Sustainability Through Eco-Design: Shedding Light on the Adoption of the ISO 14006 Standard

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Abstract The ISO 14006 ecodesign standard was created in 2011 with a view to complementing the successful ISO 14001 standard for company environmental management. Although there are a lot of works in literature on the subject that have analysed the adoption process for this last-mentioned standard, the former has not actually received so much attention. To try and make a contribution to special literature, the aim of this article is to carry out an exploratory analysis of how the ISO 14006 standard has been adopted and integrated within a series of Spanish companies that have been pioneers in doing so. After analysing the main motives that have led companies to adopt the ISO 14006 standard, the study then attempts to shed light on the impact of such adoption both on an operative level and in terms of company results. A series of conclusions are also gathered in this chapter that may be of interest both to companies and to other stakeholders.

Keywords Ecodesign · ISO 14006 · Empirical study · Spain

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1 Introduction

The adoption of Environmental Management Systems (EMSs), notably the ISO 14001 standard (ISO 2004), has grown significantly worldwide over the last two decades (for a recent review, see Heras-Saizarbitoria and Boiral 2013). Following this successful path, some other management standards that deal with environmental management aspects have been launched, the ISO 14064 standard for quantification and reporting of greenhouse gases (ISO 2006a, b, c; Stechemesser and Guenther 2012), the ISO 14031 standard for environmental performance evaluation (ISO 2013a, b; Comoglio and Botta 2012), the ISO 50001 standard for energy management (ISO 2011b; McKane 2010), among many others, and the ISO 14006 standard for ecodesign (ISO 2011a; Arana-Landin and Heras-Saizarbitoria 2011; Rio et al. 2013), between others.

ISO 14006 was created with a view to complementing the ISO 14001 standard (Cluzel 2012; Savita et al. 2012). It establishes certain requirements governing the working system that need to be met by the company with regard to activities that have an environmental impact (ISO 2011a). The main feature of the ISO 14006 ecodesign standard involves the compiling of a series of guidelines regarding incorporating ecodesign into an EMS, which enables the environmental variable to be systematically incorporated into the design and development process of products and/or services (ISO 2011a). Integration of Life Cycle Thinking in company management is a basic objective of the standard, i.e. integrating the analysis and assessment of environmental impact caused by products throughout their life cycle into the design process (Sanyé-Mengual et al. 2014; Salomone et al. 2013).

Taking into consideration these aspects, following this introduction, the article goes on to a literature review of research related with the adoption process of ecodesign standards. It later continues in the third section to describe the empirical study, while in the fourth section, the results are shown. The fifth section contains the discussion and conclusions of interest to those groups involved in the adoption of this type of standard, and the references are provided in the sixth- and last- section.

2 Literature Review

The ISO 14006 standard would not appear to enjoy the popularity of other environmental management standards (ISO 14001, EMAS or ISO/IEC 27001), due to the fact that it is a young, very specific standard governing management of a process—only of interest to those organisations that carry out design activities (Landeta et al. 2013). Furthermore, ISO 14006 "…does not establish by itself specific environmental performance criteria, and is not intended for certification purposes" (ISO 2011a).

This has had an effect on academic literature among which numerous studies can be found regarding the use of specific ecodesign tools and adoption of environmental management (Sanyé-Mengual et al. 2014; Bovea and Pérez-Belis 2012).

However, there are far fewer references regarding the adoption of ecodesign management standards by companies in comparison to adoption of ecodesign techniques (Pigosso and Sousa 2011; Knight and Jenkins 2009), and even fewer that analyse the implications that this entails for companies and the impact on results (Deutz et al. 2013; Kara et al. 2005; Arana-Landin et al. 2013). Specifically, with regard to the ISO 14006, available references are extremely rare. Among the ones existing, attention should be drawn to studies by Arana-Landin and Heras-Saizarbitoria (2011), Arana-Landín et al. (2012) and Landeta et al. (2013), which, using case studies, have noted that companies would seem to be satisfied with having adopted the standard UNE 150301 (the standard used as a reference point for creating the ISO 14006). This point was shared by previous studies related to ecodesign tools that had been carried out in manufacturing (Collado-Ruiz et al. 2008; Justel-Lozano 2008) and building (Chen et al. 2010) companies. In particular, companies maintain they have managed to reduce the environmental impact of their products, mainly improving the energy efficiency (Muñoz et al. 2009; Arana-Landin and Heras-Saizarbitoria 2011; Hischier and Baudin 2010; Sanchez et al. 2007), although many aspects that might be improved were not able to be dealt with owing to the increase in costs that this entailed. Furthermore, in a unique case study Fernández (2012) point out the company obtained operational improvements after adopting the standard. Lastly, Knight and Jenkins (2009), for the manufacturing sector, and Landeta et al. (2013) and Arana-Landin et al. (2012), for the building sector, state that companies have obtained environmental improvements despite the fact the customer rejected some of the improvements put forward, as this meant an increase in the initial cost. Even though the price increase was easily offset if we take into account the savings gained during the usage phase. This aspect was pointed out by Luttropp and Lagersted (2006). They emphasized a sustainable and environmental protection perspective may even have negative effects, if the price does not vary.

Taking into account these previous studies, the aim of this research has been to carry out an exploratory analysis, based on the motives behind companies doing so, of how the ISO 14006 standard has been integrated within their own management standard, and its operative impact and results.

3 Empirical Research

In order to address the questions raised, an empirical study of a qualitative nature was designed, based on case studies. This methodology was selected because of its suitability when analyzing the complex process of ISO 14001 adoption, in which—as has already been stated—diverse agents and actors interact (Heras-Saizarbitoria and Boiral 2013).

Research of a descriptive, mainly exploratory, nature was planned, to facilitate greater penetration in and understanding of the subject, so as identify propositions that are capable of generalization in relation to the practices observed (Eisenhardt 1989;

Yin 2009). The fieldwork was carried out in Spain, and was developed between February 2012 and March 2014, and had two main components. First, a series of semi-structured in-depth interviews were conducted with the managers in charge of ISO 14006 in the organization. The interviews revolved around a semi-structured script. This approach proved to be sufficiently open, and was consistent with the inductive method for analyzing information chosen and, consequently, did not distort the evidence obtained. Second, the organizations analyzed made a very broad range of documentation available for research related to the management system and that in this article we'll present just very shortly.

A decision was made to study the cases of companies belonging to the four industrial sectors most present among those certified in ecodesign in the Basque Country as of December 2011, i.e. furniture manufacturers and firms from the chemical, electrical-electronic and capital equipment sectors. 13 cases were developed in total: 3 according to industrial sector, except for those corresponding to electrical-electronic equipment in which case 4 were developed (Table 1).

Those cases of companies were chosen that have the most proven track record in ecodesign projects and those that offered the most accessibility to information. An attempt was also made to maintain a balance between the number of cases analysed and the capacity for treatment of data and management of information by the researcher, thus ensuring the information would be sufficient for the purpose of carrying out a cross-sectional analysis of the cases.

As recommended in specialist literature on the subject (e.g. Yin 2009), the validity of factors was supported in the course of the research by the use of diverse sources of information (direct observation, consultation, interviews, and internal and external documentary information). Internal validity was guaranteed by the search for common patterns that explain the phenomena, while reliability was ensured by using semi-structured interviews of the same type and with an assessment protocol of cases against each factor.

4 Results

Below is provided a comparative analysis of the behaviour of the companies subject to study from the four industrial sectors (chemical, electrical-electronic, consumer goods and furniture). The cross-sectional comparative analysis carried out in accordance with the comparison and contrasting techniques proposed by Miles and Huberman (1994) enabled the extent of compliance with the research proposals to be ascertained and some conclusions to be drawn for the set of industrial sectors.

Table 2 shows a summary of the results obtained from the case study for each of the sectors subject to study in terms of the research proposals. In the first column, from the left of the table, are listed the research proposals, classified into three groups: motives, the adoption and certification process, and the results obtained. The other columns refer to key aspects selected from each of the groups according to the work proposals put forward.

Table 1 Characteristics of interviewed companies

Company	Size	Type of product	Sector	Certificates in accordance with management standards
Akaba	SME (small)	Office and commercial furniture	Furniture	ISO 9001, "EKOSCAN", ISO 14001, ISO 14006
Ofita interiores	SME (medium)	Office and commercial furniture	Furniture	ISO 9001, PECAL 9, ISO 14001, OHSAS 18001, ISO 14006
Euro seating international	SME (medium)	Seats for communities	Furniture	ISO 9001, ISO 14001, ISO 14006
Inteman	SME (small)	Chemical and biological products for general industry	Chemical	ISO 9001, ISO 14001, EMAS, ISO 14006
A&B laboratorios	SME (small)	Chemical and biological products for general industry	Chemical	ISO 9001, ISO 14001, UNE 166002, ISO 27001, ISO 14006
DTS-OABE	SME (micro)	Biocides	Chemical	ISO 9001, "EKOSCAN", ISO 14006
Soraluce	SME (medium)	Boring and milling machinery	Capital equipment	ISO 9001, EFQM (SILVER), ISO 14001, OHSAS 18001, ISO 14006
Gamesa	Large enterprise	Wind turbines	Capital equipment	ISO 9001, ISO 14001, ISO 50001, ISO 14006
Orona	Large enterprise	Accessibility and mobility solutions (elevators, escalators…)	Capital equipment	ISO 9001, ISO 14001, ISO 14006
BSH electrodomésticos	Large enterprise	Household electrical appliances	Electrical-electronic	ISO 9001,ISO 14001, EMAS, UNE 166002, ISO 14006
Fagor electrodomésticos	Large enterprise	Household electrical appliances	Electrical-electronic	ISO 9001, EFQM (GOLD), ISO 14001, EMAS, OHSAS 18001, ISO 14006
Geyser-Gastech	SME (medium)	Domestic small water-heaters	Electrical-electronic	ISO 9001, ISO 14001, OHSAS 18001, ISO 14006
ABB Niessen	Large enterprise	Electrical equipment for industrial and household use	Electrical-electronic	ISO 9001, ISO 14001, ISO 14006

Source Put together by the authors

Table 2 Summary of results obtained from the case study of the furniture, chemical, consumer goods, and electrical-electronic sectors in terms of the work proposals put forward

	Proposal	Furniture	Chemical	Capital equipment	Electrical-electronic
Motives					
1	Customers	Meet the needs and requirements of environmentally-friendly products on especially informed international markets	Growing environmental awareness-raising of customers	Growing interest on the part of the market in more energy-efficient products	Increasingly demanding market that is concerned with the environmental behaviour of products
2	Product/service image	Obtain a product that can reinforce the company's brand strategy	Reinforce brand credibility	Necessary to reinforce the image of quality, efficiency and exemplary environmental behaviour on the part of the product	Improve product image
3	Company image	Differentiating factor within a highly competitive environment	Become detached from the image of a polluting and dangerous sector	There is a widespread and permanent need for differentiation in terms of competitors	Improve company image
4	Access new markets	Reinforce exports with products that have high added value in which the decision to acquire them is not so decisive	New market niches for biotechnological products on the European market	Approach to sectors which make high environmental demands of suppliers	Help to become consolidated and even access new markets on which energy efficiency and the cost of residue management are becoming competitive advantage factors
5	Action taken by public administrative bodies	Promotion of ecodesign on a strategic level by environmental and innovation agencies attached to regional governments	The drive and technical support offered by Ihobe have been keys	The drive and technical support offered by Ihobe have been keys	Attempting to reinforce legislative monitoring in environmental matters and anticipating future environmental legislation have been keys

(continued)

Table 2 (continued)

	Proposal	Furniture	Chemical	Capital equipment	Electrical-electronic
6	Improving the environmental impact of products	Company policy based on continuous improvement and excellence, not just regarding processes but also the product throughout its life cycle (life cycle thinking)	Continuous improvement of chemical and biological solutions to ensure they are cleaner and safer	Ecodesign might be a tool to help foster the development of eco-efficient products	Need to develop new systems that are more efficient and innovative
7	Environmental awareness-raising	Conservation of the environment is a strategic commitment	Sustainable development model for the business which entails developing effective and safe products for the user and the environment	Committed to the development a sustainable business model	Major conviction regarding a business model that takes into consideration all aspects of sustainability
Process					
8	Previous experience in processes involving adoption and certification of management systems	Adoption and certification tradition in accordance with international standards governing quality assurance, the environment and safety at work	Adoption and certification tradition in accordance with international standards governing quality assurance, the environment and safety at work	Previous experience in adoption and certification in accordance with international standards governing quality assurance, the environment and safety at work has been a key element in facilitating the process	Previous experience in adoption and certification in accordance with international standards governing quality assurance, the environment and safety at work has been a key element in facilitating the process
9	Difficulties with identification and assessment of environmental aspects and impact	Difficulties with obtaining initial data from suppliers of materials and components in order to assess environmental impact. Main motives: lack of awareness about the concept and implications of ecodesign, distrust of and difficulties with obtaining the	Difficulties with obtaining initial data from suppliers of substances in order to assess environmental impact. Main motives: lack of awareness about the concept and implications of ecodesign, distrust of and difficulties with	The large amount and diversity of associated materials, processes and components has meant a considerable effort required to put together an inventory; difficulties with using LCA commercial tools and their integration with other	Incomplete commercial data bases and unsuitable LCA commercial tools deemed unsuitable for company needs

(continued)

Table 2 (continued)

	Proposal	Furniture	Chemical	Capital equipment	Electrical-electronic
		environmental information required	obtaining the environmental information required	existing systems in the company	
Results					
10	Improvement in financial results	The influence of ecodesign adoption in operative costs has not been quantified; widespread belief in an increase in costs during the design and development phase	Major acceptance of the eco-designed product on the mainly European market; the eco-designed product is, generally speaking, more expensive than a similar conventional product, to a large extent owing to the costs of raw materials and the greater effort required in the product's design and development process	Ecodesign has helped the company to become consolidated on the market and, in the case of Orona, has even resulted in products being obtained that have given rise to significant success in terms of sales	Slight reduction in operative costs, mainly owing to savings in consumption of materials and shipment
11	Increase in added value	Contributes towards continuous improvement of processes and products with the inclusion of the environmental variable	Constitutes one more innovation tool; it entails taking other parameters into consideration in design and development which would have previously not have been the case; the end product offers greater performance features	Is a suitable innovation tool; it fosters improvements in key factors attached to the product such as functional nature, reliability or durability, energy efficiency and a reduction in residue generated	Provides another perspective to product creation, and fosters innovation in the product

(continued)

Table 2 (continued)

	Proposal	Furniture	Chemical	Capital equipment	Electrical-electronic
12	Improvement in their product/service image	Improves product image, although international markets tend towards product certification	Improves product image and makes it easier to obtain ecolabels	Certification reinforces brand image	Reinforces brand image
13	Improvement in their company image	Improves the company image	Lends support to the message put out by the manufacturer and provides it with credibility in the eyes of the customer; has enabled the company image to be improved and to differ from the competition	The certificate is a differentiating factor within the market	Improves the company image and even enables it to differ from the competition
14	Anticipation of compliance with legislation	This is a tool that makes it easier to anticipate future environmental legislation	Has fostered compliance with future environmental legislation	Has entailed anticipation of compliance with future legal demands both on a national and international level	Has fostered anticipation of compliance with future environmental legislation
15	Satisfaction with results	They seem satisfied, except for Orona, which would not opt for certification; preference for product certification, because the standard does not establish a system for recognising environmental behaviour of the product based on informing the customer	They seem satisfied; provides another perspective to product development (life cycle thinking); there is no clear commitment towards demanding that a level of specific requirement be established for compliance with ecodesign guidelines in future reviews of the ISO 140067	They seem satisfied; companies think they have helped mainly to make improvements in the creation process and the result is a product with greater added value; however, companies demand that a level of specific requirement be established for compliance with ecodesign guidelines in future reviews of the ISO 140067	They seem satisfied; it is a competitive tool for fostering continuous improvement in the environmental behavior of products

Source Put together by the authors

However, discussion of results provided below adds data which is not shown in the table which, although not referring to the work proposals, does nonetheless refer to other aspects attached to motives, the process and the results obtained from adoption and certification. In this respect, we should also recall for clarification purposes that the case study method enables a wealth of data to be captured in detail about the problem with research, and provides researchers with the flexibility they need to explore additional issues raised by those interviewed (Soosay et al. 2008).

4.1 Motives

In the chemical sector, obtaining more sustainable products for three of the companies analysed is dependent on obtaining products that ensure maximum safety at work, as environmental aspects in this sector are closely related to safety, e.g. both aspects are improved by replacing chemical substances with biological ones.

In the electrical-electronic and consumer goods sectors for instance, the launching on the market of more sustainable environmental products is linked to a concern with creating products which are more energy efficient, insofar as this is actually an aspect that the customer rates highly owing to its impact on the costs of using the product during its life cycle. Yet for Fagor and ABB Niessen the main motive was the need to adapt more quickly to increasingly more demanding and complex environmental legislation within an environment marked by the globalisation of markets.

Other motives such as a reduction in operative costs or attempts to better meet and improve customer expectations also formed part of business culture. However, adopting a series of strategic commitments in all industrial firms aimed at creating a new, more sustainable and environmentally-friendly business model of development, and improving environmental performance not only of the company but also of the products they market, were generally speaking noteworthy aspects cited.

4.2 Adoption and Certification Process

The adoption and certification process for the ISO 14006 standard was relatively simple in all cases. All industrial firms had experience in adopting management systems (ISO 9001, ISO 14001, EMAS, OHSAS 18001, etc.) which had created a working culture based on defined, orderly and systematised processes, and integrated ecodesign into the organisation's management system. This to a large extent ironed out any possible reticence to adoption of the ecodesign standard among staff —"this is the customary reaction to the introduction of new management systems," they point out at Geyser Gastech. In any event, all the companies highlight the effort made to convince and motivate everyone in the organisation to gain their support, which proved essential for the success of the process, although in the chemical

sector, the sales network proved to be especially reluctant—specifically in the larger organisations such as Inteman and A&B Laboratorios. They did not see the value of ecodesign as a sales argument. However, ecodesign was linked to giving up using certain chemical products, thus increasing safety, and this aspect started to attract the sales network.

In this respect, management involvement in all companies proved very important, albeit not on the same level in all cases. Attention should be drawn to the greater involvement in especially innovative companies—those from the chemical and furniture sectors.

The management was responsible for providing tools and people to ensure the project would be successful, appropriately choosing those in charge of the standard adoption process and providing any external assistance deemed necessary with contrasting experience for preparation and advice throughout the process. All companies point out that such advice had been the key throughout the process. At Gamesa they also added that they had missed the support of certifying bodies less and stated that the experience gained by certification of the UNE 150301 (AENOR 2003) ecodesign standard remained insufficient. Moreover, the fact that the standard had not been created for certification purposes raised doubts, especially among companies, but also among the different interest groups.

Another major difficulty that companies have had to overcome and are still working on—especially in the electrical-electronic and consumer goods sectors—has been the lack of staff training, in particular in the most involved areas such as design and development. There were doubts and uncertainty that made it difficult to adopt environmental criteria during the design and development phase and, in the opinion of companies belonging to the consumer goods sector, the job market has not responded to the demand for professionals with a command of ecodesign.

Companies highlight the discovery of Life Cycle Assessment (LCA) as a methodology for assessing the environmental impact of the product throughout its life cycle, which has proved a very useful discovery for design and development technicians. It enables them to improve the product's integral perspective and ascertain the environmental influence of their decisions throughout its entire life cycle.

As regards this analysis, the main problems refer to calculation of the product's environmental impact. One of them is the absence of initial data to enable the impact of the product of reference to be assessed, especially in the first experience in ecodesign. Both then as now, all companies would experience serious difficulties with obtaining the information required of its suppliers in order to put ecodesign into practice. In this sense, consensus exists when pointing out that it is genuinely difficult to achieve traceability of data regarding the environmental aspects of materials and components (inputs).

Normally these are small firms with a limited capacity for attending to the information needs required of them with regard to design. Furthermore, at this time of the current serious crisis, they generally have fewer resources at their disposal to enable them to do so, and with suppliers confining themselves to complying with the legislation applicable to them. The smaller companies subject to study, such as

Akaba and DTS OABE, add that the relatively small volume of purchases from certain suppliers implies that they are unable to exert a major influence over them. This problem would seem to be less important in large companies such as Gamesa, BSH and Fagor. In such cases, the influence they exert on suppliers in demanding a greater environmental commitment proves to be a determining factor—even more so if this is a widespread trend on the market.

Companies from the chemical sector have been especially active in developing data bases and LCA tools, except for DTS OAB, which is perhaps restricted owing to availability of resources. This is a sector in which over 100,000 chemical substances are marketed in Europe and commercial data bases only have a really small proportion of substances with environmental data at their disposal.

The second problem linked to the calculation of environmental impact is the absence of a flexible and truthful tool for doing so. Apart from Inteman and A&B Laboratorios, both chemical firms, only Orona from the consumer goods sector has developed LCA software specifically for environmental indicators. This has enabled its ecodesign tools and the ecodesign process itself to be better integrated into activities associated with the area of product design and development.

The other companies have opted to use data bases and commercial LCA tools, although have experienced integration problems with the tools used by the area of product design and development. In some cases, it is shown that ecodesign is not fully integrated into company activities, as in the case of Fagor, where it was applied in certain projects but in practice has not been internalised in the working system within the area of design. Most companies have changed LCA software on more than one occasion so as to ensure greater integration into their design system and adaptability to their requirements.

Moreover, all companies stress that the ISO 14006 standard determines how environmental improvements can be quantified—each manufacturer can choose the comparative reference and methodology and calculation tools as they see fit, in accordance with their own criterion. The criterion used to choose the basis for comparison is an open one, as the environmental balance may prove to be positive or negative depending on the model chosen. Neither does it establish mechanisms for controlling the effectiveness of the ecodesign methodology for products applied by the company, which implies that the overall environmental impact of the product will vary. As no common comparative reference exists, companies face a problem when trying to highlight ecodesign on the market. The chemical firms Inteman and A&B Laboratorios—two of the most active in terms of the continuous development of their external communication methods—created their own label to identify the eco-designed product and a classification system for the product's environmental impact, very similar to the energy label used in the case of Inteman for taking advantage of the fact that customers had been familiarised with it and found it easy to understand. Likewise, this is the main reason that would seem to encourage companies from the chemical and furniture sectors to opt for environmentally-friendly labels for their products. They state that this is the trend on international markets and represents a form of recognition for those products.

Another limitation of the standard refers to the margin for environmental improvement in the re-design of eco-designed products. Companies are facing the challenge of updating eco-designed products and the margin for environmental improvement has been considerably reduced, making it more difficult for the product to achieve this.

4.3 Results Obtained

The introduction of ecodesign standard guidelines in the company's management system has made a series of contributions, among which special attention should be drawn to the obtaining of products with greater added value and the assistance provided in anticipating compliance with future environmental legislation, as was the case with the REACH regulations in the chemical sector or the *ErP* Directive in the electrical-electronic sector.

In addition, it has enabled them to gain greater power of innovation over the design and development of products and associated processes (supply chain, manufacturer, shipment, installation, operation and maintenance, etc.). Some companies highlight the introduction of LCT (*Life Cycle Thinking*) in the product design and development systems in organisations. In any event, practically all companies maintain that it provides another perspective of the process, enabling environmental impact to be improved—in some phases more than others, according to sector and product. Only in the case of the furniture sector would Ofita seem to distance itself and state that it has not detected any innovation as a result of ecodesign.

At the same time and despite the fact that it provides another perspective in creating new products, A&B Laboratorios and DTS OABE stress that ecodesign adoption also means to a certain extent less freedom when creating such new products.

All companies share the opinion that ecodesign is a competitive tool although, with the tools at their disposal, it is difficult to showcase it from a commercial standpoint—they highlight the major effort made in launching eco-designed products on the market. Yet markets have so far not taken into consideration the environmental impact of products in their purchasing criteria, and in any event, the companies interviewed point out that public administrative bodies need to promote measures to foster the development of *green* markets. Their role is an essential one. Despite being both extensive and restrictive, current legislation needs to improve and bring itself up-to-date with the state of business techniques and practice—companies unanimously suggest the development of legislation governing environmental matters. Prominence needs to be given to the most environmentally-efficient products or those that evidence the worst behaviour should be taxed accordingly—not to do so would create a situation of unfair competition, as many companies would make no effort to innovate their products. Rather, they manufacture less efficient ones that have greater environmental impact but at lower cost.

However, one direct consequence of applying ecodesign in practically all companies has been a slight increase in the cost of the product during the design phase for several reasons, which has in turn been reflected in a slight increase in its end price. As regards the latter, Inteman add that "offering it at the same price as its traditional equivalent would detract from the eco-designed product." It has greater added value and, broadly speaking, has helped to improve the product's quality. Despite this, operative costs are also higher in the case of all sectors, even where the standard has enabled management control of the product to be improved, and this is due to greater investment in time and resources during the product's design and development phase. In addition, materials and components are in general slightly more expensive, this being most apparent in the chemical and consumer goods sectors.

In any event, none of the companies subject to study say that they have measured the influence of adopting the standard either on general costs or on business results. Adopting the standard has not entailed any noteworthy reduction in costs, given that cost reduction has traditionally been a maxim in company activities—and it is precisely the pressure of costs that is a determining factor in the margin for environmental improvement of the product, due to a cost reduction policy for the product imposed by highly competitive markets.

Nonetheless, in the chemical, electrical-electronic and consumer goods sectors in particular, in many cases cost saving in some or other of the subsequent phases of the product's life cycle (shipment, use and management at the end of the life cycle) is greater than the increase in the cost of acquiring the eco-designed product over the non-eco-designed one.

Despite all the above, companies think the ecodesign certificate will help them to meet the requirements demanded by both public and private customers, and to ensure they have a privileged position in *green* purchasing processes. The certificate essentially provides credibility and companies estimate that they will have gained in terms of brand and company image with certification. This has enabled them to differ from the competition and gain certain consumer confidence.

In any event, the chemical and furniture sectors would seem to opt for product recognition or certification systems. This is a trend that appears to be prevailing on international markets even in cases—as they point out—where the large number of systems used to assess environmental impact of products, certificates, brands and environmentally-friendly labels confuse the consumer and make it difficult to compare environmental behaviour among products with similar features. Nonetheless, they advocate this form of recognition because it enables them to compete on the same level internationally as other products from the competition. In the case of the other industrial sectors, i.e. the consumer goods and electrical-electronic groups, companies would seem not to opt for this form of recognition, because either no environmentally-friendly label exists for their products or because, as they state at BSH, such recognition systems are very costly. In both cases, companies do not directly use ecodesign as a marketing argument because they are unable to provide the customer with 100 % reliable information about the product's environmental behaviour, and try to highlight graphically and intuitively the product's functional features and environmental improvements using labels on the product.

5 Discussion and Conclusions

Diverse motives behind encouraging industrial firms to adopt and certify ecodesign management systems exist. Among them, the growing interest on the market in more environmentally-sustainable products, the search for new innovation tools, and differentiation in terms of competitors are motives shared by all companies, although, they do not stand out as the main ones. In any event, in all cases, environmental awareness-raising of individuals from the organizations themselves would seem to be the common denominator that fosters the search for tools to improve the environmental behaviour of their activities and the results deriving from them.

As for the results obtained from the implementation of ISO 14006, the companies subjected to analysis point out a major lack of awareness on the market of the ecodesign standard and of the implications that the certificate entails for the organization and its products. The customer assesses mainly those features of the product that best meet their needs and considers environmental behaviour as an *extra*. The customer does not consider improvement in the product's environmental behaviour as a reason for purchasing more in itself. However, signs of an increasing concern on the part of consumers with climate protection are occurring; although it is also true to say that this is still too small to have any effect on so-called *green* markets. Meanwhile, at these times of crisis, the price is proving to be a more determining purchasing factor than ever.

Regardless of the effort made to highlight more environmentally-sustainable products, in all companies has been improved internal and external communication, owing partly to the importance given to this chapter in the standard and as many of the companies confirm, companies are still having problems with employees adopting the new strategies. This has translated into the design and setting in motion of courses of action and initiatives aimed at improving external communication with customers, suppliers, the sales network and other interest groups, and also at the heart of the organisation—their being convinced of the need on the part of the people within the organisation themselves to note the result of their efforts and internalise environmental improvement in the product as a constant feature of their activity.

The companies subject to study confess that such environmental improvement in the product is easy to manipulate—some results or other are obtained depending on the data base and/or software used to assess impact. It is also possible to take an initial reference using a severe environmental impact that may facilitate implementation of environmental improvements with minimal effort, and this situation raises doubts in the companies analysed in all sectors. Conversely, some companies from the chemical and consumer goods sectors warn that if the ecodesign standard were less flexible and contributed towards better development and precision, this would restrict company freedom and therefore creativity, thus making it difficult to use as an innovation tool.

They also maintain such flexibility can facilitate the standard's dissemination and spread the word about ecodesign internationally. It is precisely dissemination

that is one of the areas about which all companies express doubts. They hope that in the future customers will ask for the ecodesign certificate just as they do now with other management certificates in accordance with standards, although they also fear this not to be the case insofar as there is an open debate about the possibility of being able to become certified in accordance with this, given that it has no certification purpose.

This circumstance and the fact that public administrative bodies are not carrying out more active work to develop green markets may affect dissemination of the ecodesign standard, even bearing in mind that ISO 14006 is an international standard. Despite this, companies appear satisfied with adoption and certification of the ecodesign standard, as it is a tool that improves and complements the suitable management of processes in the company by providing a very useful system that may help to streamline day-to-day procedures.

Finally, regarding the limitations of the research, it is necessary to mention those limitations of the case study methodology. A major limitation lies in the problems associated with the generalization of the results obtained through a limited number of cases, an aspect that has been criticized in the past, but the modern case study has overcome. The results of a case study do not allow for statistical generalizations, however, it is necessary talk about the analytical generalization, i.e. generalize a particular set of results of a case similar to others representing theoretical conditions.

Furthermore, Eisenhardt (1989) suggests that for analytical generalization, performing a cross-case with four to ten cases of study. Nevertheless, in the case study carried out in all sectors (except electrical-electronics) has not been able to have more than three cases. However, in this regard Eisenhardt (1989) also states it is necessary to limit the number of cases reaching a point of theoretical saturation. Other authors such as Yin (2009) note that the number of cases depends on the certainty desired on their performance and ability to predict similar results for the existence of predictable reasons. In the light of the results, in the present research, it has reached a point of theoretical saturation in the chemical and capital goods sectors. This means it will be necessary to seek further evidence to corroborate and appropriately generalize the results in other two sectors, furniture and electrical-electronics.

Therefore, the cases results could be generalized to other companies in the same sector or even some of the results could be generalized to the industry in general, taking into account the nuances and the conditions for doing so.

Another aspect that should be noted about the research topic addressed in this paper is that, since the ISO 14006 standard is in its early stages of diffusion, many issues still need to be undertaken and its analysis can be of great interest to the world academic and different interest groups that participate in the process of adoption and certification. Among them, attention should be drawn to the analysis of the keys to regional and inter-sector dissemination of the standard, the role that will be played by Ecodesign Management Systems for companies and its value on the market—bearing in mind that it has no certification purpose—and, especially the long-term influence of Ecodesign Management on financial results and company sustainability. Indeed, the number of certified companies grows gradually,

allowing the combined application of quantitative and qualitative research methodologies that enrich and extend the existing knowledge of the phenomenon under study. Also, access to staff not involved in the adoption process will be a key issue in future research that it will be worked especially in order to obtain results that provide a more objective understanding of the phenomenon.

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