011).

2.2.2. Environmental scanning and sustainability

Since sustainability mandates firms to look to the future and show a concern for the long-term well-being of humanity (Tilley and Fuller, 2000; Voros, 2001a; Kelly *et al.*, 2004), it is striking that the ES literature is relatively sparse on the topic of sustainability. A few articles assert that ES is, or could be, important in sustainable development contexts (Voros, 2001b; Schlange, 2006; Adema and Roehl, 2010, Asif *et al.*, 2011), and others make brief mention of its importance in organizational practices such as corporate planning (Clemens, 2009) or the development of corporate sustainability performance measurement systems (Searcy, 2011). Finally there are a few papers which refer to the practice of ES for sustainability in specific organizations such as Shell in Thailand (Ngamkroekjoti and Johri, 2000), companies in developing countries (Jamail and Mirshak, 2007), the public sector (Clemens, 2009) and small firms (Will, 2008). In no instances was it possible to find any detailed studies of environmental scope and targets in sustainable development contexts.

Summarizing the literature review, three distinct dyadic relationships emerge. The first relates to sustainability and SCM, where the importance of SSCM is confirmed through the many studies which have examined aspects of this. Nevertheless research gaps remain concerning the need to adopt a broader environmental and social perspective of the whole supply chain and highlighting the need for work which takes a truly balanced 'triple-bottom-line' perspective. The second relationship involves the role and practice of ES in supply chain contexts. Here, the review

identifies a need for new approaches and particularly those which move beyond a focus on individual firms to the wider supply chain. The third relationship is associated with ES in sustainable development contexts. In this domain, the literature is sparse and comparatively superficial in its approach. In most cases the treatment of ES for sustainability makes tangential reference to its importance or, at best, produces brief descriptive accounts of broader foresight or scenario planning processes which include sustainable scanning.

The conclusion of this literature review is that the intersection of these three dyads represents a significant and important research gap, i.e. SCM-focused environmental scanning approaches which take account of sustainable development. Earlier work, which begins to address this gap, proposes a conceptual framework for SSC design that incorporates a multi-level approach to environmental scanning (figure 1) (Fabbe-Costes *et al.*, 2011).

2.3. Conceptual framework and research questions

Figure 1 - A sustainable scanning framework (Fabbe-Costes *et al.*, 2011)

The framework incorporates scanning at different levels from individuals and groups of people up to the entire societal environment. The six levels represent significant depth and breadth of scope and are argued to be inherently inter-related (Fabbe-Costes *et al.*, 2011). The framework is complemented by a set of targets for each level, where - in this context - 'targets' refer to those topics, subjects or entities that firms search for, and monitor, when scanning. Implicit in the theoretical development of the framework is a debate about the most appropriate boundaries and units of analysis for sustainable SCM research in terms of activity, time horizon and geography or territory.

The purpose of this paper is to test the conceptual framework through comparison with the sustainable scanning practices of firms engaged in the design or re-design of their supply chains and networks or that are seeking to do so. In particular we propose to gather empirical data about the realities of scanning for sustainability in SC contexts so that the validity and utility of the proposed framework can be assessed. To do so we propose the following set of research questions (RQs):

Firstly, concerning the search for information:

- RQ1: How do the sustainable scanning practices used by organizations relate to the structure of the conceptual framework (Figure 1)?

Secondly, regarding sustainable scanning targets:

- RQ2: How do the targets that are monitored in practice compare to those derived from the literature (as listed in Fabbe-Costes *et al.*, 2011)?

Thirdly, concerning the scope of the search for information:

- RQ3: What is the scope of environmental scanning for sustainability in practice?

In the next section we outline the research design and methodology adopted for the investigation.

3. Research design and methodology

The nature of the research questions argued for an exploratory approach to the fieldwork and within this, a two-stage design was adopted. Firstly, semi-structured interviews were held with key informants from a range of organizations to gather rich, in-depth qualitative data. Thereafter, a quasi-confirmatory method, involving a focus group of experts, considered the outcomes of our analysis of the interview data. This two-step approach that facilitates triangulation of the issues and which is similar to others used to gather rich data (e.g. Manuj and Mentzer, 2008), is described in more detail in the following paragraphs.

The research was undertaken as part of a government-sponsored national research initiative in France (Predit 4, 2012) and was funded by the French Environment and Energy Management Agency (ADEME, 2012). Given this context, the focus of the fieldwork was on a single country (France).

3.1. Stage One: semi-structured interviews

For this stage, we wanted diversity relating to industry sector, organizational size and activity of participants. Furthermore, in order to gather the breadth of data required, we specifically needed to target interviewees from organizations operating at different supply chain points (from upstream to downstream). Accordingly, respondents were sought from firms of varying size, sector and supply chain function, and from other stakeholders to the sustainability agenda, including institutions and associations. Sampling involved direct targeting of professional contacts known to the researchers and, through these using a form of snowballing, identifying secondary contacts. Informants with experience of SCM, sustainable development or scanning were sought, and - in all cases - the organizations to which they are affiliated are known for their SCM competencies and sustainable commitment/initiatives. The unit of analysis for the study being the respondent's organization rather than the supply chain to which it belonged, informants derived from multiple supply chains. The role, sector, activity and organizational size of the final set of 45 interviewees are shown in appendix 1.

The over-arching national research initiative aimed to investigate the importance of logistics/SCM and sustainable development issues for organizations, and to understand the various SSCM initiatives and scanning practices that are used relating to future sustainable supply chains. The research, which is essentially exploratory, used a semi-structured interview guide to

gather data on a range of issues associated with these aims. To minimize bias in the results, questions were open and non-leading. Specifically, it was important that respondents provided unprompted answers and, for this reason, we did not mention any scanning targets or boundaries as we conducted the interviews. The interviews lasted between one and two hours, and were conducted and audio-recorded between December 2010 and February 2011. Once ‘theoretical saturation’ was reached (after 45 interviews) the recordings were transcribed and a two-step coding approach was used for data analysis.

In the first ‘open coding’ step (Ellram, 1996), each significant verbatim quote relevant to the research questions was noted. In particular, we captured every scanning target for future SSCs that was mentioned (RQ2). Thereafter, we related each target to its appropriate level(s) in the SSCM framework, thus completing a coding table for each interview (RQ1). During this process, we noted those topics that featured at more than one framework level (RQ1), and we captured responses that referred to the boundaries used to delineate/prioritize respondents’ SSC scanning practices (RQ3). In order to ensure rigour in this coding process three of the richest interview transcripts were initially coded independently by two researchers who afterwards compared results. As a consequence, slight adjustments were made to the process such that the analysis of the remaining transcripts would be standardized and without bias. Once all transcripts had been analyzed, the results were shared, and final coding was made and double-checked. To complete the first step, the primary results and observations for each interview were summarized, by “*writing analytic notes to explicate and fill out categories*”, a crucial intermediate step close to memo-writing from grounded theory (Charmaz, 1995: 28).

In the second step, the individual coding tables were merged into master tables, each including a compilation of all the scanning targets for one of the framework’s six levels. We then looked for similarities, and iteratively developed a view of emerging categories that could serve as a generic guideline for scanning focus definition. Finally in this step, the results of coding and categorization were compared to scanning targets identified from the literature (Fabbe-Costes *et al.*, 2011) (RQ2) and used to examine the scope of respondents’ scanning practices (RQ3).

3.2. Stage Two: focus group

In this stage, during which we sought in-depth discussion and validation of the interview results, a focus group method was considered appropriate (Sanchez-Rodriguez *et al.*, 2010). The group comprised experts drawn from members of a French ‘environment and logistics’ club which aims to develop and implement operational solutions for sustainable SCM, and is well-known in France for its SSCM commitment (Club DEMETER, 2012). The three-hour focus group, which was audio-recorded, was held in Paris on May 4th 2012 with 9 participants representing various SC roles, including retail, manufacture and third party logistics (see appendix 2). Following a brief presentation about the project and the proposed framework, we circulated the master tables from the analysis of interviews. Reflecting the content of the second column in table 3, these contained the categorized lists of targets from the interviews. For each level, we asked the experts independently to select the 3 categories that they considered to be most important (not necessarily those that they or their organizations actually scan), and to add any targets that they felt were missing. The results were collated and summarized to indicate, for each scanning level, the target(s) with a majority of choices. This provided the basis for general discussion by focus group members, including consideration of how the results might inform their future development of a collective sustainable scanning approach and critical review of the relevance and utility of this particular scanning framework.

The research methodology adopted for this study was designed to ensure, as far as possible, the reliability and validity of the data deriving from it. In particular, steps were taken to ensure that it conformed to the parallel quality criteria for qualitative research in logistics deriving from interpretivist research approaches (Halldórsson and Aastrup, 2003). Thus, in pursuit of ‘truth-value’ we directly targeted professionals who had conviction that sustainability and scanning are important issues for logistics and SCM; we used open and non-leading questions for the semi-structured interviews; we continued data collection until theoretical saturation was reached and we double-checked the final coding. Every respondent received the final report with results of the research and could comment on its ‘credibility’. To maximise ‘transferability’, we deliberately sought diversity in terms of responder organizations’ size, sector and activity and we attempted to identify best practices through the focus group. When building the master tables with target categories, we formulated generic targets that could fit with as many industries as possible. Finally, for ‘trackability and explicitness’, the process, data sources, and theories underlying the work are documented, and the interview guide and transcribed interviews are available upon request.

The fieldwork results are presented according to the sequence of the research questions in the following section, and are subsequently discussed by reference to the conceptual framework and the research questions.

4. Results

4.1. Research question 1

RQ1 sought to understand how the sustainable scanning practices used by organizations relate to the structure of the conceptual framework. Interview data addressing this question is shown in table 1 and, with respondents reporting target monitoring at all levels, provides strong evidence of the relevance of its multi-level architecture. A large majority of respondents’ practices cover several levels, with over two-thirds (69%) scanning at 5 or more levels. Only 5 from 45 (11%) reported scanning at 3 or fewer levels.

Table 1 - Number of levels mentioned in the interviews

Number of levels concerned	Number of interviews (total=45)	% of interviews	Cumulative % of interviews
6	18	40%	40%
5	13	29%	69%
4	9	20%	89%
3	3	6,5%	95,5%
2	2	4,5%	100%
1	0	0%	100%
0	0	0%	100%
Total	45	100%	100%

The data in table 2 indicate that all respondents scan at the societal level, with the network level being the least scanned. Scanning targets within the chain, function and people levels were mentioned by more than 75% of respondents and those in the firm level were cited by 69%.

Table 2 - The framework levels mentioned in the interviews

Levels of scanning (see Figure 2)	Number of interviews that mentioned scanning target at this level (total=45)	% of interviews
Societal	45	100%
Network	29	64%
Chain	44	98%
Firm	31	69%
Function	39	87%
People	34	76%
Inter-related levels ¹	34	76%
Notes		
¹ We note here number of interviews mentioning at least two targets at different levels, referring to the same topic.		

A further aim was to identify how far the framework tiers are inter-related and, to do this, we noted where individual targets called for analysis at more than one level. As indicated in table 2, the coding process found that – in 76% of the interviews – at least two scanning targets at different levels referred to the same topic, thereby demonstrating how the levels are inter-related. By way of example, respondent LSP1 (see Appendix 1) monitors technology innovations e.g. for producing green energies or saving energy, at the societal level, whilst also scanning at the chain level for new technologies being adopted or developed by truck suppliers. Further, at the function level, they scan those technologies likely to impact directly on their operations, e.g. silent trucks for night urban distribution. Respondent OS4 monitors GES emission regulations at the societal level, the way companies measure GES emissions at the firm level, and the results of professional association studies on this topic at the network level.

For RQ1, the focus group reinforced the interview results and contributed additional findings as follows:

- the importance of the societal level was generally acknowledged,
- the network level was initially less well-supported, with fewer group members suggesting that organizations scan at this level. However, it was widely considered to be a more complex concept to grasp than the others. The group discussion (unhindered by researcher input) facilitated clarification of the network level (with examples of targets related to the interconnectedness of chains, and to indirect relationships within a business) and how relevant it could be for scanning purposes, potentially resulting in more surprising information than at the firm and chain level.
- the importance of the chain level was confirmed, on the basis that individual firms cannot achieve SSCM alone,
- whilst the firm level was generally recognized, it did not attract further discussion,
- the functional level was acknowledged as a separate tier in the framework, and the participants further noted that the targets typically scanned at this level seem to be more short term-oriented than others to which they may have links e.g. at the societal level,
- the importance of scanning at the people level was strongly emphasised. Given the evolving nature of sustainable development and SSCM in firms, supply chains and society, scanning of peoples' interests, commitment and behaviours was regarded as essential.

In summary, the experts expressed considerable support for the notion of scanning levels, since the unit of analysis is different for each, and leads to a focus on different but connected targets.

They found value in the conceptual framework forcing them to step back from current concerns in order to consider the wider picture and drivers for SSCM. They were in agreement with its underlying structure and representation.

4.2 Research question 2

RQ2 sought to compare the targets monitored in practice to those derived from the literature (Fabbe-Costes *et al.*, 2011). Incorporating over 900 individual targets, spanning all framework levels, the primary data supports both breadth and depth in firms' scanning activities. Whilst these were often specific and business-dependent (even anecdotal), our coding process classified them according to general categories which developed as part of the analysis. As an example, within the resulting societal category 'Existing & developing technological trends and innovations potentially impacting supply chains', individual targets included intelligent terminals to pilot urban storage or delivery zones, new handling equipment to limit repetitive strain injury and Smartphone's progressive applications for logistics. The categories that emerged from coding the primary data are shown in column 2 of table 3, which combines the results from all framework tiers to allow between-level comparison.

The results indicate the volume and diversity of society-level targets scanned, including those associated with the field of logistics operations, constraints and potential levers. The network level is less populated although it demonstrates that boundary-crossing initiatives (such as by territory or supply chain) drive network-wide sustainable scanning activity. In addition, other businesses (e.g. IT and consultancy) that are able to support or inspire sustainable logistics practices are monitored. Whilst a wide variety of targets were articulated at the chain level, fewer emerged for the firm. The data suggest that when organizations scan firms, they focus primarily on targets relating to corporate behavior, attitudes, initiatives and needs concerning sustainable logistics. At the next level, the results indicate numerous targets concentrating generally on the logistics function. Nevertheless, several issues concerning design, production, supply and sourcing also emerged, thereby indicating the pivotal role of operations management more generally. Finally, at the lowest level, emerging categories relate to people regarded as sources of inspiration or as levers for sustainable logistics development. Employees of all types represent the main targets, whilst consumers are rarely mentioned.

Table 3 – Comparison of scanning targets at all framework levels

Level	Target categories identified from the empirical study	Target categories identified from the literature
Society	Existing & developing technological trends and innovations potentially impacting supply chains	Public/private initiatives promoting sustainable R&D programs, new technology to improve sustainability of operations (e.g. transport)
	Political trends (domestic & abroad), geo-political futures	Not mentioned
	Laws, rules and tax measures - existing or in preparation (domestic & abroad)	Regulations (international, European, national, local, importers): projects, changes, implementation (uncertainty on temporality, coherence and controls), types and terms of control/sanction, related taxes and incentives (e.g. eco-label) from environmental or other types of legislation
	Norms, certifications and labels - existing or in preparation; their level of adoption	
	Economic trends (international & domestic)	New markets and economic balances (global vs. local sourcing)
	Landscape management - international, domestic & local - including infrastructure development	Logistics infrastructure development: ports regionalization, modal shifts, green transport corridors, investments along thematic clusters
	Energy (sustainable energies, price, scarcity)	Value of raw materials and energy (geopolitical phenomena, scarcity)
	Public attitudes and perceptions of logistics, calling for more sustainability	Behaviors and opinions (pressure, demands, awareness, scrutiny) of people e.g. consumers, employees, citizens or investors
	Public institutions' attitudes and perceptions of sustainable logistics	Institutions' strategies: e.g. to promote collective action, take on activities (or not), promote sustainable guidelines (e.g. through public-purchasing directives)
		Behaviors and opinions (pressure, demands, awareness, scrutiny) of public authorities
	Publications (UN, NGOs, research) concerning health, biodiversity, pollution etc	Ecological/watchdog organizations, socially/environmentally involved NGOs, lobbies, agencies activities and positions
	Not mentioned	Changing demography, urbanization, "greying"
	<i>Re-assigned to network level¹</i>	Industrial professional group and trade union activities
	Not mentioned	Influence of quotation agencies (ex: Dow Jones Sustainability Index) insurers, lenders
Netw/k	Outputs of inter-organizational sustainable logistics processes or experiments	Collective development of labels, standards, norms, best practices, databases, guidelines, voluntary agreements; & private sector initiatives for self-regulation
	Pooling initiatives between actors from different supply chains/sectors	Partnerships to develop common solutions, pioneering experiences
	Documents and activities of professional associations & federations, consultative bodies - related to sustainability	Ability to undertake lobbying activities targeting institutions
		<i>Industrial professional group and trade union activities¹</i>
	Emerging activities and/or actors potentially impacting supply chains	Role of new actors in network governance: local authorities or government, social and trade associations, spontaneous collaborative organizations, new intermediaries, non-business partners, external consultants
	Territory (e.g. country) projects forcing a review of collaborations, to adopt network principles	Not mentioned
	Sustainable logistics practices from other activities and the potential for their transfer	<i>Leadership in the network (promoting new ideas, innovative frameworks/experiences and driving change at all levels)²</i>
	Indirect actors' contribution e.g. IT services, consultancies	Not mentioned
	Not mentioned	Network structure (number of echelons and links, relationships)

Level	Target categories identified from the empirical study	Target categories identified from the literature
Chain	Global supply chain trends/sustainable logistics initiatives	Not mentioned
	Partnership relations' evolution for sustainable logistics: requirements, needs	Development of horizontal/vertical alliances, collaborative practices, instantaneous information sharing via Internet to improve supply chain sustainability
	Sustainable logistics services offered by providers and subcontractors, their ability to cooperate	
	Identification of sustainable logistics activities that could threaten or enrich the supply chain	Not mentioned
	Attitudes, behaviors and expectations of consumers, pulling towards a more sustainable chain	Roles of actors in chains, ability to take the lead in sustainable projects
	Attitudes, behaviors and expectations of direct clients and their sustainable logistics solutions/innovations	
	Not mentioned	<i>Leadership in the chain (promoting new ideas, innovative frameworks/ experiences and driving change at all levels) ²</i>
	Competitors' sustainable logistics solutions/innovations	Competitors' green strategies
	Sustainable logistics services by TPL providers; their innovation capabilities	<i>Supply of professional services by companies (ex: logistics services) ³</i>
	Sustainable logistics services offered by providers and subcontractors, their ability to cooperate	
	Evolution of actors and activities in the reverse logistics sector: new patterns, new actors	New actors, activities, use of resources
	Existing and developing tools to support the spread of sustainable logistics across the chain	Information systems to better evaluate physical flows (ex: in reverse logistics) and chain sustainability (e.g. carbon footprint)
Firm	Sensitivity/commitment of firm to sustainability issues	Firm's maturity in logistics, SCM and sustainable development
	Firm's sustainable logistics needs and expectations	
	Sustainable logistics initiatives from inside the firm (internal scanning)	Individual firm strategy, resources, competencies, and activities for improving supply chain sustainability
	Not mentioned	<i>Resources and competencies of the firm, cultural context and environmental representations ⁴</i>
	<i>Re-assigned to chain level ³</i>	Supply of professional services by companies (e.g. logistics services)
	Firm's attitudes and initiatives for sustainable development and logistics	Free-riding and opportunistic attitudes to the demands of sustainability (e.g. in matters of CO ₂ emissions reduction)
	Sustainable logistics tools adoption supporting the deployment of sustainable initiatives	Willingness to introduce technologies/tools to improve sustainability performance
	CSR policies of companies (notably concerning logistics activities)	Not mentioned
Func/n	Evolution of sustainable transport and logistics technologies related to physical flows	Technologies (recycling, alternative distribution modes [shopping from home, in store, on the go...]), know-how
	Sustainable transport and logistics organizations and methods (eco-design, pooling, modal shift)	Experimentation of pilot supply-chain solutions, technical innovations in logistics or manufacturing
	Evolution of sustainable logistics and SCM concepts	Not mentioned
	Packaging issues (new materials, re-use/recycling, eco-design)	Not mentioned
	Reverse logistics issues -flow management/disassembly etc	Not mentioned
	Techniques & tools for sustainable industrial production/logistics	Not mentioned
	Urban logistics (distribution plans, urban platforms, freight transport in cities)	Not mentioned
	IT trends to support sustainable logistics	Not mentioned
	Sustainable source location (provider selection, calls for tender)	Not mentioned
	Sustainable logistics 'business cases' identification, impacts on sustainable performance	Not mentioned
	<i>Re-assigned to firm level ⁴</i>	Firm's resources & competencies, cultural context and environmental representations

Level	Target categories identified from the empirical study	Target categories identified from the literature
People	Sensibility, attitudes, commitment, and behavior concerning sustainable development/logistics of firm's workers, owners, operational logisticians, logistics managers, other functional managers within the firm	Personal sustainable development and supply chain orientation
		Leadership in the company (promoting new ideas, innovative frameworks/experiences and driving change at all levels)
	Not mentioned	Personal scanning orientation and practice
	Politicians' interest/will to encourage sustainable logistics	Not mentioned
	Shareholders' requirements for sustainable development/logistics	Not mentioned
	Methods for disseminating and adopting sustainable development/logistics ideas & practices by individuals (training, communication, social networks)	Not mentioned
	<i>Re-assigned to network and chain levels²</i>	Leadership in the chain/network (promoting new ideas, innovative frameworks/experiences and driving change at all levels)

For the comparative analysis, whereby the empirical categories were evaluated against those derived from the literature (shown in table 3, column 3), targets were matched according to their meaning, albeit the phrasing was slightly different in some cases. The comparison allowed us to enrich the target sets and to clarify the level of some, with 4 targets being re-coded. (These are italicized in table 3, with matching superscript identifiers in the original and re-coded location). Where the empirical results enriched understanding of a particular category, more than one target corresponds to the one from the literature. In others, interview-derived categories had broader scope than the equivalent from the literature, which hence mapped to more than one of the categories in column 2.

Comparison at the societal level indicates direct correspondence except that respondents did not mention demography and the role of quotation agencies, but did recommend (geo)-political trends as a new target. For the network, 2 new categories derived from practice, relating to territorial projects forcing a review of collaborations between stakeholders, and to the contribution of indirect actors in the network (including IT and consultancy). The network structure, deriving from the literature, was not mentioned by respondents. At the chain level, the literature target set was enriched by inclusion of SC actors such as providers and final customers and by trends in sustainable and reverse logistics. Missing from the chain-level empirical results was leadership in the chain. There was a high degree of firm-level correspondence, with interviewees adding organization's CSR policies but not mentioning the resources and competencies of the firm. The empirical results at the function level considerably extend those from the literature, with the emergence of 8 new categories relating to functions such as packaging, reverse logistics, sourcing, and urban logistics; tools which support sustainable activities; and IT developments and benchmarking against exemplary cases. Finally, at the people level, the empirical data again led to the emergence of new categories reflecting firstly, particular agents regarded as sources of inspiration or levers for change, e.g. politicians and shareholders, and secondly methods that people can adopt to disseminate information on sustainable logistics issues (including lectures, social networks, and so on). Personal scanning orientation, a category deriving from the literature (Fabbe-Costes *et al.*, 2011), does not appear in empirical results.

In order to validate the relevance of the targets lists and to establish whether any targets were missing, the empirical list of categories (column 2, table 3) was given to focus group members. From these, they selected and ranked the 3 at each level regarded as the most important for their own organization. Table 4 lists the most-cited categories, giving scores which reflect how many of the 9 group members included it in their top 3.

Table 4 – Categories of targets most-cited by focus group members

Level	Selected targets (number of citations / 9 participants)
Societal	Laws, rules and tax measures -existing or in preparation (domestic and abroad) (6/9)
Network	Sustainable logistics practices from other activities and the potential for their transfer (6/9)
Chain	Existing and developing tools to support the spread of sustainable logistics across the chain (5/9)
Firm	Sustainable logistics initiatives from inside the firm (internal scanning) (6/9) Sustainable logistics tools adoption supporting the deployment of sustainable initiatives (6/9)
Function	Evolution of sustainable transport and logistics technologies related to physical flows (5/9)
People	Sensibility, attitudes, commitment, and behavior concerning sustainable development/logistics of firm's workers, owners, operational logisticians, logistics managers, other functional managers within the firm (7/9) Methods for disseminating and adopting sustainable development/logistics ideas & practices by individuals (training, communication, social networks) (7/9)

The group members agreed that the target categories were mostly complete, but proposed a new target at the people level whereby firms should monitor the views of opinion leaders in SSCM. The group felt that the list of categories could be used as an operational tool to prioritize scanning activity. The discussion considered how the different levels are inter-linked and agreed that many sustainable scanning issues cover different levels of analysis. By way of example – as demonstrated in table 4 - the importance of monitoring tools to ensure sustainability was highly ranked at both the firm and chain levels by the majority of focus group members. Similarly, they emphasized the importance of scanning sustainable logistics practices and initiatives at both the network and firm levels. Furthermore, since 3 out of the 8 most-cited categories relate to the tools (or methods) that support the deployment and implementation of sustainable logistics activities, the results from the group highlight the importance of scanning these. Finally, in line with the interview results, the majority of group members highlighted the use of scanning targets related to people that combine the understanding of individual attitudes and behaviors with the tools to influence them.

4.3 Research question 3

In addressing RQ3, which sought to determine the scanning scope adopted by organizations, we examined the coding tables from each interview, containing altogether more than 900 targets. The extent and variety of these suggest that the scope of scanning practices has both breadth (numerous targets at each level) and depth (specific topics being explored at more than one level).

Also of relevance to scope is the notion of a 'scanning boundary', used as a tool to focus and prioritize sustainable scanning activities. Here, a number of interviewees mentioned their difficulty in delineating scanning focus, articulating problems in deciding on the appropriate positions of boundaries. The results illustrate scanning boundaries in three broad areas, as follows:

- **Geography:** some firms reported the need to monitor foreign sustainable initiatives and to scan activities that deploy on another territory: *"the main European market is England, so, we tried to benchmark our competitors there, some are impressive in sustainable logistics"* [DF3].
- **Activity:** respondents were divided on this question, with some indicating that their

scanning is restricted to activities in similar companies and industries (*"scanning inside the perimeter of our job"* [LSP6]) whilst others reported looking for sustainable initiatives in other industries (*"I carefully look at what is done in automotive and distribution"* [IF5]).

- **Time:** some respondents reported that their organizations need to implement highly anticipative long-term scanning practices: *"to monitor regulations, you have to position very, very early!"* [OS3], but also pointed out the complexities associated with this long-term perspective *"we have difficulties to think on a long term"* [OS4].

The focus group was helpful in extending the discussion about the boundaries of scanning in these three areas and generated interesting findings in this regard. Specifically, it provided a richer understanding of the end-points of the boundaries for time (from short to long term), space/geography (from local to global) and activity (from individual business unit of the firm to an extended vision of activities). It led to the idea that, by viewing each area as a continuous scale, the boundaries chosen for scanning could lead to two extreme positions. On the one hand was envisaged reactive sustainable scanning which considers the short term, local territory and the activities of the firm or project with very specific targets. On the other hand, a proactive approach would encompass the longer term, an extended territory and more general global activities with less precise targets. For any organization, its scanning boundaries can be defined by its position on each scale, and the focus group discussion suggested that these positions may vary between levels in the framework. The example emerged that, whilst regulation might be scanned only nationally, the sustainable initiatives of competitors may be scanned internationally. In this way, the findings from the focus group provide further evidence to suggest that the broad and deep scanning scope adopted by organizations monitors diverse categories of targets at different levels, some of which are inter-related.

5. Discussion

5.1. Consideration of results

Our research contributes to knowledge and practice through investigation of questions relating to the structure, targets and scope of environmental scanning in the context of sustainable supply chains. By seeking to improve understanding and develop practical solutions, it responds to the call for fundamental issues to be addressed such that prescriptive advice can be offered to managers for the creation of sustainable supply chains (Pagell and Wu, 2009). These issues include the need generally to take a more holistic perspective on supply chains (Zhu *et al.*, 2008; Wolf, 2011) rather than on individual firms and specifically so, in relation to environmental scanning (e.g. Håkansson and Snehota, 2006b). Additionally, new methods of scanning are needed which take account of the increased complexity and uncertainty in contemporary supply chains and which are based on multi-perspective frameworks (e.g. Neugarten, 2006).

Our results for RQs 1 and 2 suggest that practitioners are aware of the need to scan sustainable targets within an extended supply chain, and for such scanning to be undertaken at all levels from the society in which the organization operates, through its network and chain to the firm, its functions and people. We found evidence of scanning practice taking place at all these levels. Through our comparison of the targets monitored in practice to those found in the literature, we extend existing knowledge of environmental scanning in supply chains. Specifically, beginning at the highest level, we found that societal scanning targets were universally identified by our informants and were both numerous and diverse. This acknowledges the significance of societal issues and their *'important role in the overall sustainability debate'* (Morana and Seuring, 2011, p. 681) as well as the increasing importance of the general environment in SSCM. The prevalent role of legal and regulatory issues at this level lends weight to the view that companies remain

'hesitant to commit to sustainability measures as long as they are not forced to do so by law' (Hassini *et al.*, 2012, p. 1).

The network level was found to be least well-developed and the cause of greatest confusion among practitioners. This may result from the more widespread use of a chain metaphor in supply chain contexts than that of a network (Håkansson and Persson, 2004). Furthermore, the focus group, whilst acknowledging the complexity of this level, highlighted its importance insofar as actors from outside a firm's industry can have significant influence on its sustainable behavior (Seitz, 2006); and can be important sources of benchmarking and the transfer of best practices. Other businesses (such as those offering IT and consultancy), which are able to support or inspire sustainable logistics practices, are also monitored in practice reflecting an open vision of scanning targets that extends *'beyond established categories'* (Neugarten, 2006, p. 903). This demonstrates that organizations not only take a longer view of the supply chain but also consider actors from outside the direct chain. We conclude that pooling and networking activities are valuable scanning targets.

Our evidence from the chain level underscores the importance of an extended view of supply to include actors far upstream and downstream. Its target list extends knowledge from the literature, and indicates how managers have (and must have) a broad view of SCM (Thomas *et al.*, 2011). Providers (including TPLs) play an important role, and are considered as potential leading agents of sustainable changes in supply chains. The scanning of chain partners illustrates a key aspect in SSC relationships i.e. the identification of actors who can force partners to adapt (Hassini *et al.*, 2012).

In line with the notion that SSCM cannot be achieved by firms in isolation (*"no business is an island!"* Håkansson and Snehota, 2006a and b), the firm level had fewer targets mentioned than any other, aside from people. This suggests that – in line with the literature – practice scans with a wider sweep rather than merely focusing on the individual firm. It is also noteworthy that companies' CSR policies emerged as a target here, despite not appearing in the literature. As suggested by the focus group members, this may be indicative of the growing importance of social issues in sustainable initiatives. At the function level, for which there is relatively scant attention in the literature, our results highlight a predominance of concerns relating to logistics. Although this is not particularly surprising, given the SSCM focus of the research and the nature of the respondents, the emerging issues concerning design, production, supply and sourcing seem to evidence the primary role of operations management in sustainable initiatives. The targets also confirm the need to embrace issues beyond the core of SCM (Linton *et al.*, 2007).

Finally, the results show the paramount importance of scanning at the people level and highlight *'the opportunity to use the individual as a unit of analysis'* (Carter and Easton, 2011, p. 57). Targets emerging from the research encompassed many stakeholders associated with the firm, and thereby extended the limited scope seen in the literature. Interestingly consumers are rarely mentioned in either forum: a result which is surprising since *'the end-consumer should be the focus of the entire supply chain'* (Svensson, 2002, p. 746). The emphasis placed by our respondents on the role of politicians and shareholders reinforces the significant role played by regulation and societal pressures.

To summarize for RQs 1 and 2, the comparison of targets from our fieldwork with those deriving from the literature yielded many similarities. However, we found some literature-derived targets that are not widely acknowledged in practice (typically relating to a single level e.g. the resources of the firm and the network structure), and some targets emerging from the fieldwork that do not appear in the literature. Listed in table 5, these tend to take a broader multi-level view of the environment or reflect a more prospective/innovative approach to scanning.

Table 5 – New empirically grounded categories of targets

Level	Broad vision of the environment future	Prospective / innovative future changes
<i>Societal</i>	Political trends (domestic & abroad), geo-political futures	
<i>Network</i>	Indirect actors' contribution e.g. IT services, consultancies Territory (e.g. country) projects forcing a review of collaborations, to adopt network principles	
<i>Chain</i>	Global supply chain trends/sustainable logistics initiatives	Identification of sustainable logistics activities that could threaten or enrich the supply chain
<i>Firm</i>	CSR policies of companies (notably concerning logistics activities)	
<i>Function</i>	Sustainable source location (provider selection, calls for tender) Sustainable logistics 'business cases' identification, impacts on sustainable performance Urban logistics (distribution plans, urban platforms, freight transport in cities)	Evolution of sustainable logistics and SCM concepts Packaging issues (new materials, re-use/recycling, eco-design) Reverse logistics issues -flow management/disassembly etc Techniques & tools for sustainable industrial production/logistics IT trends to support sustainable logistics
<i>People</i>	Politicians' interest/will to encourage sustainable logistics Shareholders' requirements for sustainable development/logistics Views of opinion leaders in SSCM	Methods for disseminating and adopting sustainable development/logistics ideas & practices by individuals (training, communication, social networks)

The results for RQ3 indicate that our view of scanning, encapsulated in the framework and which draws on the notion of boundaries, can help firms avoid taking too narrow an approach. Specifically, the results suggest that scanning scope can have depth through the adoption of a multi-level perspective, and breadth through the use of boundaries relating to the dimensions of activity, time and geography. Our empirical results, particularly those deriving from the focus group, reinforce the wisdom of this approach and suggest concrete end-points for scanning boundaries across these dimensions.

Finally, we acknowledge that the notions associated with scanning scope are not new. As early as 1967 Etzioni argued for a mixed scanning approach which provides firstly a procedure for the collection of information with a scope that is both broad and (selectively) deep, and secondly a strategy for the allocation of resources. Whilst the levels encapsulated in Etzioni's multi-level mixed-scanning approach relate to the extent of coverage (high level equates to broad scope and lower levels to depth of attention) and not to the theatre of coverage (e.g. society, network, firm etc), the significance of his work is the translation of scanning outputs into managerial action. The means by which firms may harness the power of the ES framework for SSCM, beyond it guiding the scanning process itself, are the subject of our continuing research.

5.2. Limitations and suggestions for future research

As the aim of this work was to explore practices and opinions from various parties in order to investigate heterogeneous scanning practices, we sought data from a range of industries, organizations and functional roles. Accordingly, our interview results derive from a cross section of

stakeholders. Whilst a study of only limited SSCM initiatives and/or in particular industries would not have enabled us to achieve our aim, further research should now adopt a more focused approach. With the framework as a supporting tool, future research should investigate ES for narrower fields of study represented by particular industries or activities such as urban logistics and distribution, and transport and logistics pooling. By contrast to the interviews, the focus group comprised experts from the same business activity, all of whom were members of a national club with interests in sustainable development and logistics/SCM. The emphasis on logistics in some of the focus group findings (e.g. the importance of scanning tools for implementing sustainable logistics activities in research question 2) may therefore incorporate some bias. Thus, whilst the focus group stage begins the process of complementing the more general approach of the interviews, its results are limited in scope. The use of an abductive approach, within a scientific realism paradigm (Spens and Kovacs, 2006), means that the results are context dependent. Further research, involving more focus groups in different business areas and industries, will lead to more generalizable findings.

Our systematic approach to the interviews was designed to eliminate bias. For data collection, questions were open and non-leading, and we consciously avoided mentioning possible targets or boundaries to respondents. In data analysis, the process for categorizing responses was piloted and all coding was double checked. Nevertheless there remains potential for bias. The relative neglect of the network level might, for instance, reflect a failing in the framework rather than a lack of awareness on the part of respondents. On related lines, focus group members were invited to comment on a pre-existing conceptual framework rather than to compare alternative scanning models or to develop ideas from scratch. This carries the risk that participants may have said what they felt we wanted to hear, thereby artificially promoting the value of the framework. Given the risk of bias associated with our two-stage qualitative methodology, future investigation using a different approach would help to triangulate our findings.

Whilst our study highlights the importance of the network level for anticipative and collaborative sustainable scanning activities, it finds it be an aspect which companies have difficulty in comprehending. Future research, that aims to improve their understanding of the importance, role and constituents of the network in which they operate, might facilitate greater uptake of scanning activities at this level.

The research led to the emergence of the concept of scanning boundaries related to time, geography and activity. These represent different dimensions of scope which our results suggest may have variable boundaries depending on the level in the framework. There is a need to further develop these findings in order to better understand the influence of the additional dimensions and, if appropriate, to incorporate them into a re-conceptualized framework.

Finally, whilst this issue did not directly form part of the current study, it is noteworthy that many of the interviewees pointed to the difficulties associated with linking sustainable scanning activities to practical sustainability actions, initiatives and implementations. Unless the outcome of scanning leads to managerial action relating to changes in supply chain design/re-design and practice, its value is limited. We therefore argue that future research must now explicitly address this relationship and aim to extend knowledge about ES for SSCM into practical guidance for firms in order to inform appropriate courses of action. In so-doing there is a need to be mindful of the balance between the (arguable) desirability of using a scanning scope that is both broad and deep against the resource requirements that this entails; the outcome of which inevitably constrains management action (Etzioni, 1967).

6. Conclusions; managerial and research implications

The purpose of this paper was to explore the empirical reality of environmental scanning practices in SSCM contexts, and - in particular - to test a conceptual framework designed to assist with this process (Fabbe-Costes *et al.*, 2011). The research has validated the six-level framework by finding support for its structure and by confirming that scanning targets are monitored in practice at each of its levels. The result is an integrated framework for environmental supply chain scanning that includes target categories at increasingly higher levels of granularity from the society in which a firm operates to the people who represent its various stakeholders. Each level focuses on a different unit of analysis and incorporates scanning target categories which, by suggesting entities to monitor, can help organizations manage their own ES practices. The results also capture the notion of scanning scope, and point towards scanning boundaries associated with the three dimensions of activity, time and geography. Taken together, the findings can be used by organizations to design multi-perspective scanning activities and, in particular, to prioritize their scanning efforts by determining the appropriate depth and breadth of scope. Thereafter, it remains for future work to combine this guidance with a commitment to pursue the sustainability agenda into managerial courses of action.

As highlighted in the literature review, there is a notable lack of attention paid to the issue of sustainable development in ES approaches and, in this respect, our research makes a number of contributions to knowledge. Firstly, the compilation of scanning target categories that emerged refers to environmental, social and economic topics, thereby signalling the need to adopt a triple-bottom-line perspective for SCM. Secondly, it offers a comprehensive multi-level framework by which the targets of, and scope for, environmental scanning in the supply chain are articulated. Furthermore, the list of target categories informs the development of sustainable scanning approaches in practice, and will assist with the management of environmental scanning activities. The findings from the fieldwork generate insights that contribute to increased understanding in the areas of sustainability, environmental scanning and supply chain management, thereby addressing research gaps highlighted in the literature review and providing a springboard for future interdisciplinary research in these areas. The results of our research combine a complex holistic approach to the scanning factors that could influence sustainable supply chain design with a straightforward structure and target lists that guide more focused scanning activities. In this way, we contribute to meeting the needs identified in the literature for multi-perspective, supply chain-wide approaches to SSCM.

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Appendix 1 – List of interview respondents

Sector	Company activity	Code	Company size ¹	Respondents
Industrial firms	Electronics	IF1	LSB	FAB Services & Procurement Manager
	Packaging	IF2	LSB	Supply Chain Director Food
	Aerospace	IF3	LSB	Electronics components buyer
	Security Equipments	IF4	LSB	Management Systems Director
	Cosmetics	IF5	LSB	Logistics Manager
	Food	IF6	SME	Logistics and Quality Manager
	Packaging	IF7	SME	Raw Materials Procurement Manager
	Food	IF8	SME	CEO
	Food	IF9	SME	CEO
	Food	IF10	LSB	Supply Chain Manager
	Building Equipment	IF11	LSB	Supply Chain Manager
	Food	IF12	LSB	Transport & Procurement Managers
Distribution firms	Spirits	DF1	SME	Logistics Manager
	Office equipment	DF2	LSB	Purchasing, Environment Manager
	Pet Food	DF3	LSB	Logistics coordinator
	Lighting	DF4	LSB	Flow manager
Logistics Service Players	Distribution Operator	LSP1	LSB	Transport and Environment Manager
	Distribution Operator	LSP2	LSB	CEO
	Third Party Logistics	LSP3	LSB	HSQ and Environment Manager
	Freight Forwarder	LSP4	LSB	Commercial Agent
	Freight Forwarder	LSP5	LSB	Logistics and Quality manager
	Integrator	LSP6	LSB	Marketing Manager
	Integrator	LSP7	LSB	Marketing and Communication Manager
	Third Party Logistics	LSP8	LSB	Sustainable Development Manager
	Freight Forwarder	LSP9	LSB	Logistics Manager
	Dock Work	LSP10	LSB	Dock Work Manager
	Wholesaler	LSP11	SME	Retired President
Infrastructure Companies	Port	IC1	LSB	Prospective Manager & Project Executive
	Logistics Real Estate	IC2	SME	Prospective Manager
	Logistics Real Estate	IC3	SME	Sustainable Development Manager
	National River Company	IC4	LSB	Service Development Manager
Institutional Entities ²	Ministry of Transport	IE1	Not Applicable	Economic Studies Manager
	Regional Environment Department	IE2	Not Applicable	Project Executive
	Regional Innovation Centre	IE3	Not Applicable	Councillor
	Regional Transport Observatory	IE4	Not Applicable	Coordinator
	Local Waste Management	IE5	Not Applicable	Development Manager & Finance Manager
	Town Council	IE6	Not Applicable	Transport Manager
	Cluster	IE7	Not Applicable	ES Project Executive
Other stakeholders	SME Professional Association	OS1	SME	Environment Manager
	Investment Monitoring Agency	OS2	SME	Manager
	Environmental Scanning Agency	OS3	SME	Manager
	SCSC Logistics	OS4	SME	Project Executive
	SCSC Logistics	OS5	LSB	Consultant
	Logistics Consultancy Firm	OS6	SME	Consultant
	Logistics Consultancy Firm	OS7	SME	Manager
Notes				
<ul style="list-style-type: none"> 1. SME: Small to Medium-sized Enterprises (up to 250 employees) / LSB: Large Size Business (with 250 or more employees) 2. In the case of institutional entities, organizational size was not considered to be relevant to this study because of the extent and diversity of their responsibilities and / or territorial reach. 				

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Appendix 2 – Participants in the focus group

Organization	Participant's position
French Ministry of Transport and sustainable development	Representative for sustainable logistics
International retail group with every grocery retail format (hyper markets, supermarkets, urban city stores, convenience store) and with non-food e-commerce.	In charge of transverse transport projects in the group
Industrial company world leader in small household equipment	Group logistics manager
National branch of a worldwide TPL operating international express, global freight forwarding, contract logistics and mail services	Marketing and commercial director of the contract logistics branch
International retail group with multi-channel distribution (hypermarkets, supermarkets, e-commerce)	National supply chain manager
French branch of the largest leading provider of pallet, container and crate pooling services for supply chains.	Country General Manager
Integrated TPL of a worldwide fast-food company	Distribution Manager France
Leading Brewery company, with worldwide distribution	Logistics director
Consultancy company specialized in Logistics, SCM and sustainable development	Consultant responsible for running the Demeter Group.