INNOVATION IN COMPANIES WITH SUSTAINABILITY CERTIFICATION: ELEMENTS OF ITS CONVERGENCE

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Abstract
Purpose - This article aims to identify how the innovation undertaken by companies certified by B Lab act on the sustainability activities.
Design/methodology/approach – In order to verify these aspects a survey was conducted with organizations certified by B LAB, a non-profit organization that certifies companies for their social and environmental performance standards, transparency, and legal accountability. Data collection was done through a questionnaire sent to 1,968 companies certified by B LAB, 191 of them answered the survey, from 27 different countries.
Findings – The results indicate that there are impact of the innovations and eco-innovations developed by the companies in the sustainability pillars, the degrees of impact varies. In general, the radical, incremental and product/service innovations typology positively impacted the pillars. Eco-innovations, on the other hand, have different behavior, with a greater positive correlation for the environmental, then social and lastly economic pillar.
Originality/value – This study makes a theoretical and empirical contribution to better understand the impact of innovation and eco-innovation developed in companies with certification on sustainability, showing which kind of innovation better impact each sustainability pillar. Also, presents a new form of separation of the eco-innovation variables surveyed that if tested with other samples, can originate a new typology to study eco-innovation.

Keywords: Innovation, Sustainability, Sustainable Certification, Sustainable Innovations, B LAB.

1. Introduction

The present study approaches innovation in companies with sustainability certification, aiming to understand how these organizations innovate, considering the assumption of treating sustainability as an important perspective of their business, since, spontaneously, they submitted their organizations to the screen of an independent certifier.

Innovation is one of the main aspects that impact competitiveness and economic development (OECD, 2004). This happens because the ability to innovate is a conditioning to the competitiveness and perenniality of companies and nations (Calmanovici, 2011), and the development of new technologies is an important issue for increasing productivity (OECD, 2004).

However, innovations are not only important because of the positive impact on the wealth of nations and organizations, but also because they make it possible to change people's quality of life, either by the quantity of goods made available or by allowing them to have access to other standards of products and services. It is important to point out that these innovations can modify the society in a positive or negative way (Freeman and Soete, 2008). For example, product life cycles are getting shorter and the market more competitive.

The innovations, therefore, are fundamental, both for those who wish to accelerate the rate of economic development, and for those who care about the quantity of goods produced and who wish to change the direction of economic advance, in search of a better quality of life and less environmental impact. In this perspective, the introduction of these changes may be important for the conservation of natural resources and for reducing the impact on the environment and society (Freeman and Soete, 2008).

This said, innovations must be seen within the social and environmental context, since, for the most part, the impacts of innovations are little discussed. The question is not whether society is against or in favor of innovations, but its consequences (Fatheuer *et al.*, 2016).

In this sense, a research that brings to light the discussion about innovation in companies with sustainable certification becomes interesting, because it seeks to understand the relationship between the two themes and if there is integration between innovation and sustainable development, considering that these organizations already have actions related to sustainability.

Based on the foregoing, this study aims to identify how the innovations undertook by companies certified by B Lab act on sustainability activities. It is important because it provides added value to the existing literature in view that Arundel and Kemp (2009) argue that there is still scope for research and point to lack of empirical data. In addition, most of them are based on isolated cases. Furthermore, the literature on drivers of sustainable innovation is concentrated in Western European countries and there is scope for comparative studies between countries to identify differential factors and obstacles to sustainable innovation (Del Rio *et al.*, 2016).

Thus, in order to reach the proposed objective and present it in a chained and logical way, the work is divided in four sections besides the introduction, being they: literature review, methods, results and conclusions.

2. Literature review

The literature review of this article is based on three central pillars. The first one deals with the concept and contemporaneity of organizational actions of sustainability; the second on the concept of innovation and the third on sustainable innovations.

2.1 Sustainability

The concern with the rhythm and the basis on which the development of the society is happening has appeared increasingly in the last decades (Elkington, 2012; Sachs, 1998;2000; UN, 1987).

The "Our Common Future" Report (UN, 1987) was able to synthesize concerns about the human relationship with the environment and called the society for a change in its behavioral standards. The document emphasized that a new era of economic growth was under way and should be based on policies to sustain and expand the natural resource base. In this report is the most accepted definition of sustainable development as "(...) development that meets the needs of the present without compromising the ability of future generations to meet their own needs" (UN, 1987).

For Elkington (2012), sustainable development is the solution to many of the problems the world is facing and that sustainable development will be achieved through sustainability. In that sense, sustainability would be the principle that ensures that the actions made today will not limit the range of economic, social, and environmental options available to future generations.

According to Almeida (2002), the concept of sustainable development incorporates, in an indissoluble way, the economic, environmental and social dimensions of human

actions and their consequences. Elkington (2012), in turn, uses these three dimensions to explain sustainability also with the premise of dependence on its pillars. It is critical that the dimensions have the same weight and attention to ensure a sustainable outcome. The dissemination of information and the need for sustainable development must be coordinated to ensure both efficiency and effectiveness of resource use (Elkington, 2012; Rogers *et al.*, 2008).

The social pillar, deals with the improvement of the human condition, with the search for social homogeneity, fairer income distribution, equality in access to resources and social services (Sachs, 2000). If looking at the organization, this can be understood as the impact a company has on people, such as community relations, product safety, and training and education initiatives (Elkington, 2012).

The environmental pillar of sustainability, in turn, addresses the preservation of natural capital, the production of renewable resources and the limitation of the use of non-renewable resources, as well as respecting and enhancing ecosystems' ability to restore their environmental characteristics naturally (Sachs, 2000).

This dimension is influenced by two factors that are related to economic activities: the quantity of inputs extracted from the environment and the quantity of manure released as a result of production and consumption, as well as their consequences (Pollit *et al.*, 2010). That is, the environment is a provider of resources and a "container" for waste disposal (Sachs, 2004).

Finally, the economic dimension links the growth of the organization to the growth of the economy and the way it interacts to improve it and support future generations (Fischer *et al.*, 2015). This pillar addresses issues such as integrated intersectoral development and the capacity for continuous modernization of production instruments.

From the organizational point of view, this pillar refers to the economic efficiency for the perpetuation of the company (such as profit and competitive advantages) in the markets in which it operates (Barbieri *et al.*, 2010).

After presenting the concepts of sustainability and the triple bottom line (the three pillars of sustainability) the next section discusses the concept of innovation and some of its typologies and subsequently, will be presented the sustainable innovations.

2.2 Innovation

Schumpeter (1997) was one of the pioneers to write about the concept of innovation, arguing that the innovation process happens when a new idea is put into practice and diffused. The author argues that to produce, the organization must combine materials and forces that are within reach, generating new products or the same products in a different way with the recombination of elements. For him, this is the case for innovations that foster development.

In this sense, the concept of innovation encompasses the development of new goods; the creation of a new production method; the conquest of a source of raw material; a new form of organization or the opening of new markets (Schumpeter, 1997).

For Nelson and Rosenberg (1993), innovation comprises initiatives by which companies dominate and put into practice the development of products and manufacturing processes that are new to these organizations, whether or not they exist elsewhere.

The Oslo Manual (OECD, 2004) argues that the minimum requirement for defining innovation is that the product or service, process, marketing or organizational method is new (or significantly new) to the organization - whether in a way pioneered or adopted from other companies. In this sense, a pioneering innovation occurs when the new combination is implanted for the first time. Organization-level innovations occur when

this combination is new to the unit but has already been deployed elsewhere (OECD, 2004).

From the definition of the Oslo Manual (OECD, 2004) the classification of innovation is divided into four types: (i) product innovation, which must be significantly different from the previous model, or by the difference of technological characteristics, a new form of combination of these technologies or derivatives of the use of new knowledge; (ii) process innovation, which encompasses the adoption of new or significantly improved production methods, whether by changing equipment, organizing production, or a combination of these two; (iii) organizational innovation that includes the introduction of significantly altered organizational structures; implementation of new management techniques and strategic guidelines; in the organization of their place of work or in their external relations; (iv) marketing innovation occurs when it assists in the implementation of a new product or process, with significant changes in product design or packaging, product positioning, promotion or pricing (OECD, 2004). The Oslo Manual (2004) also classifies the degree of novelty, for example whether innovation is new to the company, the country or the world.

Another way of distinguishing innovation is by determining whether it is radical or incremental. Radical innovation is seen as the introduction of an entirely new combination, whether in a product or process. It represents a rupture with the previous pattern, and can cause profound impacts on social and economic relations (Tidd *et al*., 2005). They are changes that often replace existing components, or whole systems, for the creation of new networks and new connections (Carrillo-Hermosilla *et al.*, 2009). Therefore, incremental innovation refers to the introduction of some kind of improvement in product, process, organizational or marketing method. These are improvements associated with the search for increased operational efficiency (OECD, 2004).

Although in some situations innovation involves a discontinuous change, most occurrences happen in incremental form (Tidd *et al*., 2005). For the authors, innovation is often linked to optimization, doing what is already done, but better. The incremental changes refer to progressive and continuous modifications that preserve and sustain existing systems (Carrillo-Hermosilla *et al*., 2009). Radical innovations involve major changes in the economic system, while incremental innovations fill this process of change (Schumpeter, 1997).

Innovation is widely recognized as the main engine of industrial growth, as well as a cause of social and environmental disruption (Hall and Vredenburg, 2003). This happens because the general definition of innovation is neutral in relation to the content of change, it does not care about the direction of development. In this sense, innovation can also be segmented by whether it positively impacts sustainability or not, in the first case it is called sustainable innovation and this is the concept presented in the next section.

2.3 Sustainable Innovation

Innovation focused on sustainability differs from the conventional way, guided only by the market, and presupposes the incorporation of social and environmental guidelines, as well as concern for long-term impacts (Hall and Vredenburg, 2003). In this sense, technological transformations are important for the pursuit of sustainable development (Hart and Milstein, 2004).

Sustainable innovation, eco-innovation or similar terms are used to describe innovations that contribute to sustainable development. It is seen as a comprehensive concept related to social and environmental changes needed to achieve sustainability (OECD, 2009).

In the present study, the concepts of sustainable innovation and eco-innovation are understood as equivalent (Boons et al., 2013, Charter, 2007). In addition, sustainable innovation is considered as a result, a goal that can be achieved by companies, encouraged by the government, demanded by society, as a way to contribute to sustainable development (Bossle *et al*., 2016).

Sustainable innovations, as well as innovations, can be subdivided depending on their nature. Rennings (1998) distinguishes four types of eco-innovation: technological, organizational, social, and institutional.

Technological eco-innovations can be separated into curative and preventative technologies. In the first case the goal is to repair damages such as contaminated soils; while the second tries to avoid environmental impact. The category of preventive technologies is subdivided into two: integrated and additive technologies (Rennings, 2000, 1998). End-of-pipe technologies include measures that occur at the end or after the production process, are complementary, aiming to mitigate the impact and at meeting the environmental requirements (Del Rio, 2009; Frondel *et al*., 2007; Rennings, 2000; 1998).

Integrated or cleaner technologies, on the other hand, are already added to the production process, some involving high initial investments and sometimes reconfiguring the whole production process of the organization (Del Rio, 2009). They include measures that reduce the use of raw materials, energy and emissions during production and consumption (Rennings, 2000, 1998). Therefore, this type of technology is seen as an improvement to the sustainable development process and often considered to be superior to end-of-pipe technologies. These innovations follow a preventive approach to environmental problems, while the additives adopt a reactive approach, treating the problems after they have been generated (Del Río, 2009, Frondel *et al*., 2007, Rennings 2000, 1998). Reid and Miedzinski (2008) add that eco-innovation encompasses innovative or significantly improved solutions introduced at any stage of the product life cycle.

In addition to the technological eco-innovation, there is also organizational eco-innovation, defined as a change in organization, encompassing management tools at the enterprise level (Rennings, 1998). It also includes new strategies such as integration or disintegration of different business activities, all with the environmental management systems and eco-audits are typical examples of organizational measures (Triguero *et al*., 2013, Frondel *et al*., 2007).

Institutional eco-innovation, in turn, involves changes in institutional arrangements themselves and is necessary, for example, to help reorient the research and development system and ensure the direction of the technical changes needed to achieve sustainable development (Rennings, 1998).

Any successful innovation, for example technological, organizational, or institutional, must be unite with people's values and lifestyles, as behavioral changes are a prerequisite for their dissemination (Rennings, 2000). This is the definition of social eco-innovation, the innovation that changes social values to a more sustainable one (Rennings, 2000, 1998).

What this type of innovation points out is that technological change is necessary, although it is not a sufficient condition for a transition to sustainability (Del Rio, 2009; Carrillo-Hermosilla *et al*., 2009). In addition to propagating technological innovations, institutional changes such as changes in routines, social norms and regulations are necessary to encourage behavioral modifications in more sustainable directions (Carrillo-Hermosilla et al., 2009).

Therefore, in calculating the impact of new technologies on society, it must be considered how they affect various interests, areas of production and consumption habits,

culture and political context. The opportunities and challenges of technology implementation require new solutions to old problems (Frone and Constantinescu, 2014).

With this concept, the literature review is finalized. The next section is devoted to show how the research was developed, followed by the presentation and discussion of the results.

3. Methods

3.1 Sample and data collection

In order to reach the objective proposed in the present study, this research has as its purpose the description, as it aims to point out how the innovations undertaken by companies certified by the B Lab act on the sustainability actions and present the variety of characteristics of the phenomenon and the researched population (Babbie, 2007; Richardson, 1999).

In this research, the information used was from a primary source, in a cross-sectional data survey (Creswell, 2010; Freitas *et al*., 2000), with a questionnaire structured in order to reduce, but not neutralize, the researcher's bias (Creswell, 2010). The choice of this type of cut and method was made by optimizing collection time and identifying characteristics of a large population (Babbie,2007). For this reason, and due to the geographical scope of the sample, it was decided to send the invitation to participate in the survey by e-mail and the questionnaire became available electronically.

The population of the present study encompasses all the companies with sustainable certification of B LAB until November 2017. There were 1,968 companies in 58 different countries (B Corporation, 2017). The respondents were the employees of the organization who had information on the areas of sustainability and innovation of B Corps.

The questionnaire was structured based on the objectives and research design and sent to specialists for validation, with the purpose of refining the instrument and verifying the scales (Hair *et al*, 2005). Four PhDs, professors of post-graduate programs from universities in Brazil (PUC-SP, UFPR, UFRGS and UTFPR), with experience in quantitative methods and / or innovation evaluated the questionnaire.

After adjustments, a pre-test was done with 20 companies of the sample, sending the questionnaire by e-mail to verify the understanding and the form of completion of these companies. After that the questionnaire was sent to the companies of the sample, available in the Survey Monkey tool, in English and Portuguese, to fill out the link sent by email.

The collection phase occurred between December 2017 and March 2018. During this period, 191 companies from 27 different countries answered the questionnaire. The sample was for convenience, that is, the participants were chosen for the characteristics of the research and for the availability of questionnaire completion (Sampieri *et al*., 2013; Freitas, 2010).

The analysis of the data was done with SPSS Software of IBM applying tests and analyzes of three sets of statistical procedures: univariate, bivariate and multivariate techniques (Corrar *et al.*, 2007).

3.2 The B Lab Sustainability Certification

The companies selected to be part of the sample were those certified by B Lab, a non-profit organization, launched in 2007 in the United States, with the purpose of promoting systemic change to create a more social and environmentally friendly economy (B Corporation, 2017). The goal of the initiative is to establish two key issues for business growth: a certification that consumers and investors use to identify sustainable businesses; and create a legal framework that would allow certified companies to consider

the interests of all parties involved in the development of their business, not just those related to maximizing shareholder value (Harriman, 2015).

To achieve the certification, organizations must: (i) meet sustainable performance requirements; (ii) expand their governance parameters; (iii) sign a statement that the company seeks the benefit of all stakeholders, including social and environmental aspects; and pay an annual fee that varies according to the sales of the companies. The performance requirements are verifiable by means of an evaluation, in which the company must reach at least 80 points of 200, which is the maximum. The issues are related to governance, people management, community impact, customers, environment and dissemination. To maintain company B certification, the organization must update its assessment and documentation every 2 years (B Corporation, 2017).

B LAB was chosen because it is an institution that certifies the organization as a whole and not only of specific processes and products, which meets the objective of this study. In addition, by having questionnaires adapted to the type of business and size, it manages to meet various organizational standards, from multinational to microenterprises, from various segments. At the time of its conception, certification was geared more towards small and medium-sized companies, however now it already covers companies of all sizes.

That said, session 4 will discuss the results of the research. The questionnaire was composed of several questions about types of innovation and eco-innovation, characteristics of the company, among other elements that were used to correlate with the triple bottom line.

Considering the theoretical framework and previous research, two hypotheses were formulated to guide this article: H1 - even with sustainability certification, the impact of innovations is more related to the economic, then environmental, and ultimately social pillar of sustainability; and H2 - the impact of eco-innovations on sustainability is stronger on the economic pillar, followed by environmental and social pillar.

Next it will be presented the main results obtained regarding to understand how the innovations undertaken by companies certified by the B Lab act on the sustainability actions, and whether the hypotheses were confirmed or refuted.

4. Results

Before presenting the results that meet the objective of the article, it is worth characterizing briefly the sample obtained in the survey, which was composed mostly by microenterprises in the service sector with more than 10 years of operation. Respondent organizations have been certified for four years and averaged 97.41 points in the latest B Lab report. They are mostly from the United States. The most cited innovations were in product / service, followed by processes, marketing and organizational.

To this sample was asked, in order to understand the influence of innovations and eco-innovations on sustainability, to indicate the intensity of the impact of innovations made in the last three years on sustainability dimensions, where 1 represents "very negative" and 7 "highly positive". The intensity of impacts can be seen in Table 1:

Table1: Intensity of the impact of innovations on the triple bottom line

E	**1**	**2**	**3**	**4**	**5**	**6**	**7**
Environmental Impact	1,05%	1,57%	3,14%	20,42%	21,47%	25,65%	26,70%
Social Impact	0,00%	1,60%	0,50%	8,90%	16,80%	38,20%	34,00%
Economic Impact	0,00%	2,09%	2,09%	16,75%	26,18%	33,51%	19,37%

For 26,70% of the organizations the environmental impact was highly positive. If the three positive responses of the questionnaire were added, this value rises to 73.82%. For the social pillar, 38.20% of the companies said that the impact of the innovations was moderately positive, followed by 34% who said that it was highly positive. Adding the positive values, the percentage was 89%. Finally, for 33% of the companies, the economic impact of the innovations was moderately positive, while the positive one was 26.18%. The percentage of the three positive responses was 79.06%.

In this sense, although the greater number of companies have stated that the environmental impact was highly positive, if all the positive impact responses were added, the order would be: social, economic and environmental.

To better understand the position of companies in relation to the impact of innovations on sustainability, three other questions were asked, separating each pillar and placing possibilities of impact.

The first question was about the environmental pillar with aspects related to: reducing the amount of material used to generate the product / service; reducing the amount of energy and water spent to generate the product / service; reduction of pollution in water, soil or air; reduction of waste generation; and improved recycling and / or recyclability of the product. As in the previous question, the answers ranged from 1 "very negative" to 7 "highly positive". The values can be seen in table 2:

Table 2: Intensity of the impact of innovations on the environmental pillar

Environmental Variables	**1**	**2**	**3**	**4**	**5**	**6**	**7**
Reduction of material used	2,09%	2,09%	0,52%	40,84%	23,56%	18,85%	12,04%
Reduction energy and waste water	1,00%	4,70%	0,50%	40,80%	17,30%	20,40%	15,20%
Reductio pollution in water, soil or air	2,09%	4,71%	0,00%	51,83%	15,18%	13,09%	13,09%
Reduction of waste generation	1,57%	2,62%	1,05%	36,65%	24,61%	19,37%	14,14%
Improvement in recycling	2,62%	3,14%	0,52%	36,65%	19,37%	19,37%	18,32%

The highest values selected by the companies were those related to the neutral impact, varying from 51.83% in the reduction of pollution in water, soil or air to 36.65% in the reduction of waste generation and improvement in the recycling and / or recyclability of the product. The highest percentage of highly positive impact was for the improvement in recycling and / or recyclability of the product, with 18.32%, followed by the reduction of energy and water spent in the generation of the product / service with 15.20%. Adding all the positive indicators of the categories, the highest value would be the reduction of waste generation with 58.12%. Added all positive percentages from this dimension (environmental pillar) divided by the number of variables, the value was 52.78%, number smaller than the 73.82% of the environmental impact found in the previous question.

Some hypotheses for this differentiation to have occurred: by the general question the respondent puts what he believes to be, or what he believes is the right answer - he wants to meet expectation. When asked the specific questions, the respondent needed to think about the specific points, which did not give the same value as the general question. Another possibility is that the options raised were not in accordance with the actions developed by the companies; however, this is a question for future research.

Following the pillar analysis of sustainability, the social one also had the same characteristics as the environmental, with the highest values for the neutral ranging from 38.22% to the improvement in the community income distribution close to 35.08% for the improvement in safety and product quality. The only aspect that had a higher positive,

with 27.75% for "moderately positive", was the improvement of working conditions, as presented in table 3:

Table 3: Intensity of the impact of innovations on the social pillar

Social Variables	1	2	3	4	5	6	7
Improvement in the income distribution of the close community	3,14%	2,62%	1,05%	38,22%	22,51%	19,90%	12,57%
Improvement in the access to social services	4,71%	3,14%	2,09%	37,70%	18,32%	23,04%	10,99%
Improvement in the product safety and quality	2,62%	2,09%	1,05%	35,08%	16,75%	26,70%	15,71%
Improvement of working conditions	1,57%	2,09%	2,09%	26,18%	20,42%	27,75%	19,90%

In this case also the addition of the positive responses of all the social variables was below the general question. For the social pillar in the general question, the index was 89% versus 58.64% of the sum of specifics one.

This, just as in the environmental pillar, this difference in values between the general and specific questions may have some interpretations, among them that the actions are less intense than the respondents say.

The economic pillar, in turn, had two of the five aspects with the highest positive ratings, as can be seen in table 4:

Table 4: Intensity of the impact of innovations on the economic pillar

Economic Variables	1	2	3	4	5	6	7
Reduction in the cost per unit produced	2,62%	2,62%	2,62%	50,79%	18,32%	15,71%	7,33%
Increase in number of sales	1,05%	0,52%	2,09%	20,94%	24,61%	34,03%	16,75%
Improvement in efficiency in the production process	1,57%	0,52%	1,05%	33,51%	25,13%	24,08%	14,14%
Increase in product / service profit margin	2,09%	1,05%	4,71%	32,46%	24,61%	25,65%	9,42%
Increase in business revenue	1,57%	0,52%	2,62%	24,61%	23,56%	33,51%	13,61%

The increase in business revenue had 33.51% for moderately positive and increase in the number of sales 34.03%. The other three had a higher concentration in the neutral: 50.79% to reduce cost per unit produced; 33.51% to improve efficiency in the production process; and 32.46% for the increase in the profit margin of the product / service.

By averaging the positive percentages for the specific question, the value was 62.09%, against 79.06% of the previous one. So, in all dimensions, there were a difference of positive values when compared the general questions to the specifics ones, this can be related to the expectation of the company about the impact on sustainability, but when asked about specific points, it wasn't higher than they expected.

In order to better understand the behavior of companies and the impact of innovations on sustainability, correlation tests were also performed, which indicated significance in almost all crossings between sustainability pillars and incremental and radical innovations, as can be seen in table 5:

Table 5: Correlations between pillars of sustainability and radical and incremental innovation

Innavation	Tests	Environmental Pillar	Social Pillar	Economic Pillar
Radical	Correlation Coefficient	0,20	0,11	0,34

	Sig.	**0,01**	0,13	**0,00**
incremental	Correlation Coefficient	0,15	0,21	0,41
	Sig.	**0,04**	**0,00**	**0,00**

Therefore, a significance of less than 0.05 is observed between incremental innovation and the three pillars of sustainability, and between radical innovation and the environmental and economic pillars. All the correlations found are positive and the highest correlation coefficient is between the economic pillar and incremental innovation, which suggests a concern with efficiency in improving processes and products / services.

This means that, for the sample, there was a positive relationship between incremental and radical innovations with the triple bottom line. The innovations positively impacted the pillars, less radical innovation with the social pillar, in which no significant relationship was found. This data indicates that the increase in the number of radical and incremental innovations also increases the positive impact on the triple bottom line. Consequently, if there are incentives for incremental innovations and eco-innovations, the positive impact on the sustainability tripod will also increase.

The Spearman test was also applied to the typology of the Oslo Manual (OECD, 2004), demonstrating whether there is a correlation. The following table summarizes the results:

Table 6: Correlations between sustainability's pillars and innovation of product / service, process, organizational and marketing

Pillar	Test	Product/service	Process	Organizacional	Marketing
Environmental	Correlation Coefficient	0,21	0,14	0,10	0,14
	Sig.	**0,01**	0,12	0,24	0,10
Social	Correlation Coefficient	0,17	0,16	0,15	0,14
	Sig.	**0,04**	0,08	0,08	0,10
Economic	Correlation Coefficient	0,23	0,10	0,13	0,12
	Sig.	**0,00**	0,25	0,15	0,16

In the case of typologies: product / service, process, organizational and marketing, there was also a significant correlation, but only for product / service innovation with the three pillars of sustainability. That is, innovations in product / service positively impacted the tripod, with stronger correlation for the economic pillar, then environmental and ultimately social pillar.

This data indicates that innovations made in processes, organizational or marketing will not make any difference if the goal is to improve the impact form on the sustainability tripod. However, investing in new combinations for products will have some return, more concentrated in the economic pillar in view of the value of the correlation coefficient.

The last Spearman correlation test for the sustainability tripod was with eco-innovations, as can be seen in table 7:

Table 7: Correlations between sustainability's pillars and eco-innovation

Pillar	Test	Curative Eco-innovation	Preventive additive eco-innovation	Preventive integrated eco-innovation	Organizacional eco-innovaton
Environmental	Correlation Coefficient	0,18	0,40	0,50	0,36

	Sig.	0,42	**0,00**	**0,00**	**0,00**
Social	Correlation Coefficient	0,40	0,22	0,22	0,32
	Sig.	0,06	**0,02**	**0,01**	**0,00**
Economic	Correlation Coefficient	-0,21	0,12	0,11	0,18
	Sig.	0,33	0,23	0,22	**0,03**

The table shows that the organizational eco-innovations had a positive impact on the triple bottom line, with a higher correlation for the environmental pillar and lower for the economic pillar. Preventive eco-innovations (both additive and integrated) had a positive impact on the environmental and social pillar, with a stronger correlation between integrated eco-innovation and cleaner technology.

So, it can be said that the regulations and mechanisms to encourage eco-innovations act on the most beneficial types to society, the preventive and organizational eco-innovations. The curative eco-innovation that has a more remediation character is not impacted. The correlation coefficients are also higher than those presented by the innovations, which was already expected because eco-innovations already have as a characteristic a more relevant positive socio-environmental impact.

In addition to the correlation tests, other tests and analyzes were also done to explore the behavior of the data. Thus, an exploratory factorial analysis was performed, an analysis of clusters and later the groups found were crossed with the factors.

The result of the exploratory factorial analysis with the creation of three factors can be observed as follows:

Table 8: Exploratory factor analysis of sustainability variables

Variable	**Fator**		
	1	**2**	**3**
Reduction in the cost per unit produced	0,74		
Increase in number of sales	0,80		
Improvement in efficiency in the production process	0,75		
Increase in product / service profit margin	0,84		
Increase in business revenue	0,85		
Reduction of material used		0,82	
Reduction energy and waste water		0,84	
Reductio pollution in water, soil or air		0,82	
Reduction of waste generation		0,87	
Improvement in recycling		0,77	
Improvement in the income distribution of the close community			0,75
Improvement in the access to social services			0,88
Improvement in the product safety and quality			0,47
Improvement of working conditions			0,53
Variance (%)	33,05	21,37	11,34
Initial eigen values	4,67	2,99	1,59
Cronbach Alpha	0,87	0,89	0,70

It can be seen that the factors resulting from the analysis were the same ones represented in the questionnaire, based on Elkington (2012), which corroborates with the theory. Factor 1 corresponds to the economic pillar and is the one that most explains the

total variance with 33.05%. Factor 2 corresponds to the environmental pillar and factor 3 to the social pillar. The factors, after the varimax, can explain 65.77% of the total variance. The Cronbach's alpha value of the set of variables was within the acceptable limit, with 0.83 (Hair *et al.*, 2005). The respective values for each factor are shown in the table.

After the factorial analysis, a cluster analysis was performed. Table 9 shows the creation of three groups, formed according to the notes marked in the specific questions, which asked for the areas impacted by the innovations developed and the intensity of the impact. The values in Table 9 indicate the intensity ranging from moderately positive 6 to moderately negative 2:

Table 9: Cluster Analysis - companies in relation to sustainability pillars

Variables	**Groups**		
	1	**2**	**3**
Reduction of material used	5	4	6
Reduction energy and waste water	6	4	6
Reductio pollution in water, soil or air	5	4	6
Reduction of waste generation	5	4	6
Improvement in recycling	4	4	6
Improvement in the income distribution of the close community	3	5	5
Improvement in the access to social services	2	5	5
Improvement in the product safety and quality	2	5	6
Improvement of working conditions	3	5	6
Reduction in the cost per unit produced	3	4	5
Increase in number of sales	3	5	6
Improvement in efficiency in the production process	4	5	6
Increase in product / service profit margin	2	5	6
Increase in business revenue	2	5	6

Group 1 concatenates companies that say they have had a relatively high impact intensity, between a little positive and moderately positive on issues related to the environmental pillar, yet the items of the social and economic pillars are left with neutral notes, so the group will be called environmental trend.

Group 2 presents higher values for social and economic variables, hence the name: social and economic trend. The answers were between slightly positive and neutral. The latter, group 3, has the highest scores, ranging from moderately positive to slightly positive. Since all variables are above neutral, this tripod tendency group was named.

The following table shows the number of organizations in each of the groups and the percentage of the group in the total number of companies:

Table 10: Number of cases in each cluster of sustainability variables

Group	**N of Companies**	**Percentage**
1 – Environmental trend	6	3,14%
2 – Social and economic trends	113	59,16%
3 – Tripod trend	72	37,70%

The cluster of environmental trends is the smallest of them, with only 6 organizations. In contrast, the group of social and economic trends is the largest, accounting for 59.16% of the sample. The last group consists of 72 companies, 37.70% of the total and, by the

values presented in table 58, it is understood that their innovations have positively impacted the tripod of sustainability.

This, it seems to make sense to say that this sample has a bias towards the social and economic pillars of sustainability, which, for Elkington (2012), does not constitute a sustainable company, since for him it is critical that the dimensions have the same weight and the same attention to ensuring a sustainable outcome.

Following the analyzes, the One-Way Anova and Tukey tests were performed in order to understand if there were differences between the groups and the factors of sustainability, statistically significant differences were found between the majority of the groups and factors. In order to verify which was the particularities of each group, a means test was made. The numbers are listed in the following table:

Table 11: Group averages and sustainability factors

Group		**Social Factor**	**Economic Factor**	**Environmental factor**
1 – Environmental trend	Means	2,08	2,63	4,77
	Standard deviation	0,61	1,30	1,68
2 – Social and economic trends	Means	4,77	4,72	4,30
	Standard deviation	0,76	0,71	0,85
3 – Tripod trend	Means	5,53	5,72	5,78
	Standard deviation	0,82	0,78	0,77
Total	Means	**4,97**	**5,03**	**4,87**
	Standard deviation	**1,00**	**0,99**	**1,11**

It can be seen from the results that the environmental trend group has a higher mean in the environmental factor, which was already expected. Group 2 - social and economic trend has higher average in the social factor, followed by economic. The last group that tends to tripod has higher average in the environmental factor, followed by the economic one, and finally the social one.

Thus, group 2 that tends to two of the pillars is stronger in the social, while group 3 - tendency to tripod, although it has higher values for all the pillars, the environmental one stands out. It is suggested for future research to increase the size of the sample and perform it in a probabilistic way to verify if the positioning of the companies in relation to the pillars remains, with concentration for the group of social and economic trends.

5. Conclusion

The article aimed to evaluate the impact of the innovations of the organizations in the sustainability pillars and some questions were addressed for this purpose. In the general question, the strongest impact was on the social pillar, followed by the economic and the environmental pillar. When analyzing the specific questions, the picture changed, with the economic pillar first, then the social and environmental pillar.

One of the reasons for this difference may be the willingness of the company or the respondent to show that the organization is concerned with the social question, even by the profile of the sample, of companies certified by a institution that requires to be inserted in the social contract a clause saying that they seek not only the return to the shareholder, but of all parties involved and have social obligations. Nevertheless, when explicitly asked for the intensity of some of the impacts, the positions changes, showing that even they have the economic issues as central concerning in pursuing innovations.

In this sense, it can be said that the two hypotheses linked to this objective were refuted. H1 - even with sustainability certification, the impact of innovations is more

related to the economic, then environmental, and ultimately the social pillar of sustainability, was rejected in view of the fact that not all types of innovation behave in the same way. The main correlations of the economic pillar were with radical, incremental and product / service innovations. However, for process, organizational and marketing innovations the highest correlations were with the social pillar, although relatively lower. The H2 - the impact of eco-innovations on sustainability is stronger on the economic pillar, followed by the environmental and social pillar, was also rejected because most eco-innovations have a stronger impact on the environmental, social and, lastly, economic pillars. The additive, integrated and organizational preventive eco-innovations have a greater correlation with the environmental pillar, while the curative with the social pillar.

It is clear from the analysis that there is still room for a significant increase in the impact of innovations on the sustainability pillars, given the percentage of companies in the tripod trend. There are some viable paths to this process, either by the certification body itself, by increasing the certification questionnaire or by raising public awareness campaigns, or with the help of public policies, which will impact not only certified organizations.

Thus, from the theoretical point of view, the work showed the positioning of companies with sustainability certification in relation to innovations and their impacts on the triple bottom line, analyzes not found in previous work.

It is also worth mentioning that with correlation tests and the variation of importance of each pillar found in the survey, an unbalance of the triple bottom line was demonstrated. Although this balance is defended by researchers (Elkington, 2012; Almeida, 2002; Smith, 1995) in the sample was not found.

From a practical point of view, the study demonstrated which are the most impacted variables of the three pillars and which still need an incentive to be more positively impacted, which may suggest that public awareness campaigns and other activities aimed at the consumer public may impact the innovations of companies take a more sustainable course.

In addition, it is perceived that more initiatives are still needed to encourage companies on this path, not only to include the clause in the social contract to pursue the interest of all stakeholders, but to think of other alternatives to accelerate the process of sustainable development.

Also, the research brought to light several points of discussion and attention, improving the understand about the impact of innovation on sustainability, and can be used as a basis for future actions in terms of stimulating sustainability.

Despite several interesting information about the impact of innovations, it is necessary to say that this study is not free of limitations, and these limitations are inherent since the choice of method. The size and composition of the sample are limitations, taking into account that the ideal would be a probabilistic sample with a larger number of respondents, in addition to a greater number of profiles. It was also not possible to relate each innovation with the negative or positive impact on sustainability, this relation was presented in general, the impact of all the innovations made by the organization in the period of the previous three years.

In relation to future research proposals, a comparative research between companies with and without sustainability certification is suggested, in order to understand the impact of the decision of having a certification in the form of innovate and eco-innovate.

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