IMPROVING THE MANAGEMENT OF ENVIRONMENTAL REQUIREMENTS IN CLIENTS/SUPPLIERS CO-DESIGN PROCESS

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Abstract

The integration of the environmental criteria in clients/suppliers co-design process becomes an important issue owing to the growing influence of suppliers' design choices on the clients' products. This issue is currently poorly integrated in such a design context because of the limited ability for low mature suppliers to provide the basic environmental information to the clients; and of the difficulty for clients to properly size requirements in accordance with to the suppliers' expertise. The paper describes a proposed method called "Environmental specifications diagnosis method" which is being developed in order to improve the requirements management. This method aims firstly at increasing the companies' awareness toward environmental issues by positioning companies regarding the current sectorial practices. Secondly, the method provides a support for the clarification of better tuned requirements regarding the suppliers' expertise. The paper provides also results from a case study performed with an industrial of the French mechanical industry in order to test the method validity.

Keywords: Ecodesign, Collaborative design, Environmental requirements

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1 INTRODUCTION

The product development process has widely evolved for the last decades. While this process used to be mainly performed in-house to a company, suppliers have been more and more integrated to their client's product design process [Barreyre, 1998]. This trend results in the increasing product complexity which leads companies to focus on their core business [Stephan et al, 2011]. Delegating some complete tasks of the development process is also needed for reducing development costs while maintaining a high level of quality [Clark et al, 1988]. If their role was limited in the manufacturing stage until the 80's, suppliers are nowadays more and more integrated from the early stage of client's product design process as "black box" design task. In such a context, suppliers are in charge of the detailed design according to the preliminary specifications defined by Original Equipment Manufacturers (OEM) or client [Clark et al, 1991].

The integration of environmental criteria in such a product design process where suppliers reached a high level of influence may be viewed as a major challenge. Indeed the majority of environmental impacts of the product along its life cycle is heavily influenced by early stages of the product design process [Dewulf, 2003]. Hence design choices made during the conceptual design stage determine the potential influence of product on the environment across its whole life cycle. Up to 80% of components of a client's system may be provided by suppliers, which means that a major part of the environmental performance of the client system is tied up to suppliers' work. Life cycle thinking and the idea that design choices influence the impact of products on the environment imply to broaden the product design process scope. In order to be efficient, environmental issues must be dealt with all stakeholders committed at different levels. This influence has been identified by Johansson [2002] who highlights the potential benefits of suppliers' design choices on the client's system. Stakeholders become an important source of information which are required to bring the environment into the product design process [Aschehoug et al, 2012]. Because of the growing influence of suppliers on the client's activity, reaching consistent and efficient eco-design actions at the supply chain scale requires a minimal collaboration [Personnier et al, 2013], with at least the exchange of some environmental information. In a collaborative client/supplier product design context, environmental issues are usually integrated through the specifications made by the clients and sent to its suppliers. A specification is the written description of a product and the specification process could be seen as an open arena for joint discussion and negociation between the two parts [Nellore et al, 2000].

However, the typology of companies involved in the same product design process is various and their capacity to integrate such a complex issue is changing. If large companies generally have sufficient ressources and maturity regarding the environmental issue, this is not the case for smaller organisations such as Small and Medium-sized enterprises (SME) [Le Pochat et al, 2007]. Limited environmental maturity involves difficulties during the processing of the environmental requirements and leads to a limited integration of the environment in the client/supplier co-design process. The paper aims at proposing a method to improve the company's ability to manage environmental requirements in such a co-design process between the OEM and its suppliers.

The paper is organized as follows: the first section presents the background with an overview of the integration of environmental issues in the client/supplier co-design process. The second section describes the method which is currently being developed. Then the third section describes a case study to test the validity of the method. Lastly, some conclusions and future work are presented.

2 BACKGROUND

This review is mainly based on previous researches, and more specifically on an earlier empirical study performed by the authors with twenty industrials of the French Mechanical industry. It is focused on the way the environmental issues are incorporated into a multi partner design project [Michelin et al, 2014]. It has been shown that suppliers are poorly sought by their clients excepting for aspects related to environmental regulation. It is the direct consequence of (1) the weak integration of environmental criteria in product design process of clients (both system integrators and large system suppliers) and (2) the limited capacity for small suppliers to manage the environmental issues.

2.1 The weak integration of environmental criteria in clients' product development process

Environmental issues are usually seen as a constraint. Potential benefits as return on invest or innovation factors are poorly appreciated, and the environment is usually not considered as a strategic issue. Actions to integrate environmental considerations are limited to ensure the minimum legal requirements initiatives [Boks, 2006]. The sectors which have the higher degree of environmental commitment are also the one concerned with the highest regulation pressure. In the product design process, companies' strategy focus on issues related to the compliance with environmental regulations or on issues related to potential image benefit (environmental communication towards consumers). The environmental department is weakly integrated in the product design process due to the lack of exchange between environmental experts and the design team [Baumann et al, 2002]. Few companies have implemented systematic and long term eco-design actions, which may indicate a high level of integration of environment in a product design process. Environmental specifications in product design process are thus limited, so that environmental specifications sent to the suppliers are scarce. Clients' requirements are mainly focused on data collection concerning regulations compliance and sometimes on data for environmental communication, especially between large B to C clients and their OEM.

Furthermore, the purchasing department often deals with the environmental specifications. But buyers usually have a low awareness regarding environmental issues and do not often communicate with the environmental department. This causes some difficulties to elaborate the environmental specifications, even for large groups that have a department dedicated to the environmental issues. Environment is, in addition, not considered as a paramount criterion in the suppliers' choice. Companies consider environmental criteria as pure contractual elements to be taken into account in the specifications but with a marginal role in the client/supplier negotiation. During the return of tenders processing, environmental criteria have a negligible weighting factor compared to classical criteria such as cost, quality or lead time. This directly affects the return rate of suppliers to clients' requirements and the quality of the responses. Suppliers do not want to spend time and to allocate resources to rigorously meet client requirements, which will not affect their potentiality to be chosen or not.

2.2 Limited capacity for small suppliers to manage the environmental issues

Even if clients' environmental requirements are scarce and relatively basic, most of the suppliers (especially the smallest as SMEs) have difficulties to respond. The return rate and the quality of the responses (completeness, consistency to the requirement, and rigor of the argument) are poor. Two mains factors have been identified: (1) the suppliers' resources and environmental expertise limitation, (2) the B to B context which limits the possibility for supplier to get a return on invest.

First, suppliers are not sufficiently aware of environmental issues, and they are unprepared, even face to basic requirements. This multiple-faceted issue is complex to handle for a majority of companies [Vallet et al, 2013]. Designers have difficulty to appropriate this issue and to integrate it in their daily activities [Lofthouse, 2006]. Companies experience also difficulties in defining and prioritizing the eco-design practices to implement [Boks et al, 2007]. The management of environment requires a minimum of awareness, expert knowledge, human and financial ressources [Reyes et al, 2013]. This is especially true for SMEs which do not have the ability (for financial reasons) to internally develop the adhoc expertise [Le Pochat et al, 2007]. Moreover, clients requirements may be inconsistent and inadequate. Some companies, expecially in highly competitive sectors, systematically send the same requirements, regardless of the product typology or sector specificity. For instance a client may ask for a Waste Electrical and Electronic Equipment directive (WEEE) compliance while the supplier provides a component which is a non electronic product. In addition, two entities of a same company may have different environmental requirements for the same product. A low mature supplier has thus difficulty to understand clients requirements. Added to this, the expertise level to fulfill the clients requirements is sometimes distant from the real level of suppliers expertise. Small suppliers usually do not have any environmental department, at best a non-expert designer partially dedicated to such an activity. In such a context, providing the quantitative data required by the client to conduct its global Life Cycle Assessment (LCA) is for instance difficult for low mature companies [Millet et al, 2007]. It should be also underlined that LCA is too complex and time-consuming to be performed in-house by the suppliers.

Secondly, the B to B context may be an additionnal barrier. Small and middle size supplying companies in a B to C context are the ones which mostly set up eco-design actions for commercial projects. It may be explained by the higher flexibility of SMEs in identifying potential benefits of eco-design opportunities (competitive advantage and benefit for the brand image toward consumers). It is not the case with B to B suppliers selling their components to clients who have a limited interest in the environment as previously seen. The low return on invest perceived by suppliers combined with the low importance of environmental specifications (beyond regulations issues) for clients discourage suppliers to make an effort.
At last, the low ability for small suppliers to respond to clients' requirements leads to an adverse effect on the global volume and on the level of environmental specifications. Some of highly mature companies (i.e. the ones with a high level of environmental requirements) have attempted to integrate their suppliers in a pro-active environmental strategy (beyond regulations aspects), often without success. Due to those failures, companies prefer to minimize the environmental requirements and to focus on alternative design strategies. For instance with the LCA method where, faced with the supplier's unability to provide reliable data, clients use generic databases instead of asking suppliers for real data.

2.3 Towards a deeper integration of the environmental issue in the client/supplier relationship

The limited integration of the environmental criteria in the client/supplier co-design process has been underlined. The low ability for suppliers to manage the environmental issue and the lack of clients' requirements are identified as the two main factors.
Improving the ability of low mature suppliers to face up to the environmental requirements from their clients appears as an important challenge. Moreover, environmental regulations quickly evolve: as the scopes widen, the exemptions that could benefit some sectors or typology of products would end in a near future. Some sectors, which were withdrawn as aeronautics, are more and more concerned by environmental issues. In order to face up to the future requests, suppliers may have the opportunity to anticipate. The challenge is to allow small suppliers reaching the minimum level of awareness in order to manage the environmental issue, while they are limited by low resources and insufficient expert knowledge. But adopting a sustainable approach is a long-term and unpredictable way. So small firms as SMEs have difficulty in starting such an approach [Reyes et al, 2013]. In this context, the need for both guidance and information is strong [Johansson et al, 2006]. It is also proposed to act on the clients' perspective. Suppliers are less considered as original providers of environmental information than design partners who, by their choices, could influence the environmental performance of the clients' final products. The classical client/supplier relationship confines suppliers in executive tasks defined by the clients and enhances their reactive approaches toward the environment. Accordingly, clients should be aware of their suppliers' level of maturity to adapt their level of requirements and to progressively improve their suppliers' skills.
Based on this background, the following research question can be raised: "How to improve the companies' ability to face up with environmental requirements?". Two related hypotheses may be derived from this question: (1) increase the companies' awareness towards environmental issues and (2) adapt the level of environmental requirements to the suppliers' expertise improve the return rate and the quality of the responses.

3 DEVELOPPEMENT OF THE DIAGNOSIS METHOD

A proposition for improving the integration of the environmental issues in the client/supplier co-design process is developed. This ambition is consistent with the aim of research in engineering design to support industry by improving knowledge through guidelines, methods and tools. The method aims at improving the likelihood of designing a successful product (in this case providing an environmental impact reduction). The *Environmental specifications diagnosis method* has been set up in collaboration with the French center CETIM (Technical Center for Mechanical Industry) and its portfolio of associate industrials. Results from the preliminary empirical study [Michelin et al, 2014] build the foundation of the proposed work. The different parts of the method have been fed, improved and validated by the eco-design experts of the CETIM. A preliminary experiment has been performed with a large company of the railway sector. Results are detailed in the next section.

3.1 Description of the overall method

The objective is to allow French mechanical companies, whatever their maturity, to autonomously use the method, with the support of eco-design experts at the beginning of the training phase. The purpose is to help a company to manage in the meantime (1) clients' requirements and (2) requirements sent to its suppliers. The method aims at providing a potential scenario of clients' requirements (Figure 1). The motivation is to allow companies to visualize the growing environmental issues they would potentially have to face up in the future. Thus it provides strategic information to guide companies' efforts and investments to tackle the relevant environmental issues. The scenario is obtained through a model, composed by two knowledge bases fed by industrial feedbacks. Input data to run the model are provided by the target company through a questionnaire including the following items: industrial sector, products typology, internal practices, clients and suppliers' characterization, nature of client/supplier relationship, clients' requirements and requirements sent to the suppliers. The second objective is to propose a support to help companies to fulfil the environmental specifications of clients. From the obtained scenario, the company identifies the environmental requirements in which the company is ready and, above all, the potential environmental issues which would require an increased attention, according to the given company profile. The ability of the company to manage environmental issues is assessed with the *mapping of in-house practices*. Moreover, the method adapts the level of requirements according to suppliers' profile and the usual practices of the sector. Hence it provides a support for the formulation of the requirements.

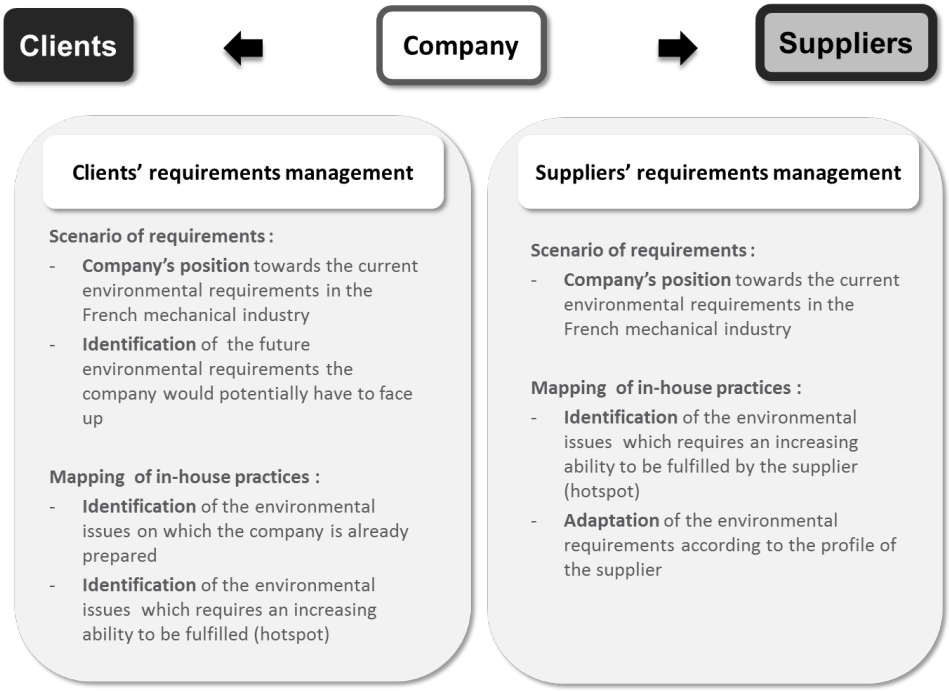

Figure 1. Objectives of the environmental specifications diagnosis method

3.2 Classification of environmental requirements

The first step consisted in building a framework of the most common environmental requirements in the French Mechanical industry. A first classification has been elaborated based on the empirical survey, then completed and validated by eco-design experts. The classification is composed of ten main *classes of requirements* and thirty *sub-classes of requirements* which are associated to a specific environmental issue. The scope of the requirements is wide: integration of environment in management process, compliance with hazardous substances regulation, data collection on each stage of the product life cycle or the evaluation of the product environmental performance (Table 1). Identified requirements are not always strictly connected to environmental issues. For instance, "mass reduction objective" is a classic specification which is not necessarily connected to an environmental issue in the mechanical industry. The classification brings up the common methods suppliers have to imperatively use in order to fulfil the client requirements in the French Mechanical Industry. For a same *sub-class of requirements*, up to four different methods imposed by clients have been empirically

identified. For instance, a client may ask its suppliers to prove their compliance toward the REACH (Registration, Evaluation, Authorisation and Restriction of Chemicals) legislation in a basic way, by a simple declarative compliance letter. A client may likewise ask for more traceability and impose its suppliers to build substances cartography according to a specific format. A client may also just ask its supplier in a global way, without imposing any method.

Table 1. Environmental requirements classification

Class of environmental requirements	Sub-class of environmental requirements	Common methods imposed by clients in the French Mechanical industry
Management and strategy practices	Certify company site and management process	ISO 14001 standard
	Assess organisation GHG emissions	ISO 14064 standard
	Certify corporate social responsibility	ISO 26000 standard
Harzardous substances	Prove REACH compliance	No imposed method Declarative compliance Substances cartography compliance without client support Substances cartography compliance with client/sector support
	Prove RoHS compliance	No imposed method Declarative compliance Substances cartography compliance without client support Substances cartography compliance with client/sector support
	Prove hazardous substances regulation compliance	No imposed method Declarative compliance Substances cartography compliance without client support Substances cartography compliance with client/sector support
	Limit the use of hazardous substances	No imposed method List from regulations Client or sector specific list
Raw materials	Elaborate a bill of materials	No imposed framework Client framework Sector framework (sector materials database)
	Measure raw materials environmental impact	No imposed method
	Improve raw materials environmental performance	No imposed method
	Reduce the product mass	No imposed method
Production	Measure energy consumption and waste during production	No imposed method
	Measure the environmental impact of production	No imposed method
	Improve the production environmental performance	No imposed method
Transport	Evaluate transport distances	No imposed method
	Identify means of transport	No imposed method
	Improve transport environmental performance	No imposed method
Utilization	Measure energy consumption during utilization	Theoretical scenario User scenario
	Measure consumables consumption during utilization	No imposed method
	Improve the utilization environmental performance	No imposed method
End of life	Prove the WEEE regulation compliance	No imposed method
	Evaluate the recyclability rate	No imposed method ISO 22628 standard Client or sector specific calculation method
	Improve the end of life environmental performance	No imposed method
	Improve the recyclability rate	No imposed method
	Elaborate a dismantling/end of life documentation	No imposed method Client framework
Environmental assessment	Evaluate the product environmental performance	No imposed method
	Elaborate a qualitative product environmental assessment study	No imposed method Client method
	Elaborate a quantitative simplified product environmental assessment	No imposed method Client method
	Elaborate a quantitative expert product environmental assessment	No imposed method ISO 14040 standard PCR/PSR frameworks
Eco-design approach	Improve the product environmental performance	No imposed method ISO 14062 standard and derived Client/sector specific method
Environmental communication	Communicate on the product environmental performance	No imposed method Compliant format with the ISO 14021 standard Compliant format with the ISO 14024 standard Compliant format with the ISO 14025 standard

3.3 A model to identify the scenario of environmental requirements

The model aims at providing a scenario of environmental requirements. It is based on two knowledge bases: the *sectorial knowledge base* and the *trends in mechanics knowledge base.*

The *sectorial knowledge base* is a compilation of data collected during the empirical survey. Industrial companies were asked about the nature and the frequency of environmental requirements they receive from their clients and they send to their suppliers. Around thirty scenarios of requirements from ten sectors from the mechanical industry have firstly been incorporated into this knowledge base. It has been completed by twenty scenarios fed by eco-design experts.

However, the *sectorial knowledge base* is not sufficient to provide a scenario of environmental requirements for any French companies of the mechanical industry. The model is mostly focused on four main sectors (aeronautics, automotive, railway and military) which are the most mature regarding environmental issues. The model has to provide a scenario if the company belongs to a low mature sector not yet integrated in the *sectorial knowledge base.* The *trends in mechanics knowledge base* has been designed in this perspective. It contains a set of rules providing, from an initial context, which kind of requirements could be sent to the suppliers. The empirical survey shows indeed that clients' requirements may be predicted considering four main factors:

- *The sector typology*. There exists a wide diversity concerning the nature and the level of requirements according to the sector of the company. It is directly influenced by the level of regulation pressure which may be strongly different according to the sector typology. A phenomenon of mimicry has been also identified. Some sectors are heavily influenced by the practices in other most mature sectors and it may be found in the specifications on the long term.
- *The client profile*. For instance, a client which has a service dedicated to the environmental issues may have highest environmental expectations. A public company may, by duty, encourage its suppliers to be compliant with an environmental regulation while the sector benefits of an exemption.
- *The product typology*. Clients' requirements are normally designed according to the typology of product. For instance for an electronic component, clients may ask for a WEEE regulation compliance. It is also recurrent that a client asks for a mass reduction of a product integrated in a mobile system that consumes energy during its utilization stage.
- *The typology of client/supplier relation*. This is directly associated with the influence of the supplier on the client's product. For instance, in a "black box" configuration suppliers are in charge of the detailed design. They are thus deeply integrated in the client product design process. From an environnemental perspective, the client may have strong requirements in term of regulation compliance, traceability management or data collection. On the opposite, clients may have less requirements in a pure purchasing context.

A total of 130 rules have been created, validated by eco-design experts and then integrated in the *trends in mechanics knowledge base.* Each rule is associated to *a potential occurrence* index which describes the potentiality that one of these rules may materialize.

3.4 Mapping of in-house practices

The mapping aims at assessing the current profile of a company through the identification of its in-house practices. The *mapping of in-house practices* has been adapted and simplified from a part of the *Eco-design maturity model* proposed by Pigosso [2013]. The eleven main classes of practices characterise the integration of environmental issues in project management and product design process (Figure 2). Each practice is associated to an *expertise level* which characterises its integration depth. A global level of practices is defined depending on the eleven *expertise level* measured. Four milestone profiles have been created. They describe the four main profiles that have been identified in the French mechanical industry:

- *Basic profile*. It represents a very low maturity company with a minimal knowledge concerning products life cycle data. The company does not integrate the environment in the project management and in its industrial strategy. It also has no expertise concerning eco-design approach and life cycle thinking.
- *Intermediate profile*. It is the most common profile in the mechanical industry. It characterises a company with a minimum of awareness toward environmental issues: minimal commitment of

the leaders, minimal knowledge about environmental regulations, but a consolidated environmental management system and designers aware of the environmental issues.

- *Proficient profile*. It describes the level of expertise of some large companies which belong to a highly mature sector. The company shows a high level of awareness: an environmental department, a formalised environmental strategy, regulation monitoring and lobbying activities, a high knowledge concerning lifecycle data and advance pure environmental practices (expert product environmental assessment, environmental communication and pilot eco-design approach)
- *Proactive profile*. This is the maximal expertise which is not reached in the mechanical industry yet. This is a hypothetical profile of a company which considers the environment as an important factor of development and innovation.

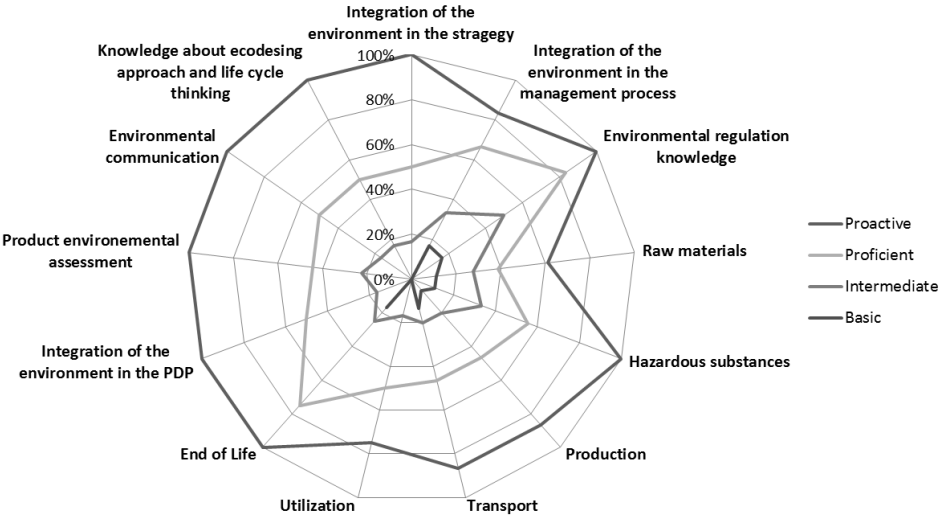

Figure 2. Mapping of in-house practices

4 USE CASE

4.1 Methodology

The method has been assessed with a large company from the railway industry. This company was chosen for its interesting kernel position in the railway industry. It receives environmental requirements from a final client and also sends demands to equipment and component manufacturers. The objective is to perform a preliminary validation of the method through three main aspects:

- The railway sector is very mature considering the French mechanical industry. The company also has a strong expertise with environmental issues, and has managed requirements with both clients and suppliers for a long time (15 years). It seems to be a relevant context to assess the robustness of the proposed model and method. A key objective is to test of the consistency of the requirements scenario. A comparison is made between requirements obtained from the developed model and real requirements usually received by the company.
- The ability to increase the companies' awareness towards clients' requirement, even for such a mature company is also studied.
- The ability to support the company in clarifying requirements to the suppliers is finally taken into consideration.

The input data have been collected though a questionnaire previously sent to the company. Due to time constraints, it was decided to conduct the method assessment with a single product, a single typical client and a single typical supplier. The data treatment and questionnaire analysis have been carried out by the researchers. Results have been presented to the three eco-design experts who were invited to discuss the results and to detail their feedback toward the proposed method. These experts are in charge both of the management of environmental issues in the company and the management of environmental requirements with clients and suppliers.

4.2 Results and discussion

The scenario of requirements has been obtained for this company (Table 2). The main classes of requirements have been ranked from the most to the least frequent. A comparison is proposed to assess the consistency of real requirements usually received by the company and the potential requirements obtained with the proposed model. All real requirements were included in the scenario of requirements. The requirements' ranking (depending on frequency) is also similar. The most frequent requirements (positions 1, 2 and 3) are the same as the real ones. A high consistency is thus reached. The scenario of demands highlights an extra requirement which is not usually received by the company. It concerns the compliance with the WEEE regulation. It could be explained by the nature of the non-EEE product chosen for this use case. The model indeed underlines some sectorial data which do not necessarily take into account the nature of the product.

Table 2. Robustness of the scenario of requirements

Class of environmental requirements	Priorization real requirements	Priorisation requirements from the model	Comparison
Prove hazardous substances regulation compliance	1	1	=
Elaborate a bill of materials	1	1	=
Evaluate the recyclability rate	1	1	=
Certify company site and management process	2	2	=
Measure energy consumption during utilization	2	2	=
Improve the product environmental performance	3	3	=
Limit the use of hazardous substances	4	4	=
Reduce the product mass	4	3	+1
Communicate on the product environmental performance	4	3	+1
Certify corporate social responsibility	4	4	=
Prove the WEEE regulation compliance	-	3	+3

The eco-design experts were very interested by the visualization of this scenario of requirements, even if they were already aware about the majority of environmental issues they could manage currently and in the future. This visualization "*allows detecting hotspots*" and allows "*positioning a company regarding the current practices of its sector in terms of decision-making support, monitoring activity and definition of working area*". For the company, it is an interesting tool for low maturity suppliers through "*the possibility to prioritize the clients' requirements*". The *mapping of in-house practices* has confirmed the company's level of maturity: between the *proficient* and the *proactive* profile. But this high level of maturity did not allow the company seeing the environmental issue which might require an increased ability. Then the second scenario of requirements, concerning the potential requirements sent to the suppliers has been presented. The specificity of this scenario is the integration of the supplier expertise level which has been evaluated as a *middle* profile. The industrial respondents expressed less interest in the possibility to adapt their environmental requirements to their suppliers' profile. As the company belongs to a highly competitive sector, it usually sends automatic compulsory requirements to the suppliers without any possibility of adjustment. However this method might be used upstream of the co-design process, "*during the initial supplier characterization process*". The method could thus "*allow suppliers viewing hotpots they need to improve in order to meet the company's level of demand*".

5 CONCLUSION AND FUTURE RESEARCH

It has been highlighted the weakness of environmental information management between clients and suppliers, yet more and more comitted in the same co-design process at different levels. This situation both results from the limited ability for low mature suppliers to provide the basic environmental information to their clients; and from the difficulty for the clients to clarify requirements in accordance with the suppliers' expertise. In order to improve the management of such requirements, an *Environmental specifications diagnosis method* has been developed. First, the proposed method increases the companies' awareness toward environmental issues by positioning companies with regards to the current sectorial practices, thanks to two knowledge bases. Companies are able to

identify the most frequent environmental requirements and to foresee the ones they potentially will have to face up. The method also guides their strategy and investments by identifying their strengths and weaknesses. Second, the method provides a support for the clarification of better tuned requirements regarding the suppliers' expertise.
A preliminary experiment has been performed to assess the proposed model and method. The robustness of the scenario of requirements has been validated with a use case. The ability to position a company regarding the current environmental requirements has been also validated. However, the company's profile was not adapted to assess the ability to highlight hotspots which require additional efforts to be tackled. The requirements adaptation in accordance to the suppliers' expertise was not considered as usable, even if the company has underlined its interest to use this approach outside the requirements management or for other configuration of clients/suppliers relation. A second experiment is currently performed with a low mature SME from the defense sector. The company's profile and context (low requirements from the clients this time but sufficiently mature sector) is well adapted to assess the ability of the method to support a company on its clients' requirements management. In parallel, a computer support system is being developed. The purpose is to provide more rapidly and automatically the scenario of demands and to allow an easy update of knowledge bases.
Future research work will focus on the enlargement of the diagnosis method. The method has to go further than just hotspots identification or a decision support system. Companies express a strong need of guidance. The second step of the method will provide a roadmap. It will support companies in the management of environmental requirements by guiding them in the choice of relevant methods and tools, the internal resources they should engage, the nature of environmental information expected from suppliers or the way to promote actions towards their final clients.

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