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## GREEN MANAGEMENT, CLIMATE CHANGE AND SMALL BUSINESS IN BRAZIL: IMPLICATIONS FOR TRAINING AND EDUCATION FOR SUSTAINABLE DEVELOPMENT

**Abstract.** *This paper presents the results of a study on the analysis of training needs regarding environmental (green) management and climate change topics in micro and small enterprises (MSEs) in Brazil and its implications on education for sustainable development. It reports on an e-mail survey of Brazilian small enterprises, whose results indicate that they are indeed interested in environmental management and climate change topics in an education for sustainable development context. The study indicates that proposals for courses on environmental management and climate change should follow a systemic perspective and take sustainable development into account. By applying factor analysis, it was found that the topics of interest can be grouped into thematic modules, which can be useful in the design of training courses for the top management leaders of those companies.*

**Key words:** *climate change, education for sustainable development, environmental training.*

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### Introduction

Education for sustainable development is a key element in the training of personnel working at enterprises, especially in respect of fostering environmentally sound management. An analysis of the findings of previous studies on environmental management in the enterprises sector reveals that there is a focus on large sized enterprises and corporations (Boiral, 2006; Kolk & Pinkse, 2007), whereas there is a paucity of studies on small enterprises and how they can adopt environmental management practices to improve their relationship with the environment. This is a paradox since small enterprises are responsible for a great part of the total industrial pollution that affects the environment (Pimenova & Vorst, 2004; Hillary, 2004).

The lack of theoretical and empirical lack of studies on green management in small sized enterprises (Zhang, Bi & Liu, 2009; Hillary, 2004) means that, in order for them to become involved in environmental management, there is a need to overcome a typical barrier: lack of knowledge about sustainable development as a whole and environmental management issues in particular (Hillary, 2004; Brío & Junquera, 2003).

Thus, the importance of adopting human resources practices to foster education for sustainable development as well as awareness on environmental management issues needs to increase. Among these needs, one of the most critical ones in raising environmental awareness among top managers of small sized enterprises is training (Cloquell-Ballester et al., 2008; Brío & Junquera, 2003).



Training aligned to environmental management is called “environmental training”, which aims at providing the target public with knowledge and environmental awareness, in lines with the goals of education for sustainable development (Leal Filho, Manolas & Pace, 2009). In order for the environmental training be effective, it is necessary to analyze the training needs of the target public (Unnikrishnan & Hegde, 2007; Brío, Junquera & Ordiz, 2008; Sarkis, Gonzalez-Torres & Adenso-Diaz, 2010) and ensure the training offered is in line with the principles of sustainable development.

A training needs analysis can be useful for identifying topics of interest, guiding the design of environmental management courses, and providing information to supporting organizations to small sized enterprises. A major research focusing on this topic was carried out with Spanish SMEs (Cloquell-Ballester et al., 2008).

Nevertheless, there is a dearth of literature on the analysis of training needs regarding environmental management including in topics such as climate change, mainly in emergent economies, like Brazil. Hence, it can be said that the following question stimulated this study: Which are the major training needs concerning environmental management and climate change in small sized enterprises located in Brazil?

Consequently, the objectives of this research are:

- Identify the main topics within the scope of environmental management and climate change that are of interest of small enterprises’ in Brazil in a sustainable development context;
- Group the identified topics providing guidelines for the design of environmental training for small sized enterprises in line with the principles of education for sustainable development;
- Highlight and discuss the implications for those who formulate policies to support small sized enterprises.

## Scientific Information Sources

### *Environmental Management and Climate Change*

According to Haden et al. (2009), environmental management concerns the incorporation of environmental objectives and strategies into the general objectives and strategies of an organization. Jabbour (2010) adds that environmental management should be based on a systemic approach to incorporate environmental issues into all organization levels. Among all issues included in the environmental management research field, climate change and global warming can be highlighted due to their importance.

Jeswani, Wehrmeyer, & Mulugetta (2008) consider climate change and global warming as among the major environmental humanity issues, which results from the buildup of Greenhouse Gases (GHG) in the atmosphere. According to Baumert, Herzog & Pershing (2005), the productive sector is the one that contributes the most to climate change. Wittneben & Kiyar (2009) argue that the productive sector is responsible not only for the challenge of reducing emissions, but also for the understanding of how the climate change influences businesses. Climate change has become a problem for all individuals, organizations, and nations (Jeswani, Wehrmeyer & Mulugetta 2008), especially due to the dependence of the productive system of fossil fuels (Wittneben & Kiyar 2009).

Galbreath (2010) states that climate change is no longer a merely scientific issue. Boiral (2006), based on a study carried out in 2004 with the 500 largest enterprises in the world, adds that 80% of the interviewees believed that climate change would affect their business as well as pertinent regulations.

Nonetheless, there is little information on how small enterprises get prepared and update on environmental management or, more specifically, on climate change.

### *Small Sized Enterprises and Environmental Issues*

Investigating micro-enterprises (MEs) and small sized enterprises (SEs) will always be highly considered due to their importance to the economic development of nations. In Brazil, this scenario is not



different. It is estimated that Brazilian MEs employ approximately 6.179.810 workers and SEs employ 7.068.717 (Sebrae, 2008).

In this study, the enterprises were classified according to the number of employees: ME, up to 20 employees; and SE, up to 100 employees (Sebrae, 2008).

Studies on MEs and SEs are also important due to the significant environmental impact caused by small sized companies (Hillary 2004). Pimenova & Vorst (2004) argue that limited information has been found on environmental impacts and environmental management in small sized enterprises. According to Hillary (2004), MSEs can be responsible for up to 70% of the industrial pollution. Therefore, it seems important to focus on MSEs when considering industrial environmental improvement (Zhang, Bi & Liu, 2009).

### *Evaluation of Training Needs in Small Sized Enterprises*

Milkovich & Boudreau (2008) consider training as a systematic process that promotes the acquisition of skills or concepts, establish rules, and perform actions that result in an improved adequacy of employees to meet organization demands. Ivancevich (1995) defines this concept as the systematic process through which the behavior of the employees is guided towards the organization objectives.

Ramus (2002) state that environmental training improves people's ability to contribute towards environmental activities. The author argues that the ability of participating in the solution of environmental problems and the motivation to do so increase if the organization has a structured environmental training program. Environmental training is also a requirement in organizations that have the ISO 14001 environmental management system (Unnikrishnan & Hegde, 2007). Jabbour & Santos (2008) highlight that all company members should receive environmental training.

Some studies focus on the importance of environmental training. Sarkis, Gonzalez-Torres & Adenso-Diaz (2010) carried out a study with large sized companies in the automotive sector in Spain. The authors concluded that environmental training is a mediator variable that influences the success of environmental management practices in the enterprises studied. They proved statistically that environmental management practices work only if the environmental training has an intermediated role, i.e., if it is offered. In other words, the companies studied adopt environmental practices (such as eco-design) only if they also offer environmental training to their employees. In addition, the authors believe that the more technical and in-depth an environmental management practice adopted is, the more it will be dependent on environmental training.

Unnikrishnan & Hegde (2007) conducted case studies on the major characteristics of the environmental training in companies in India. So far, it seems to be the only study available that focuses on environmental training based on a qualitative approach. The authors concluded that half of the analyzed companies worry about environmental training issues. They also found that environmental training requires the support of the top administration, and that the cleaner technology suppliers are responsible for offering environmental training to the companies studied.

To guarantee the success of the environmental training and to ensure it is line with the principles of education for sustainable development, it is necessary to evaluate the existing needs. This process may identify some gaps that can then become the subject of the training within an organization. Cloquell-Ballester et al. (2008) argue that small sized enterprises need to improve their relationship with the environment. However, to do so, the authors believe that it is necessary to know the main environmental management topics to be taught to small sized enterprises' employees. It is also necessary to evaluate the training needs first in order to design the adequate courses for smaller enterprises.

## **Methodology of Research**

### *General Characteristics of Research*

A quantitative analysis method – an e-mail survey – was used aiming at performing an exploratory analysis to meet the objective of investigating the need for training concerning environmental manage-



ment and climate change in MSEs located in Brazil.

The sample consisted of micro and small sized enterprises located in the state of São Paulo, which is the most industrialized state in Brazil. Among the companies studied, 120 were listed in a data bank containing e-mail addresses of their managers.

In order to elaborate the questionnaire, environmental management and climate change issues that could be of interest to the managers of those enterprises were selected. These topics (Table 1) were chosen based on a study conducted by Cloquell-Ballester et al. (2008) and on other topics considered adequate by the researchers (Unnikrishnan & Hegde, 2007). Each one of those topics generated one question. The questionnaire was pre-tested and improved. The questionnaire was sent to three researchers on environmental management. They proposed a set of improvements in the questionnaire, with the aim to make the questionnaire clearer. The final version consisted of 18 questions. These questions were defined based on the literature review. For each variable, the respondents had to choose from 5 qualifications in a Likert scale from “no interest in the topic” to “strong interest in the topic”.

**Table 1. Topics of environmental management and climate change in the study.**

<ul style="list-style-type: none"> <li>• New Technologies with lower global warming potential</li> <li>• Environmental management systems</li> <li>• Renewable energies</li> <li>• Best practices for reducing emissions from industrial processes</li> <li>• Metrics for evaluating industrial emissions</li> <li>• Environmental regulations focused on warming emissions of global warming gases</li> <li>• Atmosphere pollution and its effects</li> <li>• Enterprise sustainability</li> <li>• Environmental technologies for emission reduction</li> <li>• Natural catastrophes and emergency situations due to climate change</li> <li>• Knowledge and international language about environment and climate change</li> <li>• Development of products with the lowest environmental cost</li> <li>• Practices for the development of environmentally improved products</li> <li>• Kyoto protocol</li> <li>• Carbon credits</li> <li>• Success practical examples</li> <li>• Influence of climate change on the market I operate</li> <li>• Influence of climate change on the creation of new markets</li> </ul>
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A webpage was created to allow access to the questionnaire. To the respondents was sent an email with a direct link to the survey questionnaire. The e-mail survey was adopted due to advantages highlighted by Kaplowitz, Hadlock & Levine (2004). The questionnaires responded by managers of MSEs were automatically sent to the authors of this research. Therefore, 120 questionnaires were sent out and 43 were returned. In Brazil, there is a low business involvement in academic research. Therefore, even small, this sample is consistent with Brazilian reality.

#### *Data Analysis*

The data analysis was performed using the SPSS (Statistical Package for Social Science) software. SPSS was used to run Exploratory Factor Analysis and Correlation Coefficients. The reliability of the instrument was considered excellent with global Cronbach's Alpha of 0,909. The analysis of the results is presented next, discussing the descriptive statistics, correlations between variables and the characteristics of the main factors formed.



## Results of Research

Table 2 presents the variables used in this study and the distributions of frequencies along the scale. The highest frequency value found was 60.5% for the variable "Development of Products with the Lowest Environmental Cost" (V12), followed by 53.5% for the variable "Influence of Climate Change on the Market I Operate" (V17).

**Table 2. Distribution of frequency of the variables used in this study (%).**

Variables	1 – No interest in the topic	2	3	4	5 – Strong interest in the topic
V1 – New Technologies with lower global warming potential	4.7	2.3	37.2	11.6	44.2
V2 – Environmental management systems	4.7	2.3	20.9	27.9	44.2
V3 – Renewable energies	4.7	4.7	18.6	32.6	39.5
V4 – Best practices for reducing emissions from industrial processes	2.3	4.7	27.9	14.0	51.2
V5 – Metrics for evaluating industrial emissions	7.0	20.9	18.6	14.0	39.5
V6 – Environmental regulations focused on warming emissions of global warming gases	11.6	7.0	18.6	20.9	41.9
V7 Atmosphere pollution and its effects	4.7	4.7	20.9	23.3	46.5
V8 – Suste Enterprise sustainability	7.0	2.3	18.6	20.9	51.2
V9 – Environmental technologies for emission reduction	0	7.0	16.3	27.9	48.8
V10 – Natural catastrophes and emergency situations due to climate change	9.3	14.0	25.6	18.6	32.6
V11 – Knowledge and international language about environment and climate change	14.0	14.0	23.3	16.3	32.6
V12 – Development of products with the lowest environmental cost	7.0	2.3	7.0	23.3	60.5
V13 – Practices for the development of environmentally improved products	2.3	4.7	25.6	23.3	44.2
V14 – Kyoto protocol	16.6	11.6	30.2	9.3	32.6
V15 – Carbon credits	20.9	14.0	20.9	16.3	27.9
V16 – Success practical examples	7.0	4.7	11.6	34.9	41.9
V17 – Influence of climate change on the market I operate	4.7	7.0	16.3	18.6	53.5
V18 – I Influence of climate change on the creation of new markets	2.3	4.7	23.3	23.3	46.5

With regard to the means, the highest value were on "Development of Products with the lowest environmental impact" (V12), "Environmental Technologies for Emission Reduction" (V9), and "Influence of Climate Change on the Market I Operate" (V17), respectively. The profile of the sample, which consists of manufacturing companies, may justify the high V12 mean (Figure 1).



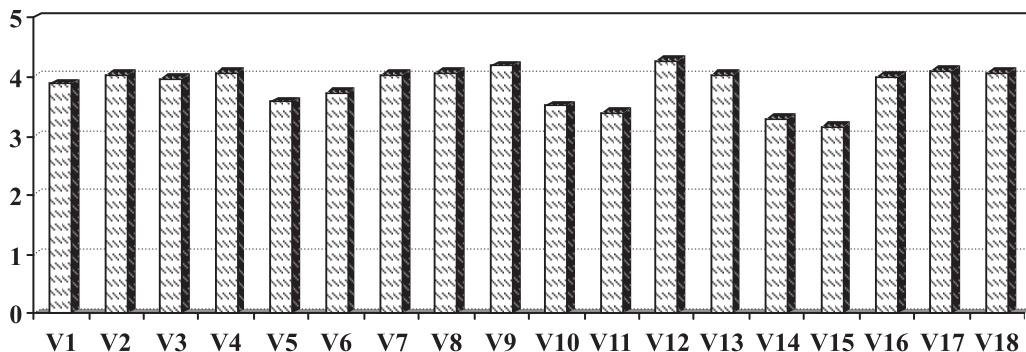


Figure 1: Graph of the mean of the variables used in this study.

The results of the correlation analysis show that approximately 70% of the correlations between the variables are significant. This can suggest that there is a relationship between the topics considered in this study and the need of systemic approach for their treatment.

Table 3. Correlation Coefficients.

	V 1	V 2	V 3	V 4	V 5	V 6	V 7	V 8	V 9	V 10	V 11	V 12	V 13	V 14	V 15	V 16	V 17	V 18
V 1	1																	
V 2	.739**	1																
V 3	.464**	.556**	1															
V 4	.548**	.553**	.532**	1														
V 5	.459**	.423**	.493**	.598**	1													
V 6	.472**	.340*	.434**	.435**	.640**	1												
V 7	.128	0.152	.189	.188	.066	.365*	1											
V 8	.467**	.470**	.486**	.428**	.318*	.426**	.327*	1										
V 9	.449**	.334	.275	.530**	.527**	.721**	.344*	.236	1									
V 10	.240	.278	.397**	.186	.222	.383*	.647**	.422**	.278	1								
V 11	.200	.186	.534**	.526**	.553**	.449**	.110	.356*	.448**	.390**	1							
V 12	.290	.196	.359*	.152	.297	.669**	.318*	.309*	.466**	.274	.018	1						
V 13	.371*	.391**	.327*	.285	.365*	.493**	.157	.541*	.372*	.245	.119	.634**	1					
V 14	.233	.261	.494**	.433**	.371*	.418	.239	.382*	.420**	.360*	.569**	.329*	.351*	1				
V 15	.351*	.342*	.403**	.251	.432**	.317*	.122	.400**	.341*	.265	.519**	.245	.415**	.745**	1			
V 16	.332*	.074	.276	0	.278	.557**	.195	.269	.296	.273	.113	.645**	.307*	.481**	.402**	1		
V 17	.232	.143	.310*	-0.78	.197	.405**	.173	.444**	.235	.494**	.299	.342*	.338*	.299	.375*	.544**	1	
V 18	.416**	.287	.370*	.098	.281	.388*	.038	.409**	.364*	.414**	.249	.430**	.446**	.420**	.515**	.499**	.752**	1

\*Significant correlation for  $p \leq 0.05$ .

\*\*Significant correlation for  $p \leq 0.01$ .



With regard to the Factor Analysis, 5 factors were extracted (considering *eigenvalue*  $\geq 1.0$ , explanation of 75.2% of the variance accumulated, and KMO test of 0.695), as shown in Table 4.

**Table 4. Factors, factor loadings, and communalities of the variables used in this study.**

Variables	Factors					Communalities
	1	2	3	4	5	
V1	0.797					0.746
V2	0.891					0.822
V3	0.544					0.605
V4	0.619					0.834
V5		0.583				0.692
V6				0.776		0.844
V7					0.982	0.870
V8	0.588					0.645
V9				0.682		0.718
V10					0.804	0.834
V11		0.898				0.855
V12				0.810		0.831
V13						0.586
V14		0.706				0.708
V15		0.617				0.703
V16			0.611			0.718
V17			0.818			0.761
V18			0.796			0.765

In order to interpret the Factor Analysis' results and name the factors generated, Tables 5,6,7,8, and 9 were drawn. The factors generated were interpreted as follows.

Factor 1 was denominated "Interest in great environmental tendencies" since it includes emergent generic and comprehensive topics, with Cronbach's Alpha value of 0.845.

**Table 5. Formation variables and Factor 1 denomination.**

Factor 1: Interest in great environmental tendencies		
Variable	Question	Factor Loading
V1	New Technologies with lower global warming potential	0.797
V2	Environmental management systems	0.891
V3	Renewable energies	0.544
V4	Best practices for reducing emissions from industrial processes	0.619
V8	Enterprise sustainability	0.588

Factor 2 was denominated "Knowledge to make environmental management tools feasible" since it includes knowledge and theoretical techniques pertinent to environmental management, with Cronbach's Alpha value of 0.821.



**Table 6. Formation variables and Factor 2 denomination.**

Factor 2: Knowledge to make environmental management tools feasible		
Variable	Question	Factor Loading
V5	Metrics for evaluating industrial emissions	0.583
V11	Knowledge and international language about environment and climate change	0.898
V14	Kyoto protocol	0.706
V15	Carbon credits	0.617

Factor 3 was denominated "Benchmarking of climate change management" since it includes examples of how companies deal with climate change, with Cronbach's Alpha value of 0.815.

**Table 7. Formation variables and Factor 3 denomination.**

Factor 3: Benchmarking of climate change management		
Variable	Question	Factor Loading
V16	Success practical examples	0.611
V17	Influence of climate change on the market I operate	0.818
V18	Influence of climate change on the creation of new markets	0.796

Factor 4 includes the variables related to the emissions of global warming gases and products. Therefore, it was denominated "Intelligence for environmental improvement of products", with Cronbach's Alpha value of 0.824.

**Table 8. Formation variables and Factor 4 denomination.**

Factor 4: Intelligence for environmental improvement of products		
Variable	Question	Factor Loading
V6	Environmental regulations focused on warming emissions of global warming gases	0.776
V9	Environmental technologies for emission reduction	0.682
V12	Development of products with the lowest environmental cost	0.810

Factor 5, was denominated "Problems caused by climate change", with Cronbach's Alpha value of 0.780.

**Table 9. Formation variables and Factor 5 denomination.**

Factor 4: Problems caused by climate change		
Variable	Question	Factor Loading
V7	Atmosphere pollution and its effects	0.982
V10	Natural catastrophes and emergency situations due to climate change	0.804





## Discussions

The objective of this study was to analyze the training needs regarding environmental management and climate change topics in Micro and Small Brazilian enterprises, in a sustainable development context. Since there are very few studies on environmental management in small sized enterprises (Brío & Junquera, 2003; Zhang, Bi & Liu, 2009) and a documented analysis of training needs in MSEs was observed only in a few occasions (such as in a study conducted by Cloquell-Ballester et al., 2008), there is a certain degree of innovation on this paper.

The main conclusions of this research are:

- Special interest in topics about “development of green products” and “Influence of environmental management and climate change on businesses”;
- Significant relationship between variables (topics) demonstrating a systemic behavior;
- Education for sustainable development must consider small enterprises;
- Grouping of topics into 5 great thematic blocks.

Based on these results, supporting organizations (governmental or non-governmental) to MSEs can plan courses on environmental management which may take the principles of education for sustainable development into account. Managers of micro and small sized enterprises can conduct initiatives for capacitating their employees focusing on topics of most interest.

## Conclusions

The study indicates that proposals for courses on environmental management and climate change should follow a systemic perspective and take sustainable development into account. By applying factor analysis, it was found that the topics of interest can be grouped into thematic modules, which can be useful in the design of training courses for the top management leaders of those companies. There is a special interest in topics about “development of green products” and “Influence of environmental management and climate change on businesses. Thus, education for sustainable development must consider small enterprises.

The academic world can contribute to it by offering extension courses on the topics discussed. Thus, there is a great venue regarding the contribution of Academy to improve environmental and climate change awareness among Micro and Small enterprises.

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