Statistical Association between Business Sustainability and Some Strategic Development Factors in Companies in the Colombian Mining Sector: The Case of Coal Companies

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Abstract

The degree of statistical association between corporate sustainability and the factors was evaluated: attitude of managers and entrepreneurs, innovation and corporate social responsibility in companies that operate, process and market coal in Colombia in 2016.

The population studied was made up of 100 companies in the coal sector. The instruments to collect the information were: Guide for the preparation of Sustainability Reports of the Global Reporting Initiative (GRI) version 3.1, instrument designed by López (2015) based on the OECD Green Paper Eurostat (2005) for the measurement of innovation, the indicator: Corporate Social Performance (CSP), known as KLD for corporate social responsibility and the modified version of the instrument: "Orientation and business Attitudes" (BAO) to measure the attitude of managers and entrepreneurs.

The project was developed in three (3) phases: In the first one, the degree of corporate sustainability, innovation, social responsibility and attitude of managers and entrepreneurs of each of the companies participating in the study were identified through a survey. In the second phase, the respective measurement instruments were applied to the coal companies participating in the study. In phase 3, the bar diagrams were made by crossing the independent variables (innovation,
social responsibility and attitude of managers and entrepreneurs) with the dependent (corporate sustainability).

The results showed statistical significance with a 95% confidence level between Corporate Sustainability and the variables: corporate innovation (p = 0.005) and the attitude of managers and entrepreneurs (p = 0.008). No statistical association could be verified between corporate sustainability and corporate social responsibility.

**Keywords:** Sustainability, innovation, responsibility, attitude, managers

**Introduction**

Robeco Sam (2014) defines corporate sustainability as the adoption of opportunities and risks that allow the company to create added value in the long term articulated with the organizational enterprise approach [1]. For Lozano (2012), incorporating sustainability into the organization, allows modifying the corporate system in relation to operations and production, management, administration, strategies, systems, supply and marketing that will have a positive impact on organizational development and its competitiveness [2]. For the national production center (CNPML, 2010: 7), sustainability is considered as an organizational strategy that generates added value and drives innovation processes integrating social, economic and environmental principles [3,4]. For (Senge, et al, 2009), corporate sustainability must allow all the barriers and limitations of the organization to be overcome by promoting radical innovation processes in various areas, to the point of changing the one-dimensional corporate approach (corrective or preventive) [5]. For Van Bommel (2011) [6], articulate corporate sustainability and innovation represents a complex challenge because many actors are involved and each with their own interests. Therefore, organizational learning (AO) according to Jimenez and Sanz (2010) [7], is a process by which the company generates new knowledge from the expertise of the human resource of the organization and where the knowledge is distributed or transferred from the global, to each member of the collective, as proposed by Van Mierlo et al (2010) [8].

For Francés et. al (2003) the company is not a neutral element in the field in which it operates and is not only at the service of private or public interests, but is a socio-economic agent whose tendency should be to achieve goals and objectives respecting society, it must recognize corporate social responsibility in front of the society or communities in which it develops [9]. For Carol and Zutshi (2004) a company that produces the best product on the market both in quality and price can not resort to the use of child labor nor to violate agreements or conventions of work [10]. For Graafland et al. (2003) showed that for SMEs in general, due to their organizational conditions, the possibility to apply Corporate Social Responsibility (CSR) is reduced [11].

For authors such as Tata and Prasad (2015), Hahn et. al (2014) and Duarte (2010) the attitude, position, values and leadership of the organization's directors facilitate or hinder the implementation of processes of corporate sustainability. In the same
way, they consider that the cognitive framework of the managers of the organization defines to a large extent, the position at the time of making decisions and the perceptions that they have of sustainability processes, so they play an important role in the culture of corporate sustainability which internally creates identity, purpose, history, direction, respect for the members of the organization and defines the bases to define structures and organizational practices that guarantee long-term sustainability of the company according to what was proposed by Duarte (2010) [12,13,14]. This project evaluated the statistical association between corporate sustainability (CS) with innovation (CI), corporate social responsibility (CSR) and the attitude of managers and entrepreneurs (AME) in companies that exploit, process and market coal.

**Materials and Methods**

**Population and sample size:** The study was carried out in a population of 100 companies that exploit, process and market coal in the departments of the Guajira, Cesar, Córdoba, Norte de Santander, Boyacá and Santander in the year 2016. The sample was made up of 80 companies in total, among which are: Carbones of the cerrejón, Cerrejón north zone, Drummond, BHP-Billiton, Glencore among other. Para definir el tamaño de la muestra se utilizó la ecuación (1) para poblaciones menores a 100.000 individuos así como lo plantea Fong et. al (2017) [15].

\[
n = \frac{\sigma^2 Npq}{e^2 (N - 1) + \sigma^2 pq}
\]  

(1)

N: Number of population elements; n: Number of elements that the sample must have; e: Error allowed; p: Probability that an element is selected (50 % estimated); q: Probability that an element is not selected (q = p); σ: Level of risk.

**Variables, phases, instruments and reliability of the test:** The variables used in the investigation were: a) Independent variables: Innovation, corporate social responsibility and attitude of managers and entrepreneurs. b) Dependent variable: Corporate sustainability.

The research was carried out in three (3) phases: In the first one, the degree of corporate sustainability, innovation, social responsibility and attitude of managers and entrepreneurs of each of the companies participating in the study were identified through a survey. In the second phase, the instruments were applied to the coal companies. In phase 3 the independent variables are crossed with the dependent variable, corporate sustainability, constructing the bar diagram of the relational analysis.

**Instruments:** To measure corporate sustainability, the guide for the preparation of Sustainability Reports of the Global Reporting Initiative (GRI) version 3.1 [16] was
used, which included the following dimensions: a) Economic dimension (economic performance, presence in the market, indirect economic impact). b) Environmental dimension (Materials, energy, water, biodiversity, regulatory compliance, transportation, general aspects, emissions, discharges, waste and products and services). c) Social dimension (Labor aspects, human rights, society and responsibility on Product ). In order to measure corporate innovation, the instrument designed by López (2015) [17] was used, based on the OCDE Eurostat (2005) green book [18], the main global parameter for the measurement of innovation. Corporate Social Responsibility was measured through the dimension: "Relations with the community" of the KLD indicator of Corporate Social Performance (CSP), known as KLD developed by the rating agencies Kinder, Lydenberg, Domini Research & Analytics (KLD) and which assess companies in their environmental performance and other areas of social performance [19,20]. The attitude of managers and entrepreneurs participating in the study was made through a modified version of the "Orientation and Business Attitudes" (BAO) instrument, originally developed by Robinson et al (1991) [21] in the United States and translated and adapted in Spain by Ibañez in (2001) (Krauss, 2005) [22]. This instrument measures the emotional, behavioral and cognitive components of the attitude. The questions of the previous instruments are of the Likert type, weighted from 0 to 5 points, from totally agree (5) to totally disagree (1). The internal reliability of the test was determined by Cronbach's Alpha [23].

The dependent variable Corporate Sustainability was classified into two categories: a) Low Corporate Sustainability (LCS) (LCS<60 points) and high corporate sustainability (HCS) (HCS≥ 60 points, out of a total of 100 points). The independent variables were classified into three categories: a) Low corporate innovation (LCI) (score lower than 60, LCI <60 points) and high corporate innovation (HCI) (score equal to or greater than 60 points; HCl≥60) b) Low corporate social responsibility LCSR (LCSR<60 points) and High corporate social responsibility (HCSR) (HCSR≥60). c) Low attitude of managers and entrepreneurs (LAME) (LAME< 60 points) and high attitude of managers and entrepreneurs (HAME) (HAME≥ 60 points of a total of 100 points).

Statistic analysis: The Chi-Square test [24] between corporate sustainability and the independent variables innovation, social responsibility and attitude of managers and entrepreneurs was used to know which of these factors are related to each other in the coal companies of the northern zone of Colombia.

Results and Discussion

Cronbach's alpha showed average values of 0.79, 0.81, 0.77 and 0.86 in the instruments used to measure corporate sustainability, innovation, social responsibility and attitude of managers and entrepreneurs respectively. This indicates a high degree of internal consistency of the tests. The Chi-Square test was
evaluated for the analysis of the relationship between corporate sustainability and the independent variables (corporate innovation, corporate social responsibility and attitude of managers and entrepreneurs).

Table 1 additionally indicates the values of p (statistical significance) where it is also observed that there is a relationship of high statistical significance between corporate sustainability with corporate innovation and attitude of managers and entrepreneurs (p <0.05).

Table 1 Chi-Square Test for Corporate sustainability

<table>
<thead>
<tr>
<th>Variable</th>
<th>Chi-square</th>
<th>GL</th>
<th>P-Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Corporate innovation (CI)</td>
<td>7.85</td>
<td>1</td>
<td>0.005**</td>
</tr>
<tr>
<td>Corporate Social Responsibility (CSR)</td>
<td>1.21</td>
<td>1</td>
<td>0.271</td>
</tr>
<tr>
<td>Attitude of managers and entrepreneurs (AME)</td>
<td>6.96</td>
<td>1</td>
<td>0.008**</td>
</tr>
</tbody>
</table>

** Relationship with high statistical significance at a confidence level of 95%

Figure 1 shows the bar graph between corporate sustainability and business innovation in the companies participating in the study.

![Contingency Chart](chart.png)

Figure 1. Bar chart corporate sustainability-corporate innovation.

18.8% of the cases, that is, almost a fifth of the studied population, have low levels of corporate sustainability due to their low levels of innovation. This is probably due to the fact that this group of companies have not considered taking risks that allow them to create added value in the long term in their organizational enterprise processes, as Robeco Sam (2014) suggests [1]. Also, these companies have not started the process of modifying their corporate system related to operations, production, management, administration, strategies, systems, supply and marketing that allow them to positively impact on their competitiveness and organizational development, as proposed by Lozano (2012) [2]. 18.7% of the cases, that is, almost a fifth of the studied population, have low levels of corporate sustainability when
achieving high levels of innovation. This is due to the fact that in these companies (15 in total) their managers still do not take risks that impact in long-term corporate sustainability and the change they have begun to generate in their organizational corporate system has been slow. In addition, these companies still do not change their innovation processes in a radical way nor have they defined a corporate approach different to the one-dimensional approach as proposed by the CNPML and Senge et. al (2009) [3, 4, 5]. 12.5% of the cases, that is, one eighth of the population reached high levels of corporate sustainability despite having low levels of innovation. This is due to the fact that in these companies (10 in total) their managers have begun to slowly articulate innovation processes with corporate sustainability and taking into account that this is a rather complex process which requires time and where organizational learning has begun to slowly distributed among the members of the organization [6, 7, 8]. 50% of the companies studied, that is, half of the population reached high levels of corporate sustainability based on high levels of corporate innovation. This is due to the fact that in this group of companies (40 in total) all have initiated a radical innovation process based on the needs of globalization processes, integrating social, economic and environmental principles. In addition, they have made changes in their one-dimensional corporate approach generating and transmitting new knowledge throughout the organization [3, 4, 5, 6, 7, 8]. This also allowed us to verify the statistical association between these variables.

Figure 2 shows the bar graph between corporate sustainability and the attitude of managers and entrepreneurs of the companies participating in the study.

![Contingency Chart](image)

Figure 2. Bar chart corporate sustainability-attitude of managers and entrepreneurs.

51.2% of the companies studied achieved low levels of corporate sustainability while their managers and entrepreneurs had a low attitude toward enterprise processes. This is probably due to the fact that the vast majority of company managers and entrepreneurs still have resistance to change. This has not allowed them to adopt positive behaviors to overcome short-term barriers and establish an organizational culture of corporate sustainability that allows the creation of identity,
purpose, history, direction and respect that will guarantee said sustainability, according to the approach of Tata and Prasad (2015), Hahn et. al (2014) and Duarte (2010) [12, 13, 14]. 15%, that is, almost one seventh of the studied population reached low levels of corporate sustainability while their managers and entrepreneurs had high levels of business attitude. This may be because they are companies that are in the process of organizational transition, that is to say, its human resource is still not articulated with the organizational learning defined by Jimenez and Sanz (2010) [7]. The 16.3%, that is to say, the sixth part of the studied population reached high levels of corporate sustainability while their managers and entrepreneurs had low levels of business attitude. This may be because they are companies (13 in total) that have human resources with high experience in the sector and that are articulated to the objectives and goals of the organization since the distribution of knowledge in the other members of the organization. Likewise, it should be taken into account that these managers were relatively new and without much experience in the coal field. That is, the low levels of business attitude of these managers is offset by the high commitment of the members of the organization [6, 7, 8].

The 17.5% (14 cases) of the companies studied reached high levels of corporate sustainability while their managers and entrepreneurs had high levels of business attitude. This is probably due to the fact that this group of companies have already started the process of organizational transformation led by their managers, overcoming barriers and limitations of the organization in the markets. That is to say, the cognitive framework, the proactive and decisive attitude of its managers has influenced the culture of corporate sustainability, generating the development of an own identity built from the definition of structures and new organizational practices [5, 12, 13, 14]. Table 1 shows that there is no significant statistical association at a 95% confidence level between corporate sustainability and corporate social responsibility.

**Conclusion**

Based on the analysis as above, it is concluded as follow: There is a statistically significant association with a 95% confidence level between corporate sustainability and corporate innovation processes. This is largely due to the fact that this type of companies have initiated radical innovation processes by changing the one-dimensional corporate approach and distributing organizational learning among all its members. There is a statistically significant association at a 95% level of confidence between corporate sustainability and the attitude of managers and entrepreneurs of the companies studied. This is due to the proactivity, positive mentality and leadership of the great majority of the businessmen of the coal companies that participated in the study. No significant statistical association could be verified at a 95% confidence level between corporate sustainability and corporate social responsibility.
References


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