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Sustainable Development Actions Employed in Different Industrial Sectors

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Abstract

Today's competitive scenario challenges companies to continue producing but also thinking in terms of resources scarcity and production processes impacts. Sustainable development proposes alternatives for companies to develop by getting the best results with minimal destruction caused to the environment and society of all present and future generations. The challenge is to show that this model of development can be employed by controlling the use, consumption and waste generated. However, this requires a management that involves all stages of the production as well as internalization of the concepts involved in sustainable development. Therefore, the objective of this study is to know the profile of some companies and the actions employed by them to overcome problems related to the implementation of sustainable processes changing paradigms. The study was divided into four steps, as the first one being the selection of eight companies from different segments and areas. The second one was an exploratory search in order to know companies' production processes. The third step was the application of a structured questionnaire on environmental issues, aiming to measure and evaluate some of the actions taken by the selected companies. The last step was the analysis of results, giving the possibility of classifying the companies' stage of sustainability in four stages, according to their actions. The survey results showed that companies have already implemented several practices in ways that benefit society and the environment, but the actions employed are just in the very beginning once it involves investments in management software, technology and professionals.

Keywords: sustainable development; indicators; sustainable actions.

1 Introduction

The concept of Sustainable Development was created in the 1980s by Prime Minister of Norway Gro Harlem Brundtland, indicated by the United Nations to study environment and development. The studies resulted in a document called "Our Common Future or Brundtland Report" in which it is quoted that sustainable development is "one that meets present needs without compromising the ability of future generations to meet their needs." The report warns about the differences between regeneration capability of natural resources and ways of consumption, and the risk of its overuse. The document also proposes a development model joining economic growth, environmental and social issues. Sustainable development is also an answer to the global awareness of the threats embedded in industrial civilization, population explosion and poverty, pollution, uncontrolled and predatory use of natural resources in early 1970 (Sampaio, 2002).

The Environmental Protection Agency of the United States (EPA) realizes Sustainable Development as a long-term approach and a viable balance between economic, environmental and social development. This balance provides opportunities for economic growth and social responsibility.

Following the same thought, John Elkington suggested the term Triple Bottom Line or "3P's" (People, Planet, Profit) in order to measure the financial performance, environmental and social enterprises. Since organizations are directly related to these three aspects, when they start measuring impacts not only by their profit but by social and environmental aspects, they will become environmentally responsible. Figure 1 shows the interrelation of the three factors and the link with sustainability.

Figure 1: The Triple Botton Line – 3P's – People, Profit, Planet. Source: John Elkington, http://www.economist.com/node/14301663.

The education of new generations is the most appropriate and effective tool for sustainability. Neto and Froes (2002) define sustainable societies as those ones where consumerism is replaced by constant investment in the community, promoting a continuous and healthy process for both the man and nature.

Thus, it can be emphasized the need to work in partnership between government, schools, society, companies and organizations to develop sustainability projects, that is, all segments requiring growth and development. The industries have their role in the growth of economy and society, although it is often seen as a source of destruction and depletion of environmental resources and they must, therefore, show their importance in society and be prominent in the identification and implementation of more sustainable options (Azapagic & Perdan, 2000).

Matos & Hall (2007) consider sustainable development as a problematical reality that requires coordination of social, economic and environmental dimensions. Linton, Klassen & Jayaraman (2007) see sustainability as an integrative concept with new initiatives aimed at society regarding environmental problems, which are adopted and proposed by public and private sectors.

Facing this situation, what perspective can be taken in the near future? It is necessary an effective environmental management as fast as the advance of the problem. It is mandatory to review some environmental laws to assess the individuals or corporations conduct, as Brazilian law does not punish as severely as it should (Giansanti, 1998).

According to Karam (2009), industrialized countries and industrial society in capitalist development have a great share of responsibility regarding the destruction of planet's natural resources. Scarcity of natural resources is a fact, and some of these resources that still exist and are available at low cost, in the near future will have costs that will have to be internalized at all levels of the production chain, directly impacting the business of organizations, as well as all involved.

Therefore, this work intends to analyze the profile of some companies about their social-environmental actions within their production processes in order to show how much those environmental practices impact in their sustainable development.

2 Sustainable Development Models

In order to allow the implementation of sustainable processes, it is necessary to design a model of sustainable development, that is, to structure the company in a way that its processes and functioning follow a sustainable model with a clear goal on the point the project should achieve. The importance of a partnership between the public and private sector relies on the fact that it is necessary to plan cities with districts and schools focused on a sustainable structure, to create sustainable enterprises or even raise awareness of sustainability for existing businesses. Silva (2006) points out that the public and private

actions should be directed from the mutual influences of those involved in the process, so that impacts about costs and benefits of each influence on the system can be assessed.

Braga et al. (2005) show that in their new model of sustainability it must work as a closed system which employs recycling and reuse of resources and it is based on the following assumptions:

- Dependence of continuous external supply of solar energy;
- Rational use of energy and resources focused on conservation and not wasting;
- Promotion of recycling and reuse of materials;
- Control of pollution, generating less waste to be absorbed by the environment;
- Control of population growth to acceptable levels, as a perspective of population stabilization.

Another model of sustainable development for businesses cited by Hart & Milstein (2003) shows that it is possible to create value for the company and all involved without losing focus on competitiveness and contributing to the environment. The four dimensions this model proposes are: clean technology develops skills for sustainable future; pollution control minimizes waste emissions from operations; product management integrates the perspectives of stakeholders in business; the vision of sustainability creates a common map to meet the unmet needs.

Porter & Kramer (2002) show a model that deals with corporate social responsibility (CSR) which can be a source of opportunity, innovation and competitive advantage for organizations. They show that corporate social responsibility can promote social and economic benefits to the organization applying responsive CSR and strategic CSR. This is due to the fact that practically all activities in processes chain of business affect the communities in which they are inserted leaving social and environmental consequences either positive or negative.

Thus, each of the presented models emphasize some aspects of sustainable development, at times visualizing the entire production chain to strengthen the environmental impacts of each step, or showing the company as a single process, or focusing a model on corporate social responsibility.

2.1 Sustainable Companies

Attitudes and consistent, ethical and rational measures aiming the protection and conservation of the environment becomes a *sine qua non* condition for good deals and for the business survival in market (Donaire, 2009).

Sharing the same idea, Savitz (2007) showed that all areas and functions of an organization, no matter its size, should be integrated into the sustainability movement such as: production and manufacturing; marketing department; sales department; department of research and development; relationship with customers; human resources department; information technology department; purchasing department; process of managing the supply chain; relationship with investors; finance and accounting; public relations of the organization; environmental health and safety; legal and governmental issues.

Some strategies of the organization may change with the environmental awareness of its leaders, reflecting the change in behavior and attitudes of its employees. Valle (2006) shows the changes from a conventional approach to a conscious approach through environmental awareness. The conventional approach reports the transposition of environmental problems and impacts to third parties, and the conscious approach makes it clear that these results can be opportunities through environmental awareness.

Meul & Passel (2012) add that when it strengthens the knowledge and information focused on sustainability for the people involved with the processes in organizations, projects and environmental actions are best developed once all sectors in the company benefit. Besides, the path to sustainable enterprises also rely on the fact that their products are made under socially acceptable circumstances of work and that all stakeholders are informed of the sustainable actions taken, showing transparency Wognum *et al.* (2011).

3 Research Development

This research was carried out in four steps:

1. Selection of eight companies from different segments and areas, as well as size and longevity in the market;

2. Visiting selected companies to know steps and operation of supply chain, their processes management and the impacts generated by their activities;

3. Application of a structured questionnaire with 37 objective questions on environmental issues, aiming to measure and evaluate some of the actions taken by companies in their production processes and their impacts to the environment and society;

4. Analysis of results, giving the possibility of classifying the companies' stage of sustainability in four stages as a method of monitoring their environmental management, according to their actions.

3.1 Selection of Companies

The surveyed companies were selected from different industrial segments, sizes and manufacturing processes with different levels of environmental impacts. This ensured that the research would cover environmental concerns in several areas. The companies' segments selected were: furniture, transportation, organic food, non-organic food, textile, metallurgical, telecommunications cables and plastics.

All the selected companies employ actions and develop programs inside and outside their plants, aimed at environmental protection and biodiversity. This can be seen in Table 1, in which it can be found some of the key actions that each company practices.

Table 1: Key actions practiced in companies

COMPANY	MAIN ACTIONS EMPLOYED BY COMPANIES
A	• products are purchased only from suppliers accredited with organic certifications; • it has labels which certify that their production is organic, and processing and storage of products are sustainable; • working model follows internal programs of environmental conduct in the organization management.
B	• it uses only renewable wood production, 60% of suppliers are FSC certified (Forest Stewardship council) - the green label for wood; • 100% of waste generated in production process is recycled internally and externally; • it develops products designed for maximum exploitation of all raw materials, reducing significantly the waste.
C	• plan for fleet renewal, keeping it between five and six years, once new trucks pollute less, spend less fuel and their maintenance is cheaper; • it carries out a maintenance plan directly with the dealership ensuring the proper condition and operation of trucks' equipment; • it maintains the CO_2 emissions levels of the fleet within standards of environmental law.
D	• it has a recycling program to properly allocate the leftovers of telecommunications cables regardless of manufacturer, via exchanging the old ones for their new cables; • it is certified by ISO 14001:2004; • it meets European standards for production of electrical and electronic products.
E	• through its Wastewater Treatment Plant it allows reuse of approximately one third of the water in their production processes; • it has ISO 14001:2004 certification; • it has own industrial landfill where its industrial solid wastes are disposed.

F	• the company invests in research and development of products aiming rationalization of water consumption; • it develops programs with the community about efficient and rational use of water; • it treats, reuses and properly disposes its solid and liquid waste.
G	• the company has a program of recycling and reuse of all waste materials internally produced; • in partnership with the community, it recycles more than 60 tons of PET bottles / month for reuse in the production of some kinds of its products.
H	• it uses renewable energy internally produced through biodigestion systems with their own waste, and the use of this alternative energy has already reached 27% of the company energy consumption; • it uses the Wastewater Treatment Plant to reduce its own waste environmental impacts; • it has development projects about building new biodigestion systems for the production of renewable energy through other industrial waste.

Source: authors

3.2 Questionnaire

The structure of the questionnaire with its indicators and the four stages of performance for sustainable development were adapted from Ethos indicators of sustainability (2007). The 37 questions that comprise the questionnaire addressed issues concerning quality, environment, environmental education, process management, life cycle impacts of products and others which are inherent to this research. The selection of the questions used in the questionnaire is given on the basis that these ones would be necessary to meet the aim of the research which is to analyze the sustainable profile of some companies in order to measure the how they are involved with environmental practices.

Each set of questions belongs to certain indicators, structured as follows: indicators 1 and 2 are directed to the responsibility in relation to future generations, and indicators 3 and 4 are directed to the management of environmental impacts. Indicators are divided as follows:

- Indicator 01 - Commitment with Improvement of Environmental Quality;
- Indicator 02 - Environmental Education and Awareness;
- Indicator 03 - Management of Impacts on the Environment and on Products Life Cycle and Services;
- Indicator 04 - Sustainability and Forest Economy and Reduction of Inputs and Outputs of materials.

In Indicator 01, the company should deal with the impacts of its activities giving their importance and following national legislation and developing internal environmental programs emphasizing the principles of environmental sustainability and its opportunities. Indicator 02 shows that the company should contribute to public awareness about the environmental challenges resulting from human activity, strengthening values of environmental responsibility. Indicator 03 takes into account studies, analyzes and actions taken to prevent the environmental impacts caused by its processes, products or services. Indicator 04 notes the company's contribution to forests conservation, combating illegal and predatory exploitation, as well as protecting biodiversity. It is still characterized by optimizing companies' processes, prevention and reduction of environmental damage.

Indicators have a number of questions according to their subject getting organized as follows: indicator 01 with 11 questions, indicator 02 with 6, indicator 3 with 13, indicator 04 with 7 questions, summing up 37 questions of the questionnaire applied for companies.

3.3 Data Analysis

Based on the results of the questionnaires and the respective indicators in percentage, the companies were classified according to the stage they are in relation to their attitudes to sustainable development. Each stage shows where the company is with its actions thus allowing the company to evaluate its evolution.

The stages are divided into four, and each of them has a percentage which represents the efficiency of the organization to environmental practices. The percentage is obtained by the positive answers given in the questionnaire, as follows:

• Stage 1 - up to 60% positive answers;
• Stage 2 - from 61% to 80%;
• Stage 3 - 81% to 90%;
• Stage 4 - over 90% positive answers.

Table 2 shows what each stage represents as well as their percentages. Each stage shows the level of good practice in sustainability and environmental management activities that the company employs.

Table 2: Stage classification of companies related to environmental actions taken

It represents a basic stage of the company's actions, in which it is still in the reactive level to legal requirements, complying only with their obligations.		It represents an intermediate stage of actions, in which the company maintains a defensive stance on environmental issues, but it is starting the changes and progress toward compliance of their practices.		It represents an advanced stage of action, in which the benefits of environmental awareness are already recognized beyond legal compliance, preparing the company for new regulatory pressures of the market, society, etc. Sustainable development and environmental responsibility are seen as strategic for the company.		It represents a proactive stage, in which the company has achieved standards of excellence in its environmental practices, involving suppliers, customers, clients, the community and also serves as reference for society.	
STAGE 1	Up to 60%	**STAGE 2**	61% to 80%	**STAGE 3**	81% to 90%	**STAGE 4**	More than 91%

Source: Adapted from Ethos Indicators of Sustainability (2007)

4 Results and Discussion

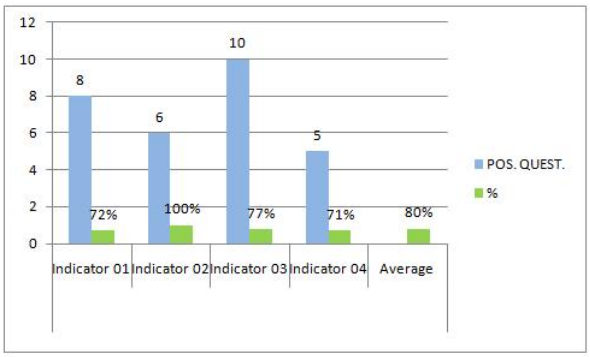
For a better understanding and interpretation of data collected in the survey some graphics were drawn with results. Thus, each graphic represents a company reporting the numbers and results according to the sustainability indicators used. For greater credibility of information received from the companies they had access only to the questionnaire, but the four indicators and the four stages classifications were not shown.

Figure 2A shows the graphic of Company A, in which positive answers were all above 70% with an overall average of 80%, resulting in a Stage 2 of environmental practices (almost being classified at Stage 3). This result can be proved by some of the actions described in Table 1, once the company develops good management with respect to Indicators 02, 03 and 04. Company A's concern about its supply chain certification and the labels reached according to sustainable actions at process, production and storage levels gives it this classification. On the other hand, there are no management strategies to deal with sustainability as an opportunity to improve competitiveness what results in internal problems becoming difficult its maintenance in the market.

Figure 2B represents Company B, which had one single indicator below 90%, Indicator 04 with 71% positive answers. The average of Company B was 91% leading it to Stage 4. Table 1 shows that the company has an efficient management of its processes from production through product life cycle, employing environmental practices. This company has achieved a stage in which all actions employed lead to reductions in raw materials and, consequently, in waste reduction, allowing the introduction of competitive products in the market regarding cost and differential.

COMPANY A

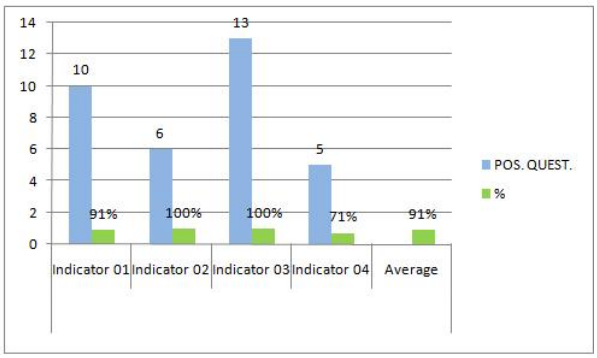
	Indicator 01	Indicator 02	Indicator 03	Indicator 04	Average
POS. QUEST.	8	6	10	5	
%	72%	100%	77%	71%	80%



A

COMPANY B

	Indicator 01	Indicator 02	Indicator 03	Indicator 04	Average
POS. QUEST.	10	6	13	5	
%	91%	100%	100%	71%	91%



B

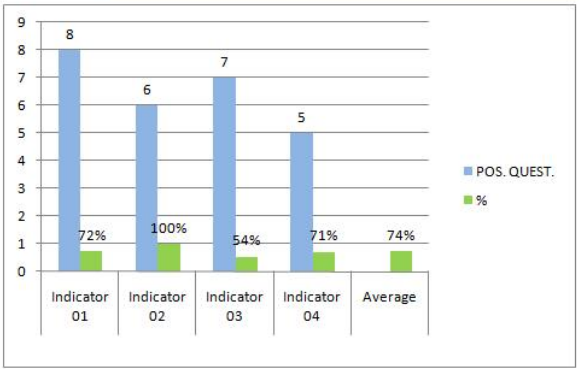
Figure 2: Data processed from Companies A and B. Source: Authors (2012).

Company C got an average of 74%, showing that the company is at an intermediate level of actions, that is, it is at Stage 2 as shown in Figure 3A. Indicators 01, 03 and 04 showed percentages of 72%, 54% and 71%, respectively, leading to the conclusion that these indicators need to be carefully taken into account. Otherwise, Table 1 shows that some actions have already been employed such as fleet management and gas emissions control into atmosphere. Considering the characteristics of this company's segment, transportation of goods, the results are due to the gas emissions that are associated to this service once the main kind of transport is made by trucks. Besides, there is an increasing concern about tires' discharge. These could be the reasons why indicator 3 was only 54% and the company was classified at stage 2. Some actions such as use of fuel alternatives, logistics analysis with clients for route and time alternatives and the correct discharge of waste (tires and oil, for example) should contribute for getting a better classification.

In Figure 3B, data is showing that Company D has also good management attitudes with an average score of 93%. Among indicators, the minimum percentage was 85% to Indicator 03. Table 1 shows some actions taken, such as recycling program and implementation of ISO 14000, which led this company to be classified at Stage 4. Despite of having a well structured reverse logistics, this company could not reach 100% for indicators 3 and 4 because there is still a gap of more appropriate alternatives for dangerous components reuse or retake which are the input materials of this industrial segment.

COMPANY C

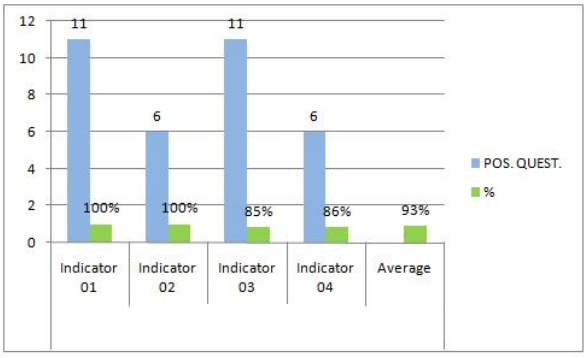
	Indicator 01	Indicator 02	Indicator 03	Indicator 04	Average
POS. QUEST.	8	6	7	5	
%	72%	100%	54%	71%	74%



A

COMPANY D

	Indicator 01	Indicator 02	Indicator 03	Indicator 04	Average
POS. QUEST.	11	6	11	6	
%	100%	100%	85%	86%	93%



B

Figure 3: Data processed from Companies C and D.

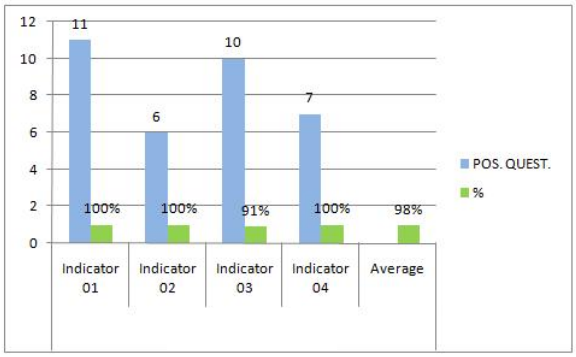
Figure 4A shows that Company E achieved 98% of efficiency in its actions and environmental practices with good results in all indicators. Table 1 shows some examples of actions which reflected in indicators classifying this company at Stage 4: a landfill site, a sewage treatment plant and ISO 14000

implementation. Besides, it must be highlighted that the company reuse water in the process what can be seen as a cleaner production action. On the other hand, many other aspects should be monitored as a way of improving the sustainability indicators as time goes by, such as technological innovation.

Company F results shown in Figure 4B is at Stage 3 with an average of 84%. Table 1 shows examples of environmental practices taken in company's management, which are mainly directed to the responsible consumption of water, but many actions should also be implemented in order to strengthen the aspects of Indicator 03. The main point here is that it is necessary to review products concepts in order to manage the most problematic impacts.

COMPANY E

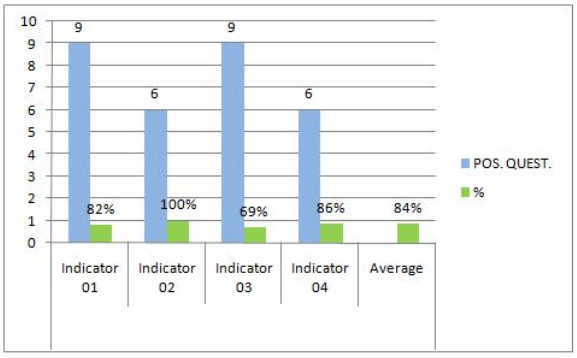
	Indicator 01	Indicator 02	Indicator 03	Indicator 04	Average
POS. QUEST.	11	6	10	7	
%	100%	100%	91%	100%	98%



A

COMPANY F

	Indicator 01	Indicator 02	Indicator 03	Indicator 04	Average
POS. QUEST.	9	6	9	6	
%	82%	100%	69%	86%	84%



B

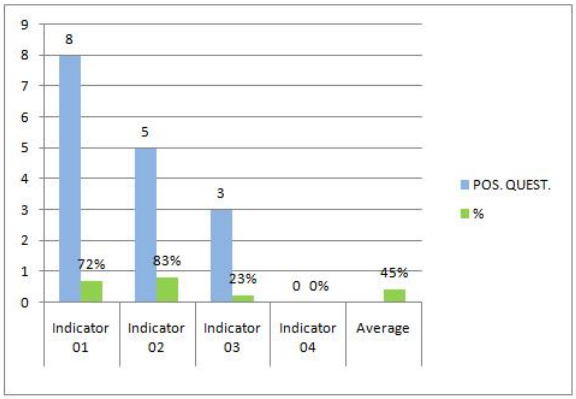
Figure 4: Data processed from Companies E and F.

Data for Company G are shown in Figure 5A, and brought more modest results mainly in Indicator 03 which refers to management of product life cycle and environmental impacts, and only 23% of answers were positive. However, Indicator 04 surprised with no positive percentage related to the optimization of production processes, resulting in an overall average of only 45%. Table 1 shows that some of the key actions taken by this company on environmental practices are really simple, compromising the result and leaving the company at Stage 1. Stage 1 shows that the company should evaluate and review their practices as soon as possible. Recycling is not the most appropriate alternative to reduce environmental impacts, and it must be seen as a common process with many steps which end in solid and liquid waste. Then, a very detailed process flux should be elaborated aiming minimization at every level.

Figure 5B shows Company H with a low percentage of Indicator 03, the same result showed for Company C, but better than Company G. Even with an average of 77%, Table 1 shows that the company employs some actions of high relevance for environmental preservation, getting Stage 2. Actions are concentrated in reducing energy consumption, but the company should analyze its product process and improve it with other practices.

COMPANY G

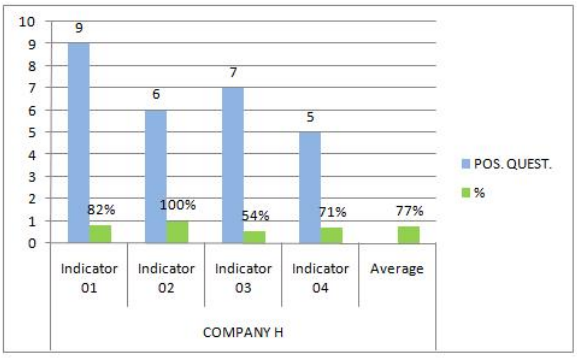
	Indicator 01	Indicator 02	Indicator 03	Indicator 04	Average
POS. QUEST.	8	5	3	0	
%	72%	83%	23%	0%	45%



A

COMPANY H

	Indicator 01	Indicator 02	Indicator 03	Indicator 04	Average
POS. QUEST.	9	6	7	5	
%	82%	100%	54%	71%	77%



B

Figure 5: Data processed from Companies G and H.

Figure 6 brings the result of all companies, showing that the overall positive average was 80%, placing companies at Stage 2 (almost classified at the Stage 3). This was due to the simplicity of actions taken by some of the companies surveyed, as shown in Table 1. However, none of the companies were classified at Stage 1 of development what can lead to the conclusion that despite of not having ISO 14000, most of the companies are concerned about practices that bring positive results to environment.

GENERAL COMPANY

	Indicator 01	Indicator 02	Indicator 03	Indicator 04	Average
% POSITIVE	84%	98%	67%	69%	80%
% NEGATIVE	16%	2%	33%	31%	21%

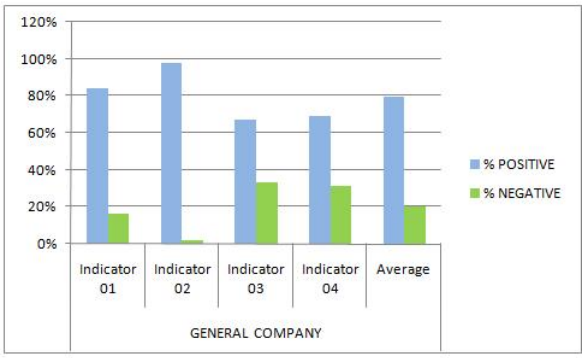


Figure 6: Average data processed from all Companies.

Only one company was at Stage 1, which is the initial stage in which the company is only worried to comply with legal obligations. The result showed that three companies were at Stage 2, one at Stage 3 and three companies at Stage 4. The four levels bring information on sustainability issues of interest to companies, so each of them has its degree of difficulty according to the type of company.

Indicator 3 (Management of Impacts on the Environment and Products Life Cycle and Services) is the one that varied the most among companies, and Indicator 02 (Environmental Education and Awareness) presented less difference. Thus, it can be noticed that organizations are most active when it comes to environmental awareness and education and are much more vulnerable to environmental impacts and product life cycle.

Indicators 01, 03 and 04 show similar results between the companies, once commitment to environmental quality, sustainability and minimization of inputs and outputs of materials, respectively, are almost equivalent, empowering companies in these respects.

5 Conclusion

In a general way, companies have already shown a concern about environment and society. This research contributes to ensure this fact, but it also makes clear that there is still much to do. It is not possible to make a true statement for all companies, but the fact is that many of them find it difficult to manage the life cycle of their products and the environmental impacts related, once it involves investments in management software, technology and professionals.

In short, companies have already developed many actions directed to environment and society, what could be demonstrated during the research once they already have projects under development on reducing the environmental impacts linked to society's satisfaction and the reduction of process costs.

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