Which is the relationship between the product's environmental criteria and the product demand? Evidence from the French food sector

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Abstract

The purpose of this paper is to identify which environmental criteria can influence the product demand in a context of business-to-business. These criteria can be related to the product's environmental characteristics, to the organization strategies or green practices developed by the firms and to the supplier selection process.

Building the conceptual framework from the literature review, a set of environmental criteria were extracted, selected and validated. These criteria were used as a basis for the definition of a questionnaire survey that was sent to 5820 professionals from the food industry in France. The analysis of the 248 complete answers shows that the environmental characteristics of the product can influence product's demand. The most influential attribute to improve the product's environmental quality that increases the product's demand is the introduction of organic labelled raw materials. Besides, the practices that influence mostly the product demand are related to the geographical proximity with the stakeholders. Moreover, the results show that the most important selection criterion when choosing a supplier is the importance given to the quality and environmental performance of components offered. Hence, we show that in the French food market, as opposite to what is usually assumed in many research works, the carbon emissions yield during the production process and transportation process have still no significant impact on products' demand. Lastly, in this work, we quantify the demand increase that company can achieve when enhancing the environmental quality of its products. We show that the impact of the enhancement of those criteria on the demand can have different aspects. 55.6% of respondents advocate for a demand increase and most of them (33.6%) estimate this increase between 5 and 10% of the initial demand. Finally, some respondents (4.8%) indicate that the enhancement of environmental quality does not necessarily increase the demand. However, without efforts to enhance the environmental quality of their products, the demand can decrease.

These findings allowed concluding that the business-customers are becoming more and more exigent by privileging organic labelled and local products and making that the companies analyse the geographical proximity with the stakeholders as a key factor during the selection process. We provide companies managers in food industry with better understanding about the environmental criteria that increase the products demand helping them to target the right decisions and to be efficient in their process of environmental quality enhancement. We also assess and try to quantify and give an estimation about the demand evolution regarding the enhancement of product's environmental quality. Our findings are also helpful for Operational Research community.

Keywords: Environmental attributes; product's environmental quality; Greenness' product; Product environmental criteria; Green practices; Green supplier selection; Supply chain management; green demand driving.

1. Introduction

Nowadays, firms offer more products with high environmental quality by improving the environmental performance of their products (Mantovani *et al,.* 2016). However, the concept of product's environmental quality is very broad and covers very different aspects, which generates confusion about the concept and does not give clear directions to companies willing to offer products with a high environmental quality (Cai, Xie, & Aguilar, 2017; Elhajjar & Dekhili, 2015). Clarifying this concept and studying the environmental criteria related to a product can prevent the company and consumers from misinterpreting the "technical" environmental performance of a product that can be associated with its consumption and that may have an impact on the product's demand.

The main research objective of this work is to identify which environmental criteria improve the product's environmental quality and to analyse how those criteria affect the product demand in a context business-to-business.

Several terms found in the literature can refer to "*product's environmental quality*". These terms refer more generally to the environmental attributes of the product (Nouira, 2013a). These attributes are divided according to consumer perception by (Deltas & Ramirez, 2004) in vertical and horizontal. The "vertical" attributes are related to decisions that influence the technical characteristics of the product (such as design decisions that influence the environmental impact through the product lifecycle) and the "horizontal" attributes, which are related to decisions that influence the environmental image of the product (Gupta & Palsule-Desai, 2011); (Nouira, 2013a),(Brécard, 2014);(Mantovani & Vergari, 2017). For instance, the selection of manufacturing processes (clean or dirty technologies) influences the level of carbon emission and energy consumption during production. Many industrials start labeling their products with carbon footprint (timberland from textile and shoes sector, Innocent juice from food industry sector). Some distributors present the number of kilometers travelled by their products. Such environmental indicators affect the customers' perception of the product in terms of environmental impact, which we call here environmental image of the product.

Nonetheless, different definitions of these environmental attributes can be found in the literature dealing with concepts such as eco-efficient product, eco-friendly product, sustainable product, and green product's issues.

- The concept of "*eco-efficiency"* was first proposed by the World Business Council for Sustainable Development in 1992, at the Rio Conference, as a contribution of the businesses to sustainable development while both improving environmental and financial performances (Heemskerk et al., 2002)
- *"Sustainable products"* can bring environmental, social and economic benefits. This concept does not refer exclusively to environmental impacts.
- The term "*green*" or "*eco-friendly*" refers commonly to products or services that are less harmful to the environment than other similar products or services (Colins, 2019)

These definitions highlight the importance of the environmental assessment through the product lifecycle and underline the importance of a real environmental approach. If the term eco-efficiency suggests that eco-efficient products are also less expensive to produce, eco-friendly products may be more expansive to produce, suggesting a potential dilemma for the producers to favour environmental or financial efficiency. This paper will focus mainly on the reduction of environmental impacts of products, whatever the financial aspects of this reduction.

The literature review identified different tools to assess the product's greenness, while the most common is the Products Life Cycle Analysis (PLCA). The European Commission proposed in 2012 to build the "Single Market for Green Products" to provide better information on the environmental performance of products. It proposes an eco-label that defines green products as those that use resources more efficiently and cause fewer environmental damage to similar products in the same category, through their lifecycle, from raw material extraction, production, distribution, use, to the end of their useful life (including reuse, recycling and recovery). However, the term 'Green products' may sometimes be used in any product category, regardless of being eco-labelled or marketed as green. (European Commission, 2012). For example, green products may be more recyclable, longer lasting, easier to fix or providing more information (European Commission, 2016). The European

Commission proposed the Product environmental footprint (PEF) as a multi-criteria measure of the environmental performance of a product or service throughout its lifecycle. Its objective is to reduce the environmental impacts of products considering supply chain activities based on the Life-cycle assessment approach. Nevertheless, the European Commission recognises that "there is no widely accepted scientific definition of what a green product and a green organisation actually are" (European Commission, 2013).

Numerous standards are proposed for assessing the environmental performance of products. Those standards can be obtained from a number of sources: (i) models (such as internal and external organisational models), (ii) product standards (including government legislation and voluntary practices such as green strategies and green practices), (iii) industry guidelines (corporate goals), and (iv) environmental sustainability requirements (such as eco-labels). Similarly, industries integrate environmental issues into their strategic decisions (Handfield, 2002). Not only because they must follow governmental legislation, but also because, end-users are becoming more aware and have been attracted by green industries offering eco-responsible products (Ghadimi et al., 2016).

In this context, the business customers, stakeholders, and end-consumers can act as drivers of environmental performance: (1) large business customers encourage suppliers to improve their environmental performance by selecting suppliers on the basis of green criteria. They also act as drivers by promoting environmentally friendly practices (Ghadimi et al., 2016). (2) Stakeholders realize that green purchasing could positively affect cost, operational and corporate performance along environmental dimensions (Handfield, 2002). (3) End-consumers demand green products and components, favouring companies that offer them (Ghadimi et al., 2016).

Many researchers tried to assess the influence of product environmental quality on the demand, and consequently, on their supply chain decisions, such as (Dong, Shen, Chow, Yang, & Ng, 2016; Du, Tang, & Song, 2016; Jiang & Chen, 2016; Liu, Anderson, & Cruz, 2012; Nouira, 2013a; Nouira, Hammami, Frein, & Temponi, 2016; Xiong, Yang, & Li, 2016; Xu, He, Xu, & Zhang, 2017; Yalabik & Fairchild, 2011; Yenipazarli, 2016; Zheng, Liao, & Yang, 2016). However, most of these studies focused on B-to-C transactions based on end-customer perception (Castellano, Gallo, Grassi, & Santillo, 2019; Dagiliūtė, Liobikienė, & Minelgaitė, 2018; Friedrich, 2018; Halati & He, 2018; Portnov et al., 2018; Tan, Johnstone, & Yang, 2016; Wen, Zhou, & Zhang, 2018; D. Yang, Lu, Zhu, & Su, 2015; Lu Zhang, Li, Cao, & Huang, 2018). However, few papers focus on B-to-B context based on large customer and stakeholders' criteria selection (Krysto & Gaustad, 2018; Li, Ye, Sheu, & Yang, 2018; Saberi, Cruz, Sarkis, & Nagurney, 2018; Wang, Wang, Zhang, & Zhao, 2018; Yu, Cruz, & Michelle, 2018; Linghong Zhang, Zhou, Liu, & Lu, 2019). This can be explained by the fact that firms are reluctant to share information, which makes data collection difficult.

Besides, both practitioners and researchers consider the existence of a correlation between the product demand and its environmental quality (see for example (Garg, 2015)). Regarding the existing works linked to the product demand, they attempt to model demand as an endogenous function depending on the product's environmental quality. They consider different criteria for describing environmental quality and most of them stress the need for conceptual works that evaluate the relation between the product's environmental quality and its demand, to understand which environmental criteria are really impacting the customer sensitivity and, consequently, on the product demand. However, none of the existing papers gives a clear idea of the environmental criteria that actually affect the product's demand in a context B-to-B.

This is reflected in the fact that various industrial sectors are considering different environmental criteria to show the environmental quality of their products. Indeed, several companies use eco-labels, some consider the carbon footprint as an environmental criterion, and others describe their social or environmental actions on the packaging of their products trying to attract customers sensitive to sustainability issues (D'Souza, Taghian, & Lamb, 2006; Brécard, 2014). Obviously, this non-uniformity on environmental criteria can derive from a misunderstanding on the environmental criteria that really influence the customers and consequently the product demand (Cai et al., 2017). This is why, it is necessary to understand which environmental criteria influence the product demand in a context business-to-business for industrials and managers.

With this scope in mind, the aim of this paper is to identify the environmental criteria that improve the product's environmental quality and to analyse the environmental criteria for which the customers are more sensitive and how those criteria influence the product demand in a business-to-business context. The motivation of this work is to help companies to understand better customers' expectations and so to be more efficient in their process and decisions for the improvement of product's environmental quality. Our second contribution is to provide insights to improve the eco-responsible product demand forecasting. We believe that such results can be helpful for both companies and OR communities for the future works. It is assumed that the environmental criteria differ from one industrial sector to another; therefore, this study will focus on the French food sector.

This paper is organized as follows. Section 2 provides a literature review to formulate the research hypotheses and describe the conceptual model proposed. Section 3 explains the methodology that describes data collection and assessment, including the double coding analysis, and an on-line survey construction. The data assessment is then presented explaining the measures and the method used to conduct the on-line survey that was proposed to 5820 managers from the French food industry, Section 4 presents the main survey results, showing the statistical analysis and test relationships between the variables. Section 5 discusses the results and validates the assumptions and hypotheses, and the research limitation. Finally, the conclusion presents the implications of this research.

2. Literature Review and hypotheses

Literature review methodological approach

A literature review was first conducted to identify the environmental criteria that may define the environmental quality of a product. The Scopus database was used to identify and quantify the published articles, considering that Scopus shows a broad view of global and interdisciplinary scientific work on a specific research topic. Databases from major publishers and library services, such as Science direct, Emerald and Springer were then selected to compare and complete the list of articles compared to the results obtained from Scopus and Web of science.

The search terms, associated with Boolean operators were defined within keywords equation, to focus the research topic (including alternative words and abbreviations).

The first selection included conference proceedings and grey literature (i.e. technical reports and work in progress). Then, a second round of keyword inclusion was conducted. Finally, a third round was performed to select only those documents that: (i) provide a detailed list or mention environmental characteristics and attributes of products, and (ii) explain green practices and green strategies to improve the product's environmental quality. Table 1 shows the main inclusion criteria considered.

Table 1. Inclusion criteria

	First round	**Second round**	**Third round**
Keywords	Green Supply Chain, Environment, Eco-product, Supply Chain, Purchase decisions	Green product, eco-responsible product, sustainable product, eco-efficiency product.	Product's environmental quality, product's environmental attributes
Document type	Paper, book chapter, conference paper, article in press	Paper, book chapter, conference paper, article in press	Paper, book chapter, conference paper, article in press, technical reports
Time interval	2007 − 2017	2007 − 2017	1987 − 2017

Language	English	English	English

Different criteria that influence the environmental quality of a product were extracted from the literature review. The researches on titles and abstracts have highlighted 415 papers that explain the product environmental quality. 252 papers study green practices and green strategies to obtain a product environmental quality, 18 explain the characteristics of environmental quality that a product must have; 86 explain the perception that consumers have of a product's environmental quality. Only two papers link the three concepts (Brécard, 2014; Dangelico and Pontrandolfo, 2010). Then based on full text and snowballing, and following a discussion among the researchers, 75 papers were finally selected according to their content. Figure 1 shows the flowchart of literature review and the screening process.

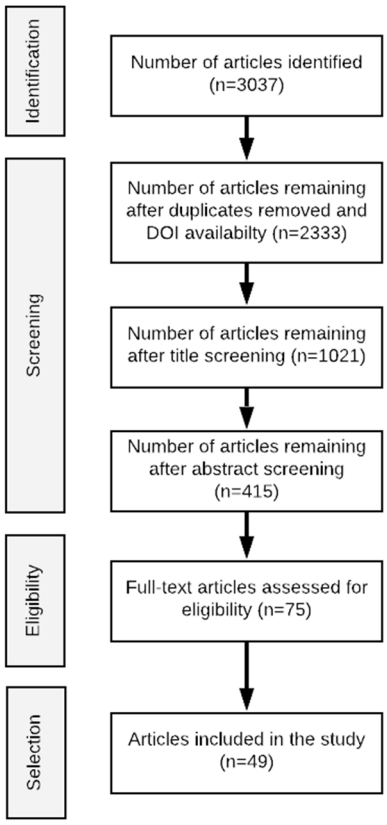

Figure 1. Flowchart of literature review and the screening process.

Proposition of a typology of environmental quality criteria for a product

From this papers' selection, about 300 potential environmental criteria were found(Palacios-Argüello, Girard, Gondran, Gonzalez-Feliu, & Laforest, 2018). To organise these 300 criteria, we proposed to classify them. To define a general typology for structuring these different environmental quality criteria, the meta-narrative analyses were used (Gonzalez-Feliu, 2011, 2013; Greenhalgh, Russell, & Swinglehurst, 2005). A meta-narrative comprises "a shared set of concepts, theories and preferred methods" and "is sited within a particular scientific discipline and should be regarded not as the unified voice of a community of scholars but as the unfolding of what they are currently discussing about" (Greenhalgh et al., 2005). This means that meta-narrative analyses are related not to words but to concepts. Indeed, researchers and scholars from similar research communities can explain and describe some product's environmental criteria in different words referring to the same concept.

The typology was first established, classifying the criteria into three groups. The first group represents the criteria that are related to the "intrinsic characteristics" of the product. The second group is related to the supply chain practices that affect the environmental quality of a product.

Finally, the third group represents the criteria related to the selection of suppliers according to their environmental performance. A first classification of the criteria within this typology was made (see Figure 2). Then, a second researcher carried out a double-coding analysis.

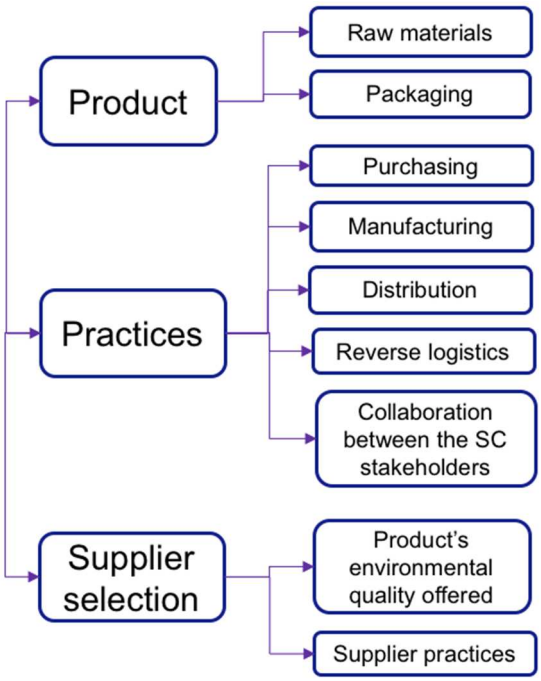

Figure 2. Typology of criteria related to the product's environmental criteria

Double coding analysis

The double-coding can be divided into two steps: intra-coding and inter-coding (Miles & Huberman, 1984). The first one refers to ensure the consistency of the coder own work by reviewing his/her results regularly. Within the second inter-coding step, the results obtained by the two coders were compared to relate them and conclude a common resolution of each contribution. The disagreements and dissonance results allow researchers to reach a common vision of data categorization. This method not only helps to have a clear idea on the research issue, but also provides a good reliability on the criteria selected.

The main categories, proposed by the first coder and used by the second coder, are presented in appendix A, B and C. (first level of typology in appendix A and B) are the same, however, the subcategories (such as O1.1) were different. The results show a similar proportion for each category and its range with slight differences. Qualitatively, each coder developed its own classification in terms of subcategories, the first coder established 18 subcategories and the second coder established 20 subcategories. However, there are similarities in some cases, but with a different formulation, other subcategories were either split or grouped.

Regarding the double-coding results, the product's characteristics grouped the same criteria for both coders. As for the purchasing category rate, both coders positioned almost the same percentage (22% versus 27%) of criteria. In the manufacturing category, 11% versus 12% of criteria were classified. In the distribution category, 18% versus 21%. In reverse logistics category, 11% versus 12%. In the collaboration category, 27% versus 28%. Finally, it can be concluding that the overall results are very similar.

The following section presents the proposed typology of environmental criteria.

2.1. Definition of the intrinsic environmental characteristic of the products

This subsection aims to present the environmental criteria, that are detailed in Appendix A, that are related to the product's characteristics and environmental attributes that define the "environmental quality" of a product found in the literature.

(Nouira, 2013a) affirms that the product's environmental quality (PEQ) is linked to the rate of green components used. Besides, (Brécard, 2014) suggests that the product's environmental quality can differ depending on the stringency of eco-labelling standards. (Deltas & Ramirez, 2004) suggest that product's environmental criteria could represent the energy efficiency of the product and the degree to which the product can be recycled. This last notion of product recyclability is defined as product's environmental criterion by (Alwitt & Pitts, 1996);(Yenipazarli & Vakharia, 2017);(Giancarlo, 2006). Similarly, (Chen, 1994) defined as products environmental quality criteria: product durability, reparability, and material usage. Chen (2001) states as important product's environmental criteria: recycled content, energy- and fuel-efficiency, and non-toxicity.

(Soylu & Dumville, 2011) define product's environmental quality (PEQ) criteria that include attributes such as: (1) be free from toxic substances, (2) be biodegradable, (3) be recyclable, (4) be upgradeable, (5) have low energy conversion.

(Villanueva-Ponce et al., 2015) define the rate of disassembly, recycling, and green raw materials as product's environmental criteria. (D'Souza et al., 2006) state that an important product's environmental criterion that is perceived by the customer is the product's environmental label. These labels can be: environment-friendly, ozone-friendly, earth-friendly, degradable, recycled, recyclable, renewable, reusable and biodegradable.

Besides, (Dangelico & Pontrandolfo, 2010) affirm that the product's environmental criteria are related to products that conserve energy and/or resources and reduce or eliminate the use of toxic agents, pollution, and waste.

(Y. Yang, Lu, Guo, & Yamamoto, 2003) define a product with environmental quality as the product that offers:

1. Excellent environmental performance: The product can minimize the impact on the environment.
2. Full use of material resources: It reduces the quantity of material, especially rare or expensive material and poisonous or harmful material.
3. Efficient use of energy resources: It maximizes the use of resources and reduces the consumption of the energy resources in its life cycle.

According to (Lindgreen, Antioco, Harness, & Van Der Sloot, 2009), the key environmental characteristic of the products are: reducing energy consumption, packaging materials, hazardous substances and product weight, and increasing recycling levels and safety measures during product disposal.
Therefore, we proposed three subcategories to position the various products' environmental intrinsic characteristics: its raw materials characteristics, the characteristics of the products components and design (eco-design, energy efficient design and labelling) and the characteristics of its packaging (more environmentally friendly packaging, availability of environmental information on the packaging) (see Appendix A).

2.2. Organisational strategies and green practices

This subsection describes the environmental criteria related to green practices and organisation strategies that can improve the environmental quality of a product that have been found in the literature.

(Gupta & Palsule-Desai, 2011) (Mantovani & Vergari, 2017) define practices that improve the product's environmental quality as the practices that aims to the reduction of emissions and of the amount of waste generated or disposed, and to increase the energy efficiency. Besides, (Nouira, 2013a) states that product's environmental quality is linked to carbon emissions from transport activities; as well as to the emission rates generated by selected production process. Similarly, (Feng et al., 2016) consider as environmental attributes the carbon emissions and energy efficiency associated with the manufacture of the product.

The product's environmental quality can differ according to the phase of the product's lifecycle (Brécard, 2014). The product's environmental quality (PEQ) is largely fixed at the design stage (Duck, 2004) but a significant reduction in pollutants may be obtained during the product's manufacturing or during the use of the product (Deltas & Ramirez, 2004).

Environmental policies during product development and purchasing practices may improve product's environmental quality (Chen, 1994). These environmental policies can be defined as best combination of material usage, choice of material, waste emission and cost-effectiveness without compromising product quality. This is confronted by Ottman et al. (2006), which states that the greenness of a product depends largely on the characteristics of its manufacturing process. These characteristics can be the prevention of air, water or noise pollution through production and distribution processes (Y. Yang et al., 2003).

Likewise, some manufacturing and transport decisions, such as the selection of clean technologies, can have environmental impacts (e.g. reduced carbon emission and energy consumption during production) and potentially impact the company's environmental image (Nouira, Frein, & Hadj-Alouane, 2014).

In a Business-to-business (b-to-b) context, "greening" the supply chain includes the dissemination of the best environmental practices. Such practices can be intra- and inter-firms. Some of these are: environmental technology transfer, cooperation and partnership practices, and environmental performance measurement. Likewise, another internal practice adopted by organizational buyers is to privilege formal partnerships and collaboration agreements between stakeholders in the supply chain (Fraj, Martínez, & Matute, 2013). Similarly, the integration of such environmental practices should be communicated through the use of marketing (Sharma, Iyer, Mehrotra, & Krishnan, 2010)**;**(Fraj et al., 2013)***;*** (Garg, 2015) **.**

(Fraj et al., 2013) define Green marketing strategy (GMS) as an approach that incorporates: (1) practices that b-to-b customers carry out on products and process to satisfy the environmental demands of their customers; (2) Decisions of b-to-b customers to communicate *"an environmentally responsible behaviour" to stakeholders.* Consequently, green marketing is a vast subject that includes information on a wide range of activities such as product design, manufacturing process, service delivery processes, packaging, recycling, among others (Vaccaro, 2009).
Therefore, we proposed five subcategories, detailed in Appendix B, to position the various green practices and organizational strategies that may affect the product's environmental quality: purchasing practices, manufacturing practices, distribution practices, reverse logistics and stakeholders collaboration practices.
Concerning the suppliers' selection practices, they can be classified in selection's criteria about the product environmental quality or about the practices of the suppliers.

2.3. Supplier selection based on environmental criteria influencing the product demand

This subsection aims to describe the environmental criteria related to the suppliers' selection processes that are considered in the literature (see Appendix C). This is an important issue because sometimes the customer cannot be aware of the product's environmental quality because suppliers did not communicate their strategies and green practices. This is as (Lacoste, 2012) called "missed opportunity" to gain a competitive advantage and, consequently increase the product demand.

Regarding the final customer behaviour (in a B–to-C context), there is a positive influence of green marketing strategies on the customers purchasing patterns (Garg, 2015). Their perception of the product's environmental quality is influenced by the use of eco-labelling, recyclable packaging, and products' claims such as "eco-friendly", "recyclable", "biodegradable" and "ozone-friendly".

However, the business customers (in a B-to-B context), are concerned about the real product's environmental quality, which can be assessed through a standard reference model developed by each company for the selection of its suppliers (Sharma et al., 2010). They also consider the communication of green practices and strategies related to environmental certifications, eco-labelling or eco-design. (Fraj et al., 2013) explain that large companies could gain credibility by emphasizing their environmental activities to their business customers. Likewise, business customers could be more reliable by emphasizing environmentally-friendly policies in their transactions with other companies, as they put pressure on their suppliers to be more environmentally-conscious.

Indeed, purchasing managers can request their suppliers or subcontractors to be certified (e.g. ISO 14001) because they are responsible not only for the procurement of raw materials but also their disposal at the end-life of the product, with the extended producer responsibility (Handfield, 2002). Sarkis (2003) states that a *green product* depends on its supplier's components. This means that a supplier can be considered as a green supplier if it offers green components and/or has environmental certifications such as ISO14001. This is reflected in the requirement made by some commercial customer to their suppliers to have the environmental management system certification (Fraj et al., 2013).

Likewise, (Villanueva-Ponce et al., 2015) define as product's environmental criteria related to supplier selection: green product design practices, environmental regulations certification and environmental audit process, the supplier's green image, the supplier's environmental competencies.

Besides, many environmental criteria can be used to select suppliers. These are proportional to the environmental demand of final consumers (Jabbour & Jabbour, 2009), and most of the criteria are used to estimate environmental impacts (Igarashi, De Boer, & Fet, 2013). However, the classification of the criteria varies among studies.

Indeed, the product's environmental criteria in a B-to-B context can be perceived in different ways. (i) How customers perceive the products' environmental quality must be distinguished from how the manager assess the environmental attributes (Garg, 2015). (Fraj et al., 2013) affirm that the background of the decision makers is reflected in their choices and sometimes determines the perception of environmental quality. (ii) The supply chain position of the customer and the power balance between buyers and suppliers can influence the environmental criteria for the supplier selection (Igarashi et al., 2013).

Furthermore, considering environmental criteria for supplier evaluation might not increase the products demand but rather select the right suppliers. It can eventually be a driver for widening a company's profit margin, reduce purchasing cost, improve competitiveness and enhance end-user satisfaction among others (Ghadimi et al., 2016).

Research gap analysis

After performing the literature review, to identify the environmental criteria that improve the product's environmental quality and to analyse how those criteria affect the product demand in a context business-to-business, the following hypotheses are proposed:

Hypothesis 1. The intrinsic environmental characteristics of the product improve its environmental quality and can affect the product demand (remains stable, decreases or increases).

Hypothesis 2. The organisational strategies and green practices within the supply chain can improve the product's environmental quality and affect the product demand (remains stable, decrease or increases).

Hypothesis 3. The environmental criteria used in supplier's selection process improve the product's environmental quality and can affect the the product demand (remains stable, decreases or increases).

2.4. Research objectives and conceptual model

Considering the research gaps analysis previous presented, the main research objective of this work is to identify which environmental criteria improve the product's environmental quality and to analyse how those criteria affect the product demand. Three other research objectives are proposed as follows:

- To extract, select and validate the environmental criteria that improve the product's environmental quality.
- To validate which environmental criteria extracted and selected affect the products demand.
- To analyse the type of influence on the product demand (remains stable, decreases or increases).

Besides, regarding the analysis of the literature review considered, Figure 3 presents an overview of the proposed constructs and their relationships.

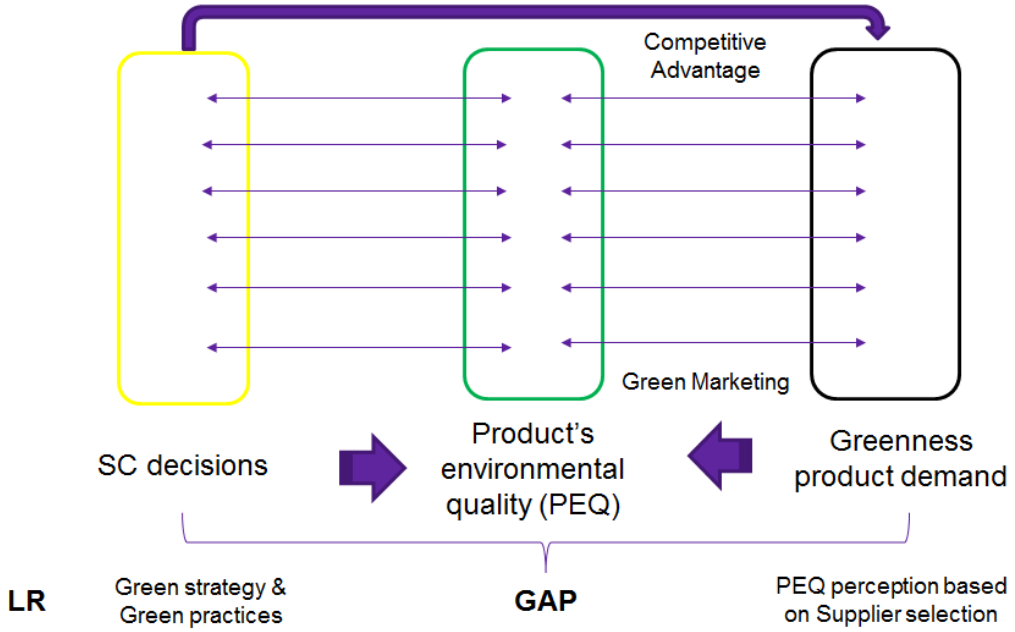

Figure 3. Conceptual approach proposed

In a Business to Business (BtoB) context, on the one hand, there are green strategies and practices that aim to improve the environmental quality performance of the product. On the other hand, the product's environmental quality (PEQ) is perceived by business customers when they select green supplier, influenced by the supplier's green marketing strategy and based on its own competitive advantage.

3. Methodology

Figure 4 shows how the criteria are extracted from the literature review and validated through two methods: (i) double coding analysis performed by two different coders, presented in the previous section, and (ii) on-line survey of 248 companies in the food industry in France.

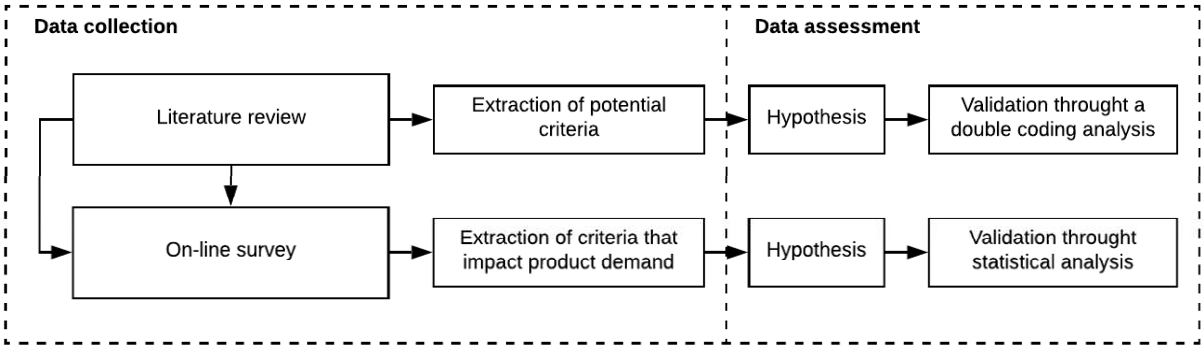

Figure 4. Methodology for extracting and validating product environmental criteria.

3.1. Data collection

The application to the French food-processing sector

As mentioned, the aim of this paper was to identify the environmental performance attributes of a product and its supply chain that can influence the demand and to endeavour to quantify this influence. However, it quickly appeared that a focus had to be done on a specific sector and market as the answer to this research question can differ according to the industrial sector under study. The food-processing sector is the first industrial sector in France in terms of turnover (172 billion € in 2017) and the second industrial sector in terms of job (420 000 jobs in France in 2017) and represents about 17 647 companies in 2017 (ANIA, 2018). It also exerts unsustainable pressures on terrestrial and aquatic biodiversity because of its contributions to climate change, pollutions and habitat loss ((Wolff et al., 2017), (Crenna et al., 2019). Because of its high-level stakes both in terms of economic, social and environmental issues, it was decided to focus on the food-processing sector for the quantitative survey of this study.

On-line Survey

The survey questionnaire was based on environmental criteria extracted from the literature review and validated through a set of semi-structured interviews. The semi-structured interviews are based on open-end questions to stakeholders that belong to the food industry in France. The sample was designed following the snowball sampling method (Bryman & Bell, 2015). To conduct semi-structured interviews, two documents were created: an interview protocol, and an interview guide. The protocol was used to explain the interview development and the interview guide was developed following the IDPA model (in French : Identification, Diagnostic, Prospective, Amélioration) developed by (Ollagnon, 1987). In total five semi-structured interviews were conducted. They lasted between 30 and 90 minutes and were conducted in French.

Regarding the qualitative data analysis, to verify the research quality approach (Bryman & Bell, 2015), additional discussions were held with researchers to ensure that a sufficient number of stakeholders were interviewed and that the perspective would be to extract environmental criteria perceived by stakeholders as criteria that impact product demand. The results of the interview analysis were discussed by the authors. To increase trust-worthiness, secondary data were read prior to the meetings. This was done to reduce the possible misunderstanding between interviewers and interviewees.

The final survey questionnaire is composed of four main sections. The first section covers the objective of the research, the description of the survey and the academic purpose from the data collected. It also includes questions about the characteristics of the company, the position of the company in the supply chain, the experience of the respondent, the current area and job title. Depending on the area where the respondent works, three other sections are proposed. The second section focuses on questions about the product's environmental criteria regarding the raw material and packaging characteristics. The third section focuses on organizational strategies and green practices that the firm performed to increase the product's environmental quality of the product. The

fourth section focuses on the environmental criteria that the company considers in the supplier selection process. Finally, at the end of the section, the quantification of the impact of this criterion on product demand is requested.

The survey was administrated through a self-completed questionnaire by internet on the Limesurvey platform. The survey was conducted from April to August, 2018. First, a pilot survey was carried out among a few professionals to validate the understanding of the questions.

Regarding the sample, the respondents' database was obtained from three different sources: (i) 6150 e-mails of managers of agro-industrial companies in France, obtained through the company Kompass, which is a global online directory of companies. (ii) 850 emails of producers, transformers and distributors from the agro-industrial sector, obtained through the Auvergne-Rhône-Alpes Observatory. (iii) 450 e-mails of managers of agro-industrial companies in Bretagne Region, obtained through the Rennes Business School. The invitation to answer to the questionnaire was sent to 7450 professionals and after e-mails validation, the final size of the population obtained was 5820.

In total, 555 anonymous questionnaires were received, 307 questionnaires were excluded due to incomplete information, having 248 valid questionnaires. Following the sample size formula suggested by (Krejcie & Morgan, 1970); considering that the population size is 5820, a sample with 95% of confidence level should be 359 valid questionnaires; this means that the number of stakeholders surveyed was not sufficient. Nevertheless, the length of the survey (57 questions), as well as the answer time (between 19 and 90 minutes) should be taken into account. Besides, contrary to most studies that can be found in the literature, this study is placed in B-to-B and not B-to-C context. Therefore, this study is an original contribution to understand the influence of product's environmental quality on the product demand in the French food sector.

The composition of the sample of respondents is shown in Table 2. The majority of the respondents work in small and medium companies. However, 43% of the total companies surveyed are part of a group. Industry types were grouped according to their main activity based on the typology of the National Institute of Statistics and Economic Studies (Insee). Despite some biases due to sampling and clustering of industries, the distribution among the study industries is fairly representative. The profile of the respondents is over 90% of high qualified profiles, including executive officers and engineers. This fact is confirmed by the years of experience that respondents have in that job, the majority have over 6 years of experience in that job, and more than 50% of the respondents have over 10 years. Finally, each area involved is between 10% and 20% of the total answers, which means that each area is fairly representative in the study. This study includes the firm size, measured in terms of the number of employees, to serve as an exogenous control variable.

Table 2. Respondents' demographics

	N	%
Firm size		
Micro: 5 employees or less	13	5,2%
Small: Between 6 and 50 employees	111	44,8%
Medium: Between 51 and 250 employees	84	33,9%
Large: Over 250 employees	40	16,1%
Group		
Part of a group	107	43,1%
Industry type		
Fruit and vegetables industry	19	7,7%
Meat industry	43	17,3%
Fish industry	13	5,2%
Grain industry	16	6,5%
Dairy industry	29	11,7%
Beverage industry	10	4,0%

Pasta and bakery industry	34	13,7%
Animal feed industry	17	6,9%
Job position		
Executive officer	170	68,5%
Engineer	55	22,2%
Technician	20	8,1%
External consultant	3	1,2%
Experience		
Less than 2 years	19	7,7%
Between 2 and 5 years	41	16,5%
Between 6 and 10 years	42	16,9%
Over 10 years	143	57,7%
Area		
RSE - Quality	139	19,8%
Purchasing - Supplies	104	14,8%
Production	101	14,4%
Logistics	72	10,3%
Marketing - Distribution	100	14,2%
Communication / Marketing	84	12,0%
Direction - HR	102	14,5%

3.2. Data assessment

The data assessment and the statistical analysis are based on the 248 complete answers received.

Questionnaire

The questions in the three parts of the questionnaire on the demand's impact were created in reference to the environmental criteria of products characteristics, organizational strategies/practices, and suppliers' selection, which are mentioned in the literature review and presented in appendix A,B and C.

The questionnaire reproduced in Appendix D, was designed as a compromise between the information needed to validate the hypotheses presented above and the limited amount of time the target respondents had available. In total, the survey has 57 questions. The first twelve questions are mandatory and, according to the respondent's area of work, the other questions are asked. The type of survey question is described as following:

- 28 Multiple choice questions representing 49.1% of the survey.
- 3 Dichotomous questions (Yes/No) representing 5.3% of the survey.
- 11 Closed-ended questions using Likert scale based on semantic differential scale method, which represents the 19.3% of the survey.
- 15 Open-ended questions representing 26.3% of the survey (e.g. detailed comments and opinions on the development of the survey.

Data analysis: Common method variance

Chi-square test was used to test differences and links between variables. The p-value was used for testing statistical hypotheses; a small p-value (typically ≤ 0.05) indicates strong evidence against the null hypothesis (H0) and consequently the null hypothesis is rejected. A large p-value (> 0.05) indicates weak evidence against the null hypothesis, which means that the null hypothesis cannot be rejected. Then to measure an association between two variables, Cramer's V is used (Cramer, 1946). Table 3 shows the values, giving a value between 0 and +1 (inclusive).

Table 3. Cramer's V : Strength of the statistical association

Cramer's V	Nature of association
0,0 – 0,04	Lack of rapport
0,05 - 0,10	Very weak
0,10 - 0,20	Weak
0,20 - 0,40	Moderate
0,40 - 0,80	Strong
0, 80 – 1,0	Very strong

4. Results and Discussion

4.1. Potential environmental criteria validation with double coding analysis

This subsection presents the results of the potential environmental criteria extracted from the literature review and selected using double coding analysis.

The environmental criteria related to product characteristics and the environmental attributes that define the "environmental quality" of a product are as follows:

- *Raw materials:* this category includes the characteristics of raw materials that improve the product's environmental quality, such as environmentally certified raw materials, less polluting or non-polluting/toxic materials, among others.
- *Packaging:* this category includes the characteristics of the product packaging such as recyclable, biodegradable, reduced size and weight packaging, and environmental information on the product packaging, among others.

The environmental criteria related to supply chain practices are:

- *Purchasing:* this category includes criteria related to the location of the supplier, the environmental impact of purchased materials, the environmental practices performed by the supplier, green purchasing guideline, and environmental partnership or environmental cooperation agreements with suppliers.
- *Manufacturing:* this category includes criteria related to decision on location of manufacturing facilities and warehouse, as well as practices aiming to the energy efficiency and eco-efficiency during the manufacturing process.
- *Distribution:* this category includes criteria related to decision on location of distribution points, energy efficiency of distribution, eco-efficiency of distribution (related to the reduction of transportation emissions and pollution control).
- *Reverse logistics:* this category includes criteria related to the formal policy on reverse logistics of the product and packaging.
- *Collaboration between supply chain stakeholders:* this category includes criteria related to customer management practices, efficiency of green network, and assessment of the product's environmental performance throughout the supply chain and the implementation of the environmental management system (EMS).

The environmental criteria related to supplier selection process with the aim of improving the product's environmental quality, are:

- Product's environmental quality offered by the supplier: This involves product labelling, environmental information about the product, raw materials origin.
- Supplier practices: It involves criteria related to supplier's internal practices such as eco-conception (e.g. innovation capacity), supply management, production and quality (e.g.

supplier's reputation), distribution (delivery conditions), collaborative practices and marketing strategies (green image).

This categorization of the criteria has been used as the basis for the design of the survey' questionnaire, which attempt to identify the relative weight of each type of criterion on the impact of product demand.

4.2. Validation of environmental criteria that impact the demand

4.2.1. On-line survey results: Descriptive statistic

This section shows the description of the quantitative survey results according to the three hypotheses presented above.

H1. *The environmental characteristics of the product improve the product's environmental quality and can affect the product's demand (remains stable, decrease or increases).*

Regarding the question about what happen if there is an improvement of the intrinsic environmental quality of the product, 55.6% of the respondent answered that there could be an increase of the product's demand, 0.9% a decrease of the demand, 24.8% a maintenance of the demand, 23.4% a change of customers, 21.5% no change in the product's demand. In fact, 26.2% considered more than one reason of those above presented.

Regarding those who answered that there could be an increase of the product's demand because of the improvement of the intrinsic environmental quality of the product, the magnitude of that increase is shown in Table 4.

Table 4. Magnitude of the increase of the demand according the product's environmental quality improvement

Magnitude of the increase	
Less than 5%	27.7%
Between 5 to 10%	33.6%
Between 10 to 25%	21.0%
Between 25 to 50%	4.2%
Between More than 50%	10.9%
Do not know or no answer	2.6%

The main cause identified for the decrease of the demand is because the increase in price. Those who answered that it could be a maintenance of the demand, 17% estimate that it is because customers have become less volatile, 28.3% because new customers replaced those who left, 5.7% for other reasons, and 49% do not know the reason for maintaining demand. Nevertheless, 62.3% of the respondents affirmed that they did not perceive a change in demand, but they would have lost orders if they done nothing, taking into account what it is called in the literature the "missed opportunity" to gain a competitive advantage (Lacoste, 2012).

Thus, it can be concluded that the first hypothesis (H1) can be validated by these results. Indeed, for more than half of the companies in the sample, the environmental characteristics of the product that improve the product's environmental quality increase the product's demand. Nearly to two thirds of the respondents reckon on the increase of more than 5% of the demand.

H2. *The organizational strategies and green practices improve the product's environmental quality and it can affect the product's demand (remains stable, decrease or increase).*

Figure 5 describes the practices that are already developed and have the most influence on the demand (0: no influence - 3: maximum influence).

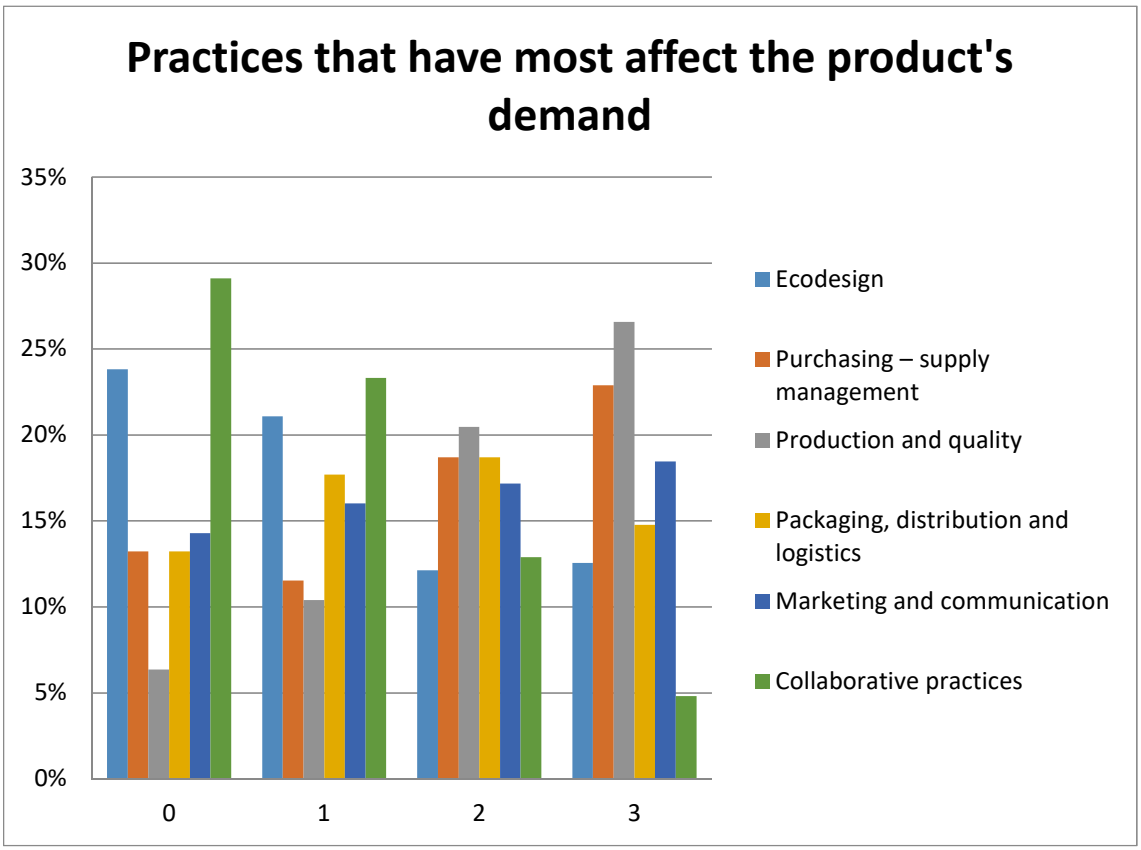

Figure 5. Practices that affect the product's demand (0: no influence - 3: maximum influence)

Production and quality practices appear to have the greatest influence on the product demand, followed by purchasing and supply management practices. In the third place, there are marketing and communication practices. These results confirm the importance addressed to manufacturing practices in the improvement of environmental quality of the product concluded by Deltas & Ramirez, (2005); Ottman et al. (2006); Nouira (2013); Feng et al., (2016). However, it is interesting to note that the point of view on these last practices is rather mitigated: the same number of respondents that think that there is no impact and those who think that there is a strong impact. Packaging, distribution and logistics practices are also mitigated. Finally, eco-design and collaborative practices are assessed as practices with least impact on product demand against to what was established by Dunk (2004), who affirmed that the product's environmental quality (PEQ) is largely fixed at the design stage.

However, the second hypothesis is not fully validated. In fact, only 23.8% of the respondents affirmed that the implementation of these practices actually increase demand positively. 27.7% do not believe that there is an increase in the product demand and the other 48.5% do not know.

Regarding those who answered that there could be an increase of the product's demand because of the implementation of these practices, the magnitude of that increase is shown in Table 5.

Table 5. Magnitude of the increase of the demand according the organizational strategies and green practices implemented.

Magnitude of the increase	
Less than 5%	31.3%
Between 5 to 10%	27.1%
Between 10 to 25%	14.6%
More than 25%	6.3%
Do not know or no answer	20.8%

H3. *The environmental criteria used on supplier selection process improve the product's environmental quality and it influences the product's demand (remains stable, decreases or increases).*

Figure 6 shows the results of the question about the product's environmental performance on the supplier's assessment, the importance allocated to the supplier's practices according to (0: no influence - 3: maximum influence).

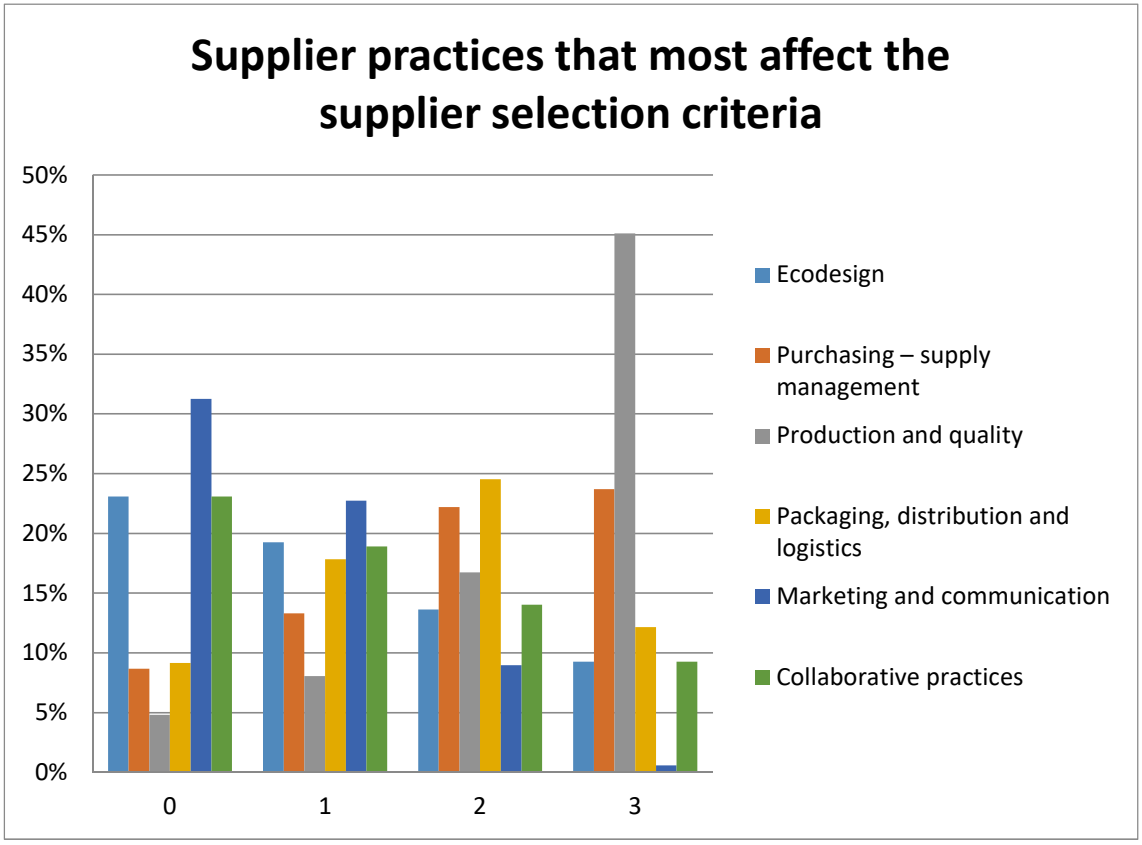

Figure 6. Supplier practices that are considered to assess the environmental performance of the supplier (0: no influence - 3: maximum influence):

To assess the environmental performance of their suppliers, the respondents stated that they focus mainly on their production and quality practices, followed by purchasing and supply management practices. To a lesser extent, they consider packaging, distribution and logistics practices. Collaborative practices and eco-design practices appear to have fewer influence on demand, while respondents claim that marketing and communication practices have the least impact on supplier selection.

As Figure 7 shows, when asking which criteria are most important when selecting a supplier, the first criterion that emerges is quality and technical specifications, slightly ahead of price and delivery conditions. The quality and environmental performance of components appear only in the background.

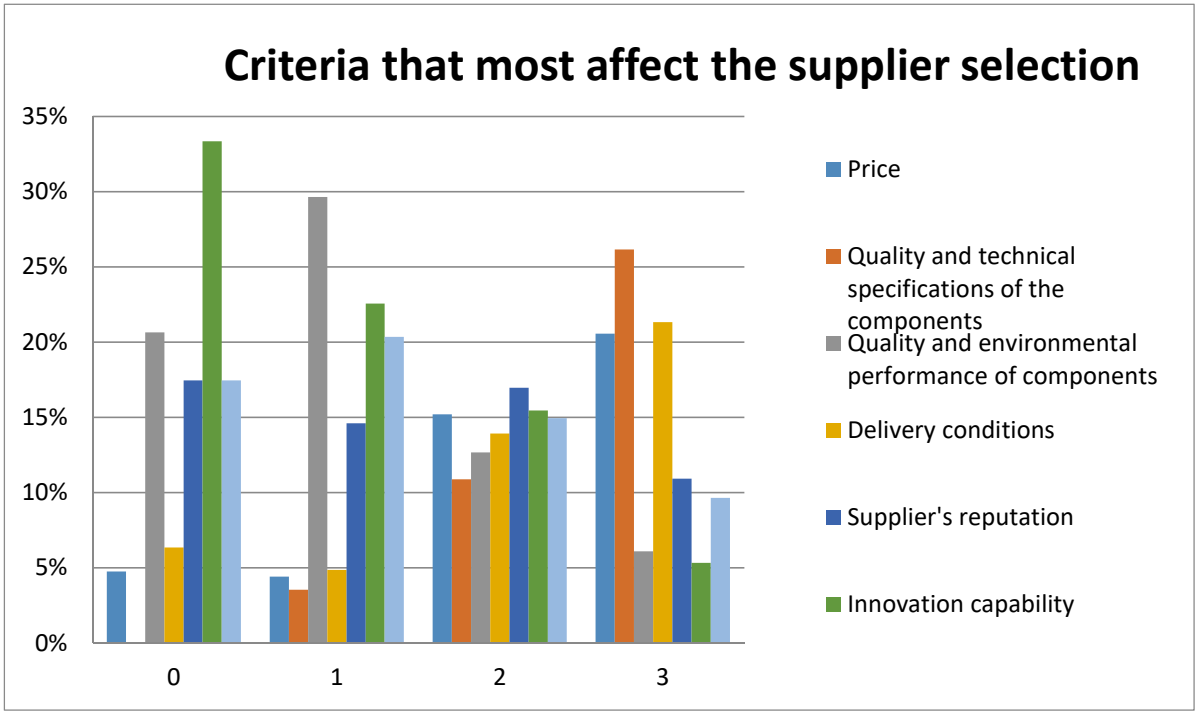

Figure 7. Criteria that most influence the supplier selection (0: no influence - 3: maximum influence):

Thus, it can be concluded that quality and environmental performance appear as a distinguishing factor, confirming that was established by Villanueva-Ponce et al., (2015) as one of the most important product's environmental criterion related to supplier selection. Moreover, only if the company already provides a product with good quality and specifications, at a competitive price and guarantees good delivery conditions.

However, almost 65% of the respondents would be willing to pay more to the supplier to improve the environmental quality of their products. 80% would be willing to pay until 5% more of the current price, 14% would be willing to pay until 15% more of the current price and, 6% would be willing to pay over 15% more of the current price. This means that considering environmental criteria for supplier evaluation might not always guaranties increase the products demand but rather select the right suppliers that can eventually be a driver for widening a company's profit margin, reduce purchasing cost, improve competitiveness and enhance end-user satisfaction among others as was affirmed by Ghadimi et al., (2016).

4.2.2. On-line survey results: Statistical test

This section shows the results of Chi-square, p-value and cramer-value test to identify the relationships between the variables. For the following analysis, only dependent variables were analysed, with a p-value < 0,05. Regarding the strength of the statistical link between the variables, only moderate and strong were considered.

H1. *Improving the product's environmental quality increases the product's demand.*

Table 6. Statistical test results regarding the H1

Var 1	Var 2	Khi-2	P-value	Cramer-value	Strength of the statistical link
QEP_D>	MP_Eq	12.7	0.00	0.2	Moderate

QEP_D>	MP_Eq (Yates)	11.3	0.00	0.2	Moderate
QEP_D>	MP_Bio	23.8	0.00	0.3	Moderate
QEP_D>	MP_Bio (Yates)	22.4	0.00	0.3	Moderate
QEP_D>	LabelPRO	38.4	0.00	0.4	Strong
QEP_D>	LabelPRO_Bio	5.9	0.02	0.3	Moderate
QEP_D>	LabelPRO_Aut	6.8	0.01	0.3	Moderate
QEP_D>	Y LabelPRO_Aut	5.2	0.02	0.3	Moderate

Table 6 shows that there is a strong statistical relationship between the increase of product demand (QEP_D>) and the fact of having a labelled product. 83.6% of the respondents who have products with label (LabelPRO) affirm that this increases the product demand. Besides, 87.5% of the respondents who have products with organic label (LabelPRO_Bio) affirm that this increases the product demand.

There are two moderate statistical relationships between the raw material characteristics and the fact of having an increase in the product demand. 86.2% of the respondents who have fair trade raw material (MP_Eq) affirm that this increases the product demand. 74% of those respondents who have organic raw materials (MP_Bio) affirm that this increases the demand.

Table 7. Statistical test results regarding the H1 focusing on the increase's amplitude of the product's demand

Var 1	Var 2	Khi-2	P-value	Cramer-value	Strength of the statistical link
QEP_D>AMP plus de 10%	MP_Bio	15.1	0.00	0.3	Moderate
QEP_D>AMP plus de 10%	MP_Bio (Yates)	13.6	0.00	0.3	Moderate

Table 7 shows that there is a moderate relationship between the increase over 10% of the product demand (QEP_D>AMP plus de 10%) when the raw material of the product is organic (MP_Bio). 75.8% of respondents who think that the product demand could increase over 10% also stated that their product contains ingredients labelled AB (organic farming).

These results show the influence on the demand of a labelled product. This fact confirms the importance considered by the business-customer or purchaser to the labels on products as Brécard, (2014) and D'Souza, Taghian, & Lamb, (2006) concluded.

H2. *The organizational strategies and green practices can improve the product's environmental quality and increase the product's demand.*

Table 8 shows eleven moderate statistical links between the variables related to the increase of product demand (IPCL_D) due to the practices developed to increase the environmental quality of the company.

Table 8. Statistical test results regarding the H2

Var 1	Var 2	Khi-2	P-value	Cramer-value	Strength of the statistical link
IPCL_D	Resp_QSE	9.9	0.01	0.2	Moderate
IPCL_D	Resp_PRO	8.8	0.01	0.2	Moderate

IPCL_D	IPD_Aap	19.1	0.00	0.2	Moderate
IPCL_D	Rec_A_50k_200k	19.0	0.00	0.2	Moderate
IPCL_D	Rec_D_<50k	21.1	0.00	0.2	Moderate
IPCL_D	Rec_D_50k_200k	17.1	0.00	0.2	Moderate
IPCL_D	D_ProxD	6.9	0.03	0.2	Moderate
IPCL_D	D_ProxF	8.8	0.01	0.2	Moderate
IPCL_D	MK_bio	15.3	0.00	0.3	Moderate
IPCL_D	Rec_SCQE_ColVeilInno	16.5	0.00	0.2	Moderate

There are two moderate statistical links between the perception in the increase of the product demand and the current position of the respondent. 35.4% of respondents who think that practices developed to increase the product's environmental quality will actually increase the product demand work in the area of QSE quality (RSE-quality (Resp_QSE)), and 25% work in the area of production (Resp_PRO). This can be explained as the perception of people whose job is linked with the manufacturing process and that are influenced by the fact that the greenness of a product depends largely on the characteristics of its manufacturing process, as established by Ottman et al. (2006).

Two moderate statistical links appear between the perception of the increase of the products demand and the importance given to purchasing and supply practices (IPD_Aap) to improve the product's environmental quality. Indeed, 79.2% of respondents, who think that the practices developed to increase the product's environmental quality can increase the product's demand, identified purchasing and supply practices as important practices that influence the product's demand (Question 47 in the questionnaire in Appendix D). These results confirmed the explanation given by (Chen, 1994) to affirm that the fact of having environmental policies during product development is an influent purchasing practice to improve product's environmental quality.

There is a moderate statistical link between the increase of products demand and favouring the purchase of regional products (Rec_A_50k_200k). 39.6% of respondents who think that the practices developed to increase the product's environmental quality can increase the product demand, privileging over the 20% of purchases of regional origin. The fact of privileging products in local context (same city, department or region) have an important impact on the perception of the environmental quality of the products as (Nouira, 2013a) stated.

Respondents working in companies with local customers are prone to think that the company's practices influence the demand. Indeed, there are two moderate statistical links between the increase of products demand and the companies who have local customers (Rec_D_<50k) and regional customers (Rec_D_50k_200k)). This can be explained by the fact that when a company and its customer are geographically close, they have a close relationship due to the proximity that promotes the knowledge by the customers of the process and supplier's facility organisation (e.g. more frequent site visits for example).

There are also two moderate statistical links between the increase of products demand and the company's distribution practices that have been developed to improve product's environmental performance, such as the location of distribution points close to the market (D_ProxD) and the location of production facilities close to suppliers (D_ProxF). Among the respondents who think that the distribution practices developed to increase the product's environmental quality could increase the product's demand, 35.7% privilege the location of distribution points close to the market (while this percentage is 18.8% of the total population surveyed) and 28.6% favour the location of production facilities close to suppliers (while this percentage is only 13.6% of the total population surveyed). These results confirm that the product's environmental quality is linked to carbon emissions from transport activities which has been stated by (Nouira, 2013) and that are considered when the distribution network should be designed.

There is a moderate statistical link between the increase of products demand and the company's green marketing and communication practices, such as organic labelled products marketing (MK_bio). Among the respondents who think that some practices of the company can increase the

product demand, 75.6% privilege the marketing of organic label on the product as the most influential practice (while this percentage is only 33.3% of the total population surveyed).

There is a moderate statistical link between the increase of products' demand and the company's collaborative practices with supply chain stakeholders, such as collaboration on monitoring, strategic information gathering to anticipate change, regulation and innovation (Rec_SCQE_ColVeilInno). This is confirmed by 75% of respondents who believe that collaborative practices developed to increase the product's environmental quality could increase the product's demand and confirmed what is stablished in the literature by (Fraj et al., 2013)*.*

H3. *The environmental criteria used in supplier selection process can improve the product's environmental quality and it affects the product's demand.*

Table 9 shows the results of the statistical link between the function of respondents and the willingness to pay more for "greener" products (AccepPrix_QPE). There is a strong and four moderate statistical link between these variables.

Table 9. Statistical test results regarding the H3

Var 1	Var 2	Khi-2	P-value	Cramer-value	Strength of the statistical link
AccepPrix_QPE	Resp_DRH	9.0	0.01	0.2	Moderate
AccepPrix_QPE	AD_AttQEAP	20.9	0.00	0.4	Moderate
AccepPrix_QPE	ASF_QPE	30.6	0.00	0.4	Strong
AccepPrix_QPE	ASF_CondComm	19.7	0.00	0.4	Moderate
AccepPrix_QPE	Rec_AF_Sensib	12.6	0.00	0.3	Moderate

The strongest statistical link is between the willingness to pay more and the selection of the quality and environmental performance of components offered considered as the most important criterion (ASF_QPE) when choosing a supplier. 100% of the respondents who assessed the quality and environmental performance of components offered during the supplier selection process as very important criterion, they are willing to pay more, with the aim of increasing the product's environmental quality. This has been discussed by Sarkis (2003) who stated that a *green product* depends largely on its supplier's components.

100% of respondents who think that their company is attentive to the environmental qualities and performance of supplies (AD_AttQEAP), are willing to pay more to increase the product's environmental quality. This is confirmed by the moderate statistical link between these variables. This confirm that in the food sector, large companies could gain credibility by emphasizing their environmental activities to their business customers, as (Fraj et al., 2013) explained.

There is a moderate statistical link between the willingness to pay more aiming to increase the product's environmental quality and the respondents who assessed as an important criterion the commercial conditions established (ASF_CondComm) when choosing a supplier. 62.1% of respondents, who assessed as important criterion the commercial conditions established during the supplier selection process, are willing to pay more to increase the product's environmental quality.

There is also a moderate statistical link between the willingness to pay more and importance given to the environmental quality generally demonstrated by their suppliers (Rec_AF_Sensib). 80% of respondents, who assessed over 60% the sensitivity to environmental quality demonstrated on average by their suppliers, are willing to pay more to increase the product's environmental quality.

Finally, and more surprisingly, there is a moderate statistical link with respondents working in the area of human resource (Resp_DRH) and willingness to pay more. 80% of respondents that accepted an increase of more than 5% of the initial price work in the area of human resources (while the human resources managers represent half of the sample of the respondents to this question). This can be complement the discussion about how customers perceive the products' environmental quality must be distinguished from how the manager assess the environmental attributes (Garg, 2015). Indeed, as Fraj et al., (2013) affirmed, the background of the decision makers is reflected in their choices and sometimes determines the perception of environmental quality.

Discussion of the results

The results are based on a survey completed by 248 professionals from the food-processing sector. The first hypothesis *Improving the product's environmental quality increase the product's demand* is confirmed and a qualitative result is obtained from that validation. Indeed, for more than half of those surveyed, the fact of improving the product's environmental quality, actually increases the product's demand (nearly to two thirds of those surveyed consider an increase of more than 5% of the demand). The most influential attribute is the introduction of labelled organic raw materials, exalting the importance given to labelled product in the environmental quality improvement and to increase the demand. In other words, environmental quality is often seen as a "marketing" label, and leads to access to other customers, categories that seek for such labels. However the demand increment remains contained.

However, the second hypothesis is not fully validated. Results show a more heterogeneous behaviour related to the perception of the organizational strategies impacts. Indeed, only 23.8% of respondents affirmed that the implementation of organisational strategies or green practices increases the demand positively. 27.7% do not think that there is an increase in the product's demand and the other 48.5% do not know. The respondent's position influences the perception about the role of "green practices" on the demand: respondents dealing with health, safety, security, environmental or production issues are more likely to think that the environmental practices of the company affect the product demand. Nevertheless, the background of the decision makers is reflected in their choices and perception in what it is the environmental quality of a product. This is why, it is important as mentioned by (Fraj et al., 2013), to analyse the standardization of criteria to assess the environmental quality of the product through the development of standard reference model developed by each company.

Besides, the practices identified as having the greatest influential on the demand are, on the one hand, the location of distribution points close to the market and the location of production facilities close to suppliers and, on the other hand, the company's green marketing and communication practices (in particular, organic label). We notice that the first group of practices (local production, location optimization among others) is mainly related to the supply chain optimization on product's demand characteristics and organization (and can be interpreted as follows: a practice that is good for environment and at the same time has positive impacts in the supply chain optimization is easy to be show as "good" and perceived as positive for both the local company and its customers). Moreover, an action that allows optimizing the supply chain is in general suitable for companies and so if at the same time, it reduces environmental nuisances and companies will develop and defend them.

Moreover, the interest in implementing organisational strategies or green practices, for the companies, is not only within a potential increase of demand. In fact, one respondent reminded that improving the environmental practices of the companies has other advantages than increasing the demand. These environmental practices can enhance the material and energy efficiency of the company; help maintain its activity, etc. In this way, it can be concluded that the environmental performance of a product appears as a distinguishing factor, but only if the company already provides a product with good quality and specifications, at a competitive price and insures good delivery conditions. Then, environmental friendly practices can also be developed only on an optimization purpose.

Concerning the third hypothesis, almost 65% of the respondents affirm that they would be willing to pay more to their suppliers to improve the environmental quality of the purchased products. This willingness to pay more is related to: (i) the importance given to the quality and environmental

performance of components purchased as the most important selection criterion when choosing a supplier. (ii) the importance given to commercial conditions and (iii) the attention given to environmental qualities and performance of the suppliers. However, this assessment needs to be precised to define the thresholds in terms of cost increases that can be accepted by companies.

5. Conclusion

Contributions

This study shows that environmental issues cannot be anymore considered as a negligible issue, including on a market point of view. Therefore, it can be concluded that:

- The most influential attribute to improve the product's environmental quality that increases the product's demand is the introduction of organic labelled raw materials.
- The practices that influence mostly the product demand are related to the geographical proximity with the stakeholders. This concerns decisions related to the facilities location such as (i) the location of distribution points close to the market and (ii) the location of production facilities close to suppliers.
- The most important selection criterion when choosing a supplier is the importance given to the quality and environmental performance of components offered.

The authors are aware that the paper have some limitations linked to the sample representativeness in the sector. However, the fact of having 248 complete answers allows having a confidence level close to 90% within the conclusions. Therefore, the results in terms of percent of the survey cannot be applicable to the entire French food sector or others industry' sectors.

Finally, intrinsic to any internet survey, some biases can be identified within the sample: those who responded to the survey and spent time on a questionnaire on this topic are probably the most interested in environmental issues, and the proportion of environmentally conscious respondents can be higher than in the population as a whole. However, there is no doubt that some of the respondents were not particularly environmentally conscious.

These findings allowed concluding that the consumers are becoming more and more exigent by privileging organic labelled and local products and making that the companies analyse the geographical proximity with the stakeholders as a key factor during the selection process. Besides, this paper contributes to the understanding of the type of influence on the product's demand when a set of environmental criteria are considered. Then, the novelty of this manuscript is based on the fact of defining which are the environmental criteria related to a product that at the same time improve the product's environmental quality and impact the product's demand in a context business-to-business.

The work presented in this paper is the first step to analyse the design models of a Supply Chain by considering the sensitivity of customers in the BtoB context to environmental performance. Thus, demand will no longer be modelled as an exogenous data but as an endogenous variable that depends on model decisions. In particular, the authors are interested in modelling the variation in demand as a function of environmental performance, on the one hand, and the relationship between this environmental performance and supply chain design decisions, on the other. This is the reason why it is important to extract, select and validate the product's environmental criteria that affect the demand, becoming a novelty with respect to existing models where demand is almost exclusively modelled as an exogenous parameter independent of model decisions.

Finally, the qualitative results were used to complete and to validate more complex models than previously proposed by (Nouira, 2013b). These models analyse the relationship between the demand and the product's environmental quality of the product. Indeed, this survey shows that the demand is not linear but it is limited by the willingness to pay according the product's price fixed and the quantity of the product purchased.

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Appendices

Appendix A. Summary of the recent literature on the product's environmental criteria regarding product characteristics.

(P) Regarding the product's intrinsic characteristics		
P1. Raw materials characteristics		**References**
P 1.1	Energy efficient raw material. Ex. thermal insulating materials	Dangelico et al (2010)
P 1.2	Raw material allowing to extend lifecycle of other product. Ex. Use of recycled material.	Dangelico et al (2010)
P 1.3	Raw material with extended lifecycle/high durability.	Dangelico et al (2010)
P 1.4	Environmentally certified raw materials	Dangelico et al (2010)
P 1.5	Renewable raw materials: Ex. - Organic material - Raw material from reforestation - Biodegradable materials.	Simon (1992); Dangelico et al (2010)
P 1.6	Raw materials not derived from threatened species or from threatened environments.	Elkington and Hailes (1988); Simon (1992); Peattie (1995); Ljungberg (2007); Dangelico et al (2010)
P 1.7	Less or non-polluting/toxic materials. Ex. - Materials not containing harmful or toxic substances for product	Dangelico et al (2010), De Medeiros et al (2017), EPA (2017)
P2. Products components characteristics		

P 2.1	**Eco-designed products:** Product with extended lifecycle/high durability by using reduced amount of toxic substances, using less or non-polluting/toxic materials Ex: - Products avoiding/reducing pollution/release of toxic substances of other products. - Products not causing unnecessary waste, either because of overpackaging or because of an unduly short useful life. - Reduction of solid wastes. - Products with reduced emissions. - Products without impact on protected species. - Products that reduce the pollution in the environment wherein disposed.	Elkington and Hailes (1988); Schmidheiny (1992); Simon (1992); Shrivastava and Hart (1995); Schvaneveldt (2003); Rao and Holt (2005); Luttropp and Lagerstedt (2006); Chen et al. (2006); Hu and Hsu (2006), Zhu et al. (2007); Zhu et al. (2008a,b), Chen (2008); Routroy (2009); Dangelico et al (2010); (Azevedo, Carvalho, & Cruz Machado, 2011); Chiou et al. (2011); Morana J. (2014); (Aung and Chang, 2014); Ahi, P., & Searcy, C. (2015); Chander et al (2015); (Chan, Yee, Dai, & Lim, 2016); EPA (2017); , Vachon (2007), Gonzalez et al. (2008), Holt and Ghobadian (2009), and Paulraj (2009), Peattie (1995), EPA (2017); De Medeiros et al (2017).
P 2.2	**Energy efficient products :** Products requiring less energy to be produced or installed. Ex: - Products working through energy coming from renewable sources by themselves generated. - Products increasing energy generation efficiency. - Thermal insulating products. - Products with low energy and resource consumption during use.	Elkington and Hailes (1988); Simon (1992); Shrivastava and Hart (1995); Robert (1995); Luttropp and Lagerstedt (2006); Ljungberg (2007); Dangelico et al (2010).
P 2.3	**Environmentally certified product:** **-** Product using label: label from environmental quality of the product or from green practices. - Carbon footprint evaluation defined as ecological quality of the product.	Rao and Holt (2005), Chen et al. (2006); Chen (2008); Gonzalez et al. (2008); Holt and Ghobadian (2009); Dangelico et al (2010); Chiou et al. (2011); (Azevedo, Carvalho, & Cruz Machado, 2011); (Brécard, 2013); (Brécard, 2014); (Chan, Yee, Dai, & Lim, 2016); (Brécard, 2017); De Medeiros et al (2017).

P3. Packaging		
P 3.1	**Environmentally friendly packaging :** - Packaging partly made of recyclable or biodegradable materials. - Packaging that can be recycled with high-energy efficient processes. - Packaging's size reducted and weight, more compact packaging. - Packaging completely reusable, remanufacturable or recyclable.	Schmidheiny (1992); Simon (1992); Roy et al. (1996); Chen et al. (2006); Rao and Holt (2005); Chen (2008); Zhu et al. (2008a,b); Routroy (2009); Dangelico et al (2010); (Azevedo, Carvalho, & Cruz Machado, 2011); Chiou et al. (2011); Morana J. (2014); (Aung and Chang, 2014); (Chan, Yee, Dai, & Lim, 2016).
P 3.2	Environmental information on product available to customer.	Roy et al. (1996); Dangelico et al (2010)

Appendix B. Summary of the recent literature on the product's environmental criteria regarding green practices and organizational strategies.

O1. Purchasing practices		Reference
O 1.1	**Suppliers location** **-** Give thought to keeping the circuits between the producer as short as possible. - Group the purchases with those suppliers who are closest - Seek out the closest competitive suppliers.	Hu and Hsu (2006), Zhu et al. (2008a), and Holt and Ghobadian (2009), (Azevedo, Carvalho, & Cruz Machado, 2011)
O 1.2	**Environmental impact of purchased materials (raw materials and packaging)** Ex. - Buy renewable materials for product and minimize the use of nonrenewable materials. - Increase the amount of recyclable materials. - Buy environmentally certified raw materials for product. - Buy of materials not containing harmful or toxic substances for product or packaging. - Do not buy materials derived from threatened species or from threatened environments.	Schmidheiny (1992); Simon (1992); Roy et al. (1996); Lippmann (1999); Schvaneveldt (2003); Rao and Holt (2005); Chen et al. (2006); Hu and Hsu (2006); Luttropp and Lagerstedt (2006); Zhu et al. (2007); Ljungberg (2007); Vachon (2007); Chen (2008); Zhu et al. (2008a,b); Holt and Ghobadian (2009); Paulraj (2009); Routroy (2009); Dangelico et al (2010); (Azevedo, Carvalho, & Cruz Machado, 2011); Chiou et al. (2011); (Aung and Chang, 2014); Morana J. (2014); (Ahi, P., & Searcy, C. (2015); Chan, Yee, Dai, & Lim, 2016); (Chan, Yee, Dai, & Lim, 2016).
O 1.3	**Environmental practices performed by the supplier**: - Supplier green image: Green marketing strategies are comunicated to the business customer. - Green certification because of the suppliers' environmentally friendly practices. - ISO certification of suppliers.	Hu and Hsu (2006); Vachon (2007); Zhu et al. (2008a,b); Holt and Ghobadian (2009); Paulraj (2009); Routroy (2009); (Azevedo, Carvalho, & Cruz Machado, 2011); Morana J. (2014); Ahi, P., & Searcy, C. (2015).
O 1.4	**Using green purchasing guideline:** - Greening procurement/ sourcing, substitute environmentally preferred buying processes. - Increase the size of your orders and your lots (group together and consolidate flows) - Communicating to third-suppliers environmental criteria for goods and services. - Providing design specification to suppliers that include environmental requirements for purchased item.	Schmidheiny (1992); Hu and Hsu (2006); Vachon (2007); Zhu et al. (2008a,b); Holt and Ghobadian (2009); Paulraj (2009); Routroy (2009); Dangelico et al (2010); (Azevedo, Carvalho, & Cruz Machado, 2011); (Aung and Chang, 2014); Morana J. (2014).
O 1.5	**Environmental partnership with suppliers:** **-** Arranging for funds to help suppliers to purchase equipment for pollution prevention, waste water recycling, etc. - Encouraging suppliers to take back packaging. - Working with suppliers to reduce and eliminate product environmental impact.	Lippmann (1999); Rao and Holt (2005); Hu and Hsu (2006); Zhu et al. (2007); Zhu et al. (2008a,b); Holt and Ghobadian (2009); Paulraj (2009); (Azevedo, Carvalho, & Cruz Machado, 2011); Ahi, P., & Searcy, C. (2015).

O 2. Manufacturing practices		Reference
O 2.1	**Location decision on manufacturing and warehouse:** - Localized production near to the consumption bases and supplier bases. - Relocate distant production sites to closer sites. - Take account of all the cost variables of long-distance supply and production (prolonged transport times, increased stock inventories, delays, less predictability, more difficult monitoring and poorer quality, increased spending on business travel, more frequent use of transport or of breakdown repairers, etc.).	Roy et al. (1996); Dangelico et al (2010); Morana J. (2014).
O 2.2	**Energy efficiency of production:** - Use of renewable energy sources in production processes. - Use of co-generation plants to provide electricityheatingand cooling in production processes. - Generating energy from exhaust hot gas/waste in production processes. - Use of more efficient energy generation systems in production processes. - Minimize energy and resource consumption in the production phase and transport.	Elkington and Hailes (1988); Schmidheiny (1992); Simon (1992); Peattie (1995); Roy et al. (1996); Rao and Holt (2005); Luttropp and Lagerstedt (2006); Gonzalez et al. (2008); Holt and Ghobadian (2009); Paulraj (2009), Dangelico et al (2010); (Azevedo, Carvalho, & Cruz Machado, 2011); Ahi, P., & Searcy, C. (2015); EPA (2017).
O 2.3	**Eco-efficiency of production:** Causing no significant damage to the environment during manufacture. Ex: **-** Proper waste disposal (ex. transforming production waste in fuel). - Using standardized components to facilitate their reuse. - Internal recycling of materials within the production phase. - Formal policy on green warehouse, lend favor to new high environmental quality (HQE) platforms. - Water use efficiency: To assess water consumption and water use during the manufacturing phase. - Reduction of emissions due in production process : * Air emissions control: To assess Air emissions and Greenhouse gas emissions, global warming contribution per unit of net value added. Using filters and controls for emissions and discharges. * Pollution control: Non-polluting manufacture.	Elkington and Hailes (1988); Simon (1992); Schmidheiny (1992); Peattie (1995); Shrivastava and Hart (1995); Roy et al. (1996); Schvaneveldt (2003); (Rao and Holt (2005); Vachon (2007); Ljungberg (2007); Gonzalez et al. (2008); Zhu et al. (2008b); Holt and Ghobadian (2009); Paulraj (2009); Dangelico et al (2010); (Azevedo, Carvalho, & Cruz Machado, 2011); (Brécard, 2013); Morana J. (2014); (Aung and Chang, 2014); Ahi, P., & Searcy, C. (2015); Chander et al (2015); Ahmadi, A., & Bouri, A. (2017), EPA (2017); De Medeiros et al (2017).
O 2.4	**Greener production technology** : Use of cleaner technology processes. Ex. - Invest in green technologies required for production of green products and that allow to make some savings in the ressources. - Training the employees to use environmental technologies in an efficiency way	Amacher et al. (2004); (N. W. Chan & Kotchen, 2014); Ahi, P., & Searcy, C. (2015); De Medeiros et al (2017).

O3. Distribution practices		Reference
O 3.1	**Location decision on distribution points:** - Avoid a proliferation of hubs, platforms, shops and depots which increase the dispersity of cargos and detours on delivery rounds; or, conversely, too centralized platforms (national or continental) which increase delays and delivery times. - Use shared logistical platforms, use river ports and railway depots to consolidate incoming flows. - Create relay points to limit the number of vehicles and the mileage covered.	Dangelico et al (2010); Morana J. (2014); De Medeiros et al (2017)
O 3.2	**Energy efficiency of distribution:** To perform the distribution by using environmentally friendly transportation. Ex. - Formal policy on the use of green vehicles: Support research and innovation in terms of clear CO2 and clean vehicles, favor newer vehicles, which are green and clean, which consume less or use renewable energies. **-** Use "soft" modes of transport (electric vehicles, electrically-assisted bicycles, etc.) for small urban distances. **-** Bio fuels use: The possibility of using biofuels, features that reduce CO2 emissions and also hybrid engine technology. - Use of flex-fuel technology (i.e. automobiles that run both on gasoline and ethanol). - Improve the vehicles in technical terms (restriction of engines, aerodynamic accessories, tires, automatic gearboxes, self-cooling engines, etc.).	Roy et al. (1996); Rao and Holt (2005), Rao and Holt (2005), Gonzalez et al. (2008), Holt and Ghobadian (2009), Paulraj (2009); Holt and Ghobadian (2009); Dangelico et al (2010); (Azevedo, Carvalho, & Cruz Machado, 2011); Morana J. (2014), Ahi, P., & Searcy, C. (2015); Ahi, P., & Searcy, C. (2015); De Medeiros et al (2017); EPA (2017).
O 3.3	**Eco-efficiency of distribution:** - Pollution control: Use modes of transport which are slower but more consolidated, more economic and less heavy emitters of CO2 (rail, river, sea) the opportunities of multimodal transport. - Reduction of emissions due to transportation : * Air emissions control: To assess Air emissions and Greenhouse gas emissions, global warming contribution per unit of net value added. Using filters and controls for emissions and discharges. * Train drivers in eco-driving and in behavior (switching off engines when stopped, use of air conditioning, etc.). * Planning vehicle routes for reduced environmental impacts (Avoid multiple deliveries to the same customer, weed out miles covered by empty vehicles. * Assess your itineraries as closely as possible (reduce the miles covered, avoid backlogs, equip your fleets with tracking devices). Give thought to keeping the circuits between the consumer as short as possible. * Increase the capacity of the transport units (e.g. layers one on top of another in a truck, or higher palettes). - Organize pooling (filling of trucks by multiple orders), multidrop (combination of small deliveries to nearby customers), multipick (concentration of deliveries from multiple suppliers), etc. to reduce the number of vehicles in circulation and with whom you can work to concentrate flows using shared means (transport, platforms).	Peattie (1995); Roy et al. (1996); Ljungberg (2007); Gonzalez et al. (2008); Zhu et al. (2008a), Holt and Ghobadian (2009); Paulraj (2009), Holt and Ghobadian (2009); Dangelico et al (2010); Dangelico et al (2010); (Azevedo, Carvalho, & Cruz Machado, 2011); (Brécard, 2013); Morana J. (2014); Ahi, P., & Searcy, C. (2015); Chander et al (2015); Ahmadi, A., & Bouri, A. (2017).

O4. Reverse logistics		
O 4.1	**Formal policy on reverse logistics:** Post-consumer collection/disassembly system. - Recovery of company's end-of-life products and recycling. - Organize your reverse logistics (packaging, old products, repairs, exchanges, unsold stock, etc.).	Simon (1992); Schmidheiny (1992); Roy et al. (1996); Lippmann (1999); Rao and Holt (2005); Hu and Hsu (2006); Luttropp and Lagerstedt (2006); Chen et al. (2006); Zhu et al. (2007); Vachon (2007); Gonzalez et al. (2008); Zhu et al. (2008a); Chen (2008); Routroy (2009); Ljungberg (2007); Gonzalez et al. (2008); Holt and Ghobadian (2009); Dangelico et al (2010); (Azevedo, Carvalho, & Cruz Machado, 2011); Chiou et al. (2011); Morana J. (2014); (Chan, Yee, Dai, & Lim, 2016); De Medeiros et al (2017).

O5. Transversal: Stakeholders collaboration practices		
O 5.1	**Customer management practices**: Cooperation with customer in the product eco-design. Ex - Working with customers to change product specifications. - Cooperation with customers for green packaging. - Customers return original packaging or pallet systems. - To asess the retention of green consumers	Lippmand (1999); Zhu et al. (2008a,b); Gonzalez et al. (2008); Holt and Ghobadian (2009); (Azevedo, Carvalho, & Cruz Machado, 2011); Ahi, P., & Searcy, C. (2015).
O 5.2	**The green network efficiency:** **-** Green strategies influence prices, qualities and market shares differently. - Collaborating with other companies and organisations for environmental initiatives. - Improving opportunities for reducing waste through cooperation with other actors. - Improve the quality of products so as to limit after-sales flows.	(Brécard, 2013); Morana J. (2014); Ahi, P., & Searcy, C. (2015).

O 5.3	**Product's environmental performance assessment:** A practice to improve the environmental performance of products is taking into account the energy efficiency of the product. - To assess the environmental cost. - Develop Life cycle assessment (LCA) for every product . - To assess Revenues from “green” products. - To perform and environmental performance measurement according to the organizational processes (environmental accounting, audits, environmental reports). - To perform and environmental performance measurement according to the regulatory compliance (compliance with ISO, number of audits.). - Evaluating environmental disclosure in annual report with the material capital expenditures to reduce the hazardous emissions. - A nonfinancial ratio based on the level of pollution emissions released by the organization or the relative quantity of hazardous waste recycled, and they feel that it is important to qualify the measure of environmental disclosure and distinguish it from its more generic connotation. - To assess number of regulatory violations by type.	Schvaneveldt (2003), Ahi, P., & Searcy, C. (2015), Ahmadi, A., & Bouri, A. (2017)
O 5.4	**Implementing environmental management system (EMS):** Integrating total quality environmental management (TQEM) into planning and operation processes. - To prepare and to obtain ISO 14000 certification (environmental management). - Environmental reporting should be reports on emissions trading schemes and include reporting greenhouse gas direct and indirect emissions, recycling or disposal waste and fuel combustion in boilers. - The environmental reporting must reflect to the emissions trading schemes and include reporting greenhouse gas direct and indirect emissions, recycling or disposal waste and fuel combustion in boilers. - Environmental compliance and auditing programs. - To apply Environmental policies and audits.	Schmidheiny (1992); Simon (1992); Rao and Holt (2005); Hu and Hsu (2006); Luttropp and Lagerstedt (2006); Ljungberg (2007); Zhu et al. (2007); Vachon (2007); Zhu et al. (2008a); Zhu et al. (2008a,b); Gonzalez et al. (2008); Routroy (2009); Holt and Ghobadian (2009); Dangelico et al (2010); (Azevedo, Carvalho, & Cruz Machado, 2011); Morana J. (2014); Ahi, P., & Searcy, C. (2015); Ahmadi, A., & Bouri, A. (2017).

Appendix C. Summary of the recent literature on the product's environmental criteria considering during the supplier selection process.

(S) Regarding the product's environmental criteria considering during the supplier selection process.		
S1. Product's environmental quality offered by the supplier		**References**
S 1.1	Product labelling	Dangelico et al (2010); Fraj et al., (2013)
S 1.2	Environmental information about the product	Dangelico et al (2010); Sharma et al., (2010)
S 1.3	Origin of the raw materials	Elkington and Hailes (1988); Simon (1992); Peattie (1995); Sarkis (2003); Ljungberg (2007); Dangelico et al (2010)
S2. Supplier practices		**References**
S 2.1	Eco-conception (e.g. innovation capacity; green product design practice)	Simon (1992); Dangelico et al (2010)
S 2.2	Supply management, production and quality (e.g. supplier's reputation),	Dangelico et al (2010); Handfield, (2002)
S 2.3	Distribution (delivery conditions)	Jabbour & Jabbour (2009); Igarashi et al., (2013)
S 2.4	Collaborative practices and marketing strategies (green image).	Fraj et al., (2013); Villanueva-Ponce et al., (2015); Garg (2015); Ghadimi et al., (2016)

Appendix D. Translation of the survey's questionnaire

CONCLUDE

CONception des Chaînes Logistiques avec Une Demande sensible à la performance Environnementale

https://conclude.mines-stetienne.fr/

Preliminary information about the survey

Rennes School of Business, the Polytechnic Institute of Grenoble and Mines Saint-Etienne are jointly working on the CONCLUDE project, which is supported by the ANR (National Agency for Research).
In this context, we seek to gather the opinion of professionals and capitalize on their practices in the field. We have selected the agri-food industry as the target sector.
To do this, we carry out an online survey.

Investigation of environmental factors that can affect the level of demand

Form for the agri-food industry

It has 4 parts:

A. General information about the respondent and your company
B. Concerning the environmental quality of your products
C. Concerning your practices to satisfy and develop the environmental quality of your products and the performance of your processes
D. Regarding the quality and environmental performance of your suppliers

PART A : General information

Information of the establishment

1.
2. Company name _____

3. What is the number of jobs on the site: :
   - 5 ou less
   - 5– 50
   - 50 – 250
   - More than 250
   - Unknown answer or no answer

4. Is your company part of a group?_
   - Yes
   - Not
5. What is the name of this group?_____

6. What is the number of people in the group:
   - 10 or less
   - 10 – 250
   - 250 – 2000
   - More than 2000
   - Unknown answer or no answer

7. What type of agri-food industry does your company belong to?

   - Fruit and vegetables industry
   - Meats industry
   - Fish industry
   - Grain industry
   - Dairy industry
   - Beverage industry
   - Pasta and Bakery industry
   - Animal feed industry
   - Other:

8. On the global supply chain, between raw materials and final consumers, you think that there is/are: (Please select only one of the following proposals)
    - 1 single stage of transformation (ex T3)
    - 2 stages of transformation (ex T1 and T3)
    - 3 stages of transformation (ex Q1 - Q2 - Q3)
    - More than 3 levels of transformation between producer of raw materials and final consumer
    - Do not know
9. Within the complete chain, what levels of activity does your company cover? * Please select at least one answer or all the possible answers:
    - Agricultural production
    - Storage near the upstream side of the chain
    - Upstream transport, before primary transformations
    - Primary transformations
    - Storage after primary transformations
    - Transport after primary transformations
    - Intermediate transformations
    - Semi-finished products storage
    - Transport of semi-finished products
    - Final transformation
    - Warehousing of finished products
    - Transport to distributors
    - Distribution to end consumers
    - Other
    - Do not know or no answer

Information about the respondent

10. What is your job title?
    - Executive officer
    - Engineer
    - Technician
    - External consultant
    - Other
11. Specify your function: _____
12. What is your experience in this position?
    - Less than two years
    - 2-5 years
    - 5-10 years
    - More than 10 years
13. Your current position will lead you to deal mainly with questions:
    - Health, safety, security and environment - Quality
    - Purchasing - Supplies
    - Production
    - Logistics
    - Marketing - Distribution
    - Communication / Marketing
    - Direction - HR

PART B : Regarding the environmental quality of your products

14. Which of the following criteria best define the environmental quality of your product (Raw Materials):
    - Use of non-toxic products in the process (cleaning, admixtures, etc.)
    - Preference for raw materials of local or national origin
    - Use of fair trade ingredients
    - Use of ingredients with guaranteed traceability
    - Use of ingredients labeled AB (organic farming)
    - Use of ingredients labeled with other labels (eg UTZ, etc.)
    - Other characteristic: _____
    - No criteria

15. What other criteria do you want to mention?
    - Criterion 1
    - Criterion 2

Packaging

16. *Which of the following criteria best define the environmental quality of your product:*
    - *Preference for non-toxic packaging*
    - *Preference for recyclable packaging*
    - *Preference for biodegradable packaging*
    - *Packaging displaying environmental information on the product*
    - *Packaging specifying the sorting instructions*
    - *Other characteristic*
    - *No criteria*

17. What other criteria do you want to mention?
    - Criterion 1
    - Criterion 2
    - Criterion 3

18. Are your products labelled with respect to the environment?
    - YES
    - NO : no label
    - Do not know or no answer

19. Do they own these labels?
    - AB (organic farming)
    - Fair trade
    - Another label

20. Is there any other labels to specify?
    - Label 1 :
    - Label 2 :
    - Label 3 :

21. With the improvement of the intrinsic environmental quality of your product, do you think that the events that are listed can occur?

    - An increase of the demand
    - A decrease of the demand
    - Maintenance of the demand
    - A change of customers
    - No change
    - Other change

22. What might be the magnitude of the increase of the demand?

- Less than 5%
- from 5 to 10%
- 10 to 25%
- 25 to 50%
- more than 50%
- do not know or no answer

23. Do you estimate that demand has decreased because:
    - The price has become too high
    - Other

24. Do you feel that the demand has been maintained because:
    - Customers have become less volatile
    - New customers replaced those who left
    - You did not receive a change but you would have lost orders by doing nothing
    - Other

25. Please specify if there is other explanation for maintaining the demand?_____
26. What other change in your customers have you noticed with the improvement of the environmental quality of your products (reference to your answer to question 21)?_____
27. On your market, how do you perceive the AVERAGE positioning of your direct customers regarding the environmental quality of the products, with a scale of 0 (insensitive) to 3 (enthusiastic):
    - Today
    - By 3 years

PART C : Practices to increase the environmental performance

Purchases

28. What part (as a% of the total volume) of quantities purchased at an origin is:
    - Local (<50kms) … %
    - Regional (<200kms) … %
    - National … %
    - International … %

29. Is your company associated with a purchasing group?

    - YES partially
    - YES, the company is a purchasing group
    - NO
    - do not know or no answer

30. Does this group have specific actions to improve environmental performance? If yes, it could be:
    - Help with the installation of organic agriculture
    - Help to have a more robust offer
    - Other

31. What purchasing practices has your company developed to increase the environmental quality of its products and processes:

    - Selection of local suppliers
    - Consideration of environmental impacts in the choice of purchased raw materials
    - Establishment of a responsible purchasing policy
    - Fair trade
    - Cooperation with suppliers on specifications
    - Cooperation on packaging management
    - Cooperation on storage and transport modes
    - Respect for the earth
    - Respect for animals
    - Respect for biodiversity
    - Other (s) to be specified:

Detailed examples:

- Respect for the earth: choice of seeds adapted to climate and land-field, prohibition to use synthetic chemicals
- Respect for animals: choice of local breeds, a diet from organic farming and the forbidden use of certain drugs
- Respect for biodiversity: hedgerow, ancient breeds
- Cooperation with suppliers on specifications: development of organic products in the region, seasonal purchases, among others.

32. Clarify

    - Action 1
    - Action 2
    - Action 3

Production

33. In your opinion, which practices in the production process have been developped by your company to increase the environmental quality of your product / process?

    - Energy efficiency of equipment
    - Control of water consumption
    - Use of better technologies available for production
    - Choice of refrigeration technologies (GHG emitting fluids)
    - Reduction of emissions in production
    - Severe limitation of food additives, dyes and others
    - Waste prevention
    - Noise reduction
    - Reduction of odor nuisance and atmospheric pollution
    - Limitation of the volume and toxicity of polluting discharges into the water
    - Valorization of production waste
    - Choice of inventory management (type of storage, inventory levels ...)

- Training and information of good practice staff
- Other actions (to be specified)
- No action
- Do not know or no answer

34. Which ones:
    - Action 1
    - Action 2

Distribution

35. Distribution for your main customers : they are (in % of volumes managed)
    - Local (<50kms) … %
    - Regional (<200kms) … %
    - National … %
    - International … %

36. Is your company associated with a distribution group?
    - YES partially
    - YES, the company is a distribution group
    - NO
    - Do not know or no answer

37. Your products are distributed through a network of subcontractors (transport, sales ...). How much volume is it related to?
    - less than 10%
    - between 10 and 35%
    - between 35 and 65%
    - between 65 and 90%
    - more than 90%

38. In your opinion, what distribution practices have been developed to improve environmental performance:

    - Localization of distribution points near the market
    - Location of production sites near the supplier market
    - Optimization of kilometers traveled for transportation
    - Logistics mutualization
    - Choice of transport packaging
    - Use of less emitting technologies for road transport (ex : electric trucks, CNG trucks, Euro 6)
    - Use of alternative modes to road transport (e : rail or river freight)
    - Other: _____
    - Any

39. Which ones :
    - Action 1
    - Action 2

End-of-life management of your product packaging

40. In your opinion, what practices have been developed for end-of-life packaging management to increase environmental quality:

- Compostable or biodegradable packaging
- Edible packaging
- The lightest possible packaging
- Recyclable packaging
- Recycling instructions on the packaging
- Other actions (to be specified) _____
- Any

41. Which ones :
    - Action 1
    - Action 2

COMMERCIAL and MARKETING Practices

42. In your opinion, which environmental quality marketing practices have been developed by your company?

    - Communication on environmental practices (CSR activity report)
    - Organic Label
    - Other labels (to be specified)
    - Packaging information (ex recycling guidelines)
    - Choice of "moderate" communication media
    - Training of sales teams
    - Other: _____
    - None

43. Specify other labels:
    - Label 1
    - Label 2

44. Which actions:
    - Action 1
    - Action 2

COLLABORATIVE Practices

45. What practices of collaboration with supply chain stakeholders impact the environmental performance. Please estimate between (0: none ... 100 essential), the impact of following practices:

    - Cooperation with the customer for the product's eco-design
    - Collaboration for an environmental management system development
    - Monitoring the environmental performance of the product throughout the supply chain
    - Collaborative actions to manage and limit waste
    - Group monitoring of partners (regulation, innovation ...)
    - Shared management control

46. Are there other collaborative practices important to you?
    - Action 1
    - Action 2

Practices summary - Impacts

47. In your opinion, what are the practices already developed that have the most influence on the demand (0: does not influence - 3: maximum influence):

Practices	0	1	2	3
Ecodesign				
Purchasing – supply management				
Production and quality				
Packaging, distribution and logistics				
Marketing and communication				
Collaborative practices				

48. Thanks to your company's practices with supply chain stakeholders, can the environmental performance of your products and processes increase your demand?
    - YES
    - NO
    - do not know or no answer

49. If YES, could you quantify it?
    - less than 3%
    - between 3 and 5%
    - between 5 and 10%
    - between 10 and 25%
    - more than 25%
    - do not know or no answer

PART D : Regarding the environmental quality of your suppliers

50. Do you feel that your company is attentive to the environmental qualities and performance of your suppliers?
    - Not at all
    - A little
    - Enough
    - A lot

51. The offer of products with environmental qualities adapted to your needs, is in your opinion:
    - Rare or does not exist
    - Available but remote
    - Available but too irregular
    - Available but often out of size
    - Available but expensive
    - Other supply difficulties
    - Without difficulty
    - Do not know or no answer

Interpretation of items

- Is available but poorly calibrated = out of size, penalizing aspect imperfection ...
- Is available but remote = deliveries subject to delays and extra costs
- Is irregular = variable quantities (waste, missing quantities due to inclement weather ...)

52. Other supply difficulties

    - Option 1
    - Option 2

53. How do you rate the sensitivity to environmental quality demonstrated on average by your suppliers (between 0: indifferent and 100: convinced)

    - Sensitivity

54. To assess the environmental performance of the suppliers, how much importance do you allocate to the criteria and practices they have (0: no influence - 3: maximum influence):
    - Ecodesign
    - Purchasing – supply management
    - Production and quality
    - Packaging, distribution and logistics
    - Marketing and communication
    - Collaborative practices

55. In the selection of your suppliers, how much importance do you allocate to the following criteria?

    - Price
    - Quality and technical specifications of the components
    - Quality and environmental performance of components / supplier.
    - Supplier referencing

56. In the selection of your suppliers, how much importance do you allocate to the other following criteria (0: none ... 3: major)

    - Delivery conditions (lead-time, splitting, proximity ...)
    - Supplier's reputation
    - Innovation capacity
    - Commercial conditions (payment.)
    - Other unspecified

57. To improve the environmental quality of your products, on the purchasing side, you would be ready to pay:

    - No more expansive
    - up to 5% more expansive
    - up to 15% more expansive

more than 15% more expansive

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