Analysis of the sustainability of the aviation sector in Brazil, in the context of anthropogenic climate change

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Abstract

In relation to pursuing sustainable development, environmental issues are included on the agendas of organizations as a subject of fundamental importance. In fact, a growing number of companies, under increasing pressure, in relation to developing environmentally responsible operations, are formalizing commitments to preserve the natural environment as an important operation variable in the face of increasingly competitive markets. In this study, scenarios within the economic, social, technological and environmental parameters are analyzed. In order to transform affirmations into numeric indicators, using the Likert scale.

Keywords: sustainable development, competitive advantage, critical factors indicators.

Introduction

The search for integrated ways to address environmental issues and development has resulted in the need for the creation of concepts which allow this duality to be dealt with harmoniously (SEIFFERT, 2011).

The aim of this research was to analyze whether the sustainable development of the Brazilian aeronautics company Embraer satisfies the current necessities without compromising the capacity of future generations with regard to responsibilities related to preserving the planet.
The global hypothesis considered in this study is that the sustainable development of the Brazilian aeronautics industry is based upon the presupposition of permanent economic expansion, generating improvement in the applied indicators as well as environmental preservation. Sustainability applied to the Brazilian aeronautics industry relates to the ability to be self-sufficient with regard to its responsibilities associated with preserving the planet.

**Literature Review**

Fleischmann *et al.* (1997) noted that economic and environmental issues are often interlinked. With the increasing demands for “green” products, the logistics systems which deliver these products into the hands of the consumers must also be “green” (WU *et al.*, 1994).

It can be noted that there is a potential issue between reverse logistics and green logistics (ROGERS *et al.*, 1999; LOURENÇO *et al.*, 2002). A reduction in (or the principles of the conservation of) energy and the environmental pollution associated with better planning and transport and the use of packaging with a better employment of materials, can be considered as an integral part of the green logistics agenda.

The strategy of reduction at source of a product should be used to minimize the unnecessary emissions and environmental effects, thus obtaining possible competitive advantages (WU *et al.*, 1994; MARIEN, 1998). In addition, according to the same authors, the basic principles for the reduction at source of products are:

- the production of smaller and lighter products resulting in lower logistics costs;
- the minimization of production and distribution operations to reduce the generation of materials which have no useful purpose;
- the reuse of packaging materials and containers more than once; and
- the replacement of materials which are not environmentally friendly.

These strategies can increase the satisfaction of the final users with a reduction in terms of costs and residues.

Lave *et al.* (1999) provided economic-environmental criteria in which recycling is a good policy only when the environmental discharges and resources used for the collection, classification and recycling of material are less than the environmental discharge and the resources required to produce the equivalent raw material, plus the resources needed to safely store the material. Beamon (1999) suggested that the first step in this challenge is to redefine that basic structure of the whole product chain in order to address environmental questions and minimize the use of resources and emission of residues.

Rodrigue *et al.* (2001) argue that while technological and spatial development have improved the cost, efficiency and reliability of cargo and passenger transport systems, at the same time the negative environmental impact of transport has been recognized by society and
lies at the center of sustainability issues, particularly in urban areas.

In fact, focusing on the production chain is a greater step in the adoption and development of sustainability, since the processing of the product is considered from its initial phase related to the raw materials up to the delivery of the product to the consumer (SEURING et al., 2008; LINTON et al., 2007), including each link of the business chain, that is, the logistics, strategic planning, information services, marketing and sales, and finances, in which each manager is responsible for stimulating the initiatives for sustainability (SARKIS, 1998).

The interaction between sustainability and the production chain is the next critical step according to recent studies in the area of operations and the environment (CORBETT and KLEINDORFER, 2003), in operations and in sustainability (KLEINDORFER et al., 2005).

Sustainable products is a terms used to refer to all types of products aimed at improving environmental and social quality, and is related to environmental and social standards of implementation. In other words, the final objective is to satisfy the clients and gain a competitive advantage in the market (BOWEN et al., 2001, KOVACS, 2004, MEYER, 2000).

In the literature the importance of sustainability and energy efficiency is also highlighted (HALLDORSSON and KOVACS, 2010), and the need for a review at the operational level is identified, where this issue is neglected and widely ignored. Abukhader and Jonson (2004) carried out a detailed review of the literature and observed weak links between logistics and environmental preservation strategies, in relation to an understanding of their implementation.

Considering that the managers are vital to each functional area, they must understand how each section affects the overall productivity chain (MURPHY et al., 1996). The value chain refers to the company, the management process and the operations involved in the manufacturing of goods and/or the provision of services.

The distribution chain refers to the operations which encompass the processes of the movement of the finished products and their storage at the point of consumption. Reverse logistics presents the idea of sustainability and the end of the product cycle and has gradually come to represent an important approach for the suppliers, consumers and government entities (MEADE et al., 2007; PRAHINSKI and KOCABASOGLU, 2006).

Thus, the overall objective of this study is to evaluate the behavior of the Brazilian aeronautics industry which is aware of the use of clean technologies.

Specifically, the aim is to identify success factors within the social, economic, technological and environmental spheres which can be verified and replicated, as well as to determine the degree of suitability in which they are found.

**Methodology**
It is of vital importance that this study is carried out using methods which are scientific, since there is no science without the use of scientific methods (MARCONI and LAKATOS, 2001).

The method of case studies aims to investigate contemporaneous and real phenomena, prioritizing an understanding of the factors rather than their analysis. The definition of the number of cases to be analyzed is dependent on the degree of certainty which the research results are target toward. It is considered that the use of multiply cases enables the observation of evidences in different contexts, providing the study with more substance (YIN, 2005).

The aim of the literature search is to place the researcher in direct contact with everything which has been written on a certain subject, in order to provide the scientist with parallel reinforcement in the analysis of their studies or the manipulation of their information (MARKONI and LAKATOS, 2001).

The second method was a quantitative exploratory study carried out by way of statistical analysis, where data were obtained through the application of a questionnaire, in which the questions formulated were of the type multiple choice, some being complemented with the possibility for an open response. This questionnaire was applied as a pre-structured interview, with qualitative characteristics, to the Brazilian aeronautics industry in the second semester of 2012.

The questions had five possibilities for response using the Likert scale of 1 to 5, in order to quantify and relate predefined scenarios and they were organized according to themes: environmental, social, economic and technological, with 13, 10, 19 and 9 questions for each area, respectively. This research was mainly focused on case studies of organizations which work in the production chain and are proactive in the search for clean and innovative technologies.

**Analysis and Results**

An evaluation was carried out through a directed study, by collecting information from executive managers, using a matrix-questionnaire which was comprised of five scenarios of suitability, from scenario 1, that is, it does not satisfy the minimum requirements of sustainability, through scenario 3, which partially satisfies these requirements, up to the maximum score of scenario 5, where the organization is fully compliant with the requirements.

The scoring of 1 to 5 is based on the Likert scale, which is one of the best known psychometric scales and is used for quantitative research, since it aims to record the level of agreement or disagreement with a statement or defined position. The scenarios were constructed according to four groups of indicators: environmental, economic, technological and social (with 13, 10, 19 and 9 questions, respectively), with the aim of demonstrating the degree of sustainability in which they are found.
By way of illustration, Chart 1 shows a compilation of the relevant data obtained from the information collected through the matrix-questionnaire, where: Q is the number of questions which comprise each indicator; T is the total number of possible points; P is the total number of points obtained and the last column (%) gives the P/T ratio.

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<th>CHARACTERISTICS</th>
<th>BRAZILIAN AERONAUTICS INDUSTRY</th>
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<td>INDICATORS</td>
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CHART 1: Comparative data for the segments studied.
Source: Authors of the study (2013).

In general, it can be observed from Chart 1 that the action taken toward achieving a level considered to be adequate is still lacking, considering that this is a segment which employs advanced technology in its activities, but which, on the other hand, still employs a highly manual process, besides being a new segment, involved in an environmental of strong competition.

Figure 1 shows the results given in Chart 1 in a more didactic form, where the percentage reached can be visualized.

![Figure 1](image_url)

FIGURE 1: Didactic comparative visualization of the indicators.
Source: Authors of the study (2013).

In this organization, which is a market leader in its segment, it can be observed that awareness and responsibility regarding environmental issues is clearly present, with a commitment to sustainability and reducing greenhouse gasses (GHGs) through theoretical approaches which, however, are still not translated into absolute reality in the everyday practice of the actions carried out.
Analysis of Technological Indicator

In the medium term, the company intends to incorporate important activities, such as: a survey on the carbon footprint of its products, which requires the determination of all of the GHG emissions during the product life cycle and also to be concerned with designing its products so that they can be recycled and to design them so as to facilitate their disassembly and the reuse of the components which can reliably be reapplied.

The company expressed a commitment to its process with the aim of achieving clean production (CP). The aim of CP is to satisfy the demand by society for environmentally correct products through the use of efficient and renewable energy systems and materials which offer no risk to the biodiversity of the planet.

The first steps toward CP are a change in the production process and a committed to the international standard with regard to the efforts to reduce and control GHG emissions.

Within the company there was a notable awareness of training and the development of employees in relation to the domain of clean technologies and the consequent reduction in GHG emissions. This includes improvements in relation to maintenance (preventing leaks), a reduction in the use of toxic chemicals and internal recycling systems for the reuse of water or heat which would be dissipated.

In summary, there is a path which needs to be taken in the direction of sustainable business, which encompasses the technological aspects studied.

Analysis of the Social Indicator

The level of commitment to the promotion of education regarding clean technologies can probably be explained by the positioning of the managers, where clean technologies lead to a gain in competitiveness and consequently greater generation of employment and income.

The company is committed to promoting education and training in the area of and use of clean technology in the medium term, as well as to the implementation of a ‘world class’ work safety standard, in order to evolve in the use of new technologies.

It is also committed to stimulating social integration in order to improve the assimilation of new behaviors and knowledge in relation to the preservation of the environment and the use of clean technologies, as well as to implement policies regarding the distribution of profit and results achieved through the use of new technologies in the medium term.

There is clear preoccupation with the training and development of employees with regard to the dominium of technologies and the consequent reduction of GHG emissions. The company guarantees the safety of the product when used under the normal conditions for which it was specified and if appropriately disposed of after use.
There is a clear motivation of the employees resulting from the growth of the sector, from gaining slices of the market and an improvement in the productivity in all activities carried out, contributing to a good internal and external environment, however, a qualitative step upward in terms of sustainability needs to be taken, so that future generations of the current staff can benefit from these procedures.

**Analysis of Economic Indicator**

The managers stated that the level of debt of the company does not compromise the efforts to reduce GHGs; however, this understanding does not wholly translate into practical activities.

There is also an understanding on the part of public opinion and the market, where around 25% consider efforts to reduce/not emit GHGs to be important and a large part are not aware of such efforts. Thus, it is necessary to invest in awareness publicity in order to sell products at a fair price and increase the profitability.

To the company, environmental quality is an important segment within its activities, based on the orientation and awareness of all of the employees and research studies, with periodic audits being carried out to validate the certificates obtained.

There is a clear notion that part of the market considers efforts to reduce GHGs to be important, leading to a moderate increase in the volume of sales.

In summary, the business perception is still directed toward the idea of increasing the costs of actions related to environmental preservation.

In weighing up the relevant factors, the actions focused on sustainable business and preservation verses the economic aspects involved, as well as a return on investment, the scales are weighted toward the purely capitalist vision of the managers.

**Analysis of Environmental Indicator**

There is an adequate understanding of the importance of issues related to environmental responsibility. This is completely understandable given the maturity of the managers since they are constantly driven by norms, regulations and laws, that is, all of the regulatory aspects applicable for them to provide for markets which demand a proactive and effective posture regarding the preservation of the environment and the use of alternative energy sources.

Nevertheless, the company is still moving rather slowly toward understanding this question, although there is a clear concern among the managers regarding the future, with respect to environmental aspects, the development of activities and the long lasting effects of their actions.

In order to control the certifications achieved, the company created an Integrated System of Environmental, Safety, Heath and Quality Management (SIG-MASSQ), the role of
which is to facilitate the analysis of all of the actions in a global manner, integrating the company, staff, contractors, partners, environment, health, safety and quality, always focusing on the company results.

SIG-MASSQ resulted from an awareness of the influence that the company has on the lives of people who participate in its direction, in the environment and in the regions where it is installed. The implantation of SIG-MASSQ unites efforts from everyone in the direction of an increasingly more competitive company which is aware of its role in society.

In general, ever greater efforts are being made to reduce waste and appropriately treat GHG emissions, aimed at achieving efficient results.

Discussion

Trends

Evidently, this segment, which has been active since the last century, mainly the last few decades, is driven by different normalizations, semiautomatic and completely automatic industrial activities, which means that the supply partners have also gained an awareness of the importance of pursuing similar perceptions and attitudes.

Thus, with the ever increasing concern with environmentally sustainable business, it has not been and is not currently being characterized for the automotive segment, a task which is considered to be extremely difficult and therefore there is a long path to be taken.

The essence of the above comments are applicable to the Brazilian aeronautics industry which, although having achieved some steps not taken by the automotive segment, needs to advance in terms of environmentally sustainable business, with regard to the actual issue of competitiveness and, mainly, safety in the area in which it is inserted. However, it should be noted that the managers do have an awareness regarding the putting into practice of challenging strategies, plans and actions in this regard.

Final considerations

Based on the study carried out and the data collected, many of the responses, with regard to the indicators studied and the degree of maturity reached, direct efforts toward redefining guidelines, seeking sustainable business, considering that this is a relatively new company which is still finding its equilibrium.

The company is moving toward excellence in its operations; however, the indicators reflect that currently the proactivity is not adequate considering the speed with which responses aimed at environmental preservation are required and the importance of visualizing a competitive edge, in order to migrate toward the required sustainability.

The study showed that one approach, creating and maintaining the characteristics of sustainability, within the industrial context, and collaborating in the solving of the environmental crisis faced by civilization, is to focus on leading companies, copy and adjust the model, internalize the importance of procedures and encourage proactivity with regard to
greenhouse gasses (GHGs), even when these companies act in other segments, taking advantage of the opportunities for benchmarking.

It can be observed, specifically, that the dissemination of sustainable logistics can be encouraged in these companies, with an emphasis on the reduction of GHG emissions in the supply chain, the process, the general procedures, the transport and the product life cycles.

The sustainable development of the Brazilian aeronautics industry fulfills the current requirements without compromising the ability of future generations; however, it is lacking activities which need to be carried out in relation to its responsibility to preserving the planet.

The hypotheses considered in this research were shown to be true, although the results verified are still preliminary. The mission, vision and values of the organization leave a gap with regard to the aspects of sustainable business and environmental preservation and with respect to future generations.

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