Ecodesign strategies and the product development process within northeast sme brazilian companies

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Abstract:This research work is part of the "Institute Fabric of Millennium – IFM", a national project which aims to support the product development process within Brazilian companies and financially supported by CNPq. The research aims to identify the use of Ecodesign Strategies within Northeast and Southeast Brazilian Small and Medium Enterprises (SMEs) and their external and internal drivers as well as the "roadblocks" for their implementation.
In order to achieve these goals a research methodology approach was set. The initial stage of the research methodology was based upon an extensive literature survey. Then, a questionnaire was developed aiming to identify whether Brazilian SME companies within these regions are taking into account environmental aspects during their product development process. The questionnaire was used to support a series of visits and interviews with designers and people responsible for the product design within 49 SMEs located at Northeast and Southeast regions of Brazil.
This work has shown that legislation and government regulations were the main external drivers for companies to adopt Ecodesign strategies within their product development while environmental and production cost reduction; and the opportunity for new markets were considered to be the main internal driver for Northeast and Southeast regions respectively. The main roadblocks for implementing Ecodesign were the lack of market demand for environmental friendly products and the perceived view from companies that the development of "green" products will bring commercial drawbacks to them.
Keywords: Ecodesign practices, northeast and southeast Brazilian SME, product development, external and internal drivers, roadblocks.

1. Introduction

This research work is part of the "Institute Fabric of Millennium – IFM", a national scientific project which aims to support the product development process within Brazilian companies and financially supported by CNPq (National Research Foundation).

Since the last decade, environmental concerns and fierce competition have become to be key aspects to companies within globalized markets, especially to SMEs. Most of the Brazilian SME companies are considered to be "family business" and currently employees a total of 60 million people. They are 4.5 million small businesses, accounting for 98% of industrial, commercial, and service undertakings, more than 60% of urban jobs, and around 21% of the GDP as well as being responsible for 12,4% of all exports on a direct way (SEBRAE, 2003).

The results of this research are based on the analysis carried out within 49 SMEs which are located at the Northeast and Southeast part of Brazil. A number of 36 companies are located at the Northeast (25 of them were located at the Rio Grande do Norte State and 11 of them were located at the Bahia State). In addition, a number of 13 companies were located at the Southeast region of Brazil (10 of them were located at São Paulo and 3 of them at the State of Minas Gerais). Therefore, the results presented in this article are only valid for the companies researched. There is no intention to generalize these results to others SMEs throughout Brazil.

2. Research Aims

This research work is based on a group of visits within SME Brazilian companies. Interviews were carried out with professional designers or those who were responsible for the product development in those companies. Basically, the research intends to:

♦ Present which Ecodesign strategies are most used within these companies;

♦ Identify the relationship between these strategies and their possible External and Internal drivers, and;

♦ Identify the main "roadblocks" for companies to incorporate environmental aspects into their product development.

It is believed that the analysis of these aspects will bring new insights for designers on how the development of "environmental friendly products" can be carried out within SME companies. Previous studies based on this project have already been published elsewhere (COSTA & GOUVINHAS, 2002).

3. Literature Review

Ecodesign is regarded as a "systematic integration of environmental considerations into product and process design" (IRAP, 2003). As environmental issues have become more important for competitiveness and Ecodesign offers a new perspective for product development.

3.1 Ecodesign Benefits

In general terms, Ecodesign can help companies to enhance their environmental performance and, as a consequence, to improve the competitiveness of their products. Therefore, companies can achieve further benefits such as (CHARTER, 2001):

a. The reduction of the environmental impact of products;

b. The optimization of raw material consumption and energy use;

c. The improvement of waste management;

d. The opportunity to drive companies towards innovation;

e. The reduction of production costs and so on.

However, some previous studies on application of Ecodesign strategies have indicated that there are some barriers for their implementation. For example, companies have suggested that they do not feel themselves responsible for the protection of the environment; they also do not see clear benefits from implementing environmental protecting actions and they believe that there is no alternative solution at the moment (Van HEMEL & CRAMER, 2002). As a consequence, few companies have implemented Ecodesign strategies into their product development process.

3.2 Ecodesign Internal and External Drivers

There are some factors which stimuli the implementation of Ecodesign within the company. These can be classified as internal drivers when it comes within the company itself, and external drivers when it comes from the company's surroundings (Van HEMEL & CRAMER, 2002).

Some research works have identified these internal and external drives. For example, the need for increasing product quality; the image corporation improvement and the need to reduce costs can be seen as internal drivers within companies. Similarly, new government policies; the increasing market demands for environmental friendly products and the fierce competition can be seen as external drivers for companies (LEWIS & GERTSAKIS, 2002).

3.3 An Overview of the Ecodesign Strategies and the Strategy Wheel

van Hemel has identified 33 Ecodesign strategies for the development of environmental friendly products (Van HEMEL & CRAMER, 2002). These strategies were classified within 7 groups and organized in the so-called "Ecodesign Strategy Wheel" (see Figure 1) (IRAP, 2003). This wheel provides a basic framework that can be used systematically to review the entire life cycle of a product.

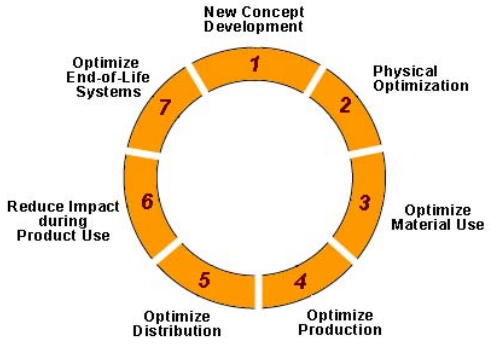

Figure 1: Ecodesign Strategy Wheel (IRAP, 2003)

Optimizing the product's performance will require a balance of functional, economic and environmental

elements. The Strategy Wheel begins with new product concepts, and covers design, materials selection, production, distribution, and the use and end of a product's life. These strategies should be seen as guidelines that designers have to consider when developing environmental friendly products.

Many research works have been carried out to verify the utilisation of these strategies within companies. Some of them were more concerned on the development of environmental friendly products itself (LEWIS & GERTSAKIS, 2002) while others were more concerned on the utilization of ecodesign at strategic level (TISCHNER, 2001; TUKKER, HAAG & EDER, 2000; Van HEMEL & CRAMER, 2002). In Brazil, the studies on ecodesign issues have also similar variation. Some of the research works have analysed the use of ecodesign strategies within furniture industry at strategic level (VENZKE, 2002) while others have tried to indicate the potential use of the strategies within SME companies (ECHEVESTE, DANILEVICZ & SAURIN, 2001).

Despite of these efforts, research works on the application of ecodesign strategies in Brazil seems to be very shallow. It is believed that a more detailed analysis is required to evaluate these issues. Therefore, a research work was proposed aiming to tackle the development of environmental friendly products into more details.

4. Research Methodology

In order to verify the research aims and hypotheses listed in section 2, the following research methodology was established:

4.1 Phase I

The initial phase of this research was based on a literature review when aspects related to the application of ecodesign within SME companies were considered. The study has indicated that the practice of ecodesign strategies varies largely throughout the world. In some countries such as Sweden and Norway, Ecodesign is more largely developed while in other countries it is still in its infancy (TUKKER, HAAG, & EDER, 2000). The literature review was also important to evaluate why Ecodesign is so important for competitiveness and which were the main strategies suggested in the literature (Van HEMEL, 2001).

4.2 Phase II

Based on the results from the literature review, a questionnaire was developed in order to support the analysis of the use of ecodesign strategies within Brazilian SME companies. The questionnaire was divided into two parts. The first part included the analysis of the internal and external drives as well as the "roadblocks" for implementing Ecodesign within SMEs. In addition, each Ecodesign strategy was analyzed. The second part of the questionnaire included an open question where the respondents were stimulated to make their comments regarding the use of Ecodesign. As a consequence, 49 SME companies were randomly contacted based on the following classification (SEBRAE, 2003): 11 companies were considered as micro business (companies which have up to 19 employees); 22 companies were considered to be small business (companies which have from 20 to 99 employees) and 16 of them were considered to be medium business (companies which have from 100 to 499 employees). These companies represent many branches of industry such as: Wood Furniture, Packaging, Manufacturing Metal Products, Fiber Glass Products, Glass Products and Clothing Industry. The analysis was based on observations and interviews with designers and/or professionals responsible for product development who had significant experience and a good overview of company methods and procedures. These results are presented in section 5 of this work.

5. Discussion

In this section, it will be carried out a comparison between Northeast and Southeast SMEs perception regarding the outcomes achieved.

5.1 External drivers for implementing environmental issues into product development process within SME companies

This section shows the results regarding the external drivers for the implementation of Ecodesign strategies within SME companies. It can be observed that there are some similarities and differences regarding the perceptions of the SME companies of both regions researched.

5.1.1 Northeast SME companies

The analysis of the results have indicated that the three most important external drivers for implementing environmental issues into product development process into Northeast SME companies are respectively:

I. *Legislation and government regulations* – These results suggest that the government plays an important role as

the main driver for implementing environmental issues into SME companies. The government can introduce new procedures to increase the level of awareness and conscious regarding environmental issues into business. This could be achieved by, for instance, the adoption of workshops, seminars and training for those companies willing to take part of a general Ecodesign program. In fact, the government has already taken some of these actions. However, few of these programs have effectively help companies to change the way they develop their products. Other actions could also include the implementation of a tax reduction program for those companies which develop environmental friendly products.

II. *Suppliers offering raw material of better environmental performance* – Northeast SME companies considered that the lack of local suppliers offering raw material with better environmental performance is considered to be an expensive requirement for developing environmental friendly products for the local market. In addition, most of these companies visited have argued that customers are not willing to pay a higher price for environmental friendly products. Moreover, some companies have suggested that there is not a demand for "green" products.

III. *Environmental pressure from industrial organisations and increasing market demands for environmental friendly products* – This third external driver is due to the adoption of ecodesign strategies from companies' main competitors. In order words, SME companies will only become concerned with environmental issues if their competitors have done the same. As a consequence, environmental issues are not considered to be a strategic issue for their business at the moment. These findings are similar to some European countries such as Portugal, Spain, Ireland and Greece (TUKKER, HAAG & EDER, 2000).

5.1.2 Southeast SME companies

The analysis of the results have indicated that the three most important external drivers for implementing environmental issues into product development process into Southeast SME companies are respectively:

I. *Legislation and government regulations* – This result is the same as that found to Northeast SME companies. Once again the government plays an important role as the main driver for implementing environmental issues into SME companies.

II. *Increasing market demands for environmental friendly products* – Southeast SME companies have stated that the increasing market demands for environmental friendly products could be one of the main drivers for implementing Ecodesign strategies within their product development process. It seems that these companies have not perceived that there are already "potential markets" to be explored either at the local markets as well as at the international markets for environmental friendly products.

III. *Competitors have already applied Ecodesign strategies on their product development* – This means that these companies will only apply Ecodesign strategies on their product development if their competitors do the same. During the interviews, it was noticed that Southeast SME companies are most concerned with their daily activities as well as the reduction of production costs. Therefore, the environmental issue is not perceived as a strategic issue for their business.

It can be concluded that the majority of the companies visited have a "reactive behaviour" regarding the development of environmental friendly products. It is believed that this happens because most of the companies visited do not have a strategy plan for growth. They are more concentrated on their daily activities and do not establish a medium/long strategic plan for their business.

5.2 Internal drivers for implementing environmental issues into product development process within SME companies

5.2.1 Northeast SME companies

The analysis of the results have indicated that the three most important internal driver for implementing environmental issues into product development within Northeast SME companies are respectively:

I. *A reduction of the environmental impact and costs* – Few companies have argued that they are concerned with the environmental impact of their products. However, it was observed that most of the companies visited are mainly concerned with cost reduction. Nevertheless, adopting Ecodesign practices can also lead companies to reduce their production costs. As consequence, cost re-

ductions may be used as the main stimuli for companies to adopt Ecodesign practices.

II. *An improvement on the corporate image and new market opportunities* – The companies visited have also mentioned that the improvement in the corporate image and new market opportunities could be considered as external drivers for developing environmental friendly products. However, a deeper analysis has indicated that most of these companies do not considered themselves to be technically and financially prepared to develop environment friendly products. In addition, it was observed that there is a lack of vision from the interviewees regarding the potential market for environmental friendly products.

III. *Interesting on long term innovation opportunity* – In practice, this option seems to be very difficult for companies to implement, mainly due to the Brazilian economic instability and a lack of long-term governmental policies addressed to the research and development process within such companies.

5.2.2 Southeast SME companies

The three most important internal drivers pointed out by Southeast SME companies are respectively:

I. *New market opportunities* – Once again, new market opportunities have been considered as one of the main internal drivers for companies to implement ecodesing strategies within their product development process. However, companies need to be assisted regarding training and technological improvements to be prepared to attend this new market demands.

II. *Reduction of production cost (lowest price of selling)* – It was also observed that most of these companies are mainly concerned with cost reduction rather than environmental issues. Companies have not perceived that improvements on environmental aspects of their products may also help them to reduce production costs.

III. *An improvement on the corporate image* – Corporate image has also been considered to be an important driver for implementing ecodesign strategies within company's product development process. Some companies have now realised that their companies have to be associated to important issues such as environmental protection and social responsibility. However, it seems that these companies do not know yet how to implement these aspects within their daily procedures.

It can be concluded that there are some aspects which are similar to companies from both regions (i.e. new market opportunities and improvement on the corporate image). This means that companies are concerned to be more competitive in order to increase their market share and to satisfy new costumers' demands. However, a deeper analysis has indicated that companies are not sure on how this higher competitiveness can be achieved.

5.3 "Roadblocks" for implementing Ecodesign strategies into product development process

5.3.1 Northeast SME companies

The main roadblocks that were found to affect the implementation of Ecodesign within Northeast SME companies were:

I. *Ecodesign strategies only become relevant if supported by market demands* – As mentioned before, due to the lack of commercial vision, most of the SME companies visited do not believe that there is an internal market demand for environmental friendly products. This does not happen at the European market, which is more environmental conscious and, therefore, it demands environmental friendly products (Van HEMEL & CRAMER, 2002; VENZKE, 2002). Unfortunately, Brazilian SME companies do not have tradition to develop products to the export markets. As a consequence, they only perceive their internal market as the entire potential market that they can provide their products and services.

II. *Lack of available technical possibilities at the moment* – Many SME companies visited claimed that there is a lack of qualified personnel and technological support to implement Ecodesign strategies into their product development process at all operational levels. In other words, not only production workers should be trained but also personnel at the managerial level. In fact, Ecodesign is mainly taught at universities and in postgraduate courses. Therefore, there is a need for more investments on education in order to create a group of professional capable to attend the demand for new product developers. This seems to be the case for some European countries as well (Van HEMEL & CRAMER, 2002).

III. *The development of "green" products will bring commercial drawbacks to the companies* – It was also observed that SME companies believe that the development of "green" products can become a commercial drawback to their business performance. They are concerned that consumers may not perceive the commercial benefits of these products and, therefore, it is necessary to make clear to their customers that environment friendly products have a competitive advantage when comparing to their main competitive products. In fact, it was observed that most of the companies are not willing to take risks facing the present internal and external commercial situation. Many companies believe that environment friendly products are more expensive and, therefore, are less competitive in the marketplace.

5.3.2 Southeast SME companies

The three main roadblocks that were found to affect the implementation of Ecodesign within Southeast SME companies were:

I. *Ecodesign strategies only becomes relevant if supported by market demands* – Once again, companies believe that there is no market demand for environmental friendly products. Therefore, there is no reason for developing environmental friendly products.

II. *Environmental friendly product development only becomes relevant if supported by environmental legislation* – The Brazilian government plays an important role on this aspect. New legislation which supports the development of ecofriendly products would force companies to review their strategies.

III. *The development of "green" products will bring commercial drawbacks to the companies* – Once again, companies are concerned that consumers may not perceive the commercial benefits of environment friendly products. Perhaps, new educational actions should be taken to increase customers concerns on environmental protection.

5.4 Comments on Ecodesign Strategies

Comments and conclusions of each group of Ecodesign strategy for Northeast and Southeast regions are presented bellow.

Group of Strategy 1

This first group of strategy is used to implement a whole change into the product design concerning with reducing the overall environmental impact of products and services. It focuses on basic assumptions regarding the function of a product; determining the end-users' needs and even, how the specific product will meet end-users' needs.

Frame 1: Group Strategy 1 – Concept Development.

New Concept Development *"perception of the most SME companies"*	
NE	• SME companies **partially** believe that their products are "environmental friendly"; • To carry out a market research to identify their end-users' needs; • **Half** SME companies **agree** and **half disagree** that there is a demands for environmental friendly products at the moment; • SME companies have **already** the technical skills required to develop "environmental friendly" products; • Currently products developed by SME companies meet end-users´ needs.
SE	• SME companies **believe** or **partially believe** that their products are "environmental friendly"; • To carry out a market research to identify their end-users' needs; • **There is no** a demands for environmental friendly products at the moment; • SME companies **have no** technical skills required to develop such products; • Currently products developed by SME companies meet end-users´ needs.

Either northeast as well as southeast companies believe that their products may harm the environment. This can be verified due to the type of SME companies researched. Despite northeast SME companies have argued that they are capable to develop environment friendly products, it was noticed that this is based on their shop floor capabilities. There is no concern of this kind at the product development level. Despite of these results, it was observed that one of the barriers for implementing Ecodesign strategies within SME companies is the lack of qualified personnel in this area.

In addition, most of SME companies also claimed that they carry out a marketing research and that they meet end-users' needs.

Group of Strategy 2

This second group of strategy is related to the physical optimisation of the product. In other words, this strategy aims to enhance the functional and aesthetical performance of the product with the proposal of extending its useful-life.

The application of this strategy lead to additional improvements in environmental aspects of a product.

Frame 2: Group Strategy 2 – Physical Optimization.

	Physical Optimization *"perception of the most SME companies"*
NE	• Try to integrate different product functions; • Try to maximize the reliability and durability of their the product; • Easy maintenance and repair are considered during product's development; • Try to make it simple without affecting its functionality and/or overall cost; • Easy-to-follow manual instructions on regular maintenance and repair are **not** developed together with the product; • Product is developed based on a modular structure as possible; • Product can be upgraded considering functional and/or aesthetical aspects
SE	• Try to integrate different product functions; • Try to maximize the reliability and durability of their the product; • Easy maintenance and repair are considered during product's development; • Try to make it simple without affecting its functionality and/or overall cost; • Easy-to-follow manual instructions on regular maintenance and repair **are** developed together with the product; • Product is developed based on a modular structure as possible; • Product can be upgraded considering functional and/or aesthetical aspects.

Most of the respondents claimed that their products are developed in such a way that they are simple, reliable, durable, easy to maintain and repair as well as that their product's functions are integrated and they can be upgraded when considering functional and/or aesthetical aspects. However, it was also observed that most of Northeast SME companies claimed they do not develop an easy-to follow manual instruction on maintenance and repair for their products. This means that customers might have to rely on after sales service to maintain their products on a regular basis. Furthermore, a modular structure is one of the key product's characteristics to achieve these goals and this is taken into account by most of SME companies.

Nevertheless, it was observed that these strategies are implemented in a superficial manner. Therefore, the systematization and deepness on the implementation of these strategies within the product development process have not been identified within companies of both regions.

Group of Strategy 3

This group of strategy focuses on selecting the most environmentally appropriate materials, substances and surface treatments for product manufacture.

Frame 3: Group Strategy 3 – Optimize Material Use.

	Optimize Material Use *"perception of the most SME companies"*
NE	• Product is **partially** developed using materials or additives which can cause hazardous emissions to the environment and/or health during production; • **Half** SME companies develop their product using renewable materials; • Raw materials used in their product are found far away from their processing or they are difficult to extract; • Product **is not** developed with recycle production residues obtained from other industrial processes; • Product is developed using spare materials obtained from other industrial process; • SME companies have a program of destination from their residues for recycling or re-use by other companies; • Product is developed to use less material as well as reduced packaging size and volume
SE	• Product **is not** developed using materials or additives which can cause hazardous emissions to the environment and/or health during production; • SME companies **do not** develop their product using renewable materials; • Raw materials used in their product **are not** found far away from their processing or they **are not** difficult to extract; • Product **is not** or it **is partially** developed with recycle production residues obtained from other industrial processes; • Product **is not** developed using spare materials obtained from other industrial process; • SME companies have a program of destination from their residues for recycling or re-use by other companies; • Product is developed to use less material as well as reduced packaging size and volume.

Most of the SME companies visited claimed that they use products and/or additives which can cause hazardous emissions to the environment as well as the human health. This is particularly true because most of these companies were from the wood furniture business which requires the use of solvents and special hazardous chemicals.

In general, companies try to reuse residues of their production processes to the maximum. However, they do

not use recycle production residues obtained from other industrial processes. Many of them believe that the use of this type of material may disqualify their products. Companies have also indicated that such residues are sold or donated to other companies. Dumping residues into the land field comes as the last option.

Group of Strategy 4

This group of strategy focuses on approaches to production that involves practices for "cleaner" production (PmaisL, 2003).

Frame 4: Group Strategy 4 – Optimize Production.

Optimise Production Techniques *"perception of the most SMEs companies"*	
NE	• Product **is not** developed to be manufactured using alternative cleaner energy sources for production process; • Product is developed in order to generate less production waste.
SE	• Product **is not** developed to be manufactured using alternative cleaner energy sources for production process; • Product is developed in order to generate less production waste.

The great majority of SME companies claimed that they do not manufacture their products using cleaner energy sources such as natural gas. However, most of the respondents claimed that their products are developed to generate less production waste. Based on these results, it is believed that the respondents are more concerned with the reduction of cost production of their products rather than the reduction of their environmental impact. Na verdade, observa-se que o ganho ambiental vem como conseqüência do ganho econômico.

Frame 5: Group Strategy 5 – Optimize Distribution.

Optimise Distribution Systems *"perception of the most SMEs companies"*	
NE	• SME companies **do not** consider a re-usable packing system based on a take-back program from the producer to distributor, retailers and end-users; • SME companies adopt recyclable materials for non-returnable packaging and more durable materials for returnable packaging.
SE	• SME companies **do not** consider a re-usable packing system based on a take-back program from the producer to distributor, retailers and end-users; • SME companies adopt recyclable materials for non-returnable packaging and more durable materials for returnable packaging.

Group of Strategy 5

Application of this fifth group of strategy ensures that products are transported from the producer to the distributor, retailer and end-user in the most efficient manner possible.

Most of SME companies claim that they do not consider or do not apply a packaging take-back program in their companies. On the other hand, these companies use recyclable packaging materials or more durable ones. There is, therefore, the need for developing and implementing a re-use packaging system and/or a recycling packaging system for this group of companies.

Group of Strategy 6

This group of strategy focuses on product design to reduce environmental impact during product use. Therefore, aspects such as energy efficiency consumption, the adoption of cleaner energies and the employment of less consumable are considered in this strategy group.

Frame 6: Group Strategy 6 – Reduce Impact during Product Use.

Reduce Impact During Use *"perception of the most SME companies"*	
NE	• Products are developed to be energy efficiency during their use; • Product is developed to use clean energy sources; • Product is developed to reduce the use of consumables such as water, oil, filters, cleaners/detergents and food/ organic materials during its life cycle; • The consumables used in their products are considered to be "clean".
SE	• Products are developed to be energy efficiency during their use; • Product is developed to use clean energy sources; • Product is developed to reduce the use of consumables such as water, oil, filters, cleaners/detergents and food/ organic materials during its life cycle; • The consumables used in their products are considered to be "clean".

It was observed that most of SME companies do not apply these strategies when developing their products. The reason for that is because most of the companies visited is related to the furniture business and, therefore, they are not main consumer of water, oil, filters and detergents as well as any type of energy.

Group of Strategy 7

This last group of strategy is aimed at re-using valuable product parts/components and ensuring proper waste

management at the end of a product's useful life. Optimised end-of-life systems can reduce environmental impacts through reinvestment of the original materials and energy used in manufacturing.

Frame 7: Group Strategy 7 – Optimize End-of-Life.

Optimise End-of-Life Systems *"perception of the most SME companies"*	
NE	• Products are developed to be totally or partially re-used at the end of its useful life (either for the same application or a new one); **(not applied)** • All components of their products or at least part of them can be remanufactured to be re-used either for the original purpose or for a new one; **(not applied)** • All components of their products or at least part of them can be used as materials suitable for recycling; • All components of their products or at least part of them can be incinerated without causing any harm to human health; • Product is developed to be easy disassembled after their useful life.
SE	• Products are developed to be totally or partially re-used at the end of its useful life (either for the same application or a new one); **(not applied)** • All components of their products or at least part of them can be **partially** remanufactured to be re-used either for the original purpose or for a new one; • All components of their products or at least part of them can be used as materials suitable for recycling; • All components of their products or at least part of them can be incinerated without causing any harm to human health; • Product is developed to be easy disassembled after their useful life.

To most SME companies of the Northeast region, it is not possible to re-use or remanufacture of the product due to the type of the components or raw materials used in it. To most SME companies of the Southeast region, the possibility of remanufacturing their product is more significant than the Northeastern SMEs. This mainly due to the fact that most of the SMEs visited in the Southeast is from the manufacturing sector.

Most of SME companies claim that all components of my product or at least part of them can be used as materials suitable for recycling and/or incinerated without causing any harm to human health. Porém poucas tem conhecimento dos reais potenciais de poluição e contaminação inerente desta. Furthermore, easy disassembled after its useful life is still observed.

6. Conclusions

This work has shown that legislation and government regulations were the main external drivers for companies to adopt Ecodesign strategies within their product development. The Brazilian government should play an important role in this process by promoting new strategies such as "green seals", tax reduction incentives and awareness programs to improve the level of environmental conscious throughout costumers in order to create a demand for environmental friendly products.

Regarding internal drivers, reduction of environmental impacts and production costs were considered the most important one by Northeast SME companies. In fact, these SME companies are more concerned on the economic aspects of the product development (i.e. cost reduction issues and/or functional quality improvements) rather than the possible environmental impacts of the product. On the other hand, Southeast SME companies claim new market opportunities as most important internal one. Therefore, Southeast SME companies seems to be more pro-active than Northeast SME companies.

In terms of 'roadblocks" for implementing Ecodesign strategies, most of the SME companies visited in both regions consider that there is not a demand for environmental friendly products and that new technologies and the development of "green" products will bring commercial drawbacks to the companies. It is believed that these aspects are inter-related. The lack of demand for environmental friendly products make companies sceptical regarding investments in this area.

Therefore, in order to catch up with the new trends of European markets, the Brazilian government needs to stimulate the adoption of environmental strategies within SME companies. Some of these actions have already been taken, however, it has not achieved good results so far. It is expected that further research in this area will bring more insights to direct which actions should be taken for a widespread implementation of Ecodesign strategies within SME companies.

7. Acknowledgement

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