Corporate Sustainability: Evaluation of the Social, Economic and Environmental Equilibrium of Companies in the Three-Dimensional Euclidean Space

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Abstract

The challenges faced by the business ventures when pursuing corporate sustainability have been strengthening the development of information and tools for evaluating corporate actions related to sustainable development. Such actions, according to the United Nations, must be built over three interdependent and mutually supporting pillars – economic development, social development and environmental protection.

Oliveira and Garcia (2008, APC Asian Pacific Conference) present an adaptation, for application to a business context, of the integrated environmental evaluation model proposed by UNEP/UNESCO (1987). The model, originally developed for the evaluation of hydrographic basins, was used to calculate the index of socioeconomic and environmental equilibrium of the company Natura Cosméticos S.A. The concepts and mathematical techniques of the model and the third generation of indicators (GRI-G3), published by the Global Report Initiative GRI, were used. In both cases the Composition Programming (CtP) technique is utilized to calculate the equilibrium point between the social, economic and environmental variables. This point is represented by an ordered pair in the two-dimension Euclidean plan ($p = (L_1,L_2)$), being one dimension obtained by the aggregation of the social and economic variables and the other by the environmental variables.

This paper presents a proposal for calculating the indicator considering its representation in the three-dimensional Euclidean space ($p = (L_1,L_2,L_3)$), with the first dimension composed by the social variables, the second by the economic variables and the third by the environmental ones. For such, the mathematical formulations of the original model are adapted to the three-dimensional space, and the same indicators and parameters of Oliveira and Garcia's (2006) application, published in 2006 Natura S.A. Annual Report, are used.

The application enables the comparison of the results of both models, and, thus, the three-dimensional approach contributes for a better managerial analysis, since the separation of the social, the economic and the environmental dimensions allows better understanding of the corporate actions necessary for obtaining a greater sustainability index.

1 Introduction

For a long period of time, organizations and, consequently, their managerial information systems have been focused on financial matters and the aspects regarding the efficiency of productive systems. This notion is becoming outdated due to the evidence that the operation context of the companies becomes more complex and the decision process presents more and more restrictions. One of the significant components for this change in managers' thinking and action has been the growth of ecological awareness in society, the government and the organizations themselves, which have begun to incorporate these orientations into their strategies (TINOCO; KRAEMER, 2004).

The environmental advantages take place when new procedures are introduced in the operational activities, seeking to reduce the risks related to the environment, in addition to resulting in the definition of rules for carrying out operations with degrading impact potential (TINOCO; KRAEMER, 2004). Many reasons have led administrators to consider social-environmental matters: compliance with the laws, cost efficiency, competitive advantage, public opinion and reputation (BATEMAN; SNELL, 1998).

From the point of view of the accounting-managerial systems, the need of establishing planning, measurement, control and evaluation mechanisms of the environment degrading process is created in the corporate context. The idea is grounded on the need to help managers with the decision process in activities that involve anthropic actions with the purpose of promoting development based on sustainable aspects. In spite of the low consensus level on the concept of sustainable development, there is the need to develop tools to measure sustainability (BELLEN, 2007).

In this sense, Oliveira (2007) made an adaptation of the UNEP/UNESCO model (1987) developed and published by the *International Hydrological Programme* (IHP) in 1984, to calculate the sustainability index that could be used in the corporate context. According to the model, the index represents an equilibrium measure between socioeconomic and environmental actions of the companies.

The model named UNEP/UNESCO (1987) was proposed by the *Scientific Expert Group*, a UNESCO work group for integral evaluation of water basins. It represents an environmental management strategy based on the eco-systemic analysis, by drawing up a multilevel weighed balance of indexes obtained in monitoring actions of the observed region (UNEP/UNESCO, 1987).

In the adaptation of the model, Oliveira (2007) proposed the use of a structure of development indicators proposed by the *Global Reporting Initiative* – GRI (2006; 2006a,b,c,d,f), to represent the economic, social, and environmental perspectives of the companies. The GRI reports directions for the preparation of annual reports incorporating sustainability concepts. The content of these reports comprises information on economical, environmental and social aspects, whose approach in the three simultaneous dimensions is known as the *Triple Bottom Line* – TBL (DAUB, C.H, 2006). Applications on TBL may be found at Chapman e Milne (2004) e Raar (2002).

As in the UNEP/UNESCO (1987) model, the multicriteria methodology used was Composition Programming (CtP). This methodology considers multiple goals with multiple criteria, which may be composed of several levels, thus assisting managers in their decision-making process when faced with conflicting situations, such as in the case of economic decisions measured against socioenvironmental decisions (COHON, 2003).

The work by Oliveira and Garcia (2008) presents the model application for the calculation of the sustainability index of the company Natura Cosméticos S.A. for the year 2006. Only two perspectives were used for the calculation of the indicator: environmental indicators in one group (Environmental perspective) and social and economic indicators in one sole group (Socioeconomic perspective). The calculated index allowed the diagnosis of the current situation of the company and the simulation of managerial alternatives for their improvement.

In this sense, it is relevant to intensify the discussion about the problem of integrating organizational management support methodologies to the decision process, allowing the improvement of their sustainability condition. The work by Oliveira and Garcia (2008) presents an adaptation proposal of the UNEP/UNESCO model as a managerial instrument capable of assisting internal company directions in order to achieve greater sustainability index, observing the equilibrium of their actions.

The application considering the social and economic perspective in an aggregate way may not allow a more accurate analysis of this equilibrium, since there is a trade off between the two perspectives, with the performance in one perspective to be compensated by the performance in the other perspective. The analysis of the three perspectives in a segregate way also allows a more objective application of the equilibrium concept in the TBL approach.

Hence, the purpose of this research is the application of the model, considering the three separate perspectives. For that it is required to calculate the triple order of indicators $L = (x, y, z)$ in a three-dimensional Cartesian system, which represents the current state of sustainability of Natura Cosméticos S.A., as well as analyze the trade off among economic, social and environmental conditions represented by the metrics arranged in each of the axis *x*, *y* e *z*.

Natura Cosméticos S.A. is a Brazilian company, with operations in Brazil, Argentina, Bolivia, Colombia, Chile, Mexico, Peru and France. It is a leading company in the cosmetics, hygiene products and perfumery sector. It has been proposing the application and the spreading of socially responsible and environmental sustainable managerial practices. Its annual report (2006) has been published in accordance with the GRI proposed guidelines, with open access to the public of the information and indication in the report of the code of indicators.

According to the research typology developed by Raupp and Beuren (2004), this research may be classified with regard to its goals as exploratory and descriptive research, since it deals with a subject that has been little explored and described the adaptations required for enlarging the model. As for the problem approach, the research is quantitative, since it uses data measurement techniques for the calculation of the index – employing he CtP methodology – and offers the empirical testability possibility of the model.

This article is divided into 5 sections: in addition to this introduction, section 2 presents the theoretical framework; section 3 highlights the methodological procedures used; section 4 presents the research results and section 5, the final considerations.

2 Theoretical Framework

2.1 Multiple Criteria Decision Aid Methodologies (MCDA)

The MCDA approach may be characterized as a set of methods seeking to clarify a problem in which the alternatives are evaluated by multiple criteria in most cases conflicting (GOMES, GOMES; ALMEIDA, 2006). This type of approach does not present an ideal solution to problems, but among all possibilities, it is the most coherent with a value scale and the method used. An action option is rarely more attractive or preferable to others, considering all purposes. In this sense, decision problem structuring is more of an art than a science, not existing one sole set of purposes for each situation (KEENEY; RAIFFA, 1976).

Two scientific paradigms have served as base for the several theories proposed to support the decision: the rationalist and the constructivist. The first, usually connected to the decision-making process, is aimed at solving more structured problems, whose orientation to support decisions is to seek a great solution through a choice of alternatives (WAGNER, 1986 *apud* ROSSETTO, 2003). The most important rationalist paradigm presupposition refers to the requirement that the deciders are completely rational. Only individuals fully rational, free from "deviations" related to values, beliefs and institutions may describe reality objectively. However, in complex situations, the decision-making context may not always be depicted in an exact way and the rationality of the decision makers escapes from total objectivism (ROSSETTO, 2003).

The constructivist paradigm, in turn, has as the strongest presupposition the fact of acknowledging the importance of the deciders' subjectivity. Therefore, it defends the impossibility of excluding from the decision process the subjective aspects of the deciding agents, such as their values, goals, prejudices, culture and institution (ENSSLIN; MONTIBELLER NETO; NORONHA, 2001).

There are three main types of classification of the multiobjective methods found in the literature. The first classification, proposed by MacCrimmon in 1973, is founded on the solution form adopted for the problem equation, whereas the second, suggested by Cohon and Marks, uses the position held by the decider and the analyst as defining elements of the classification (BRAGA; GOBETTI, 1997). The third classification, proposed by Vincke, is structured on preference relations between several alternatives (BROSTEL, 2002).

Pursuant to the classification by Cohon and Marks, which is the most divulged (BROSTEL, 2002), multicriteria methods, specifically the Commitment Programming (CP) and the Composition Programming (CtP) are included among the techniques using a progressive preference articulation. The deciding agent acts along the decision-make process, and may change opinions in case the solution to the problem does not reach the proposed goals.

The Commitment Programming – CP is a multicriteria decision supporting methodology developed in the seventies by the researchers Yu (1973) and Zeleny (1974). Its basic idea is the determination of a set of efficient solutions that are near an ideal and unreachable point. This set is referred to as a set of commitment solutions. The method is explicitly based on a geometric notion of the best. The closest solutions to the ideal solution are identified in it through the use of a proximity measure, considered by Raju and Pillai (1999) as belonging to the metric L_p family. The commitment solutions are defined for each alternative through the distance between the alternative and the ideal solution.

The CP method is characterized by an interactive process, usually with the progressive establishment of preferences by the decider, until a satisfactory solution is reached. According to Bollmann (2001), the characteristic of this method is that, when a solution is reached, the decider is asked whether the level of accomplishment of goals is satisfactory and, should the answer be negative, the problem is changed and solved again. In this sense, there are situations in which the evaluation criteria weights originate from the problem structure and the possibility of establishing an interactive process with managers, with the possibility, in some cases, of being defined exclusively in the analyst's view and, subsequently, submitted to verification and approval by the one(s) responsible for making the decision.

The Composition Programming method – CtP was first introduced by Bardossy in 1984 as an empirical technique to solve problems. The CtP is a multilevel multicriteria programming method, in which the a general multiobjective problem, with *m* goals, is transformed into a problem with one sole goal. This method has been conceived by researchers as an extension to the Commitment Programming, due to the CP limitation in providing a structure for organization of the attributes and/or goals hierarchically. The CtP, as originally formulated by Bardossy, may be seen as a Commitment Programming technique in two levels. In the first level, it is established a commitment between the criteria of each goal. In a composition procedure, a trade-off is set forth in the second level among the problems goals for each alternative considered (PÉREZ, 1995).

In the UNEP/UNESCO model, the CtP method is used to calculate the proposed improvements in the socioeconomic and environmental equilibrium indicator, which represents the current situation of the system. It is used in the composition of the indicators (criteria of each goal) in 3 levels. In the first, the basic indicators are grouped directly, as they have been extracted or gathered, forming second-level criteria. In the second level, secondary information, or standardized subindexes, are gathered, derived from the initially considered parameters. In the third level, secondary information, derived from the group of indicators considered third level, is gathered again. The final result is reached by obtaining an equilibrium point (x,y), which may be represented in the bidimensional Euclidean space. The distance between the point reached and the point considered ideal characterized the current state of the system, that is, its equilibrium between current environmental quality conditions and economic and social development.

More detailed studies and applications on the methods mentioned may be found at Keeney and Raiffa (1981), Tecle (1988), Pérez (1995), Bramont (1996), Braga e Gobetti (1997), Generino (1999), Ensslin, Montibeller Neto and Noronha (2001), Brostel (2002), Gomes, Araya and Carignano (2004), Oliveira (2004), Shimizu (2006), Gomes, Gomes and Almeida (2006).

2.2 Application of the UNESP/UNESCO Model in the corporate context

The UNEP/UNESCO model (1987) emerged from a seminal study developed and published by the *International Hydrological Programme* (IHP) of UNESCO in 1984, with one of the purposes of finding practical solutions to problems related to water resources that could be applicable worldwide. The IHP goals were expanded so that they could cover not only hydrological aspects concerning environmental activities, but also social and economic aspects related to the use and maintenance of water resources. The main applications that make explicit reference to the methodology developed by UNEP/UNESCO are focused on the management of water resources in and environmental management: Bollmann (2000); Bollmann and Marques (2000); Rossetto (2003); Yurdusev and O´Connell (2005); Bollmann (2006).

Oliveira e Garcia (2008) present an adaptation, for application in corporate context, of an environmental evaluation model proposed by UNEP/UNESCO (1987). The model was used to calculate the socioeconomic and environmental equilibrium index of the company Natura Cosméticos S.A., based on the 2006 annual report entitled “Our Common Future”.

The following steps are required for applying the methodology, according to Oliveira (2007): a) definition of the goal of the study and its coverage; b) definition of the perspectives that shall be considered in the system under investigation (environmental, social, economic, others); c) definition of groups of second-level composite indicators representing the perspectives adopted; d) definition of the basic indicators representing each second-level composite indicator; e) selection of the measurement units for each basic indicator; f) evaluation of the best and worst value for each basic indicator (definition of standards); g) definition of the preference structure (choice of weights for the variables).

In the work by Oliveira and Garcia (2008) the environmental and socioeconomic perspectives were considered. In spite of being methodologically possible the choice of as many levels as deemed convenient, UNEP/UNESCO (1987) recommends the selection of at most 2 or 3 levels, since the mathematical routines are more complex and graphic visualization of the results becomes more difficult.

The selection of the basic indicators and the second-level composite indicators followed the structure reported by the GRI in 2006, which represents the third generation of directives for preparation of sustainability reports, referred to as GRI/G3. The content of these reports comprises information on the economic, environmental and social aspects, whose approach in the three simultaneous dimensions is known as *Triple Bottom Line* – TBL.

In the GRI/G3, the performance indicators are organized in the Economic (codes EC1 and EC9), Environmental (codes EN1 and EN30) and Social categories, the latter subdivided into the Society (codes SO1 through SO8), Labor Practices & Decent Work (codes LA1 through LA14), Human Rights (codes HR1 through HR9) and Product Liability (codes PR1 through PR9) categories.

As for the selection of the measurement units, the information on the indicators extracted from the Natura report, especially the ones of social character, could not be quantitatively measured. Some binary qualitative measures were set forth for them; however, preference was given to rational-type quantitative scales. For Gallopin (1996, *apud* Bellen, 2007), qualitative indicators are preferable to quantitative ones at least in three situations: when quantitative information is not available; when the interest attribute is inherently non-quantifiable and when cost determinations force them to.

The definition of the highest and lowest values for each indicator was exclusively based on the information disclosed by Natura through its annual report. There has been no interactive process with the company's managers so as to capture their preferences. According to Bramont (1996, p. 48) the "MCDM methodologies, as the analyst or consultant, only contribute to assist the decider. Choosing and preferring are tasks exclusive of the decider, since no one can do them for him/her". Due to the absence of interaction between the decider and the analyst, the following criteria have been established according to Oliveira and Garcia (2008):

a) For the maximum values:

i) goals set forth by the company for the year 2007, as temporal horizon of analyses;

ii) in the absence of specific goals or objective information justifying the use of other values, the current situation verified by the indicator was considered as the best situation;

iii) for qualitative indicators, in which normalized scales between 0 and 1 were ascribed, value 1 has been defined as the best indicator condition;

iv) in some cases where the use of the current value as a superior baseline was unviable, since it would represent a limitation to the productive capacity of the company, the average growth of the indicator as of the year 2004 was considered;

iv) in very rare cases, extrapolations were considered with regard to the current value.

b) For the minimum values:

i) values verified by the indicator of the year 2004;

ii) some situations allowed the use of the worst condition of the indicator, ascribing value 0;

ii) in some cases the average growth of the verified indicator was considered as of the year 2004;

iii) for qualitative indicators, to which normalized scales between 0 and 1 were ascribed, value 0 has been defined as the worst indicator condition;

The application of the proposed methodology predicts the interference of weight *P* (balance factor) and α (importance factor) for the evaluation criteria. According to Goecoechea et al. 1982, apud Brostel, 2002, the determination of the weights in problems involving decisions may be done by using two approaches: a derived from the observer, when judgment on the decider is simulated, or the one explained by the client when the weight values are obtained directly from the deciding agent. As a result of the subjectivity inherent to the process of attribution of ponderation structures in MCDA methodologies, the approach derived from the observer has been chosen. Thus, the variables were considered to have the same α weight, since it has not been possible to establish a relation of the importance predominance of the socioeconomic variable with regard to the environmental perspective, nor the basic indicators referring to the three perspectives concerning the second-level composite indicators. For the *P* parameter, which emphasizes the importance of deviations, the $P=2$ alternative was considered.

In the analysis by Oliveira and Garcia (2008), 69 indicators were used. Out of this total, 14 are related to the organization economic performance, 20 concern the environmental performance and 35 are connected with the social performance of the company. The indicator was obtained considering 2 perspectives, the Socioeconomic (considering economic and social indicators) and the Environmental (considering only environmental indicators).

The sustainability index calculated was of L= 0,538, defined by the pair or Cartesian coordinates (0,34;0,62). The first coordinate represents the Environmental perspective and the second coordinate represents the Socioeconomic perspective. The L sustainability index calculated evidences the distance of the current sustainability status to an ideal point of coordinates (1;1) in the Cartesian plan. The result of the index of the company Natura Cosméticos S.A. demonstrated, according to the authors, an acceptable equilibrium, however, in a stage yet incipient of sustainable equilibrium due to the low performance presented in the Environmental perspective.

3 Methodological Procedures

In order to comply with the calculation proposal of the sustainability indicator of the company Natura S.A., considering the segregation in the three perspectives – environmental, social and economic - a triple order of indicators $L=(x,y,z)$ in the three-dimensional Cartesian system. The L distance indicates the trade off between the economic, social and environmental situation represented by the metrics aligned in each one of the axis *x, y* and *z.* For that purpose, the mathematical formulations of the original model are adapted to the three-dimensional space and the same indicators and parameters as applied by Oliveira and Garcia (2008) are used, as reported in the Annual Report of the Company Natura S.A. for the year 2006.

The state calculation procedures begin with the selection of the basic first-level indicators gathered with the information disclosed by the company object of this research, which shall be used to constitute the second and third-level composite indicators.

The (I) indicators have been divided into groups according to their functionality: (IE) economic; (IS) social indicators and (IA) environmental indicators. All indicators were normalized so that all variables would be homogenized since they are variables of different natures, producing for each magnitude an adimensional number with scale between 0 and 1, which reflects the current status between these extremes. Given the maximum value ascribed to the indicator (I_{i+}) and the minimum value (I_{i-}), the normalized value of *I* may be calculated as an index (NI_i), with the choice between the two expression below made so that S_i is positive:

$$NI_i = \frac{I_i - (I_{i-})}{(I_{i+}) - (I_{i-})} \quad (1) \qquad NI_i = \frac{(I_{i+}) - I_i}{(I_{i+}) - (I_{i-})} \quad (2)$$

The normalized indicators are thus obtained for the economic (*NIE*), social **(***NIS*) and environmental (*NIA*) dimensions.

Yurdusev e O'Connell (2005) emphasize that, the choice between equations (1) and (2) should be made to guarantee that NI_i represents the current relative position with regard to the best value ascribed. In brief, the NI_i index indicates the I_i distance to the best and the worst parameter, defined by managers or extracted from legislations or the literature on the specific topics. Searcóid (1997) presents an enlarged review of the distance metrics applied to several methodologies.

In the sequence, the data gathering, composition and grouping process is presented, for which the Commitment Programming technique has been used. Information gathering for the final composition of the sustainability indicator takes place in three stages.

The first stage consists of the definition of the second-level composite distances, calculated for all second-level indicators (groups formed from a set of basic indicators), using the following equation:

$$L_j = \left[\sum_{i=1}^{n_j} \alpha_{ij} \times NI_{ij}{}^{p_j} \right]^{\frac{1}{p_j}} \text{ with } \sum_{i=1}^{n_j} \alpha_i = 1 \qquad (3)$$

wherein:

L_j: composite distance, from the ideal point, a group of normalized basic indicators *i* constituting the second-level indicator *j*;

NI_{ij}: value calculated for the *i* normalized index for each basic indicator constituting the second-level indicator *j*;

n_j: number of basic indicators constituting the second-level indicator *j*;

α_{ij}: weights expressing the relative importance of *n* basic indicators in the second-level group *j*. The sum of the weights in any group is always equal to 1;

p_j: balance factor between indicators of the group *j*. It is equal or higher than 1. The value will depend on the emphasis the researcher wishes to give to stress great divergences and deviations.

An essential definition is the one of the weight of each variable with regard to the degree of importance of the same in the analyzed situation. In the mathematical equations this weight is represented by α. The two parameters α and *p* act as a mechanism of double ponderation. The first, defined as an individual ponderation structure of indicators (α symbol in equation 3), allows to express the relative importance of the basic indicators within a *j* group of second-level indicators.

Thus, for each one of the basic indicators, we have the following expressions:

$$LE_j = \left[\sum_{i=1}^{nE_j} \alpha E_{ij} \times NIE_{ij}{}^{p_j} \right]^{\frac{1}{p_j}} \qquad (4)$$

$$LS_j = \left[\sum_{i=1}^{nS_j} \alpha S_{ij} \times NIS_{ij}{}^{p_j} \right]^{\frac{1}{p_j}} \qquad (5)$$

$$LA_j = \left[\sum_{i=1}^{nA_j} \alpha A_{ij} \times NIA_{ij}{}^{p_j} \right]^{\frac{1}{p_j}} \qquad (6)$$

wherein:

NIE_{ij}: value calculated for the i normalized economic index for each basic indicator constituting the second-level indicator j;

NIA_{ij}: value calculated for the i normalized environmental index for each basic indicator constituting the second-level indicator j;

NIS_{ij}: value calculated for the i normalized social index for each basic indicator constituting the second-level indicator j;

nE_j: number of basic economic indicators constituting the second-level indicator j;

nEj: number of basic environmental indicators constituting the second-level indicator j;

nS_j: number of basic social indicators constituting the second-level indicator j;

αE_{ij}: weights expressing the relative importance of n basic economic indicators in the second-level group j.

αE_{ij}: weights expressing the relative importance of n basic environmental indicators in the second-level group j.

αS_{ij}: weights expressing the relative importance of n basic social indicators in the second-level group j.

From the calculation of the composite distances for each second-level indicator, represented by equations (4) and (6), the three third-level composite distances adopted in the model may be calculated according to the following formula (7):

$$L_k = \left[\sum_{j=1}^{m_k} \alpha_{jk} \, L_{jk}^{\ p_k} \right]^{\frac{1}{p_k}} \qquad (7)$$

L_k: composite distance from the ideal point of m numbers of L_js constituting the third-level group k;

m_k: number of L_j elements linked to the third-level group k;

L_{jk}: second-level composite distances constituting third-level group k;

α_{jk}: weights representing the relative importance of m numbers L_js constituting the third-level group k;

p_k: balance factor for the third-level group k.

Thus, for each one of the first-level indicators calculated, we have the following expressions:

$$LE_k = \left[\sum_{j=1}^{m_k} \alpha_{jk} \, LE_{jk}^{\ p_k} \right]^{\frac{1}{p_k}} \qquad (8)$$

$$LS_k = \left[\sum_{j=1}^{m_k} \alpha_{jk} \, LS_{jk}^{\ p_k} \right]^{\frac{1}{p_k}} \qquad (9)$$

$$LA_k = \left[\sum_{j=1}^{m_k} \alpha_{jk} \, LA_{jk}^{\ p_k} \right]^{\frac{1}{p_k}} \qquad (10)$$

The indicators, in this case, are also weighed.

The last step is the final composition between the third-level distances. This composition is done through the following mathematical calculation:

$$L = \left[\sum_{k=1}^{n_g} \alpha_{kg} \; L_{kg}{}^{p_g} \right]^{\frac{1}{p_g}} \qquad (11)$$

L: composite distance characterizing the current state of the system;
n_g: number of third-level L_k elements;
L_{kg}: third-level composite distances constituting the fourth-level composite indicator;
α_{kg}: weights expressing the relative importance between the third-level elements k;
P_l: balance factor for composition of the fourth-level composite indicator.

The simplified mathematical routine is presented as $L = (LE, LA, LS)$ using $p = 2$. According to UNEP/UNESCO (1987) this structure has been showing to be applicable to conflict situations (*trading off*) between the environment and social and the economic.

$$LE = \left[\sum_{k=1}^{n_g} \alpha_{kg} \; LE_{kg}{}^{p_g} \right]^{\frac{1}{p_g}} \qquad (12)$$

$$LS = \left[\sum_{k=1}^{n_g} \alpha_{kg} \; LS_{kg}{}^{p_g} \right]^{\frac{1}{p_g}} \qquad (13)$$

$$LA = \left[\sum_{k=1}^{n_g} \alpha_{kg} \; LA_{kg}{}^{p_g} \right]^{\frac{1}{p_g}} \qquad (14)$$

Table 1 presents the second-level indicators used in the application, identifying the corresponding perspectives and their code according to GRI/G3. The basic indicators comprising the second-level indicators are described in Annex 1.

Table 1: Description of indicators

INDICATOR	ABBREVIATION	FUNCTIONALITY
ECONOMIC	EC1	Economic Performance
	EC6, EC7	Market Presence
	EC8, EC9	Indirect Economic Impacts
ENVIRONMENTAL	EN1	Materials
	EN3, EN5	Energy
	EN8, EN10	Water
	EN12, EN13, EN14, EN15	Biodiversity
	EN16, EN21, EN22	Emissions, Effluents and Waste
	EN26, EN27	Products and Services
	EN29	Transportation
	EN30	General
SOCIAL	SO1	Community
	SO4	Corruption
	SO5, SO6	Public Policies
	LA1, LA2, LA3	Employment
	LA10, LA11	Training and Education
	LA13, LA14	Diversity and Equality of opportunities
	HR1, HR2	Investment Practices and Purchase Processes

HR6	Children's Work
HR7	Forced Work or Analogous to Slave Work
PR1	Client's Health and Safety
PR5	Labeling of Products and Services
PR6	Marketing Communications

Source: research data

The methodological process may be illustrated in Figure 1, as follows:

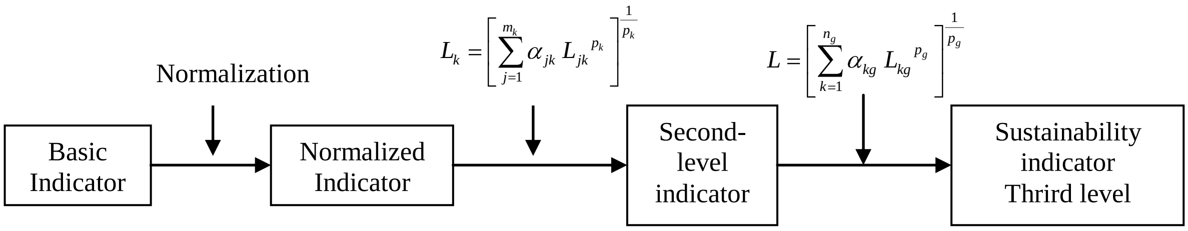

Figure 1: Calculation process of the sustainability indicator
Source: Own work

Table 2 presents the result of the gathering of indicators in the three composition levels:

Table 2: Gathering of Indicators

INDICATOR		First Level	Second Level	Third Level
ECONOMIC	EC1	0,189453	0,011964	0,703029569
	EC6, EC7	0,668475	0,148953	
	EC8, EC9	1,000000	0,333333	
ENVIRONMENTAL	EN1	0,00000	0	0,663007
	EN3, EN5	0,99005	0,122525	
	EN8, EN10	0,67473	0,056908	
	EN12, EN13, EN14, EN15	0,50549	0,031941	
	EN16, EN21, EN22	0,68268	0,058256	
	EN26, EN27	0,81652	0,083338	
	EN29	0,00000	0	
	EN30	0,83240	0,086611	
SOCIAL	SO1	0,00000	0	0,230426
	SO4	0,00000	0	
	SO5, SO6	0,00000	0	
	LA1, LA2, LA3	0,32015	0,008541	
	LA10, LA11	0,33606	0,009412	
	LA13, LA14	0,18309	0,002793	
	HR1, HR2	0,18590	0,00288	
	HR6	0,00000	0	
	HR7	0,00000	0	
	PR1	0,00000	0	
	PR5	0,59468	0,02947	
	PR6	0,00000	0	

Source: Research data

The L distance representing the current state of the system, calculated pursuant to the formula (11) is L= 0,574. The result may be graphically visualized in figure 2 as follows, noting that it is only an illustration since the metrics used is not the Euclidean Distance:

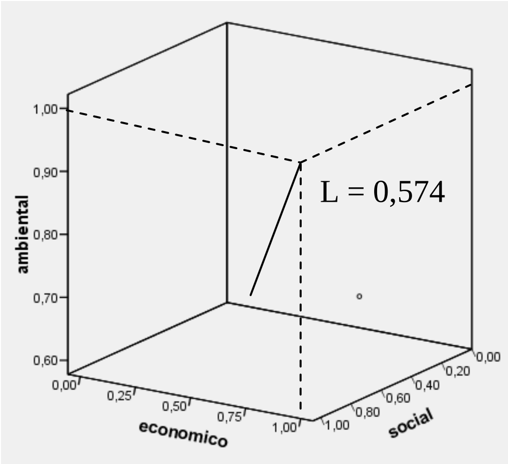

Figure 2: Illustration of distance L to the ideal point
Source: Own work

4 Analysis and Discussion of Results

The index calculated in the three-dimensional space, representing the distance to the ideal point of coordinates (1,1,1) is L=0,57. The magnitude is similar to the one found in the bidimensional space, with the same coordinate of the environmental perspective (~0,66), since the database used is the same applied in the bidimensional space. With the segregation, it is possible to better interpret the results of the social and economic perspective which gathered is represented by the distance 0,34. This figure may be interpreted as acceptable when compared with the result of the environmental perspective, which is 0,66, promoting improvement actions only in the environmental perspective.

However, the result of the economic perspective is of 0,70 and that of the social perspective is 0,23, demonstrating the good performance by Natura in the social indicators and the possibility of improvements in the economic perspective. Analyzing Table 2, we may verify that actions may be undertaken to improve all groups of indicators, especially EC6, EC7, EC8 and EC9. Also in the environmental perspective, actions may be undertaken in almost all indicators, except for EN1 (Materials) and EN29 (Transportation), which have reached the maximum values.

Based on the indicators of managerial goals set forth by Natura, managerial measures may be taken so that the equilibrium measure is displaced towards the ideal equilibrium point $L = (1;1;1)$.

One form of analysis may be established from the basic indicators and with the interaction of managers who know internal restrictions, we may conduct an operable plan of improvement goals for the indicators throughout time.

On the other hand, the CtP methodology allows the obtainment of several action scenarios, where it is possible to prescribe concrete actions in the most deficient social, economic and environmental conditions. Thus, it is possible to establish a condition considered “dominant optimum” and carry out simulations in the indicators to reach this solution.

As an illustration, we consider the sustainability index L = 0,35 and coordinates LE = 0,40, LA = 0,40 and LS = 0,23. The goal is to determine the investment priorities for the economic perspective to go from 0,70 to 0,40 and the environmental from 0,66 to 0,40. The social perspective is kept because it presents good performance. The primary indicators for these results in third level are presented in Table 3:

Table 3: Simulation of Indicators

INDICATOR		Current Indicators	Simulated
ECONOMIC	EC1	0,189453	0,17345
	EC6, EC7	0,668475	0,60884
	EC8, EC9	1,000000	0,28147
ENVIRONMENTAL	EN1	0,00000	0,00000
	EN3, EN5	0,99005	1,01867
	EN8, EN10	0,67473	0,10187
	EN12, EN13, EN14, EN15	0,50549	0,36015
	EN16, EN21, EN22	0,68268	0,00000
	EN26, EN27	0,81652	0,31974
	EN29	0,00000	0,00000
	EN30	0,83240	0,00000
SOCIAL	SO1	0,00000	0,00000
	SO4	0,00000	0,00000
	SO5, SO6	0,00000	0,00000
	LA1, LA2, LA3	0,32015	0,32015
	LA10, LA11	0,33606	0,33606
	LA13, LA14	0,18309	0,18309
	HR1, HR2	0,18590	0,18590
	HR6	0,00000	0,00000
	HR7	0,00000	0,00000
	PR1	0,00000	0,00000
	PR5	0,59468	0,59468
	PR6	0,00000	0,00000

Source: Own work

According to the calculations developed in electronic spreadsheets, associating the preferences of the research analyst or the decision agent, the following managerial alternatives may be proposed:

Economic Perspective:

a) EC1 indicator – Investments in education and training of collaborators of Operação Brasil, from R$16.286 thousand to R$16.901 thousand.

b) EC6 indicator – Expenses with local suppliers (Cajamar Operation), from R$25,69 million to R$26 million.

c) EC8 indicator – investments in professional qualification for suppliers and remuneration of the diffuse traditional knowledge (Benevides Operation), of R$0,00 to R$ 402 thousand;

d) EC9 indicator – Geographic reach of the operations provided by hiring local suppliers (Benevides Operation), from 0 to 17 municipalities.

Environmental Perspective:

a) EN5 indicator – Percentage of sun energy use within the company's energetic matrix from 0.02% to 0.01%;

b) EN8 indicator – Water consumption, from 141.883 m^3 to 120.219 m^3;

c) EN10 indicator – Reuse percentage on the total water treated at the effluent treatment station, from 42% to 91.24%;

d) EN12 indicator – Percentage of biodiversity assets certified as a result of the cultivation and management of native plantations and forests, from 63% to 66.2%.

e) EN15 indicator – Number of biodiversity input and assets used in the productive process, which are found in the list of endangered species by the Brazilian Institute of Environmental and Renewable Natural Resources (IBAMA) and the IUCN, from 2 to 1.

f) EN16 indicator – Total of CO2 emissions, from 120.492 tons to 50.000 tons;

g) EN21 indicator – Percentage of effluents treated before discard, from 71.71% to 100%;

h) EN22 indicator – Class I waste, from 1.323,05 to 815,14 tons; Class II-A waste, from 4.556,84 to 3.145,64 tons; Class II-B waste, from 951,52 to 494,26 tons.

i) EN26 indicator – Environmental impact of packages per amount of product, from 83.20 to 57.89 mPt/Kg; Percentage of use of refills over the total invoiced items, from 19.8% to 19.92%; Percentage of recovered packages compared with the total of invoiced items, from 0% to 60.84%;

The result may be visualized in Figure 3, representing the simulated distance L_S = 0,35 and the calculated distance L_c = 0,57 and the equilibrium point E.

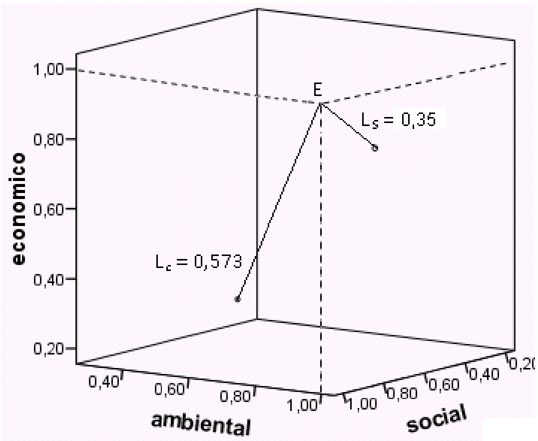

Figure 3: Illustration of simulated distance to the ideal point
Source: Own work

5. Conclusions

The purpose of investigating the economic, social and environmental dimensions separately has suggested a greater analysis possibility and the proposal of alternatives. The result allowed the verification of the existing trade off and the social and economic perspectives, verifying that the social action by Natura presents excellent performance whereas the situation of the economic indicators require significant improvement to achieve equilibrium considering the 3 dimensions. The result seems coherent with the actions by the company Natura, which has been presenting to Brazil a quite strong discourse concerning care about communities, labor practices, human rights, children's work and responsibility with their products. As for the environmental perspective, it is possible to infer that since the indicators represent more recent global concerns, it is at a more incipient developmental stage.

Due to the possibility of establishing achievement (multicriterial) goals in each (multilevel) group of indicators, the application demonstrates that the CtP methodology is a powerful tool to assist managerial actions in companies. It is a technique that uses progressive preference articulation, with the deciding agent playing an essential role in the analysis and search of alternatives to improve the indicator. For this purpose, a simulation was carried out aimed at demonstrating the alterations in the indicators that may lead to a better sustainability indicator. Alterations were proposed in indicators EC1, EC6, EC8, EC9, EN5, EN8, EN10, EN12, EN15, EN16, EN21, EN22 and EN26. However, the viability of these alterations depends on the interaction with managers, who may establish operational goals within the existing restrictions and for future periods.

This work has been motivated by the need of improvement and dissemination of managerial instruments, still incipient, to support corporate decisions comprising social and environmental aspects. The model presented by Oliveria and Garcia (2008) allows the consideration of performance standards which are disclosed by the companies through annual reports adopting the GRI/G3 directives. This represents a possibility of research of the sustainability level of companies through the information disclosed, with the possibility of adopting common parameters in the models (for several companies or for companies of the same sector) so that their results are comparable. Also from the point of view of scientific research, it is possible to submit the model to empirical tests, analyzing their results with regard to the performance of companies and corporate sustainability theories.

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Appendix 1:

Economic Disclosure: EC1 – Distribution of wealth to the stockholders (million R$); Distribution of wealth to the consultants (million R$); Distribution of wealth to collaborators (million R$); Distribution of wealth to suppliers (million R$); Distribution of wealth to the Government (million R$); Investments in education and training of collaborators of Operação Brasil (thousand R$). EC6 – Contracting local suppliers for acquisition of merchandises and supplies (Operação Brasil); Expenses with local suppliers, in million R$ (Operação Cajamar); Expenses with local suppliers, million in R$ (Operação Itapecerica da Serra); Expenses with local suppliers, in million R$ (Operação Benevides); Training of local entrepreneurs to act as suppliers, in number of trained ones (Operação Cajamar). EC7 – Local recruiting for positions of high manager (Operação Brasil). EC8 – Investments in professional training and remuneration of traditional knowledge divulging, in thousand R$ (Operação Pará). EC9 – Geographic range of operations by contracting local suppliers, in number of cities (Operação Benevides).

Environmental Disclosure: EN1 - Total use of material by kilo, except water; Total use of material by liter, except water. EN3 – Direct consumption of energy, in Joules. EN5 – Percentage of solar energy use. EN8 – Water consumption, in m^3. EN10 – Percentage of water reuse (of water purified at the effluents station). EN12 – Percentage of diversity assets certified due to cultivation and handling of plantation and native forests area. EN13 – Appreciation of partnerships and/or established suppliers in areas of environmental protection. EN14 – Existence of current actions to manage risks of damages to biodiversity. EN15 – Number of supplies and assets of the biodiversity used in the productive process, which are considered in the list of endangered species by IBAMA and by IUCN. EN16 – Total of CO2 emissions, in tons. EN21 – Total volume of effluents treated before discard, in relation to the total water consumption. EN22 – Total amount of Class I wastes, in tons; Total amount of Class II-A waste, in tons; Total amount of Class II-B wastes, in tons. EN26 – Environmental impact of the packages by quantity of product; Percentage of use of refills over the total invoiced items, in Operação Brasil. EN27 – Percentage of recovered packages in relation to the total of invoiced items. EN29 – Certification of transporters of products and other goods and material used in the operation, as to the control of greenhouse gas emission

(GGE). EN30 – Total of investments made in corporate liability and expenses with environmental protection, in thousand R$.

Social Disclosure: SO1- Existence of projects that aim at an increase of the capacity of supplier organizations, established in the local communities, to keep the existing operations and to start new ones, in number of projects. SO4 – Total number of ascriptions, demission or punishments due to corruption. SO5 – Existence of formal criteria as to the participation in the elaboration of public policies and lobbies. SO6 – Donations made to political parties, politicians or related institutions. LA1 – Number of collaborators in the company, linked to the Operação Brasil; Number of interns in the company, linked to the Operação Brasil. LA2 – Index of collaborators' Turn Over, linked to the Operação Brasil. LA3 – Existence of additional benefits for full time employees. LA10 – Average of annual training hours, by collaborator, in the Operação Brasil. LA11 – Percentage of scholarships given by number of enrollments for the Programa Natura Educação. LA13 – Composition of physically challenged collaborator, in relation to the total of collaborators, in the Operação Brasil; Composition of female collaborators, in relation to the total of collaborators, in the Operação Brasil; Composition of "pardos" (brown people) and black collaborators, in relation to the total of collaborators, in the Operação Brasil; Composition of collaborators that are over 45 years old, in relation to the total of collaborators, in the Operação Brasil. LA14 – Average monthly wage of female collaborators, in the Operação Brasil; Average monthly wage of male collaborators, in the Operação Brasil; Average monthly wage of female "pardos" (brown people) and female black collaborators, in the Operação Brasil; Average monthly wage of female non-black and female non-brown collaborators, in the Operação Brasil; Average monthly wage of male black and male brown collaborators, in the Operação Brasil; Average monthly wage of male non-black and male non-brown collaborators, in the Operação Brasil; Average monthly salary of collaborators under 45 years old, in the Operação Brasil; Average monthly salary of collaborators over 45 years old, in the Operação Brasil. HR1 – Contracts of benefits partition for remuneration of traditional knowledge and access to the genetic patrimony, in attendance to MP 2186-16/2001. HR2 – Percentage of suppliers self-assessed in quality, environment and social responsibility; Percentage of suppliers audited in quality, environment and social responsibility. HR6 – Existence of contracts with specific labor contractual terms of constraint of child labor. HR7 - Existence of contracts with specific labor contractual terms of prevention of forced and compulsory labor. PR1 – Animal testing, in number of experiments; Existence of systematic efforts to approach health and safety along the cycle of life of a product/service. PR5 - Customer satisfaction polls in relation to its products and services. PR6 – Existence of formal politics to the observation of codes or voluntary patterns related to marketing communications, applied to the entire organization.