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Model of Social and Environmental Scientific Research: A Theoretical test Applied to the Analysis of Environmental Public Policies and the Economic and Socio-Environmental Performance of Firms

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Abstract— *This theoretical essay aims to bring up an empirical investigative scientific model based on the approaches of systemic and Cartesian thinking to explain the construct system of government policies and actions related to socio-environmental issues and the economic and social-environmental performance of firms. In this context, it is necessary to highlight the relevance of proposing the construction of a scientific research model to evaluate how socio-environmental issues and public environmental policies influence the economic and social-environmental performance of firms, from the epistemological and theoretical perspectives based on systemic thinking to shape the abstract mental model (conceptual model) of the observed reality and through the Cartesian thought to determine the prescriptive elements of the logical (operational) model of the investigative process. The construction of an empirical research model is an efficient tool to establish connections of distinct realities and their practices associated to search for borderline knowledge, through the appropriation of the epistemological knowledge, theories and the underlying techniques applied to theories. The investigation tool built for research is based on the variables of the conceptual model and the set of problematic situations in the business point of view, covering questions about environmental legislation, institutional instruments for direct regulation in the market; responsibility for environmental damage; international and regional socio-environmental agreements; environmental marketing, economic, environmental and social performance.*

Keywords— *Social-environmental public policies. Social-environmental scientific research model. Economic and socio-environmental performance.*

I. INTRODUCTION

In terms of the relationship between society, government and the market, with the business segment as reference, it is necessary to understand if environmental issues impact business decisions, whether due to the need to conform to government policy guidelines dictated by the government, or because of actions of organized society that impose certain standards or rules in defense of the environment to be adopted in segments of economic activity, because there is evidence of a gap in this interlocution between government agents and the business segment in search of a common denominator, with regard to environmental issues. According to Marcovitch (2006), there are significant differences between the time of political logic and business logic. In this scenario, there are still companies that advocate economic growth as a necessary evilness for development, relegating the socio-environmental issues to second place. However, there are companies of the size of General Electric and Wal-Mart with strategies for green product portfolio, as well as companies such as Super-Bac, specializing in biotechnology for waste treatment or Floresta, a manufacturer of organic cosmetics that adopt and develop management practices related to their business activities with respect to the principles of sustainable development. So we came to a standstill? No, there is no deadlock, although there is still a strong dichotomy between the economic and environmental

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currents. Reason why, it is necessary to seek answers to some questions: 1) Do public environmental policies affect the economic and social-environmental performance of companies? 2) Does environmental legislation influence the economic and social-environmental performance of companies? 3) Do actions of the public power related to environmental issues influence the economic and social-environmental performance of companies? The answers to these questions will be of great value to know the extent to which environmental public policies can influence the economic and socio-environmental performance of companies. In this context, the relevance of proposing the construction of a scientific research model to assess how environmental issues and policies influence the economic and social-environmental performance of firms, under the epistemological and theoretical perspective structured in systemic thinking must be highlighted, to format the abstract mental model (conceptual model) of the observed reality and through the Cartesian thought for determination of the prescriptive elements of definition of the logical (operational) model of the investigation process. Have et. al (2003, XVI) advocate that a model will always be a powerful tool, if combined with experience, knowledge and employed at the right time, for solutions to certain phenomena or facts.

Systemic thought establishes the mental instruments for abstract description of the reality observed in relation to its constituent parts. Therefore, through the systemic approach, the construction of the conceptual model allows the researcher to expand its dimensions to better understand how socio-environmental issues and their degree of relationships, interactions and interdependence among the various organizational, technological and cultural elements can be associated to the economic and social-environmental performance of companies. On the other hand, the deterministic precepts of the Cartesian view lead to the understanding of the phenomenon or fact by means of the logical description, through the application of statistical procedures, the study variables that attest to their validation and reliability. According to Martins (2005), a research model seeks to specify the nature and importance of relationships between variables, constructs and factors that can offer, based on scientific theories, explainings and explanations of a given System.

Therefore, based on the following question: do public policies and governmental actions related to socio-environmental issues have any association with the economic and social-environmental performance of firms?, this theoretical essay aims to present a proposal of a scientific model of empirical research based on the approaches of systemic and Cartesian thinking to explain the construct system of government policies and actions related to socio-environmental issues and the economic and socio-environmental performance of companies. On the other hand, the contributions of this study will be relevant to open new borders of knowledge in relation to the understanding of environmental issues, especially if environmental public policies and public power actions, based on the regulatory and normative framework of the State, influence the economic and social-environmental performance of companies.

II. THE THEORETICAL CONTRIBUTION APPLIED TO THE INVESTIGATION MODEL

2.1 Economic and socio-environmental enterprise performance under the systematic approach

The sustainability phenomenon, the balance of natural ecosystems in harmony with living beings, has its archetypes studied in various branches of applied natural and social sciences and their respective areas of specialization. These are frontier topics of scientific knowledge coupled with theories of the exact, biological and human sciences which comes from pioneering and contemporary studies on man's anthropic action in nature. Among the numerous preselected sustainability studies related to sustainability, the following stand out: the demographic growth issues of Thomas Malthus's theory (Nobre and Amazonas, 2002); the concern with the environmental degradation and of irreversible character provoked by the action of the man portrayed by George Perkins Marsh, in 1864, in the book Man and Nature, the pioneerism of Svante Arrhenius in 1896, in supporting the hypothesis of correlation between CO2 emission and Earth's temperature (Marcovitch, 2007). There are also issues related to the technological progress from the industrial revolution and its improvements during the twentieth century, when man improves steam engine and expands his capacities in industry and transport. (Goldemberg and Lucon, 2007).

Yet, it is from the 1970s that concern for the environment and its sustainability-related factors gain momentum when Maurice Strong and Ignacy Sachs coined the concept of eco-development. Also in this decade, the First United Nations Conference on Environment and Development (Stockholm, 1972) was performed, which originated the United Nations Environment Program (UNEP). The Brazilian government, in a pioneering way, in 1981, institutes the Politics and the National System of Environment and creates the National Council of the Environment - CONAMA with the participation of the civil society. Also worthy of note was the fact that, in 1985, as a mark of

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Brazilian society, it began the discussion of socio-environmental issues in the first national meeting with the proposal of the creation of extractive reserves, under the command of the seringalist Chico Mendes (Silva, 2006). In 1987 the World Commission on Environment and Development (CMMAD) of the United Nations, chaired by the Prime Minister of Norway, Gro Harlem Brundtland, adopted the concept of Sustainable Development in his report Our Common Future, also known as the Brundtland Report (Aliegri, Almeida and Kruglianskas, 2007, Bellen, 2004; Lago, 2007). However, it was in Eco-92, in Rio de Janeiro, during the United Nations Conference on Environment and Development, at the 1992 UN Earth Summit, that the concept was incorporated as a principle, which served as the basis for formulation of the Agenda 21, with more than 170 countries participating in the Conference as signatories.

However, the consolidation of the concept of Sustainable Development at the World Summit on Sustainable Development, held in Johannesburg, South Africa, through the 2002 Policy Statement, should be highlighted, describing it as a set structured in three interdependent dimensions and interactors - economic development, social development and environmental protection. The United Nations Conference on Sustainable Development (UNCSD) - Rio + 20, which assesses the renewed political commitment of nations to sustainable development and new emerging challenges to meet global challenges, is also associated with this scenario. These dimensions include society, government and companies that are committed to meeting the needs of the current generation, without, in the meantime, compromising the ability to meet the needs of future generations. (Almeida, 2010, Gaetani et al. 2012.).

Therefore, under a new perspective of world vision, whose perspective on the phenomena related to the individual and the new way of thinking the present and the future as interdependent elements and also in relation to the complex interactions between dimensions: society, government and companies, we seek to understand Economic and Socio-environmental Business Development under the systemic approach. Systems theory came to revolutionize the way we know and understand phenomena. It is at first seen as the counterpoint of logical thinking, which was based on the Cartesian principles of evidence, analysis, synthesis and enumeration, in the representation of its parts as the sum that forms the whole. However, systems theory with its principles based on concepts that the whole does not consist of the simple sum of the parts, revolutionizes the way of thinking the phenomena (Guimarães et al. 2009). According to Woodworth (1976, p. ix) the systemic reality differs from the Cartesian reality:

> The systems approach is a way of thinking about the elements that make up an organism or phenomenon, moving beyond the component parts to the whole, for the consideration of how the subdivisions work, and for an examination of the purposes for which the organism works.

Thus, systemic thinking is formed from the analytical understanding of the set of interrelated parts that constitute a dynamic process of interaction between the various divisions that have a certain phenomenon. In systemic thinking we seek to understand a phenomenon from the whole that it represents and not by the behavior of its parts, therefore, an antithesis to Cartesian thought, where the laws that govern the behavior of the whole are considered fundamental (Rapoport, 1976). In addition, the understanding of systemic thinking becomes significant when we use the concepts and foundations of holism. Holism has the central idea that the universe is a self-organizing reality and matter, life and mind are inseparable (Smuts, 1999). The dimensions of economic, environmental, and social development that make up the archetype of sustainable development are inseparable and self-organizing forming a set comprised of nature, man and the universe.

The systemic vision of sustainable development is based on the organicity, purpose, overallity and aggregability of socio-environmental ecosystems and their economic, environmental and social, interdependent and integrated dimensions, in a dynamic interactive process with the environment, both (ecosystem and environment) in a constant pace of change (Figure 1). Therefore, from the viewpoint of sustainable development, socio-environmental ecosystems and society are living in a continuous process of social, technological and cultural values changes that impose transformations on a sustainable society, through an evolutionary process (Bellen, 2005).

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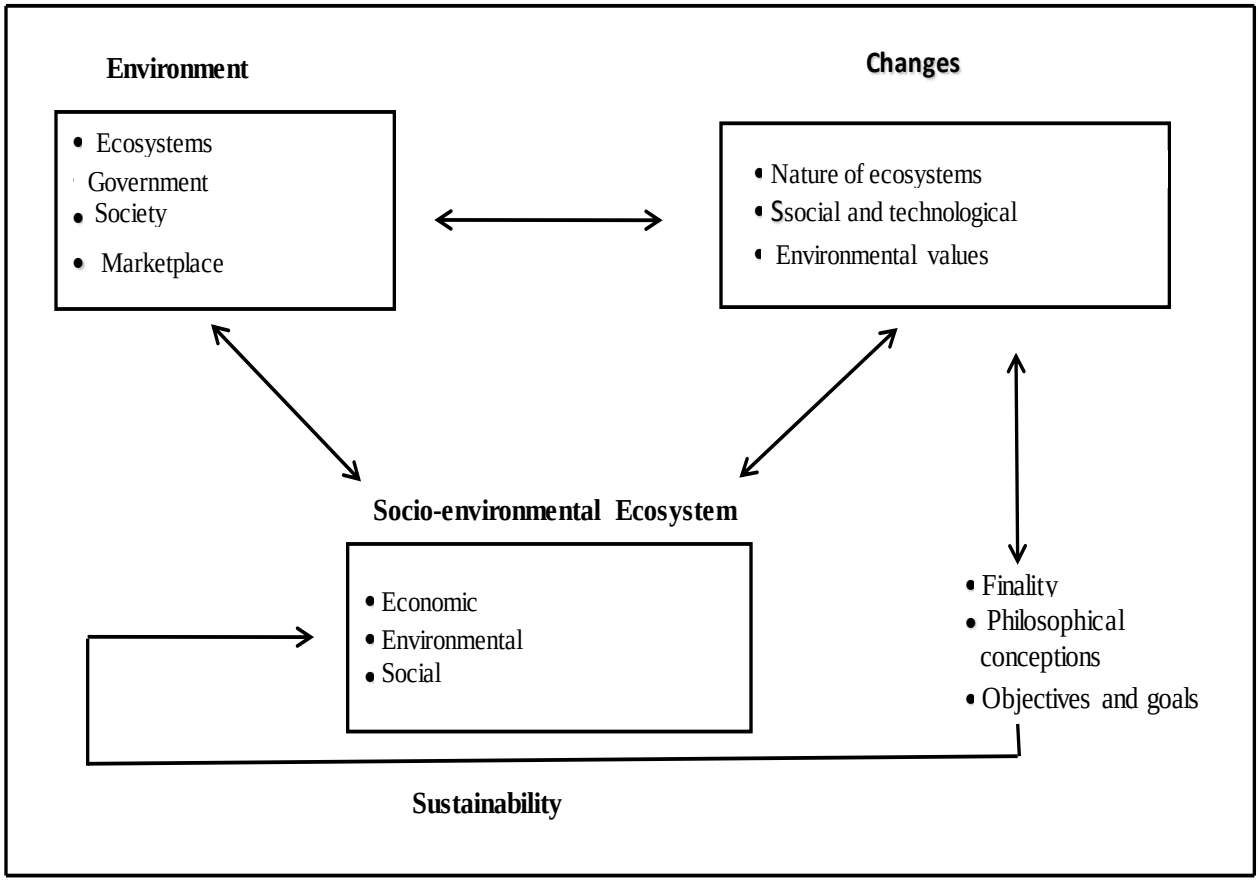

Fig.1: Sustainable development: a systemic view

Source: Almeida (2010)

The sustainability of the business ecosystem is based on the firm's business strategies, based on the premise of making use of natural resources, in order to preserve the conditions for future generation use. Thus, the environmental inputs, the public environmental policies and the actions of the public power are processed by the business ecosystem, in which the firm's business is dimensioned considering the factors related to ecology and the environment, law and the environment, economy and the environment and administration and the environment. The results, business policy and economic, environmental and social performance are new elements inserted into the environment, which will be evaluated to feedback the business ecosystem.

Therefore, the business vision of sustainable development is based on the entrepreneur's expertise in establishing a strategic alignment to insert environmental issues into the core business of the company. On the other hand, the environmental ecosystem presents a series of constraints caused by the set of actions and interests dictated by environmental stakeholders - the society, government and market to be processed by the business ecosystem and that are dimensioned from the strategic business point of view as threats or opportunities. Hence, it is important to be alert to the scenario of changes signaled by the environment, especially those arising from the action of the State as an economic agent, making political decisions associated with the production, circulation and consumption of wealth under interventionist or non-interventionist ideas whose environmental public policies based on different development styles produce differentiated impacts on business performance.

2.2 The deterministic epistemological basis applied to the investigation model

The dimensions of a phenomenon or fact studied can be described and explained by the construction of a conceptual and operational model of investigation, since its variables and indicators allow an analysis of its constituent elements in an orderly and structured way. In this context, the conceptual (abstract) model describes the mental organization for understanding the phenomenon studied in its various dimensions, as well as their respective interactions among

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its various constituent elements. On the other hand, conceptual models become deterministic (operational) insofar as their constituent elements are dissected from their dimensions into variables and indicators that allow them to be measured by statistical tools. According to Martins and Theofilo (2009) the definition of operability leads to a series of procedures to which a measurable meaning is attributed to a concept applicable to a specific set of circumstances. Therefore, based on the concepts and fundamentals of the systemic approach, one can construct the conceptual model of investigation and fulcrum in Cartesian thought, making use of statistical tools, searching for explainings and logical explanations by applying a statistical method of descriptive and inferential analysis.

The (deterministic) operative model, based on the set of variables and data indicators, allows the analysis of research data through the application of the descriptive analysis method, using percentage relative frequency, position, dispersion and association measures and by the inferential method for hypothesis validation. The authors and specialists in applied statistics to social sciences (Malhotra, 2008; Monteiro Filho, 2003; Mattar, 1996; Levin, 1987) point out that position measures are characterized as instruments for finding what is typical in a group of data and falls within the so-called central tendency measures (mean, fashion and median) and separations (Quartis, Decis and Centis). Now, the dispersion measures (total amplitude, mean deviation and standard deviation) are classified as instruments that allows evaluating the degree of concentration and also the variation that the data has around the mean. In the case of association measures (linear regression, correlation) these are used to verify if there is a relation and / or association between two or more data set searched. They also report that inference methods are useful for testing hypotheses. Table 1 presents an overview of the typologies of Scales and the statistical methods that can be used for data analysis.

Table 1: Measurement Scales for Data Analysis

Scale	Features	Statistical method	
		Descriptive	Inferential
Nominal	Numbers identify and classify objects	Percentage and mode	QI- Square; Binomial Testing
Ordinal	Allows the ordering of numbers in relation to the object	Percentile and Median	Correlation of Posts; Friedman's ANOVA
Interval	Allows the comparison of differences between ranges in relation to an object	Interval, Mean, Standard Deviation	Product-moment Correlation, t-Test, ANOVA, Linear Regression, Factor Analysis
Reason	Comparison of absolute measures and proportion	Geometric Mean and Harmonic Mean	Coefficient of variation

Source: Adapted from Malhotra (2008) Mattar (1996)

Therefore, there are several scales that allow the methodological analysis and interpretation of data of a given empirical research. However, considering data collection through the application of a questionnaire structured on a Likert scale, a set of integrated statistical tools should be sought to allow the validation of the research instrument, test of significance of hypothesis, as well as analysis of the degree of association between explanatory and explained variables studied. We will now describe some of these statistical methods for analyzing and interpreting empirical research data.

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In order to analyze the validation and reliability of the research instrument, it is possible to use the Cronbach Alpha that measures the internal consistency of the data based on the average correlation between the items (Rodrigues and Paulo, 2007) and the Pearson correlation coefficient to measure the degree of association between the grouped components of each question.

According to Selltiz et al. (1967) the scientific process increases the probability that the data obtained are significant, accurate and unbiased to the research question proposed. In this context, the validation of an analogical construct is conditioned to a meticulous scientific process of verification of hypotheses constructed from theoretical and epistemological approaches and, above all, submission of these hypotheses to tests of significance, by applying parametric or non-parametric statistics. For Stevenson (1981) the purpose of the tests of significance is to evaluate the statements about the values of population parameters. In this way, one can, based on a certain statement about a population parameter, by applying a test of significance, make a decision to accept or reject a certain hypothesis. According to Gujarati (2000) the test of significance is a statistical procedure in which the results of the sample are used to verify the validity or falsity of a null hypothesis. The process to determine the test of significance of hypotheses should observe the following requirements (Doria Filho, 1999; Matar, 1996 and Stevenson, 1981), namely:

a) Define the hypothesis H0 (null) and the hypothesis H1 (experimental)
b) Select the appropriate statistical test for the problem
c) Choose a level of significance critical value (s)
d) Calculate the value of the statistical test and compare it with the critical value (s)
e) To decide whether to accept or reject the null hypothesis (H0)

Thus, according to the specificities of the sample data, a parametric or non-parametric statistical tool is applied to test the hypothesis significance.

The linear correlation is a measure that determines the association between a dependent (explained) variable in relation to an independent (explanatory) variable, measuring the degree or the force of that relationship between the variables (Black, 1997; Larson & Faber, 2007; Bruni, 2009). For sample data, Pearson's correlation coefficient (r) was used to determine the strength and direction of the relationship between the dependent (Y) and independent variables (Pearson's correlation coefficient), which were obtained from a given population and that were measured in interval data. X).

The Pearson correlation coefficient expresses, numerically, the degree or the force as the direction of the correlation that presents a variation between -1.00 and + 1.00. The association terms closest to 1, in both directions, describe the greatest correlation force.

III. THE MODEL OF SOCIO-ENVIRONMENTAL SCIENTIFIC RESEARCH

The construction of an empirical research model is an efficient tool to establish the connections of the different realities observed and its practices associated with the search for knowledge of borders, through the appropriation of the knowledge of epistemology, theories and the underlying techniques applied to theories. It is in this context that it is idealized the theoretical and operative constructs to explore, understand and explain the dimensions and structuring elements of a certain scientific phenomenon. Therefore, the socio-environmental phenomenon can be understood and explained from the epistemological appropriation related to the Environmental Public Policies and actions of the public power.

Public environmental policies and public power actions are instruments of the government to meet the demands of society and are operationalized through the application of normative and regulatory acts which impose certain constraints on the business ecosystem. Thus, these regulations are agents that interfere in the dynamics of the business ecosystem, being able to influence, directly or indirectly, the results of the business subsystems that make up certain segments of the economic activity, by virtue of their spatial or geographical boundaries. Nevertheless, it may influence the results of business performance, therefore, explicitly or implicitly, environmental public policies and actions of the public power, as well as, through regulation of the organs of the environmental system, interfere in the economic and social-environmental performance of companies.

3.1 The theoretical model

The conceptual model of socio-environmental scientific research proposed here presents the independent variables of the environmental - political ecosystem and socio - environmental governmental actions, as inputs to be processed by the business ecosystem. The results of this processing can be dimensioned in terms of the dependent variables of economic and socio-environmental business performance. Therefore, it will be sought, through the appliance of this model, to know if

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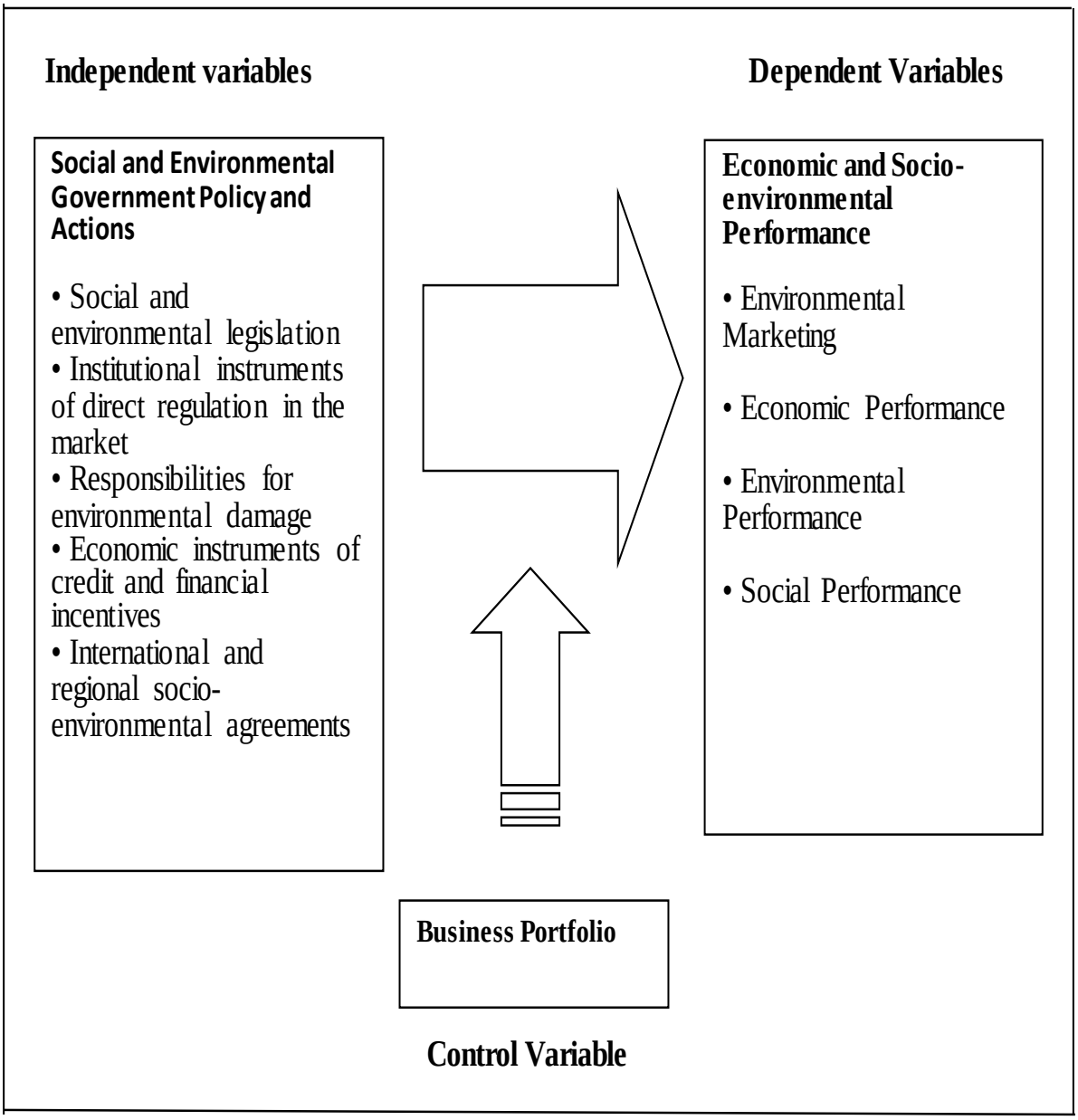
the independent variables of social and environmental governmental policies and actions influence the economic and socio-environmental corporate performance of the firms, dimensioned by the variables dependent on environmental marketing and economic, environmental and social performance (figure 2).



Source: Authors

Fig.2: Social and environmental government policy and actions and the economic and socio-environmental performance of the Firms

The construction of social and environmental governmental policies and actions focuses on obtaining data and information on public environmental policies referenced in social and environmental legislation and by public authority actions related to the inherent aspects of environmental issues. It is also focused on knowing thematic frontiers of knowledge and the epistemological bases of theoretical approaches contextualized with environmental issues viewing to identify contributions to the foundation and understanding of the concept of

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economic and social-environmental business performance, whose assumptions are:

- Identify in the socio-environmental legislation and its conditions of normalization and regulation of economic activities, with regard to environmental licensing, the direct institutional instruments of market regulation and the aspects related to liability for environmental damages.
- Identify the actions of public power in environmental matters and its determinants related to the economic instruments of social and environmental credit and financial incentives of economic activities and to the International and Regional Socio-environmental Agreements.
- Identify business actions related to sustainable business performance, as well as evidence on business practices associated with the economic, environmental and social performance of companies.

3.2 The operational model of research

From the taxonomy of the theoretical model, the arrays of the logical structure of the political variables and socio-environmental governmental actions (independent variable) were elaborated; economic, environmental and social performance (dependent variable) and business size (control variable). Tables 2, 3 and 4 present the analysis structure of the variables and the set of indicators.

Table 2: Dimension, independent variables, variables indicators and Issue of approach

Dimension	Independent variables	Variable Indicators	Issue of approach
Social and environmental government policy and actions	Social and environmental legislation	Difficulty in meeting the technical criteria for releasing the environmental license	Technical criteria for licensing
		Response time for analysis and dispatch of the environmental permit	Environmental Leave Release Time
		Intensity of the Company's expenditures to comply with Environmental Legislation	Intensity of expenditure
	Institutional instruments of direct regulation in the market	Influence of regulatory instruments in the Company's production system	Environmental regulation instruments
	Liability for environmental damages	Sanctions for environmental damages	Tax and / or administrative penalties
	Economic instruments of credit and financial incentives	Application of economic instruments related to environmental issues	Environmental economic instruments
	International and regional socio-environmental agreements	Environmental technical standards related to international and regional socio-environmental agreements	Environmental technical standards

Source: Authors

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Table 3: Dimension, dependent variables, variable indicators and Issue of approach

Dimension	Independent variables	Variable Indicators	Issue of approach
Economic and socio-environmental performance	Environmental Marketing	Marketing of products with the eco-label	Environmental Marketing
	Economic Performance	Business performance under the economic and financial prism	Economic Performance
	Environmental Performance	Use of natural resources and emissions of waste, effluents and greenhouse gases	Environmental Performance
	Social Performance	Corporate social responsibility actions	Social Performance

Source: Authors

Table 4: Dimension, control variable, variables indicators and Issue of approach

Dimension	Independent variables	Variable Indicators	Issue of approach
Business Portfolio	Demographic Profile	Classification of company size	Number of Employees
		Annual gross revenue of the company	Annual Gross Revenue
		Export percentage	Percentage of exports and, relation to gross revenue
		Socio-environmental organic structure	Organic way of dealing with socio-environmental issues

Source: Authors

3.3 The basis of the research instrument

The logical structure of the data collection instrument is conceived from the dimensions of socio-environmental governmental policies and actions and of economic and socio-environmental performance. Each dimension is associated with a set of indicators of the variables, which are expressed by a question of the questionnaire. The questionnaire is modeled as an opinion poll in three blocks, namely:

I) Company Profile - Ranks the companies surveyed in relation to size, gross sales, export volume and the form of the company's socio-environmental organic structure.

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II) Environmental Public Policies - This block is divided into two sections. The first one seeks to get to know the positioning of the companies surveyed on the issues related to socio-environmental legislation, the institutional instruments of direct regulation in the market and the aspects circumscribed to the responsibility for environmental damages. The second section deals with issues related to the economic instruments of credit and financial incentives and to international and regional socio-environmental agreements.

III) Economic and Socio-environmental Business Performance - we seek to identify the degree of economic and socio-environmental results of the firms surveyed. The business actions are evaluated: environmental marketing, economic, environmental and social performance.

The instrument of data collection should be elaborated in a scale of the Likert type, with value of score of 1 to 5. The Likert scale is of characteristic sum and it allows the ordering of attitude of favorability or unfavorability in relation to a certain object, but does not measure how much this attitude is more or less favorable (Selltiz et al., 1967). According to Gill (1999), the results obtained by manifestation of attitude and / or opinion about a problem studied, through the application of data collection instrument built on the Likert-type scale, can be analyzed using the tests of correlation. However, it should be noted that there is a discussion among researchers on the use of parametric and non-parametric statistics in the analysis of the data obtained through the Likert scale. Carifio & Perla (2007) emphasizes that non-parametric statistics should be applied to ordinal data. However, Allen and Seaman (2007) stress that ordinal (Likert-scale) data analysis as the data range is based on the assertion that parametric statistical tests are more powerful than non-parametric alternatives. Carefio and Perla (2007) point to the use of Pearson's correlation, multiple regression, variance analysis and F-test as possible parametric statistical instruments for the Likert scale data analysis. But according to Kislenko and Grevholm (2008), there is no consensus among researchers on which methods are suitable for using the Likert scale.

IV. CONCLUSION

The central focus of the socio-environmental scientific research model emerges from the question: do public policies and governmental actions related to social and environmental issues have any association with the economic and socio-environmental performance of firms? Coming from this question problem, the conceptual model (figure 2) was designed as a social and environmental policy and the economic and social-environmental performance of the firms, organized and operationalized through the set of variables related to public social and environmental governmental policies and actions (table 2). economic and socio-environmental performance (table 3) and business profile (Table 4). The research instrument built for research is based on the variables of the conceptual model and in the set of problem situations in view of the business segment covering questions about environmental legislation, institutional instruments for direct regulation in the market; responsibility for environmental damage; international and regional socio-environmental agreements; environmental marketing, economic, environmental and social performance. After applying the research in a certain segment of companies, the data collected must be submitted to statistical procedures which attest to their validation and reliability.

Lastly, it is recommended that data from empirical research go through an analysis of descriptive and inferential statistics. The descriptive analysis is done through the interpretation of the percentage relative frequency and Pearson coefficient of variation analysis. The inductive or inferential analysis is based on the application of Pearson's correlation technique to determine the degree of association between the studied variables. For the experimental hypothesis of the research, we suggest the application of the significance test as measured by the F statistic. Pearson's correlation and the Cronbach's alpha are also applied to validate the applied research instrument, as well as to measure the degree of internal reliability of the data collected.

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