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ANALYSIS OF GREEN PRODUCTS IN THE LIGHT OF ECODESIGN STRATEGIES AND ENVIRONMENTAL LABELING: THE GREENVANA CASE

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ABSTRACT:

The present study aimed to evaluate the environmental aspects of green products from the web of Ecodesign strategies proposed by Brezet *et* Hemel (1997) and Environmental Labeling regulated by ISO 14020. This is an exploratory and descriptive research, of the case study type. The case chosen was the Greenvana Company, specialized in the virtual retail of green products. Of the 715 products analyzed, the most used type of labeling was self-declaration, with the most used being: degradable (53%), recyclable (40%) and elongated product life (28%). The use of green stamps occurred in only 20% of the products and the most used were FSC and IBD. As for the *ecodesign* strategies, the most used was the selection of low impact materials, specifically, selection of non-aggressive materials and recyclable materials.

Keywords: *Ecodesign; Environmental Labeling; Green Product; Sustainability*.

1. INTRODUCTION

The search for increasing and/or maintaining levels of economic development has been one of the great concerns of the rulers in the current context, whether these are from more developed or developing countries. Parallel to this search, the sustainability of the current economic model is discussed, since, in essence, this type of development leads to strong environmental impacts, caused, on the one hand, by the excessive consumption of natural resources well above the capacity of recovery of the planet; on the other hand, it presents an increasing discharge of solid, liquid and gaseous residues, that have caused strong socioenvironmental implications.

Given this context and considering that the stimulus to economic growth is strategic for the survival and sovereignty of the nations and that the balance and socio-environmental well-being must be preserved, new forms of action are discussed, constructed and little by little applied, by different institutions, whether governmental or non-profit or not, in different spheres of action, local, regional and international, acting separately or collectively. It is based on the understanding that the responsibility for the construction of a more sustainable economic development is an obligation of all, that is, of the different social actors: governments, organizations and citizens.

In the specific case of for-profit organizations, they are the main agents that cause environmental impacts. However, as a way of reversing this situation, a process of restructuring of its management models has begun by incorporating environmental aspects, either voluntarily, by legal pressures or by market pressures.

It should be noted that the incorporation of such environmental practices occurs in different forms and intensities, since the organizations are heterogeneous and act in different contexts, resulting in a diversity of practices or environmental strategies that can be inserted in a *continuum*, where in one extremity they present the strategies that are purely reactive to deal with legal aspects and, on the other far end, the most proactive strategies, that is, those that go beyond compliance with legal requirements and are guided by the search for competitive advantages.

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Considering the more proactive stance, such organizations have adopted different environmental management models and tools, such as certified environmental management system, cleaner production, environmental auditing, environmental impact assessment, green marketing, environmental labeling and eco-design. These tools, in general terms, seek to improve organizational environmental performance by improving their work processes and products/services, focusing on different aspects, such as lower consumption of resources and energy; use of less aggressive materials; waste reduction, reuse and recycling; and extended product life cycle and multi-functionality.

One of the practices that has been growing by organizations is the creation of products that contemplate environmental attributes, whose denominations are presented in a varied way in the literature: green products, environmentally correct and friendly products, ecologically correct, sustainable products, among others. In the development of these products, the organizations have different environmental management tools, such as eco-design, which has aroused interest not only in companies but also in academia. Over the years different eco-design tools have been developed, most of which are available for use by organizations. The interest of researchers in the theme of eco-design has also increased, considering that, by its nature, it presents itself as multidisciplinary. According to Baumann *et al.* (2002), eco-design has been heavily studied in the fields of engineering, business and politics.

In this context, it is possible to emphasize the importance of the use of eco-design tools when designing products with environmental attributes, since the types/quantities of materials to be used, aspects inherent to the production process, functionality, use and lifetime and the type of final arrangement will be defined at the design stage, i.e. the design phase of a product implies thinking about all subsequent phases of the product life cycle.

The creation of green products contributes to the reduction of environmental impacts, to the improvement of the competitiveness of organizations and to the wishes of consumers sensitive to environmental issues. And once created, organizations need to pass this information on to their current and potential customers, which can be accomplished through another environmental management tool known as environmental labeling. These are statements about the environmental attributes of a product that may be explicit on labels, brochures, or ads.

The important contributions of the use of eco-design tools and environmental labeling for the creation and communication of green products are acknowledged. However, a more careful reflection and evaluation is needed on when, in fact, a product can be considered green, since, on the one hand, there is no consensus in the literature about the concept of green product, and on the other, there is an increasing amount of products launched in the market as green.

Thus, the following question comes up: To what extent can products conceived and communicated as green be considered, in fact, green?

In view of the explicit research problem, this article aimed to evaluate the environmental attributes of green products using, for this purpose, the web of eco-design strategies and the type of environmental labeling used.

2. THEORETICAL FOUNDATION

2.1 Green Products

In the literature, there is no consensus on the concept of green products. Considering that there is a diversity of existing green products and expectations of expansion of these products, the construction of a concept that encompasses a wider range of products has become a major challenge since each green product presents particularities and different types/possibilities of contributions and environmental impacts.

It is notable that there is a consensus around the characteristics of green products, especially regarding the reduction of environmental impacts caused by these products when compared to conventional products. This reduction stems from a lower consumption of resources/energy or the consumption of less aggressive resources and from the reduction of the consequences in the manufacture, use and final disposal of these (Reinhardt, 1998; Ottmann, 2006; Luttropp *et* Lagerstedt, 2006), in addition to other characteristics associated with the green nature of products, as explained in figure 1.

All of the characteristics cited in figure 1 end up relating to one or more stages of the product life cycle. What is perceived is that these products are inserted in a *continuum*: from an extreme side, they have few characteristics or of low significance, on the other extremety, many characteristics or of greater significance.

2.2 Environmental Labeling

Environmental labeling refers to statements made about the environmental aspects of a product, which may be explicit on labels, leaflets or advertisements. It presents itself as an important environmental management tool and contributes to improving the competitive advantages of orga-

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Authors	Characteristics associated with the green nature of a product
Elkington et Hailes (1988)	- not to endanger the health of the consumer or other persons; - not to cause any significant damage to the environment during manufacture, use or disposal; - not to consume a disproportionate amount of energy during manufacture, use and disposal; - not to cause unnecessary waste, whether due to improper packaging or a short service life; - not to use materials derived from endangered species or threatened environments; - not to involve unnecessary use or cruelty to animals; - not to adversely affect other countries, particularly those in the third world.
Simon (1992)	- reduced raw material, high recycled content; - non-polluting manufacture/non-toxic materials; - not to use unnecessary animal proof; - no impact on protected species; - low energy consumption during production, use and disposal; - minimal or no packaging; - reuse whenever possible; - long service life, upgradeability; - post-consumer collection, dismantling of the system; - remanufacturing capacity.
Schmidheiny et Diebold (1992)	- eliminate or replace products; - eliminate or reduce harmful ingredients; - reduce weight or volume; - produce concentrated product; - mass/bulk production; - combine the functions of more than one product; - produce fewer models or styles; - redesign for more efficient use; - increase the useful life of the product; - reduce packaging waste; - improve reparability; - redesign for consumer reuse; - remanufacture the product.
Robert (1995)	- minimize the use of non-renewable materials; - avoid the use of toxic materials; - use renewable resources according to your replacement rate.
Shrivastava et Hart (1995)	- low environmental impact during use; - easy composting, - products reused or recycled at the end of their useful life.
Roy et al. (1996)	- capable of reducing global environmental problems; - energy efficient; - easily repairable; - designed to last or to be reused, reconditioned or recycled; - generate minimal pollution and waste; - may be safely disposed; - minimum use of materials, including packaging; - made from renewable or abundant resources, or recycled materials; - If possible, manufactured locally and with materials obtained locally to reduce transport requirements; - environmental information about the product available to the buyer; - not harmful to human health; - satisfies a genuine human need.
Luttropp et Lagerstedt (2006)	- not to use toxic substances; - minimize energy and resource consumption in the production and transport phases; - use high quality structural and material features to minimize weight; - minimize the consumption of energy and resources in the use phase; - promote repair and improvements; - promote long life; - invest in better materials, surface treatments or structural arrangements; - promote repair, improvement and recycling; - use as few connecting elements as possible.

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Ljungberg (2007)	- reduce materials and energy use for a product; - reduce emissions, dispersion and creation of toxic products; - increase the quantity of recyclable materials; - maximize the sustainable use of renewable resources; - minimize the intensity of service for products and services; - extend the life of a product; - assess and minimize environmental impact; - have a functional economy; - use reverse logistics; - increase efficiency in the use phase.

Figure 1 - Characteristics of green products

Source: Adapted from Dangelico *et* Pontrandolfo (2010)

nizations, since it informs the client of the environmental superiority of its products, and can influence them in the purchasing decisions.

Declarations are regulated by ISO 14020 and there are three types (I, II and III). Type I are statements made and certified by external organizations, such as green seals; they are governed by ISO 14024; and made in various sectors to measure aspects related to energy and water efficiency and forest management. Type II declarations, called self-declarations and governed by ISO 14021, refer to those made and communicated by the company itself, without the participation or confirmation of other companies. As an example, we have: compostable, degradable, designed for dismantling, elongated product life, recovered energy, recyclable, reduced resource use, reduced water consumption, reusable and rechargeable, and waste reduction.

According to Wells (2006), the use of self-declarations has resulted in a wide range of advertisements supported by the creative constraints of marketing agencies, appealing for the belief in the veracity of the information by the consumer, which has not always been the case.

Type III statements or technical data sheets explain the environmental impact of the product throughout its life cycle. They are governed by ISO 14025, which is still being elaborated and discussed due to the complexity and difficulty of its implementation process.

Regardless of the type of environmental labeling used, they must follow certain principles, as stated in ISO 14020:

- They should not be made to create trade barriers;
- Generalized and difficult to prove statements such as those of the type: the product promotes sustainable development are prohibited;
- Information about the environmental attributes of the product should be given to customers when requested;
- They should be based on science and not on popular myths;
- They cannot be misleading;
- They need to be easy to verify.

It should be noted that there are other types of statements that do not relate to the environmental attributes of the product and therefore cannot be considered as environmental labeling. As an example, statements can be made about the type of material used (classification of plastic or glass); the quality of the product (quality seal), and the company's contribution to non-governmental organizations (NGOs).

In this way, the improvement and growth of the use of environmental labeling has been observed as a response to the growing concern in terms of the protection of the environment by governments, the market and citizens. In this process, companies are beginning to identify environmental concerns as a competitive advantage and distinction in the market (Barros *et* Freitas, 2010).

In addition to environmental and organizational contributions, environmental labeling can be a powerful tool for discussing the environmental impact caused by different economic activities and their respective products/services, as well as for the development of environmental awareness and changes in terms of consumption habits. Such contributions, however, can only occur if the tool is used correctly, that is, if the statements are, in fact, true, otherwise they will be instruments of environmental deception.

2.3 *Ecodesign*

The incorporation of the environmental dimension into the design of products/services has been increasingly frequent in the business context due to legal and institutional impositions, or by strategic options of the organizations themselves as new business opportunities. According to Peneda *et* Frazão (1994) *apud* Nascimento

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et Venke (2006), in addition to the attributes of efficiency, quality, functionality, aesthetics, cost and ergonomics, the environmental attributes are also included in the development of new products.

In this sense, the improvement of the environmental performance of a product needs to be thought from the conception of the product and permeate its entire life cycle. To do so, there are a variety of eco-design tools that can be used by organizations, from the simplest to the most sophisticated checklists, supported by information and communication technologies.

From the diversity of eco-design tools Bovea *et* Perez-Belis (2010) propose a taxonomic grouping them in three groups: a) Methods for assessing environmental impact, divided into qualitative techniques, seven tools, semi-qualitative (n=5) and quantitative (n=6); b) Tools for the integration of environmental aspects in the design process, presenting 20 tools; and c) Methods for integrating environmental requirements with other traditional aspects, with seven tools (see Figure 2).

Among the tools described, we highlight eco-design strategies (RAILS), specifically the proposal of Brezet *et* Hemel (1997), LiDS Wheel or *Teia de Estratégia de Ecodesign* (TEE - Ecodesign Strategy Web), which was used in this study.

To support the evaluation of the product, TEE presents eight generic eco-design strategies and 33 principles, classified at product component level, product structure level and product system level, as described in figure 3.

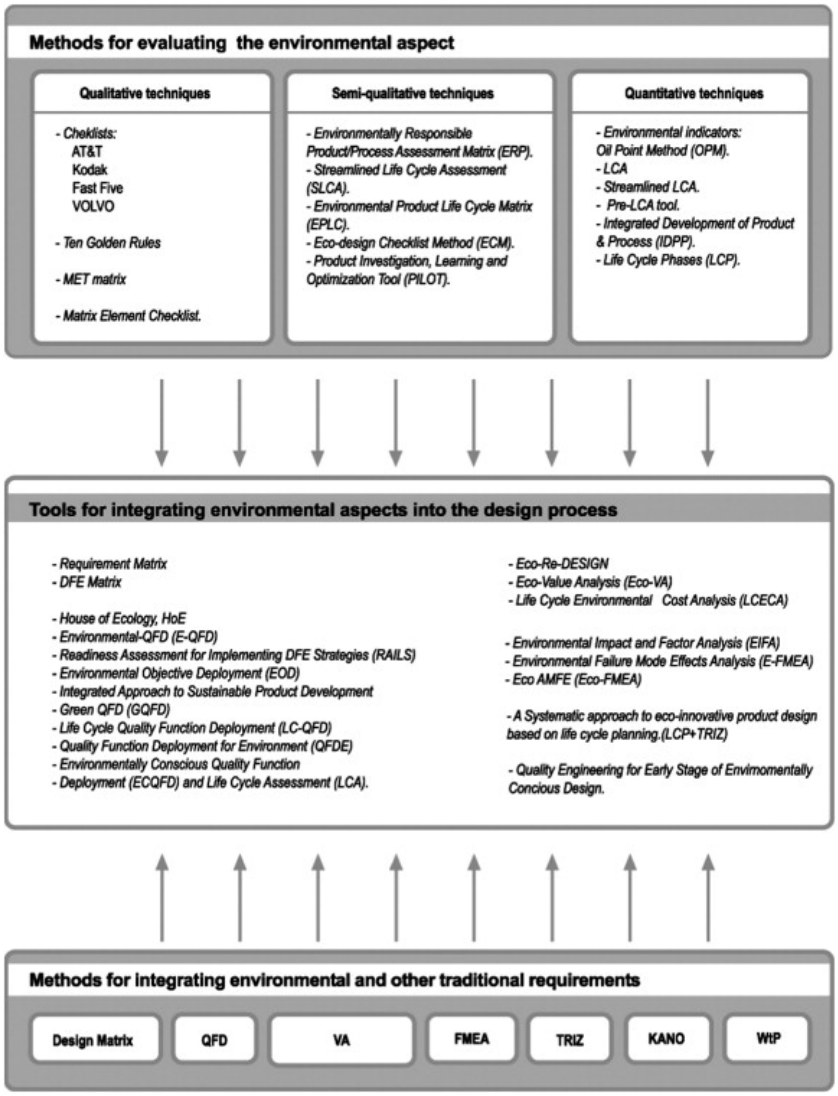

Figure 2 - Ecodesign tool taxonomy
Source: Bovea et Perez-Belis (2010)

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	Generic Strategies	Principles
-	0. Development of a new concept	0.1 Dematerialization 0.2 Shared use of the product 0.3 Integration of functions 0.4 Functional optimization of the product or component
Product component level	1. Selection of low impact materials	1.1 Non-aggressive materials 1.2 Renewable materials 1.3 Recycled materials 1.4 Materials of low energy content 1.5 Recyclable materials
	2. Reduced use of materials	2.1 Weight reduction 2.2 Volume reduction 2.3 Rationalization of transport
Product structure level	3. Optimization of production techniques	3.1 Alternative production techniques 3.2 Reduction of production process steps 3.3 Reduction of consumption and rational use of energy 3.4 Use of Cleaner Energies 3.5 Reduction of generation of waste/residues 3.6 Reduction and rational use of production inputs.
	4. Efficient distribution system	4.1 Reduction and rational use of packaging 4.2 Use of cleaner packaging 4.3 Use of efficient transport systems 4.4 Efficient Logistics
	5. Reducing environmental impact at the user level	5.1 Low power consumption 5.2 Use of cleaner sources of energy 5.3 Rational use and reduction of inputs during application 5.4 Use of clean supplies 5.5 Prevention of waste by design.
System level of the product	6. Product life cycle optimization	6.1 Reliability and durability 6.2 Easy maintenance and repair 6.3 Modular structure of the product 6.4 Use of classic design in the sense of style 6.5 User's zeal with the product
	7. Post-use optimization	7.1 Reuse of the product 7.2 Refurbishing and remanufacturing 7.3 Recycling of materials 7.4 Clean incineration 7.5 Energy reuse

Figure 3 - Eco-design Strategies
Source: Adapted from Hemel et Cramer (2002)

The results obtained from the evaluation are represented by a graph of the web type and represent a variation of 20 percentage points, ranging from 0% (center of the graph) to 100% (last circle). The center of the web represents inadequate environmental performance and the outermost circle performs optimally. Once the results are identified, one can choose the strategies with low performance and prioritize them.

Considering the theoretical contributions on the tools of environmental labeling and eco-design, it is believed that they can contribute significantly to evaluate environmental attributes of products denominated green.

3. METHODOLOGY

This research, according to its characteristics, is classified as exploratory and descriptive (Vergara, 2002). As for the means, it was framed as a case study, for having carried out a more accurate analysis about a certain phenomenon. According to Yin (2003), case studies represent the preferred

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strategy when one has little control over events and when the focus is on contemporary phenomena embedded in some real-life context.

The case chosen was the company Greenvana, created in 2010 for exclusive online sales of products with green attributes. In Brazil, the company was considered one of the largest and most influential in this type of business, receiving prominence as a sustainable entrepreneurship in the *Guia Exame de Sustentabilidade* (Sustainability Exame Guide) 2011. Currently, Greenvana has more than 2,000 products, distributed between its two departments: Greenstore and Greenforma. For this research was considered the department Greenstore, with its 715 products arranged in eight categories: 1. Baby, 2. Office and Stationery, 3. Pets, 4. Technology and Innovation, 5. Home, 6. Children and Adolescents, 7. Fashion, 8. Beauty and Wellness. All products accompany description of their respective environmental attributes. The second department, Greenforma, focuses on trade in products and systems for building, refurbishing and water and energy efficiency, and offers basic energy solutions such as the photovoltaic system.

The data collection period was from October 2012 to June 2013. The data obtained were of the secondary type, collected on the company's own website, where the products to be analyzed were chosen, accompanied by their respective attributes.

The analysis of the data was done in a qualitative and quantitative manner, since the research involved objective and subjective aspects, whether quantifiable or not. The focus of the analysis were the environmental attributes described for each product, which were evaluated from the Eco-design Strategy Web, to identify the strategies used and the types of environmental labeling used.

4. PRESENTATION AND ANALYSIS OF RESULTS

4.1 Environmental Labeling

It was found the use of labeling type I, referring to green labels, and Type II, related to self-declarations.

As for the green seals, it can be verified that they were used for only 20% (n=143) of all analyzed products (n=715). From this small number, it was noticed that, when confronted with the diversity of seals with the quantity of products, the category Children and Adolescents became evident: of the 136 products presented, 60 (44.11%) were associated with one of the 4 seals identified 5).

Another category that also used 4 types of green stamps was the House; however, compared to the amount of products disposed, the occurrence was insignificant: of the 206 products marketed in the category, only 10 (4.85%) had any of the four seals identified.

The category of Technology and Innovation was the one

Categories	No. of products	Types of products
1. Baby	96	Clothes for babies (boys and girls), accessories, blankets and sheets, baby bottles and pacifiers.
2. Office and Stationery	40	Office supplies (notebooks, pencils, paper blocks), school supplies (notebook, cases, pens and pencils).
3. Pets	22	Collars, leads (for dogs), houses, beds (for dogs and cats), hygiene and cleaning products (for cats)
4. Technology and inovation	14	Solar powered products (cell phone chargers, lamps), water-powered clocks, rechargeable batteries, water purifying bottle, whiteboard sheet, etc.
5. Home	206	Kitchen utensils (trays, bowls, dishes, tableware, salad bowls), bedding, table and bath (duvet, sheets, bedding, towels), accessories and utensils for bathroom (trashcan, brush holder, soap dish), decoration products (cushions, futton, vases), cardboard furniture (puffs and benches).
6. Children and adolescents	136	Toys (jigsaw, carts, dolls), clothing and footwear (female and male), accessories (backpacks, lunch boxes), others (notebooks).
7. Fashion	177	Clothing and footwear (male and female), accessories (ecobags, backpacks, purses), others (paper wallet).
8. Beauty and wellness	25	Personal care products (nail enhancers), bath products (liquid soap), accessories and utensils for daily use (vegetable sponges, combs, bamboo brush), others (yoga mat, wooden massagers).

Figure 4 - Types of products by categories
Source: The Author

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Categories	Type I - green stamps	n	Type II - self-declaration	n
Baby	IBD Seal GOTS Certification IMO Certification	30 01 01 T=32	2 - Degradable 4 - Elongated product life 7 - Recyclable content 9 - Reduced water consumption	Combined = 23 Isolated = 01 T= 24
Office and Stationery	FSC Seal	14 T= 14	2 - Degradable 6 - Recyclable	Combined = 23 Isolated = 01 T= 24
Pets	FSC Seal Ecocert Seal	01 02 T= 03	2 - Degradable 3 - Designed to be disassemble 4 - Elongated product life 6 - Recyclable	Combined = 06 Isolated = 13 T= 19
Technology and inovation	ROHS Seal	02 T= 02	4 - Elongated product life 5 - Recovered Energy 6 - Recyclable 10 - Reusable and rechargeable	Combined = 07 Isolated = 04 T= 11
Home	SGS Certification Fair trade Seal IBD Seal ROHS Seal	06 02 01 01 T= 10	2 - Degradable 4 - Elongated product life 6 - Recyclable 8 - Reduced use of the resource 9 - Reduced water consumption	Combined = 91 Isolated = 68 T=159
Children and adolescents	FSC Seal IMO Certification IMO and Control Union Certification IBD Seal	27 12 12 09 T= 60	2 – Degradable 4 - Elongated product life 6 - Recyclable 9 - Reduced water consumption	Combined = 11 Isolated = 45 T= 56
Fashion	IBD Seal Fair Trade Seal IMO and Control Union Certification	01 04 09 T= 14	2 - Degradable 4 - Elongated product life 6 - Recyclable 8 - Reduced use of the resource 9 - Reduced water consumption 10 - Reusable and rechargeable	Combined = 50 Isolated = 99 T=149
Beauty and wellness	Ecocert Seal NOP and IBD Seal FSC Seal	01 01 06 T= 08	2 - Degradable 4 - Elongated product life 6 - Recyclable 10 - Reusable and rechargeable	Combined = 12 Isolated = 05 T= 17
Total products		T= 143		T= 459

Figure 5 - Environmental Labeling
Source: The Author

with the fewest seals, with only one green stamp, which was found in two products of the 14 existing ones. Figure 6 better delineates the product categories analyzed, as it quantifies each one with its respective percentage values, relating the total of identified green seals to the totality of products that used them and how this is reflected in the amount of products present in each category.

As to the type of green seals, 10 different types were used, listed below:

- IBD (Instituto Biodinâmico de Desenvolvimento/ Biodynamic Development Institute);
- GOTS (Global Organic Textile Standard);
- IMO (Instituto de Mercado Ecológico/Institute of Ecological Market);
- ROHS (Restriction of Certain Hazardous Substances/ Restrição de Certas Substâncias Perigosas);
- ECOCERT (Certificação Orgânica - Organic Certification);
- SGS (Société Générale de Surveillance/Companhia de Verificação Geral/ General Verification Company);
- COMÉRCIO JUSTO (Fair Trade);
- Control Union (União de Controle);

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Category	Diversity of green seals	Total products	Total products with green seals	% of products that used green seals
Baby	3	95	32	33,68%
Office and Stationery	1	40	14	35%
Pets	2	22	03	13,63%
Technology and inovation	1	14	02	14,28%
Home	4	206	10	4,85%
Children and adolescents	4	136	60	44,11%
Fashion	4	177	14	7,91%
Beauty and wellness	4	25	08	32%

Figure 6: Use of green seals

Source: The Author

- FSC (Forest Stewardship Council/Conselho de Manejo Florestal);
- NOP (National Organic Program/Programa Nacional Orgânico).

It should be noted that the most used types were the FSC for 48 products and the IBD for 42 products, both of which represent 63% of the products with this type of certification.

When analyzing the use of green seals by categories of products, it was verified that they were more used by the categories Children and Adolescents and Baby, corresponding to 44% and 34% of their products, respectively (see Figure 5). This can be due to the location of the certifiers in Brazil, which facilitates access, as well as the breadth of products that these seals cover. The FSC seal, for example, includes a set of products whose main raw material comes from ecologically-managed wood, and can be present in accessories such as combing brushes, children's toys, crayons and paper sheets.

Regarding the self-declarations, it was verified its predominance in many products: of the 715 products analyzed, 459 had some type of self-declaration, which represents 64.20% of the total products.

The most commonly used self-declarations were: degradable (53%), recyclable (40%) and elongated product life (28%), which were present in seven product categories. The degradable self-declaration was present in 244 products; the recyclable, in 182 products; and the shelf life of the elongated product in 129 products.

Of these self-declarations, it is worth mentioning the contributions of degradability and the extension of useful life, mainly in its implications on the final disposal of the product that guarantee a smaller impact to the environment. Regarding the characteristic of being recyclable, although important, it is perceived that its effects may not be effective, since there is no guarantee that the products and raw materials will be recycled, mainly by the structure in force in the country when the collection of solid waste occurs.

In all product categories more than one type of self-declaration was used, given the name of combined self-declarations (see figure 5). The self-declaration with the lowest use by products and categories was designed for disassembling: only two products use it and were disposed in the same category, which represented a number that was not expressive before the declarations degradable, recyclable and elongated product life, already detailed.

Products whose self-declarations presented could not be considered as such according to ISO 14021 standards were found. These self-declarations were used in 113 products, representing 15.8% of the analyzed products. As an example, the self-declarations are: "does not use child labor" and "ISO 14001 certification", which refer to the company and not to the product. "ISO 14001 certification" refers to the company's environmental management system and not specifically to the company's products, therefore, it does not qualify as environmental labeling. This finding is worrying, mainly because it is a company that was created to sell only "green products", which shows the fragility in terms of the analysis and selection of the products that will be sold under that label. The need for the company to be more knowledgeable about environmental labeling and more rigorous in terms of the choice of products is necessary in order to ensure that self-declaration is not characterized as a form of eco-deception.

4.2 Eco-design Strategies

Regarding eco-design strategies, the "low impact materials selection" strategy predominates in all categories of the products analyzed, specifically the "non-aggressive materials" principle, which alone accounted for 529 (74%) of the 715 Analyzed. The other principles of this strategy occurred in fewer number, such as "recycled materials" present in 227 products and "recyclables", identified in 195 products (see figure 7).

The use of this type of strategy brings important contri-

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butions, mainly when reducing the level of aggressiveness of the materials used, reducing the impacts on the environment and human health. It also highlights the contributions of the use of recycled materials, which reduce the use of natural resources and the final disposal of products and also contributes to sustainability. Nevertheless, such contributions are relatively minor because there is no guarantee that materials will actually be recycled since the recycling process includes activities that are outside the dominium and control of the organizations responsible for the making/selling of such products.

The second most prevalent strategy was the "optimization of post-use", comprising a total of 169 products. The principles identified in this strategy were "product reuse" and "material recycling". The reuse of the product brings important contributions by allowing a better exploration of the useful life of the product, reducing the consumption of new materials and delaying the beginning of a new productive process; while the recycling of the product has a smaller contribution, as mentioned previously.

The "product lifetime optimization" strategy was present in six of the eight categories of products analyzed; however, only the use of the "reliability and durability" principle was verified, resulting in a total of 154 products or 21.54% of the total of products studied. This principle brings important contributions, especially with regard to durability, which allows the product to be extended, i.e. the usage time is extended, delaying the disposal and, consequently, reducing the consumption of resources in a larger period of time.

With regard to the least used strategy, we can highlight the "development of a new concept", which occurred in only 20 products, which included the principles of "integration of functions" and "functional optimization of the product or component". It means that, of all the products surveyed, those that use this strategy are reduced to only 2.80%. Although little used, this strategy has important contributions, mainly because it interferes in the other strategies. However, when designing products, it is necessary to think about and contemplate all stages of the product life cycle, which requires trained and sensitive design professionals with environmental vision and interdisciplinary work skills. Certainly, due to these aspects, it is observed the difficulty in terms of applying this strategy by companies.

The only unused strategy was the "reduction of the use of materials", which demonstrates the lack of concern of organizations with the finitude of natural resources, considering them abundant and inexhaustible.

Finally, it should be noted that almost all eco-design strategies were used; however, these included the use of few principles, which were among those that were easier to apply and easy to see by customers, such as selection of low impact materials. Therefore, it can be inferred that the economic bias, strongly present, results in the limitation of options regarding the design, development and improvement of products with green attributes.

5. CONCLUSION

The type of labeling most used in the analyzed products was self-declaration, and degradable (53%), recyclable (40%) and elongated product life (28%) were the most common ones. The use of green seals occurred in only 20% of the products, which had mainly the FSC and IBD seals.

These results clearly show the organizations' choice and preferences for self-declarations that may arise from aspects such as the need for third-party involvement (certification companies) for such labeling to be used. This significantly reduces the cost of labeling and also the time of operation, and the way the communication of the attribute becomes more direct, simple, objective and easy to understand by the general population. On the other hand, there are few types of green seals available, as well as strong requirements to meet the criteria imposed by such seals, often difficult to meet by small and medium-sized companies.

However, the ease of use of self-declarations may lead to misleading practices on the part of companies, since they do not need to be proven in advance. They may also overvalue a type of attribute that has little or no immediate environmental contribution to the detriment of other types, such as "recyclable", which deals with a future possibility of environmental gain that may or may not become a reality and the "reduced consumption of water/energy"; different from "does not contain toxic substances", whose environmental gains are immediate.

Regarding eco-design strategies, it is necessary to think about which stages of the product life cycle can cause more environmental impacts and, from product design, to define the environmental attributes to be incorporated in each stage. In the case studied, of the eight eco-design strategies, the most used ones refer to the strategy "selection of low impact materials" (non-aggressive materials) and the strategy "post-use optimization" (reusable and recyclable). This scenario reveals little concern in terms of the other stages of the product life cycle.

Finally, it is important to highlight the particularities of the various products and sectors, which reflect different conditions for the creation of green products, involving aspects related to supply, such as internal organizational conditions (financial resources, inputs, technology, knowledge, among others) (Demand for green products, level of awareness of

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Categories/ Strategies	0	1	2	3	4	5	6	7	Observations:
Baby		1.1		3.1					Isolated strategy 1.1 = 41 Combined strategies = 54 Total products = 95
Office & Stationery		1.1 1.3 1.5					6.1	7.1 7.3	Isolated strategy 1.1 = 31 Combined strategies = 9 **Total products = 40**
Pets	0.3 0.4	1.1 1.3 1.5					6.1	7.3	Isolated strategy 1.1 = 02 Isolated strategy 1.3 = 05 Combined strategies = 15 **Total products = 22**
Technology and innovation	0.3 0.4	1.1 1.5				5.2 5.3 5.4	6.1	7.1 7.3	Isolated strategy 6.1 = 02 Combined strategies = 12 **Total products = 14**
Home	0.4	1.1 1.2 1.3 1.5		3.1	4.2	5.1 5.2 5.4	6.1	7.1 7.3	Isolated strategy 1.1 = 26 Isolated strategy 1.3 = 08 Combined strategies = 172 **Total products = 206**
Children and adolescents	0.4	1.1 1.2 1.3 1.5		3.1 3.2 3.3 3.6	4.2	5.4	6.1	7.1 7.3	Isolated strategy 0.4 = 05 Isolated strategy 1.1 = 51 Isolated strategy 1.5 = 01 Combined strategies = 79 **Total products = 136**
Fashion	0.4	1.1 1.3 1.5		3.1 3.2 3.3 3.5 3.6			6.1	7.1 7.3	Isolated strategy 1.1 = 52 Isolated strategy 1.3 = 02 Isolated strategy 1.5 = 01 Isolated strategy 6.1 = 02 Combined strategies = 120 **Total products = 177**
Beauty and wellness		1.1 1.2 1.3 1.5						7.3	Isolated strategy 1.1 = 12 Combined strategies = 13 **Total products = 25**

Figure 7 - Eco-design Strategies

Source: The Author

Subtitle: The eight eco-design strategies*:*

0. Development of a new concept
0.3 Integration of functions
0.4 Functional optimization of the product or component

1. Selection of low impact materials
1.1 Non-aggressive materials
1.2 Renewable materials
1.3 Recycled materials
1.4 Materials of low energy content
1.5 Recyclable materials

2. Reduced use of materials

3. Optimization of production techniques

3.1 Alternative Production Techniques
3.2 Reduction of production process steps
3.3 Reduction of consumption and rational use of energy
3.5 Reduction of wastes/residues generation
3.6 Reduction and rational use of production inputs

4. Efficient distribution system
4.2 Use of cleaner packaging

5. Reducing environmental impact at user level
5.1 Low power consumption
5.2 Use of cleaner energy sources
5.3 Rational use and reduction of inputs during application
5.4 Use of clean supplies

6. Product life cycle optimization
6.1 Reliability and durability

7. Post-use optimization

7.1 Reuse of the product
7.3 Recycling of materials

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society and customers, competition, government pressures, among others). Both conditions may be more or less favorable to the creation of green products.

With regard to the research contributions, the debate about green products, their attributes and their different forms of evaluation, is highlighted, especially when two important environmental management tools are used together: Ecodesign and Environmental Labeling. Regarding the limitations, due to the number of products analyzed (n=715) and the use of only secondary data, it was not possible to cross-reference information from customers, suppliers, production companies and others. As suggestions for future research, it is recommended that this study be extended to other companies that have green product lines, both manufacturers and marketing specialists.

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