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The Assessment of The Companies' Sustainable Development Performance

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Abstract

At present, the content of sustainability reports tends to appear in forms and units that are not easy to convert in comparable unitary terms. We have advanced the design of a composite index of sustainable development that would evaluate the performance of the companies as a time function and that would ensure the integration of sustainable development indicators in a relevant and useful manner.The proposed model is wished to be an advance in the assessment of the sustainability of companies. We have used the simulation method, and the impact of every indicator on the global sustainability of the company was determined with the technique of analytic hierarchy process. The model refers to the fashion in which the environmental, economic and social indicators can be associated in sub-indexes and finally in a global index of the company's performance.The results of the proposed model show that it is feasible and easy to apply at company level, although, none of the ways to express quantitatively such a complex concept as sustainable development could not be perfect. The disadvantage of the model would be that the fashion the weights of the indicators are determined is not direct and precise.

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1. Introduction

The sustainability reports present a set of indicators of sustainable development that can be used in order to assess the sustainability performance of a company. They transform the sustainability aspects in quantifiable values of economic, environmental and social performance, with the main purpose to help solving the key preoccupation for sustainability and to provide information on the fashion in which the company contributes to sustainable development.

A well-defined necessity was identified to develop a comprehensive framework of sustainability criteria that focus on the performance of every industrial sector and even more specific, to evaluate the sustainability of the companies. Tens of indicators were suggested for the assessment of the improvement of a manufacturing process, of an industrial location or of a company. But none of these regulations represents an attempt to create aggregate measures that could be used for a facile comparison, for example, to assess the development of the companies using a composite index that renders simplified and quantitatively expressed information about their environmental performance(Perrini and Tencati,2006).

In the last years, the international research focused on the development of composite indexes, mainly for comparisons between states regarding their economic, environmental and social progress. Despite these evolutions, there still is not available a useful method to assess the integration of sustainability at company level. In order to face the challenges of sustainability, an approach of an integrated assessment of the companies is necessary to provide a good guidance in decision making. Although the canon of indicators aggregation to assess the company was accepted, the methods of aggregation are still insufficiently developed or are not available for all the aspects of sustainability (Sikdar et al., 2012).

Within this context we have proposed the design of a composite index of sustainable development that would evaluate the performance of the companies as a time function, which ensures the integration of the sustainability indicators in a relevant and useful manner for making the decisions.

2. A model for the integration of the sustainability indicators

The proposed model reduces the number of the indicators by aggregation in a composite index. The procedure of the calculation is divided in several phases. For the beginning, the appropriate indicators are selected in groups of economic, environmental and social indicators. The indicators with positive and negative effect are taken into consideration: for example, a raise of the air pollutant emissions per unit of product has obviously a negative impact, while a bigger operational profit has a positive effect on the economic performance of the company.

The main problem of the indicators' aggregation is the fact that they are expressed in different units. A way to solve this problem is the normalisation of each indicator using the equations (1) and (2). To increase transparencyof performance and to increase credibility, we suggest that all data to be afterwards standardized and / or aggregated towards specificindicators to suit particular information needs (Fig.1). Grouping is strongly connected to the selection of indicators. Selected indicators are grouped according to the main aspects of sustainability (economic, $j = 1$, environmental, $j = 2$, and societal group of indicators, $j = 3$). For each group j, indicators i of positive performance (I_{ji}^{+}) in the perspective of sustainability are considered (i.e. indicators whose increasing value has a positive impact to SD). Indicators of negative performance towards SD (I_{ji}^{-}) are also determined at this stage (Krajnc andGlavic, 2005).

$$I_{N,ijt}^{+} = \frac{I_{A,ijt}^{+} - I_{\min.jt}^{+}}{I_{\max.jt}^{+} - I_{\min.jt}^{+}} \tag{1}$$

$$I_{N,ijt}^{-} = 1 - \frac{I_{A,ijt}^{-} - I_{\min.jt}^{-}}{I_{\max.jt}^{-} - I_{\min.jt}^{-}} \quad (2)$$

where$I_{N,ijt}^{+}$ is the normalized indicator *i* of type "more is better" for group of indicators *j*(economic, environmental or social), for time (year) *t* and $I_{N,ijt}^{-}$ is the normalized indicator *i* of type "less is better" for group of indicators *j* for the same time (year) *t*and I_A is the average value of an indicator.

The decision makers at company level have diverse opinions and are interested in different indicators. As the indicators guide the strategic planning and the control activity, they must be carefully defined and must take into consideration the specific interest of the company. According to Azapagic and Perdan (2000), every company has its own strategy of sustainable development and concentrate on various indicators, assigning different weights to individual indicators. Therefore, the next procedural step of the index calculation comprehends the *determination of the weights* assigned to every indicator. The weights could be obtained by an inquiry of the experts, or by public investigations on environmental aspects. Though, in order to practically determine the weights for the environmental indicators, the evaluators are often collating with a lack of data. Even more difficulties could be expected in obtaining the weights for the economic and social indicators. Therefore, we have used the *process of analytic hierarchy* in this model.

This is done by *pair-wise comparisons* between each pair of indicators. The comparisons are made by posing the question which of the two indicators *i* and *k* is more important with respect to the SD of the company, respectively. Hafeez et al. (2002) proposed that the intensity of preference is expressed on a factor scale from 1 to 9. The value of 1 indicates equality between the two indicators while a preference of 9 indicates that one indicator is 9 times the importance of the one to which it is being compared. This scale is chosen because in this way comparisons are being made within a limited range where perception is sensitive enough to make a distinction.

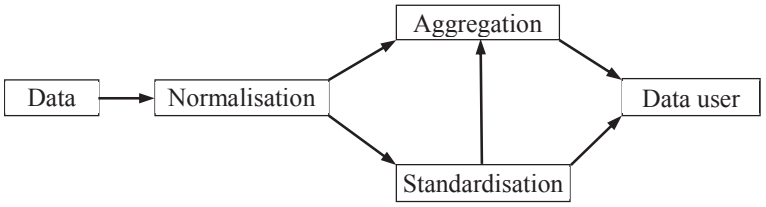

Fig.1.Stepwise approach to development of sustainability indicators(Olsthoorn et al., 2001)

The calculation of the index is a step by step procedure of grouping the different basic indicators in sub-indices of sustainability, for every group of indicators j. The sub-indices can be achieved with the equation 3:

$$I_{s,jt} = \sum_{jit}^{n} w_{ji} * I_{N,jit}^{+} + \sum_{jit}^{n} w_{ji} * I_{N,jit}^{-} \quad (3)$$

$\sum_{ji}^{n} W_{ji} = 1,\ W_{ji} \geq 0$, where $I_{S,jt}$ is the sub-index for every group of indicators (j) in period t; W_{ji} is the weight of the indicator i in the group j of indicators (Glavic and Krajnc,2005).

Lastly, the sub-indices are combined in a composite index of sustainable development:

$$I_{SD,t} = \sum_{jt}^{n} W_j * I_{s,jt}, \quad (4)$$

where W_j is the weight given apriori to the group j of the indicators. These weights should reflect the hierarchies and/or the priorities in the opinion of the decision makers.

3. Study case: applying the model to a textile manufacturing company

The effectiveness of the proposed model was tested in a study case. The necessary data were collected from a Romanian textile manufacturing company, which has yarns and fabrics as products. The monitoring of the activity endorsed the aspects: raw materials and auxiliary materials, resources (water, electric energy, and natural gas) and the waste management.

A comprehensive framework for designing the performance management system has to encompass all important aspects for creating such a system, to ensure that the correct measures are selected, and to provide suggestions for measures in all critical dimensions. The following characteristics are critical for performance measures (Winrothet al., 2012):

- Derived from strategy
- Clearly defined with an explicit purpose
- Relevant and easy to maintain
- Simple to understand and use
- Provide fast and accurate feedback
- Link operations to strategic goals
- Stimulate continuous improvement

In order to track the success of the sustainable development of the company, the model was applied and the index and sub-indexes were calculated for the period 2011-2013. The indicators of the sustainability performance were grouped in three sections covering the economic, environmental and social dimensions, based on the conventional model of sustainable development. Tables 1, 2, 3 list the performance indicators of the company. The frequency of their tracing and calculation was the calendar year.

The economic dimension of the sustainability refers to the company's impacts on the welfare of the stakeholders and on the economic systems at local and national level. The economic performance comprehends all the aspects of economic interactions, including traditional indicators in financial accounting, but also intangible assets that do not systematicallyappear in financial reports.

The environmental dimension implies the impacts of the company on natural systems. The measurements must ensure a balanced vision on the impacts of inputs- using of resources-, and of outputs - emissions, effluents, waste, and of final products. From all three types of sustainability indicators, the quantitaveexpression of environmental performance are the most developed and have reached the highest level of consensus among the experts.

The social dimension reflects the attitude of the company towards the treatment of its own employees, providers, contractors, clients, and also its impact on the entire society. A good social performance is important for the long term business success. Though, it is difficult to incorporate this dimension of sustainable development. For this reason, there still are few indicators developed and measured. The measurement of social performance implies less consensus than the environmental one.

In order to determine the weights of the selected indicators, there were performed pair comparisons of the indicators, in terms of their impact to the global assessment of the sustainability. The priorities are presumed and can vary depending on the opinion of those who make decisions in the company (Zhou et al.,2012).

The normalization of the indicators was performed in order to pass over the different measure units. Thereby, the indicators could be combined and the calculation of the global index was possible.

Table 1. Economic indicators of the analysed company

Indicator	Measure unit	2011	2012	2013	Average
Turnover	Monetary units	54652997	62211867	60009979	58958281
Operational profit	Monetary units	2530224	2827498	26728615	10695446

Investments	Monetary units	366341	695200	7135280	2732274
Net profit	Monetary units	3183970	1396910	20066510	8215797
Research&development expenses	Monetary units	94200	72100	112300	92867

Table 2. Environmental indicators of the company

Indicator	Measure unit	2011	2012	2013	Average
Natural gas consumption	M^3/1000 m.u.	66.49	58.41	46.07	56.99
Electricity consumption	Kw/1000m.u.	144.22	116.93	101.47	120.87
Water consumption	M^3/100m.u.	5.73	5.57	4.33	5.21
Carbon dioxide emissions	Mg/m^3	11	13.1	5.7	9.93
Nitrogen oxide emissions	Mg/m^3	50	43	76.2	56.4
Sulphur oxide emissions	Mg/m^3	0.4	0.2	0.3	0.3
Used water	M^3	294737	243061	238044	258614
Water suspensions	Mg/l	110.2	90.5	76.27	92.32
Hydrogen sulphide	Mg/l	0.08	0.07	0.08	0.076
Biological oxygen demand	Mg/l	130	150	113	131
Chemical oxygen demand	Mg/l	280	300	282	287.3
Water temperature	°C	19.2°	18.1°	16.5°	17.93
Chromium, lead, copper, nickel in water	Mg/l	1.72	0.565	1.071	1.11
Phosphorus	Mg/l	0.07	1.38	0.08	0.51
Abluents	Mg/l	15	17	11.9	14.63
Salvaged waste	Kg/1000m.u.	2.32	2.02	2.43	2.25
Eliminated waste	Kg/1000m.u.	2.54	2.28	2.18	2.33

m.u.=monetary units

Table 3. Social indicators of the company

Indicator	Measure unit	2011	2012	2013	Average
Work accidents	No/year	4	2	1	2.33
Work illnesses	No/year	3	1	1	1.67
Training programs for employees	No/year	5	3	2	3.33
Non-profit programs	No/year	3	1	2	2

The last stage of the model is the combining of the sub-indexes previously calculated in the composite index of sustainable development for each period of time (year). For the final calculation of this index each partialindex was multiplied by its weight, which reflects the importanceconferred to the groups of economic, environmental and social indicators. We have assigned equal weights (0.33) to each partial index in order to derive the global index. Of course, there are other methods of weighting that can be used for this purpose, for example by consulting public opinion or using the judgement of the experts. The concept of sustainability gives nevertheless equal importance to all the three aspects, which makes the equal weights a rational choice.

The purpose of the index is to quantitatively express, in a simple manner, the much more complex composing of many indicators. It can be also used to inform company's managers about its tendencies of development. The most proper use is, still, in a limited context, to reflect the status of the company regarding the sustainable development, and to provide information for the decisional process.

4. Conclusions

The results of the proposed model show that it is feasible and easy to apply at company level. The global index can be a way to measure the current performance of the sustainable development of the analysed company, although none of such way of quantitatively expressing such a complex phenomenon could not be perfect.

While the information regarding sustainability is usually treated separately, in this paper we have tried to transform it in a shape that answers the necessities of the decision makers. As the sustainability practices become clearer, the sustainability reporting begins to offer a measurable value to those whose activity consists of the assessment of the healthy sustainable development of firms and of the influence of future actions in this regard (Hudson et al., 2001). Today, the content of sustainability reports tend to appear in forms and units that are not easy convertible in unitary, comparable terms. The proposed model wishes to be an advance in the assessment of companies' sustainability and makes the information more useful to decision making. The disadvantage would be the way in which the weights of the indicators are determined, which is not direct and precise.

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