

Analysis of Organizational Sustainability: the Building Industry Case

Julio Nichioka^a

Oswaldo Luiz Gonçalves Quelhas^a

^aFluminense Federal University (UFF), Niterói, Brazil

Abstract

The current study aims at establishing comparability mechanisms among Sustainability implemented aspects, which may assess both maturity stage and the adherence to Sustainability Management Systems of Brazilian Civil Construction firms in Building subsector. The analysis of Sustainability Management Systems implemented by Civil Construction firms was performed by using the tool and by carrying out interviews with five firms within the segment. The collected outcomes were treated under intra-case and inter-case methods, which verified the current maturity stage and the adherence to Sustainability Management Systems. The use of a simulator made the determination of the firms final classification possible in relation to the their Sustainability Management Systems efficiency.

***Keywords:** Sustainability Management Systems, Sustainability, Sustainability Performance Indicators, Civil Construction.*

Introduction

This study involves the establishment of mechanisms of comparability between the Sustainability aspects in use, which may allow evaluation of the stage of understanding and the adherence of the Sustainability Management Systems of the Brazilian Civil Construction Industry in the buildings subsector, related to the sustainability – results economics, environmental and social. The study also sought to make an evaluation of the efficiency of these systems. In order to carry out a comparative analysis, an evaluation instrument was developed, contemplating four dimensions – Leadership, Economics, Environmental and Social. Subdividing the dimensions resulted in 13 aspects, and then 81 indicators of Sustainability performance were identified, which became the basis for the Organizational Sustainability Analysis Study (OSA), and for the questionnaire used to collect information for the study. An analysis of this Management Systems implemented for the Sustainability by building companies was made using that instrument as well as interviews at five of those companies. The results obtained were treated with the intra-case and inter-case study

methods, and the understanding stage and adherence of the Management Systems were assessed. The utilization of a simulator allowed the definition of the final classification of the companies in relation to the efficiency of their Management Systems for the Sustainability.

Sustainability and Assessment Sustainability Tools

The World Commission on Environment and Development (CMMAD, 1988) published in 1987 - the Brundtland Report - which provided the present definition accepted of Sustainable Development as “what implies in meeting the present needs without compromising the future generations ability to meet their own needs”. Since then, and with a succession of worldwide events, there has been an increasing level of attention to ensure that the pillars of business continuity (ELKINGTON, 1994) are being met – economic, social and environmental, which are also aspects of sustainability.

Instituto Ethos (2006) categorically affirms that “the successful organizations will be those which are committed to Sustainability in its various aspects, in a continuous and simultaneous fashion.”

Barbosa, president of the Brazilian Federation Bank (Federação Brasileira dos Bancos) and an executive of Banco ABN Amro Real, acquired by Santander and in line with the president of Santander, emphasizes that Sustainability issues are on all executives’ agenda and has become part of every firm’s business strategy. It has become a business itself (BRAZILIAN BUSINESS, 2008).

Another managers’ huge concern is to measure organizational performance, so as to provide means to assure management adherence to business planning. Measurement and processes’ control are very difficult tasks for firms, and even more in relation to sustainability, since they are still undergoing a consolidation process.

Amaral (2003) states that the process of establishing Sustainability performance indicators is partially scientific and political, since a given impact – atmospheric emissions – can be scientifically characterized as environmental as it affects the air. But concerning the political aspect, it can be essential or not for the firm, when analyzed under the perspective of the influences and pressures at any given moment.

Mitchell (1997), on the other hand, states that in relation to Sustainability Indicators, the debate has just started, as there is no existing formula or single recipe to assessment that is unsustainable yet.

There are several tools or related documents for assessing Sustainability, which, with small adaptations, could be used as reference documents, once they have been used by several Brazilian firms which showed concern and carried out effective actions towards Sustainability. Table 1 below shows some of the most common documents in Brazil and worldwide.

The first four tools allow firms to declare their management practices in relation to the specific dimensions described. The first three cover the three dimensions – economic, social and environmental, while the Domini Social Equity Fund works only with the social dimension indicator. Instituto Ethos was specific, dealing only with the social aspect. In its latest version (2007), Instituto Ethos began contemplating Sustainability.

Some investment funds, such as Domini(USA) monitor indexes, ensure that reliable information is conveyed to the investor.

FTSE International owns a database which allows the disclose of its indexes, ensuring information confidence and transparency. FTSE has also developed monitoring mechanisms for several indexes of other entities, in order to facilitate decisions by investors, directing them to sites which control databases.

The last three indexes are generated as work function by which the originating institutions perform in collecting and treating statistic information, made through databases available or by specific information furnished to stakeholders. They became significant data sources, which are referenced in any research work.

Sustainability has been largely discussed in the media as in the late 90s, but little has been published at academic level in Brazil (Silva (2003); Amaral (2003); Librelotto (2005); Vieira (2005); Santos (2007); Quelhas and Araujo (2006); Quelhas and Silva (2006) and Deponti, Eckert and Azambuja (2002)). Among those Brazilian publications analyzed, five covered economic, environmental and social dimensions (EES), while one covers the technical dimension, in relation to agriculture. Only three are directed to Civil Construction (CC), two of those are directed towards the product (buildings), and a third is related to strategic management, where performance, positioning and firm conduct, as well as its competitive advantages are assessed.

Worldwide, there are publications and methodologies devoted to several segments: (Jung, Kim and Rhee (2001); Singh *et al* (2007); Labuschagne, Brent and Erck (2005); Montabon, Sroufe and Narasimhan (2007); Shen *et al* (2005); Tam *et al* (2006); Székely and Knirsch (2005)) – which use several tools as well as environmental and/or sustainability assessment methodologies.

By observing the sectors which are the subject of the work identified, only two are related to CC, as follows:

- Shen *et al* (2005) –focused on measuring the CC business environmental through a life cycle analysis, which used the Multi Dimensional Analysis Matrix as the measuring metric; and
- Tam *et al* (2006) – accesses the environmental indicators performance by using Regulatory Bylaws from Hong Kong and Management System Audits as tools. The quantification of indicators was obtained by Weighted Average / Relative Importance.

Table 1 - Sustainability Assessment Tools

Nr.	Tools/Indexes	Publication			Characteristic
		Entity	Initial	Current	
1	Instructions for Preparing Sustainability Reports (G3)	Global Reporting Initiative – GRI / UN	2000	2006	Orientation guide open and available to all citizen
2	Dow Jones Sustainability Index (DJSI)	SAM Indexes and Dow Jones Indexes	1999	2008	Self-evaluation in relation to Sustainability practices.
3	Business Sustainability Index (Índice de Sustentabilidade Empresarial - ISE)	BOVESPA	2005	2008	Self-evaluation in relation to Sustainability practices.
4	Domini 400 Social index	Domini Social Equity Fund	1997	2008	Self-evaluation in relation to social practices
5	Preparation Guide for Report and Annual Statement of Business Social Liability (Guia de Elaboração de Relatório e Balanço Anual de Responsabilidade Social Empresarial)	Instituto Ethos	2001	2007	Initially focused only on social dimension.
6	NPI Social Index	FTSE International	1998	2007	Database and Indicators for firms
7	IBASE Index	IBASE	1998	2007	Database to set up Information Systems.
8	Sustainable Development Indicators	IBGE	2002	2006	Monitoring Sustainability of the type of development in Brazil.
9	Human Development Index (HDI)	PNUD	1990	2007	Assesses the development level of the population in a country

Organizational Sustainability Analysis Study

Three points must be highlighted as relevant:

- a) The establishment of OSA for firms within CC business, Building sector, which would furnish stakeholders or development and investment banks with information for decision making;

- b) Rising concerns among countries and international organizations in relation to the social, economic and environmental impacts of activities, which seek not only economic efficiency of productive processes, but also standards improvement of social welfare and environmental quality;
- c) The recognition of firms' intangible assets as part of their valuation and as a tool to facilitate the allocation of private funds among productive activities, once stakeholders will assess organizations based on those assets, and they are positively measured and leveraged by the control and minimization of social and environmental impacts.

Study Framework

The study contemplated four dimensions – Leadership, Economic, Environmental and Social. The split of these dimensions resulted in 13 aspects, and later, 81 Sustainability performance indicators were identified, which became the basis for the assessment questionnaire, and turned it into *the most adequate questionnaire applicable to the CC business, Buildings subsector*.

The 81 Sustainability performance indicators were consolidated according to the Organizational Sustainability aspects considered by the GRI G3 (2006); the article “*The measure of corporate environmental performance and its application to the analysis of efficiency in oil industry*”, by authors Jung; Kim and Rhee (2001) – Gscore Methodology; the Excellence Criteria of the Brazilian National Quality Foundation (Fundação Nacional da Qualidade, 2008); as well as the inclusion of specific criteria developed by the author, thus establishing the OSA proposed study represented in Figure 1- Framework of Organizational Sustainability Analysis Study, and in Figure 2 - The description of study *construction*.

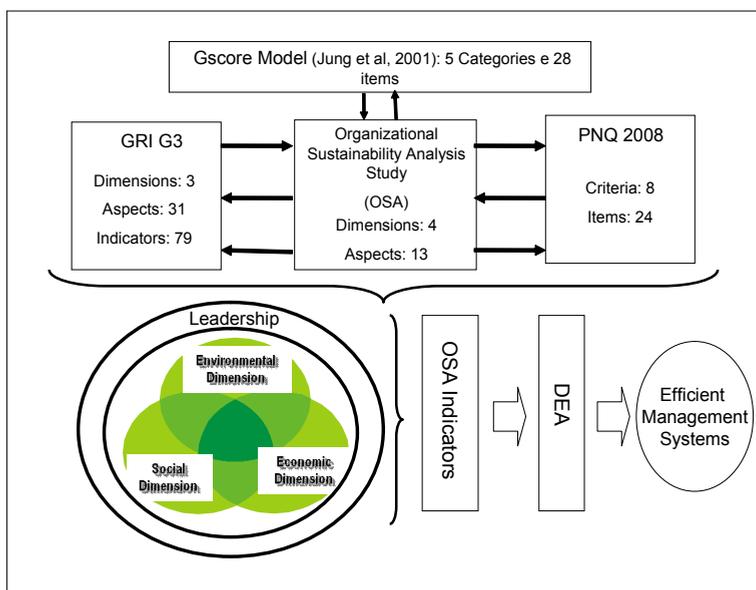


Figure 1 - Framework of Organizational Sustainability Analysis Study

Civil Construction Firms Selection

Some researchers recommend defining the sample size to be studied at the very beginning of the planning process, but Eisenhardt (1989) does not recommend this practice. Instead, he suggests that the limiting factor is attained when “theoretical saturation” is reached. Such a situation is prone to occur, typically, in the interval between four and ten cases studied. Eisenhardt (1989) also emphasizes that in various investigations, the ideal sample is detected when five cases are analyzed.

Three firms, which went public on BOVESPA market and which are considered large (GP), were chosen as the first group of firms to be studied, as well as another two firms indicated by a professional in that field.

Another nine medium or small-sized firms (MP) were selected because they were indicated by specialists who operate in firms in CC business or who had a professional relationship with such firms. In Table 2, the information described synthesizes the position of the firms selected for the study and their development .

It can be concluded that, of the 14 firms identified for participation in the initial assessment, the study was restricted to only five firms, which were subsequently codified according to the description above.

Analysis of the Organizational Sustainability of Companies in the Brazilian Civil Construction Business

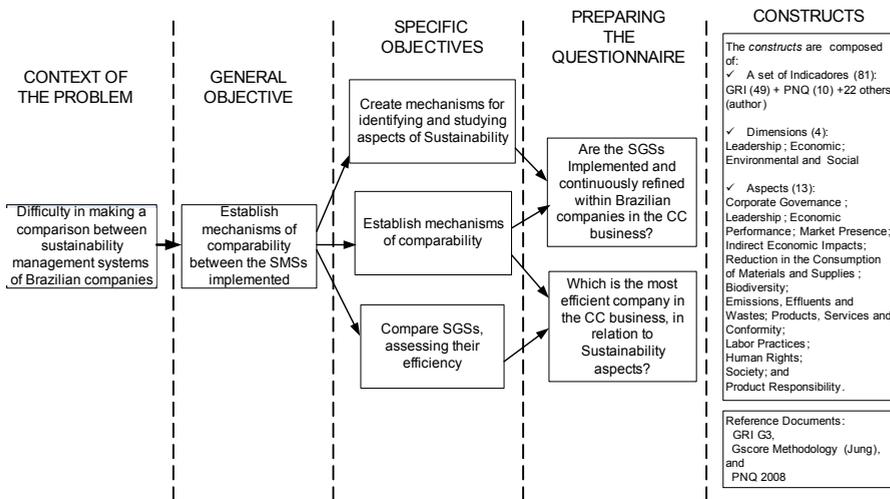


Figure 2 - Description of the study construction

Intra-case Analysis

After obtaining the values which the individuals interviewed attributed to the indicators, graphs were set up with the perception of the degree of importance and adherence of each aspect of the organizations, and eventually a value was obtained

for Likert scale average. These graphs allow different observations in relation to the neutral value of importance and adherence.

The graphs also allowed a better visualization of the metrics attributed by each company.

For the assessment of the implementation of a Sustainability Management System (SMS) maturity stage for the firm, the metric used was the calculation of the Importance of Sustainability to the Civil Construction Company (ISC) and the Adherence to Sustainability by the Civil Construction Company (ASC).

Table 2 - Firms selected for the stud

Firms		Position / Developments	Code Allocated
1	GP1	Alleged needs to maintain information confidentiality, didn't allow contribution to the study.	No
2	GP2	Excessive delay, alleging an excess of responsibilities.	No
3	GP3	Contributed to the elaboration of the study.	CC4
4	GP4	Excessive delay. Directed to another internal liable party at every moment.	No
5	GP5	Excessive delay, despite showing interest in responding.	No
6	MP1	Pilot company. Contributed to the elaboration of the study.	CC1
7	MP2	Does not contemplate Sustainability in the management of the organization.	No
8	MP3	Does not contemplate Sustainability in the management of the organization.	No
9	MP4	Contributed to the elaboration of the study.	CC3
10	MP5	Does not contemplate Sustainability in the management of the organization.	No
11	MP6	Contributed to the elaboration of the study.	CC2
12	MP7	Contributed to the elaboration of the study.	CC5
13	MP8	Excessive delay, despite showing interest in responding.	No
14	MP9	Did not respond.	No

Degree of Sustainability Importance

Table 3 and Figure 3 present the degrees of Importance of IA Aspects for the five firms studied.

Table 3 - Degree of Sustainability Importance for the five firms studied

Aspects		CC1		CC2		CC3		CC4		CC5	
		IA	Mean IA								
1	To have Effective Corporate Governance available	7,80	7,80	7,80	2,80	3,40	-1,60	8,60	3,60	5,00	0,00
2	To develop a pro-active organization, in response to strategies and its objectives	7,29	7,00	7,00	2,00	4,00	-1,00	8,14	3,14	2,71	-2,29
3	To minimize direct economic impacts	4,67	6,83	6,83	1,83	0,50	-4,50	8,33	3,33	6,67	1,67
4	To obtain "social license for operations"	3,50	5,75	5,75	0,75	0,25	-4,75	5,50	0,50	7,50	2,50
5	To effect positive indirect economic impacts	4,33	4,67	4,67	-0,33	0,33	-4,67	8,33	3,33	5,67	0,67
6	To reduce inputs in the materials and supplies processes, in relation to a standard productivity level	5,29	4,29	4,29	-0,71	2,57	-2,43	7,57	2,57	5,86	0,86
7	To preserve nature	7,00	2,50	2,50	-2,50	0,00	-5,00	2,50	-2,50	3,50	-1,50
8	To increase production of outstanding goods	2,22	1,11	1,11	-3,89	0,44	-4,55	3,00	-2,00	3,22	-1,78
9	To pollute less	6,00	6,75	6,75	1,75	0,50	-4,50	8,00	3,00	7,00	2,00
10	To establish correct and decent labor practices	6,45	5,27	5,27	0,27	1,27	-3,73	9,00	4,00	4,27	-0,73
11	To respect people	4,75	4,50	4,50	-0,50	1,13	-3,87	8,50	3,50	4,13	-0,88
12	To reduce the impact to communities and society	5,50	3,25	3,25	-1,75	0,63	-4,37	8,50	3,50	4,63	-0,37
13	To reduce the impact of Liability aspects	6,50	5,50	5,50	0,50	0,83	-4,17	8,00	3,00	6,33	1,33

The IA Average value is obtained by calculating each IA, subtracting the average value considered (5) according to Likert scale. The results allow the identification of the values which are above or below Neutral Importance. The Average IA-is called the Importance Degree of the Aspects of the company in relation to the average.

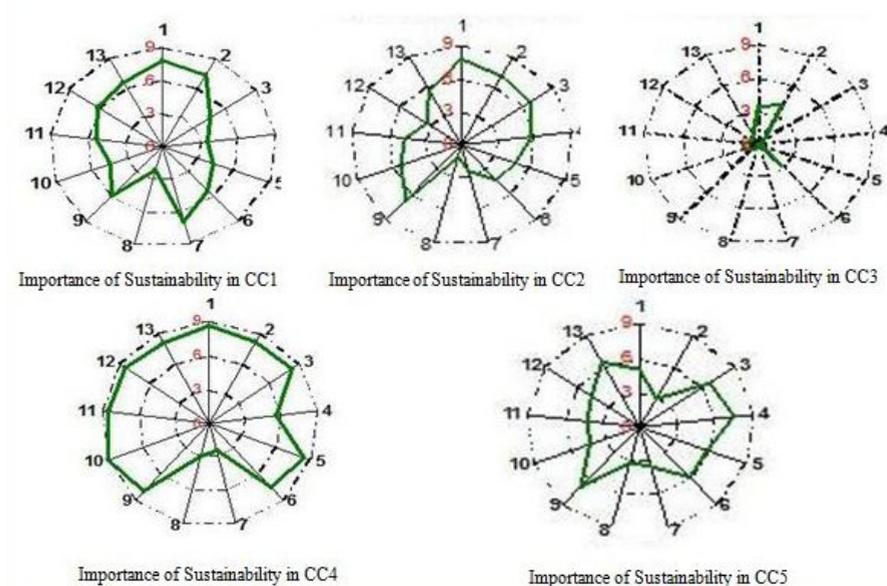


Figure 3 – Graphic representation of the Sustainability Importance of five firms studied among the thirteen aspects analyzed

The degree of sustainability importance for firms can be calculated by using the following expression:

ISC = Importance of Sustainability in Company CC = Sum of the IA of CC / nr. of aspects

Thus, calculating, we find out:

Table 4 –Sustainability Importance Degree for the Firms Studied

Sustainability Importance for the Firm	Value obtained	Importance	Classification
CC1	5,43.	Neutral	2°
CC2	5,02	Neutral	4°
CC3	1,22	None	5°
CC4	7,23	Important	1°
CC5	5,11	Neutral	3°

Adherence Degree of Sustainability Management

Table 5 and Figure 4 present the Adherence Degrees of Aspects, for the firms studied.

Table 5 – Adherence Degree of Sustainability Management for the five firms studied

ASPECTS		CC1		CC2		CC3		CC4		CC5	
		AA	Mean AA								
1	To have Effective Corporate Governance available	5,80	0,80	7,40	2,80	2,00	-3,00	6,60	1,60	3,40	-1,60
2	To develop a pro-active organization, in response to strategies and its objectives	4,71	-0,29	7,00	2,00	3,00	-2,00	5,57	0,57	2,43	-2,57
3	To minimize direct economic impacts	4,33	-0,67	6,83	1,83	0,50	-4,50	7,33	2,33	6,33	1,33
4	To obtain “social license for operations”	2,00	-3,00	5,25	0,25	0,25	-4,75	4,00	-1,00	6,50	1,50
5	To effect positive indirect economic impacts	2,00	-3,00	4,67	-0,33	0,33	-4,67	7,00	2,00	4,33	-0,67
6	To reduce inputs in the materials and supplies processes, in relation to a standard productivity level	2,57	-2,43	4,14	-0,86	2,29	-2,71	5,57	0,57	5,00	0,00
7	To preserve nature	5,00	0,00	1,50	-3,50	0,00	-5,00	2,50	-2,50	2,50	-2,50
8	To increase production of outstanding goods	0,22	-4,78	1,11	-3,89	0,44	-4,56	2,33	-2,67	3,00	-2,00
9	To pollute less	2,75	-2,25	6,75	1,75	0,50	-4,50	6,00	1,00	6,00	1,00
10	To establish correct and decent labor practices	4,45	-0,55	4,55	-0,45	1,27	-3,73	8,64	3,64	3,73	-1,27
11	To respect people	3,13	-1,87	4,50	0,50	0,88	-4,12	7,75	2,75	3,63	-1,38
12	To reduce the impact to communities and society	2,88	-2,12	2,88	-1,22	0,63	-4,37	7,75	2,75	3,25	-1,75
13	To reduce the impact of Product Liability aspects	4,83	-0,17	5,50	0,50	0,63	-4,37	7,33	2,33	5,33	0,33

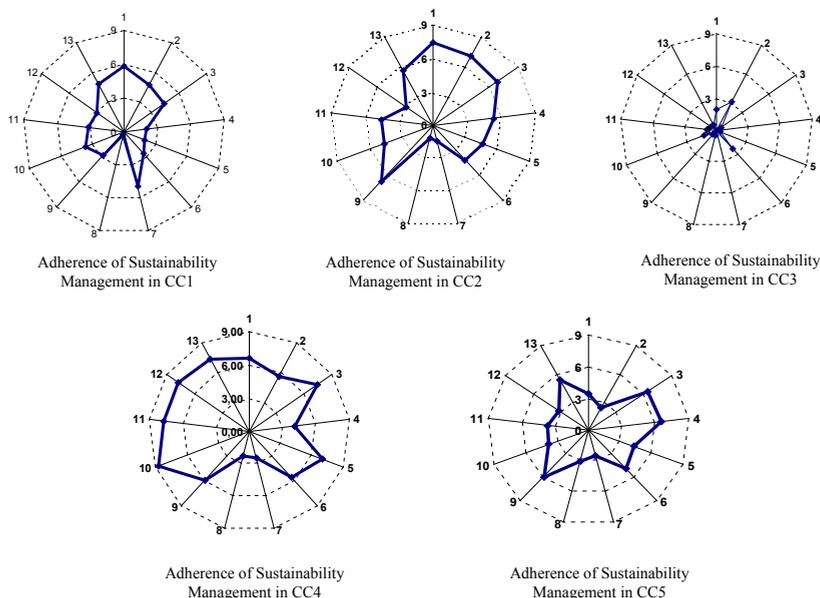


Figure 4 - Adherence Degree of Sustainability Management for the firms studied

The Average AA value is obtained by calculating each AA, subtracting the average value considered (5) according to Likert scale. The results allow the identification of the values which are above or below the Neutral Adherence. The Average AA-is called the Adherence Degree Aspects of the firm in relation to the average.

The ASC was calculated according to the arithmetic average of all aspects, according to the following equation:

$$ASC = \text{Adherence of CC Firm Sustainability Management} = \frac{\text{Sum of CC AA}}{\text{nr. of aspects}}$$

Thus, calculating, we find out:

Table 6 – Sustainability Management Adherence for the firms studied

Sustainability Management Adherence	Value obtained	Characterization	Classification
ASC1	3,37	Non-existing practice, but it will be implemented soon	4°
ASC2	4,78	Occasionally practiced	2°
ASC3	0,98	Practice does not exist	5°
ASC4	6,04	Between occasionally practiced and practiced routinely, but not documented	1°
ASC5	4,26	Occasionally practiced	3°

Inter-case Analyses

The inter-case analysis allowed comparing the maturity degree with its practice in the Sustainability Management of firms in relation to the dimensions and the aspects contemplated in OSA study.

The degrees obtained in each dimension were observed as well as the description of the degrees obtained for the aspects, and in some situations, the basic comments about the probable reasons for differences in the final results.

Degree of Importance of the Aspects

Table 7 below describes the Importance of Aspects values (IA) and the average value of the Importance of the Aspect according to Likert scale (Average IA) for all firms interviewed.

Firm CC4 stands out as the one which has the highest degree of maturity, as it considers the aspects of sustainability as “important” (value of 7,23) in the corporate management, while Company CC3 had the smallest degree of maturity, with the result of “without any importance” (value 1,17).

The other three firms studied are categorized as “neutral importance”, with less than 7,5% difference between them (highest = 5,43 and lowest = 5,02). Thus, we can say that there is not much difference in the Sustainability management among those organizations. Based on Table 7 values , Figures 5 and 6 are presented below.



Table 7 –Importance of Aspects Degree for the Firms Studied

Aspects and Concepts		CC1		CC2		CC3		CC4		CC5	
		IA	AverageIA	IA	Average IA	IA	Average IA	IA	Average IA	IA	AverageIA
1	Corporate Governance - To have Effective Corporate Governance available	7,80	2,80	7,80	2,80	2,60	-2,40	8,60	3,60	5,00	0,00
2	Leadership and Performance Analysis - To develop a proactive organization, in response to strategies and its objectives	7,29	2,29	7,00	2,00	4,14	-0,86	8,14	3,14	2,71	-2,29
3	Economic Performance - To minimize direct economic impacts	4,67	-0,33	6,83	1,83	0,50	-4,50	8,33	3,33	6,67	1,67
4	Market Presence - To obtain "social license for operations"	3,50	-1,50	5,75	0,75	0,25	-4,75	5,50	0,50	7,50	2,50
5	Indirect Economic Impact - To effect positive indirect economic impacts	4,33	-0,67	4,67	-0,33	0,33	-4,67	8,33	3,33	5,67	0,67
6	Materials and Supplies Consumption Reduction - To reduce inputs in the materials and supplies processes, in relation to a standard productivity level	5,29	0,29	4,29	-0,71	2,57	-2,43	7,57	2,57	5,86	0,86
7	Biodiversity - To preserve nature	7,00	2,00	2,50	-2,50	0,00	-5,00	2,50	-2,50	3,50	-1,50
8	Emissions and Wastes - To produce less non-intentional products	2,22	-2,78	1,11	-3,89	0,44	-4,56	3,00	-2,00	3,22	-1,78
9	Products, Services and Conformity - To pollute less	6,00	1,00	6,75	1,75	0,50	-4,50	8,00	3,00	7,00	2,00
10	Labor Practices - To establish correct and decent labor practices	4,45	-0,55	5,27	0,27	1,27	-3,73	9,00	4,00	4,27	-0,73
11	Human Rights - To respect people	5,25	0,25	4,50	-0,50	1,13	-3,87	8,50	3,50	4,13	-0,87
12	Society - To reduce the impact to communities and society	6,25	1,25	3,25	-1,75	0,63	-4,37	8,50	3,50	4,63	-0,37
13	Product Liability - To reduce Product Liability impact of aspects	6,50	1,50	5,50	0,50	0,83	-4,17	8,00	3,00	6,33	1,33
Importance of OSA Aspects Degree		5,43		5,02		1,17		7,23		5,11	

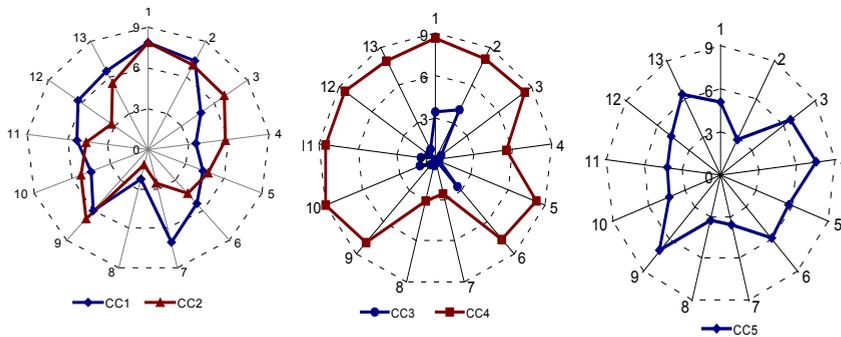


Figure 5 - Importance of the Aspects Degree (IA) for the Firms Studied

In Figure 5, only in three aspects was Firm CC4 surpassed by others. Also:

- Market presence – the best score was 7,50, obtained by Firm CC5. The policy of hiring local labor and suppliers made the difference, according to its manager. The second highest score was achieved by Company CC2, with 5,50;
- Biodiversity – the best score was 7,0, obtained by Firm CC1. The planning and approval stages for a project in a preserved area to be carried out next year, are arising new concepts and perceptions as well as helping its score. The second highest score was achieved by Firm CC4, with 3,50;
- Emissions and Wastes – the best score was 3,22, obtained by Firm CC5. The difference in the final value is not very significant, and the final scores were low, showing the little importance of this aspect for the firms studied. The second highest score was achieved by Firm CC4, with 3,00;

To complement the information provided, Firm CC4 obtained the highest score in Corporate Governance aspects (8,60); Leadership and Performance Analysis (8,14); Economic Performance (8,33); Indirect Economic Impacts (8,33); Consumption of Materials and Supplies Reduction (7,57); Products, Services and Conformity (8,00); Labor Practices (9,00); Human Rights (8,50); Society (8,50); and Product Liability (8,00).

Figure 6 allows the aspects identification of what is above neutral importance in each organization. It is believed that the higher values for importance are associated with indicators that show that the firm is already using management concepts in its projects, or even if it does not use them yet, it has prior knowledge about trends in the application of such concepts in its business sector.

The aspect with least importance is emissions and wastes, which suggests that the introduction of new concepts is required at the technological level, as well as in the methodological and cultural levels.

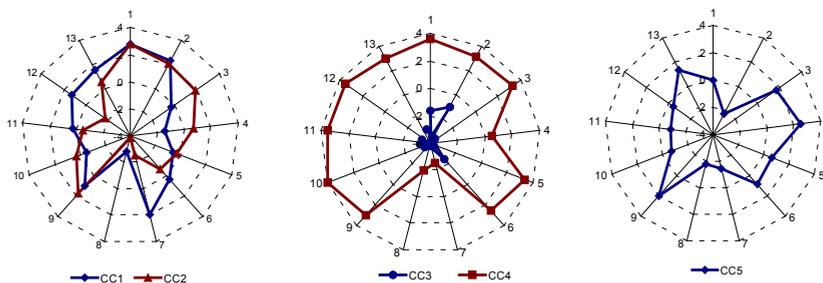


Figure 6 - Importance of Average Aspects Degree (Average IA) of the firms studied.

The analysis of the dimensions is presented by the next four tables, 8 through 11. The leadership dimension was highly rated in three organizations: Firm CC4, with 8,37; Firm CC1, with 7,55; and Firm CC2, with 7,40.

From the statements given, and not only by its final score, it can be noticed that Firm CC4 has already has a well-defined organizational structure, with a view that entails functional management and management by processes, besides using six committees and management tools that provide the dynamism required by its corporate management.

Table 8 - Importance of Leadership Dimension Degree

Importance of Leadership Dimension Degree							
	Dimension	Aspect	CC1	CC2	CC3	CC4	CC5
1	Leadership	Corporate Governance	7,80	7,80	3,40	8,60	5,00
2		Leadership and Performance Analysis	7,29	7,00	4,00	8,14	2,71
		Total	7,55	7,40	3,70	8,37	3,86

The Economic Dimension had three of the highest scores: Firm CC4 with 7,39; Firm CC5 com 6,61; and Firm CC2 with 5,75.

Table 9 - Importance of Economic Dimension Degree

Importance of Economic Dimension Degree							
	Dimension	Aspect	CC1	CC2	CC3	CC4	CC5
3	Economic	Economic Performance	4,67	6,83	0,50	8,33	6,67
4		Market Presence	3,50	5,75	0,25	5,50	7,50
5		Indirect Economic Impacts	4,33	4,67	0,33	8,33	5,67
		Total	4,17	5,75	0,36	7,39	6,61

The Environmental Dimension had Firm CC4 with the highest score, of 5,27, followed by Firm CC1, with 5,13, and Firm CC5, with 4,90. The three firms achieved values near “neutral importance”, showing that there is still much to be done in the environmental approach, so that significant results would be achieved in the CC field.

Table 10 - Importance of Environmental Dimension Degree

Importance of Environmental Dimension Degree							
	Dimension	Aspect	CC1	CC2	CC3	CC4	CC5
6	Environmental	Materials and Supplies Consumption Reduction	5,29	4,29	2,57	7,57	5,86
7		Biodiversity	7,00	2,50	0,00	2,50	3,50
8		Emissions and Wastes	2,22	1,11	0,44	3,00	3,22
9		Products, Services and Conformity	6,00	6,75	0,50	8,00	7,00
		Total		5,13	3,66	0,88	5,27

The Social dimension had Firm CC4 with the highest score, of 8,50, followed by Firm CC1, with 5,61, and Firm CC5, with 4,84. A large difference can be seen between Firm CC4 and the others, so the expectation in its positive results would eventually be matched by the others.

Table 11 –Importance of Social Dimension Degree

Importance of Social Dimension Degree							
	Dimension	Aspect	CC1	CC2	CC3	CC4	CC5
10	Social	Labor Practices	4,45	5,27	1,27	9,00	4,27
11		Human Rights	5,25	4,50	1,13	8,50	4,13
12		Society	6,25	3,25	0,63	8,50	4,63
13		Product Liability	6,50	5,50	0,83	8,00	6,33
		Total		5,61	4,63	0,97	8,50

Aspects Adherence Degree of OSA Study

Table 12 below describes the Aspects Adherence values (AA) and the Average AA (Aspect Adherence average value according to Likert scale) of all firms interviewed. The highest global Adherence to Sustainability was achieved by Firm CC4, with the value of **6,03** – between **practiced routinely** and **occasionally practiced**, followed by Firm CC2, with **4,78** (**occasionally practiced**) and Firm CC5, with **4,26** (between **occasionally practiced** and **not-existing practice, but it will be implemented soon**).

With the analysis performed in relation to the dimensions and aspects importance, it can be concluded once more that Firm **CC4 has a higher degree of maturity** than the other firms which participated in the study.

It can be seen in Figure 7 that Firm CC4 was surpassed by the other firms in six aspects:

- Corporate Governance – the highest score was 7,40 achieved by Firm CC2. The perception of its principal executive is that its Corporate Governance allows it to be recognized and remain established in the marketplace as a firm with a positive differential. The second highest score was achieved by Firm CC4, with 6,60;
- Leadership and Performance Analysis - the highest score was 7,00 achieved by Firm CC2. The explanation is the same as for the item above – Corporate Governance. The second highest score was achieved by Firm CC4 with 5,57;
- Market Presence – the highest score was 6,50 achieved by Firm CC5. The hiring local labor policy and suppliers made the difference, according to its manager. The second highest score was achieved by Firm CC2, with 5,25;
- Biodiversity – the highest score was 5,0 achieved by Firm CC1. The planning and approval stages for a project in a preserved area to be carried out next year, are arising new concepts and perceptions and helping its score. The second highest score was achieved by Firms CC4 and CC5, tied with 2,50;
- Emissions and Wastes – the highest score was 3,0 achieved by Firm CC5. The difference in the final value is not very significant and the final scores were low, showing the little importance of this aspect for the firms studied. The second highest score was achieved by Firm CC4, with 2,33;
- Products, Services and Conformity – the highest score was 6,75 achieved by Firm CC2. The second highest score was achieved by Firms CC4 and CC5, tied with 6,00.

To complement the information provided, Firm CC4 obtained the highest score in Economic Performance aspects (7,33); Indirect Economic Impacts (7,00); Consumption of Materials and Supplies Reduction (5,57); Labor Practices (8,64); Human Rights (7,75); Society (7,75); and Product Liability (7,33).

Figure 8 allows the aspects identification which are above the average adherence of each organization. The company which showed the **best result in relation to the Sustainability Adherence Aspects** in the business is Firm **CC4**, while Firm **CC3** showed that **the practice does not exist** in its organization.

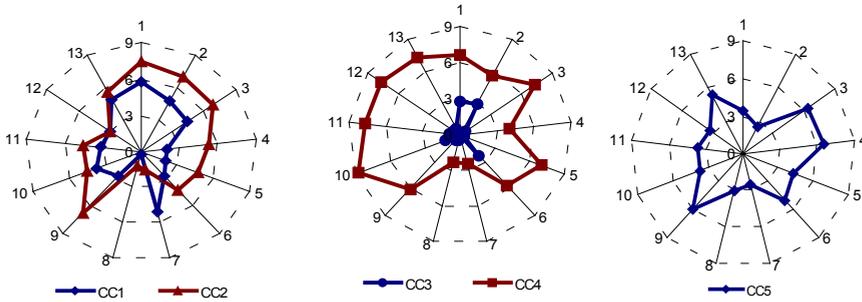


Figure 7 - Degree of Aspects Adherence (AA) of the firms studied

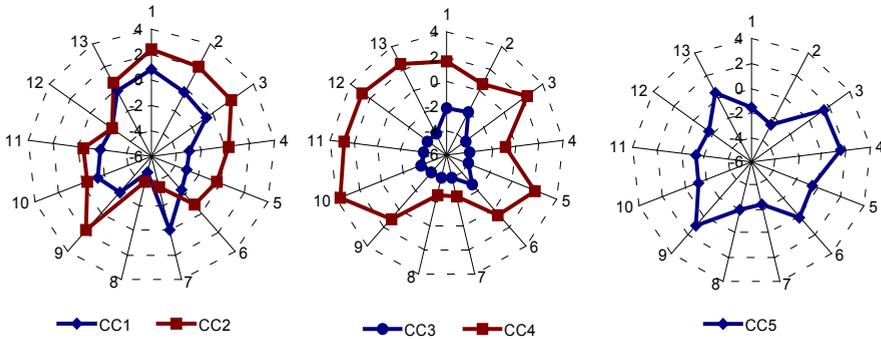


Figure 8 – Degree of Aspects Average Adherence (Average AA) of the firms studied

Firm **CC2** stands out in the Leadership dimension, where it achieved a score of **7,20**, which represents that this aspect is **“practiced routinely, but not documented”** (see Table 13, below).

In relation to the Economic and Social dimensions, Firm **CC4** achieved the highest scores, obtaining, respectively, 6,11 (between **“occasionally practiced”** and **“practiced routinely, but not documented”**) and 7,87 (between **“practiced routinely, but not documented”** and **“practiced routinely and documented”**) (see Table 14 and 15, below).

Table 12 - Degree of Adherence Aspects for the firms studied

Aspects and Concepts		Degree of Aspects Adherence of the Firms Studied									
		CC1		CC2		CC3		CC4		CC5	
	AA	Mean AA	AA	Mean AA	AA	Mean AA	AA	Mean AA	AA	Mean AA	
1	5,80	0,80	7,40	2,40	2,00	-3,00	6,60	1,60	3,40	-1,60	
2	4,71	-0,29	7,00	2,00	3,00	-2,00	5,57	0,57	2,43	-2,57	
3	4,33	-0,67	6,83	1,83	0,50	-4,50	7,33	2,33	6,33	1,33	
4	2,00	-3,00	5,25	0,25	0,25	-4,75	4,00	-1,00	6,50	1,50	
5	2,00	-3,00	4,67	-0,33	0,33	-4,67	7,00	2,00	4,33	-0,67	
6	2,57	-2,43	4,14	-0,86	2,29	-2,71	5,57	0,57	5,00	0,00	
7	5,00	0,00	1,50	-3,50	0,00	-5,00	2,50	-2,50	2,50	-2,50	
8	0,22	-4,78	1,11	-3,89	0,44	-4,56	2,33	-2,67	3,00	-2,00	
9	2,75	-2,25	6,75	1,75	0,50	-4,50	6,00	1,00	6,00	1,00	
10	3,64	-1,36	4,55	-0,45	1,27	-3,73	8,64	3,64	3,73	-1,27	
11	3,13	-1,87	4,50	-0,50	0,88	-4,12	7,75	2,75	3,63	-1,37	
12	2,88	-2,12	2,88	-2,12	0,63	-4,37	7,75	2,75	3,25	-1,75	
13	4,83	-0,17	5,50	0,50	0,63	-4,37	7,33	2,33	5,33	0,33	
Degree of Adherence Aspects of OSA study		3,37	4,78	6,03	0,98	4,26					

Table 13 – Degree of Leadership Dimension Adherence

Degree of Leadership Dimension Adherence							
	Dimension	Aspect	CC1	CC2	CC3	CC4	CC5
1	Leadership	Corporate Governance	5,80	7,40	2,80	6,60	3,40
2		Leadership and Performance Analysis	4,71	7,00	2,86	5,57	2,43
		Total	5,26	7,20	2,83	6,09	2,92

Table 14 - Degree of Economic Dimension Adherence

Degree of Economic Dimension Adherence							
	Dimension	Aspect	CC1	CC2	CC3	CC4	CC5
3	Economic	Economic Performance	4,33	6,83	0,50	7,33	6,33
4		Market Presence	2,00	5,25	0,25	4,00	6,50
5		Indirect Economic Impacts	2,00	4,67	0,33	7,00	4,33
		Total	2,78	5,58	0,36	6,11	5,72

Table 15 – Degree of Social Dimension Adherence

Degree of Social Dimension Adherence							
	Dimension	Aspect	CC1	CC2	CC3	CC4	CC5
10	Social	Labor Practices	3,64	4,55	1,27	8,64	3,73
11		Human Rights	3,13	4,50	0,88	7,75	3,63
12		Society	2,88	2,88	0,63	7,75	3,25
13		Product Liability	4,83	5,50	0,63	7,33	5,33
		Total	3,62	4,36	0,85	7,87	3,99

In relation to the Environmental dimension, Firm **CC5** had the highest score, with **4,13** (between “a non-existing practice , but it will be implemented soon” and “occasionally practiced”) (see Table 16, below).

With the analysis performed in relation to the dimensions and aspects Adherence, it can be concluded once more that Firm **CC4** achieved the highest score, of **6,03**, which represents between “occasionally practiced” and “practiced routinely, but not documented”. It can be seen that Firm **CC4** has a better routine Sustainability management practice than the other firms which participated in the study.

Table 16 - Degree of Environmental Dimension Adherence

Degree of Environmental Dimension Adherence							
	Dimension	Aspect	CC1	CC2	CC3	CC4	CC5
6	Environmental	Consumption of Materials and Supplies Reduction	2,57	4,14	2,29	5,57	5,00
7		Biodiversity	5,00	1,50	0,00	2,50	2,50
8		Emissions and Wastes	0,22	1,11	0,44	2,33	3,00
9		Products, Services and Conformity	2,75	6,75	0,50	6,00	6,00
		Total		2,64	3,38	0,81	4,10

In order to provide a better understanding, in a synthetic and conclusive view, Table 17 was prepared with the information presented so far.

Table 17 – Summary of Firms Assessment in the Civil Construction Business

	Importance		Adherence	
	Result	Interpretation	Result	Interpretation
CC1	5,43	Neutral Importance	3,37	Non-existing practice, but it will be implemented soon
CC2	5,02	Neutral Importance	4,78	Occasionally practiced
CC3	1,22	No importance	1,03	Non-existing practice
CC4	7,23	Important	6,03	Between “occasionally practiced” and “practiced routinely, but not documented”
CC5	5,11	Neutral Importance	4,26	Between “occasionally practiced” and “non-existing practice, but it will be implemented soon”

SMS Efficiency Analysis

Carrying out comparisons of SMS composed of elements with different valuations, as a function of the initial stage of the concepts involved in Sustainability establishment, they required the use a weights' simulation for each OSA component element. The indicators' weight was obtained by using averages of the values given for the indicators, as provided by the managers interviewed, as all of them are active in CC, Buildings subsector, and are aware about the indicators' impacts over their firms.

The Simulator

a) Values of the Indicators

The results for each questionnaire item obtained during the interviews correspond to the indicators – the Importance of the Sustainability Indicator values – in Table 18, called LG1, LG2, LG3, LG4 and LG5. For the simulation, the values used for aspects adherence are those declared by the individuals' interviewed.

b) Aspects Values

The final value of each organization aspect was obtained by calculating the weighted values of the indicators average (results from the interviews), pertaining to each aspect, and the indicators' values average. The column "Average" was computed as the arithmetic average of the assessment given to the same indicator, by the managers of the firms listed in Table 18.

Table 18 – Values given for the indicators, and the overall average of each indicator

Indicators	Codes	CC1	CC2	CC3	CC4	CC5	Average
Fairness among owners and protection of stakeholder's rights	LG1	7	9	7	9	5	7,4
Values and Organizational Principles Influence on the promotion of Sustainability	LG2	9	9	0	9	7	6,8
Codes of Ethics and implemented	LG3	7	3	0	7	3	4,0
Identification and handling corporate risks	LG4	7	9	3	9	7	7,0
Transparency and prompt communication with stakeholders	LG5	9	9	7	9	3	7,4

The aspects values of each company were obtained by using the weighted average, which is the sum of the scores products attributed by those interviewed (columns CC) and the respective average (column Average), divided by the average sum. The calculation for Firm CC1 is shown as follows:

Corporate Governance Firm Aspect CC1 = AGC1

$$AGC1 = \frac{7 \times 7,4 + 9 \times 6,8 + 7 \times 4,0 + 7 \times 7,0 + 9 \times 0 \times 7,4}{7,4 + 6,8 + 4,0 + 7,0 + 7,4} = 7,9$$

The choice of the weighted average was based on the principle that each decision maker values, perceives and has a different view, when analyzing any subject, thus, it is desirable to adjust the methodology for each item calculated by appropriate weighing average. It is worth observing that if the same weight were to be given to all the indicators, which is the concept underlying the arithmetic average, one would return to the condition developed in the prior chapter of this study.

c) Dimensions Values

Calculating all the aspects of each firm, and of the other firms studied, the results described in Table 18 were obtained. For the dimensions values' calculation, weights were also chosen to be allocated to aspects.

The aspects and dimensions weights were obtained in a “workshop”, with Production Engineering graduate students. The group was composed of 18 students, who gave scores between 0 and 5 to aspects and dimensions. The average values obtained were rounded to whole numbers, thus arriving at the final values described in Table 19, below.

Then, the Leadership dimension was obtained by the values weighted average of each dimension component aspects in the table, with the respective weights described in table 19, giving the values described in Table 20. Maintaining the same computing logic, the other dimensions can likewise be obtained.

Table 19 - Values calculated for each aspect of the firms studied

Aspects	CC1	CC2	CC3	CC4	CC5
1.1 Corporate Governance	7,9	8,3	3,8	8,8	5,1
1.2 Performance Analysis	7,4	7,2	4,3	8,2	2,9
2.1 Economic Performance	5,9	7,5	0,6	8,8	6,9
2.2 Market Presence	4,7	6,8	0,1	5,7	8,1
2.3 Indirect Economic Impacts	5,1	5,6	0,2	8,3	6,2
3. Consumption of materials and supplies Reduction	5,8	5,6	3,0	8,6	6,2
3.2 Biodiversity	7,0	2,9	0,0	5,4	3,6
3.3 Emissions and wastes	5,7	3,3	0,7	7,8	6,0
3.4 Products, Services and Conformity	6,2	7,5	0,6	7,8	7,3
4.1 Labor Practices	7,0	5,8	1,2	9,0	4,8
4.2 Human Rights	6,3	5,8	1,3	8,2	5,2
4.3 Society	6,5	3,7	0,5	8,4	5,2
4.4 Product Liability	7,2	6,3	0,8	9,0	6,5

Table 20 – Dimensions and Aspects Weights obtained when performing a simulation

Dimension	Weight	Aspects	Weight
1. Leadership	5	1.1 Corporate Governance	5
		1.2 Performance Analysis	4
2. Economic	2	2.1 Economic Performance	4
		2.2 Market Presence	3
		2.3 Indirect Economic Impacts	3
3. Environmental	3	3.1 Consumption of materials and supplies Reduction	4
		3.2 Biodiversity	2
		3.3 Emissions and Wastes	3
		3.4 Products, Services and Conformity	4
4. Social	2	4.1 Labor Practices	4
		4.2 Human Rights	3
		4.3 Society	2
		4.4 Product Liability	4

d) OSA Study Values

Based on the calculated values for the dimensions, again taking the weighted average of those values and with the weights described in Table 20, the following results were obtained (Table 21):

- Firm **CC4** in **1st** place - **SMS best efficiency**– with a final average of **8,2**, out of a possible 9,0;
- Firm **CC1** in **2nd** place, with a final average of **6,7**, out of a possible 9,0;
- Firm **CC2** in **3rd** place, with a final average of **6,6**, out of a possible 9,0;
- Firm **CC5** in **4th**.place, with a final average of **5,3**, out of a possible 9,0;
- Firm **CC3** in **5th** place – **SMS worst efficiency** - with a final average of **2,2**, out of a possible 9,0.

Table 21 – Scores achieved by the firms studied

	CC1	CC2	CC3	CC4	CC5	Dimension	Weight	CC1	CC2	CC3	CC4	CC5
OSA	6,7	6,6	2,2	8,2	5,3	1. Leadership	5	7,7	7,8	4,0	8,5	4,1
						2. Economic	2	5,3	6,7	0,3	7,7	7,0
						3. Environmental	3	6,1	5,2	1,3	7,7	6,1
						4. Social	2	6,8	5,6	1,0	8,7	5,5

In Table 22, a short version of OSA simulation is presented. For Firm CC4, the final value obtained, despite being the result of a self-assessment process, shows

that there is only a small variation between the four dimensions studied, equal to 1,0, which demonstrates that the organization management follows a well drawn path. The highest value calculated was for the social dimension, with 8,7, and the lowest value calculated was for the economic dimension, with 7,7. These results well illustrates that Organizational Sustainability is being implemented as a directive business strategy established that it is backed by a real commitment of part of its Top Management. Some evidence, such as the creation of a specific Committee for Sustainability, with effective performance analyses coordinated by management, reflect their pro-active institutional stance.

Conclusion

This study aimed to establish comparability mechanisms for the Sustainability aspects implemented within Brazilian firms in the CC business.

- With OSA adherence maturity stage of Brazilian firms Sustainability Management in the CC business, Buildings subsector could be assessed;
- OSA constructs were fundamental in order to assess the implementation level of a company Sustainability aspects and to allow the quantification of the indicators established;
- OSA operation occurred by generating and applying the supporting instruments/documents during the interviews within the firms, which then allowed new assessments to be made about Sustainability management;
- Through data and information collection, the study resulted in metrics which allowed the quantification and subsequent comparison between different SMS;
- In developing CC Firms assessment, the study made the maturity and the SMS adherence analysis possible, allowing a comparative and quantitative analysis. It was found that Firm CC4 showed the highest maturity and adherence degree, while Firm CC3 obtained the lowest maturity and adherence score;
- In performing SMS efficiency analysis, it became possible to convert those values into a referential basis, through the use of a simulator, which allowed the development of an index for comparison and relative positioning.

After carrying out the study, it is expected that it will be of great contribution:

- Greater dissemination of Sustainability and Organizational Sustainability Management Systems concepts in the CC business Buildings subsector;
- Inclusion of Organizational Sustainability aspects in firms strategic business directions in CC business Buildings subsector;
- Creating a culture of establishing metrics for Sustainability aspects in business activities, both on an operational and strategic level;

Despite Brazilian CC segment is stigmatized as being conservative, the present study identified signs of change in that profile, probably due to globalization and constant threat of foreign capital entry into that segment. It was clear during the execution of this study, that there are clear signs of a managerial re-directioning towards Green Building, as well as towards the insertion of Sustainability in projects' management of those firms.

References

Amaral, S. P. (2003), Estabelecimento de indicadores e modelo de relatório de sustentabilidade ambiental, social e econômica: Uma proposta para Indústria do Petróleo Brasileiro, Tese de Doutorado (PPE/COPPE), UFRJ, Rio de Janeiro. (in Portuguese)

BRAZILIAN BUSINESS (2008), Investimento Consciente, Entrevista com Fábio Colletti Barbosa, Brazilian Business. (in Portuguese)

CMMAD. Comissão Mundial Sobre Meio Ambiente E Desenvolvimento (1988), Nosso Futuro Comum, Rio de Janeiro: Fundação Getúlio Vargas. (in Portuguese)

Deponti, C. M.; Eckert, C. and Azambuja, J. L. M. (2002), "Estratégia para Construção de Indicadores para Avaliação da Sustentabilidade e Monitoramento de Sistemas", Agroecol. e Desenv. Rural Sustentável, Porto Alegre, Vol.3, No. 4, pp. 44 - 51. (in Portuguese)

Elkington, J. (1994), "Towards the sustainable corporation win win win business strategies for sustainable development", California Management Review, Berkeley, Vol. 36, No. 2, pp. 90-100.

Eisenhardt, K. M. (1989), "Building Theories from Case Study Research", The Academy of Management Review, Vol. 14, No.4, pp. 532-550.

FNQ. Fundação Nacional da Qualidade (2008), Critérios de Excelência 2008, Avaliação e Diagnóstico da Gestão Organizacional. Fundação Nacional da Qualidade, S. Paulo. Available: <http://www.fnq.org.br/site/484/default.aspx>. Access: 20/02/08. (in Portuguese)

GRI. Global Reporting Initiative (2006), Sustainability Reporting Guidelines, Amsterdam. Available: http://www.globalreporting.org/NR/rdonlyres/812DB764-D217-4CE8-B4DE-15F790EE2BF3/0/G3_GuidelinesPTG.pdf. Access: June, 2007.

Instituto ETHOS (2006), Critérios Essenciais de Responsabilidade Social Empresarial e Seus Mecanismos de Indução no Brasil, Instituto Ethos, São Paulo. Disponível em http://www.uniethos.org.br/_Uniethos/Documents/criterios_essenciais_web.pdf Acessado em 5 mar 2008. (in Portuguese)

Instituto ETHOS (2007), Guia de Elaboração de Relatório e Balanço Anual de Responsabilidade Social Empresarial, Instituto Ethos, São Paulo. Disponível em <http://www.uniethos.org.br/DesktopDefault.aspx?TabID=3706&Alias=uniethos&Lang=pt-BR>. Acessado em 5 mar 2008. (in Portuguese)

Jung, E. J. ; Kim, J. S. and Rhee, S. K. (2001), “The Measurement of Corporate Environmental Performance and its Application to the Analysis of Efficiency in Oil Industry”, Elsevier, Journal of Cleaner Production, Vol. 9, No. 6, pp. 551-563.

Labuschagne, E. C ; Brent, A. C. and Erck, R. P. G. (2005), “Assessing the Sustainability Performance of Industries”, Elsevier, Journal of Cleaner Production Vol. 13, No. 4, p 373-383.

Librelotto, L. I. (2005), Modelo para Avaliação da Sustentabilidade na Construção Civil nas Dimensões Econômica, Social e Ambiental (ESA): Aplicação no Setor de Edificações, Tese de Doutorado (PPGEP), UFSC Florianópolis. (in Portuguese)

Mitchell, G. (1997), “Problems and Fundamentals of Sustainable Development Indicators”. Available: <http://www.lec.leeds.ac.uk/people/gordon.html>. Access: 13/07/01.

Montabon, F.; Sroufe, R. and Narasimhan, R. (2007), “An examination of Corporate Reporting, Environmental Management Practices and Firm Performance”, Elsevier, Journal of Operations Management, Vol. 25, No. 5, pp. 998-1014.

Quelhas, O. L. G. and Araújo, F. O. (2006), “Responsabilidade Social e Estratégia Corporativa: Uma Proposta Orientada à Sustentabilidade Organizacional na Indústria Automobilística Brasileira”, Boletim Técnico Organização & Estratégia, v. 2, n.1, p. 1-28. (in Portuguese)

Quelhas, O. L. G. and Silva, L. S. A. (2006), “Sustentabilidade Empresarial e o Impacto no Custo de Capital Próprio das Empresas de Capital Aberto”, Gestão e Produção, v.13, n.3, p. 385-395. (in Portuguese)

Santos, L. L. (2007), Sustentabilidade na Construção Civil: Proposta para um Conjunto Residencial Popular Sustentável, Monografia (Departamento de Engenharia de Materiais e Construção - Curso de Especialização em Construção Civil) Escola de Engenharia da UFM, Belo Horizonte. (in Portuguese)

Shen, L. Y.; Lu, W. S.; Yao, H.; Wu, D. H. (2005), "A Computer-based Scoring Method for Measuring the Environmental Performance of Construction Activities", Elsevier, *Automation in Construction*, Vol. 14, No. 3, pp. 297-309.

Silva, V.G. da (2003), *Avaliação da sustentabilidade de edifícios de escritórios brasileiros: diretrizes e base metodológica*, Tese de Doutorado (Departamento de Engenharia de Construção Civil), Escola Politécnica da Universidade de São Paulo, São Paulo. (in Portuguese)

Singh, R. K.; Murty, H. R.; Gupta, S. K. and Dikshit, A. K. (2007), "Development of Composite Sustainability Performance Index for Steel Industry", Elsevier, *Ecological Indicators*, Vol. 7, No. 3, p 565-588.

Székely, F. and Knirsch, M. (2005), "Responsible Leadership and Corporate Social Responsibility: Metrics for Sustainable Performance", Pergamon, *European Management Journal*, Vol. 23, No. 6, pp. 628-647.

Tam, V. W.; Tam, C. M.; Zeng, S. X. and Chan, K. K. (2006), "Environmental performance measurement indicators in construction", Elsevier, *Building and Environment*, Vol. 41, No. 2, pp. 164-173.

Vieira, T. M. P. (2005), *Proposta de indicadores de sustentabilidade para o setor de distribuição de combustíveis: o caso da Petrobras Distribuidora S.A.*, Dissertação de Mestrado (Programa de Pós-graduação em Sistemas de Gestão). Niterói, UFF, 2005. (in Portuguese)

Biography

Julio Nichioka is an Assistant Professor in the Industrial Engineering Department at the University of the State of Rio de Janeiro (UERJ). He received his M.Sc. degree in Industrial Engineering from the Federal University of Rio de Janeiro in 1996 and his Ph.D. degree in Construction Engineering from the Fluminense Federal University in 2008. His teaching and research interests are in Quality Management, Integrated Management Systems and Social Responsibility.
Contact: nichioaka@uerj.br

Oswaldo Luiz Gonçalves Quelhas currently is an Associate Professor in the Federal University Fluminense (UFF). He received his M.Sc. degree in Construction Engineering from there Federal University Fluminense, in 1984 and his Ph.D. degree in Industrial Engineering from there Federal University of Rio de Janeiro, in 1994. His teaching and research interests are in Design and Control of Production and Manufacturing Systems, Management Systems and Social Responsibility. He was the CEO of the ABEPRO (Brazilian Industrial Engineering Association) from the 2006 until 2009. He is header of LATEC (Technology; Business Management and Environmental Laboratory) and vice-coordinator of the Professional M.Sc. Program in Management Systems of the Industrial Engineering Department of the UFF.
Contact: quelhas@latec.uff.br



Article Info:

Received: July, 2009

Accepted: May, 2010