Proposal of a reference sustainability framework

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Abstract. Since several years, the word *sustainability* has earned relevance within different backgrounds, with its meaning dominantly related to environmental and social issues. In fact, environmental changes and a higher awareness about social issues and poverty moved international institutions and different countries to take strategic care of sustainability. Because of its increasing importance, several definitions have been proposed, in order to define specifically its meaning and to address its main dimensions. This work aims at better understanding the actual state of sustainability practices within industrial companies. To pursue this, an explorative research has been implemented through the use of a questionnaire, responded by 20 companies. Afterwards, all the results have been analyzed and classified in a Reference Sustainability Framework.

Keywords: Sustainability, Empirical Research, Reference Sustainability Framework, Sustainability Model.

1 Introduction

Since the early beginning of the 20st century the term sustainability has been connected with environmental issues. However, it can be seen today as the joining point of four different macro-areas: (i) environmental, (ii) economical, (iii) social and (iv) institutional. Even if a broad amount of definitions about sustainability already exist (e.g. Brundtland Commission [1] and "The dilemma of sustainability" [2]), because of its complexity, this topic can't be explained so clearly and, sometimes, it

creates conflicts among different companies where is used. The only thing widely accepted is that sustainability is somewhat strictly connected with the value for the company. For this reason, the cooperation of all the actors involved in sustainability issues is important to define a common understanding of the problem (designers, managers, customers, institutions, industrial companies, etc.) . Hence, this paper tries to define, through an explorative research within Italian and multinational companies, a new framework able to map sustainable strategies and evolutions, clarifying the implementation of sustainability activities inside enterprises.

2 State of the art on Sustainability

The literature about sustainability can be divided in two main streams: (i) articles about sustainability areas of interest and (ii) tools for sustainability measurement. The first group describes in deep what is considered in each of the four areas inherent to the sustainability concept. The second one makes the point on which are the available instruments and international standards supporting sustainability assessment and improvement inside a company.

2.1 Sustainability dimensions

Sustainability can be described from different perspectives. From the environmental side, the focus is pointed on four natural resources: air, water, land, minerals & energy. For each of them a series of assessment measures are defined (e.g. waste, quality, consumption, impact, etc.) [3]. Because of its unequivocal effects (e.g. Earth's average surface temperature), the environmental sustainability is the most discussed in international debates. Valuable examples are: (i) European Union treaties addressing climate changes issues, (ii) the 1992 United Nations Framework Convention on Climate Change (UNFCCC) and its Kyoto Protocol agreed in 1997 and (iii) the G8 that took place in L'Aquila in June 2009. The social dimension is concerned with the company's impacts on the social systems in which it operates, as well as the company's relationship with its various stakeholders. Social sustainability can be focused on Human Resources (internal focus) or on the local / regional / international society where the company is inserted in (external focus) [3]. From the economic point of view, sustainability is measured through four relevant criteria: financial health, economic performance, potential financial benefits and trading opportunities [3]. Finally, the institutional dimension was inserted by the United Nation as a prerequisite for sustainable operations, projects or, even, corporate sustainability at different strategic level [3]. Another point of view on sustainability refers to supply chains, considering two important characteristics of the phenomena: multi-dimension (as previously defined) and multi-scale (geographical, institutional and temporal) [4].
All this different perspectives to consider the same topic underline the need of a universally accepted theory concerning sustainability. A valuable effort to do that is described in Manderson (2006) [5], where sustainability is analyzed from the "time" and "dynamic" point of view. With this general concept of sustainability, it is possible

to derive some clarification criteria which can easily gather the multitude of sustainability interpretations and contextual applications.

For the measurement of sustainability performance, there are broad amounts of indicators, clustered according to each main dimension. Economic indicators have been used to measure the state of the economy of this century, social indicators are largely a post-World War II phenomenon and environmental indicators are more recent. Within the economic indicators the Index of Sustainable Economic Welfare (ISEW) developed by Herman Daly and John Cobb, and its recent refinement named ”Genuine Progress Indicator” (GPI) are even more used instead of the Gross Domestic Profit (GDP) index [8]. For the social perspective, there are broadly five types of indicators: informative, predictive, problem oriented, programme evaluative and target delineation. Many social indicators are partly economic, environmental and sustainability measures too; they can be comparative, between and within socio-economic and ethnic groupings. There is little correlation in the level of well-being as measured by objective parameters on the one hand and subjective parameters on the other. There are considerable difficulties associated with the aggregation of indicators and in the design of weighting schemes. There can be aggregation of indicators of a similar nature, but in general aggregation, and certainly a single index, is uncommon, although there is little desire or attempt, at present, to aggregate indicators or derive a single index [8]. Among environment indicators, the ecological footprint, is prevalent. It is a method for estimating the area of productive land required to produce the materials and energy required to support and to absorb the wastes generated by the present way of life. The footprint is an input/output measure of consumption, technological activity, and trade flows of all biophysical material needed by and produced by that city or nation expressed in terms of productive land area but using monetary conversions [9].

Given this amount of indicators, there are many criteria to select the adequate group to use, but all of them have similar objectives (e.g. multi-dimension, forward looking, locally-based, etc.) [8]. The “Prism of sustainability”, described in Spangenberg (2002) [10], is a useful example to take into account the four dimensions of sustainability in an integrated overview. In order to implement such an idea, special attention must be devoted to the inter-linkages of different dimensions as this is where compromises have to be sought and where synergies materialize. Probably, the best known inter-linkage indicator is eco-efficiency, which integrates economic and environmental objectives. The prism of sustainability not only integrates the four dimensions of sustainability, but also includes all the inter-linkages between them. A specific assessment of sustainability in the production area is given by Veleva and Ellenbecker (2001) [7] with the definition of “sustainable production” as the creation of goods and services using non-polluting processes and systems.

2.2 Sustainability tools

The concept of sustainable manufacturing is well known inside companies and various methodologies exist for each phase of the lifecycle (e.g. Design for Environment [31, 12, 6], Cleaner Production [12, 52], Green Manufacturing [12, 53], Waste minimization [12, 6], Zero Emission [12, 54], etc.). A series of tools have been developed to evaluate the sustainability of products. Some valuable examples are: Life Cycle Assessment (LCA), Life Cycle Management (LCM), Social Life Cycle Impact Assessment (SLCIA) and Total Performance Assessment (TPA).

LCA was developed as an analytical tool to assess the environmental impacts of products or services. As it was considered a great instrument to analyze a product's life cycle from the sustainable point of view, many people developed their own methodology [14]. However, a company with the aim to operate in a sustainable manner needs to think about the whole product chain, and not just within its own sphere of legal responsibility. A life cycle assessment, in accordance with the ISO 14040 standard, proceeds iteratively through four phases: (i) Goal and scope definition, (ii) Inventory analysis, (iii) Impact assessment and (iv) Interpretation. The first one defines objectives and parameters to be assessed; the second involves data collection and modeling of the product system, as well as description and verification of data; the third interprets the inventory results into their potential impacts on the areas of protection of the LCA (e.g. natural environment and resources, human health, etc.); in the last phase the results of the other phases are interpreted according to the goal of the study using sensitivity and uncertainty analysis.

LCM is considered a sustainability tool because one of its aims is to minimize the environmental and socio-economic burdens associated with product throughout its entire life cycle. Its importance lies on the fact that it makes product sustainability operational for businesses through continuous improvements of product systems, as well as, supporting business assimilation of, for example, integrated product policies [15]. LCM incorporates environmental, economic and social aspects throughout the life cycle. Firstly, product development and design are involved in Design for Sustainability methodologies; production and distribution make possible to implement sustainable strategies (e.g. Material Flow Cost Accounting (MFCA) method). Similarly, purchasing aids sustainability with a precise selection of raw materials and suppliers, instead sales and marketing can plan new actions for promoting sustainable products. Finally, stakeholder relations are taken into consideration in order to involve them within all the corporate social responsibility initiatives of the company.

The Life Cycle Assessment methodology has obtained a widespread use for decision support, though it considers only environmental impacts. For this reason SLCIA method was developed in order to emphasize the social responsibility of all business activities of a company [13]. The comprehension of the social profile of a company depends on the choice of assessment parameters and the complexity of modeling. A correct use of SLCIA consists on a number of different social impact categories, both standardized and specifically defined by company needs, which together give a covering impression of the company's social conduct.

3 Empirical research

During 2009, an empirical analysis about sustainability strategies used by Italian and international companies was performed. On a sample of 350 enterprises contacted, only 20 only 20 multinational companies (11 with headquarter in Italy and 9 with, only, a presence in Italy) gave their acceptance to be interviewed. Results were collected with direct and indirect interviews performed through a specific questionnaire. The questionnaire was composed by five parts: (i) introduction to the sustainable strategy of the company, (ii) specific questions about the sustainable strategy of the company, (iii) sustainability and technology (technological improvements versus sustainability strategies), (iv) social issues and (v) future expectations.

Firstly, all the companies have been classified and listed according to their total amount of annual net sales, number of employees, investments towards sustainability solutions and number of years of interest within sustainability issues. Secondly, all the companies interviewed have been collected in 5 clusters, according to all the 60 variables used for every interview, using the software Minitab 14. The variables used for creating these clusters have been taken from the data chart of the indirect interviews, because they collected all the information needed to classify the companies with the software used. Thirdly, each cluster has been analyzed from its sustainable profile and economic dimension.

In general terms, companies having the highest amount of annual net sales, compared to the other companies interviewed, have at the same time the highest amount of investment towards sustainability.

Only two multinational companies are practicing sustainability strategies from a long time, respectively from 60 and 40 years ago, when first approaches towards sustainability issues were made. Others approached sustainability from 26 to 15 years ago. All the other companies started to make environmental and social reports less than 10 years ago, maybe attributed to an increased market demand of greener products, an increasing legislative and competitive pressures towards sustainable practices.

Some companies pay attention either to environmental or social issues; others give special discerns to internal social initiatives and CO_2 emission reduction. But, plenty of multinational companies take much more attention to all of the sustainability issues. For this reason, it is possible to assert that these last companies have a much more powerful sustainability strategy, oriented widely to prevent both environmental, economical and social issues.

A limited group reached three main goals, including waste reduction, improvement of manufacturing efficiency and a better energy efficiency. The other remaining companies reached also higher quality within manufacturing processes, which has led consequently to a better brand image. Only one company has reached all the benefits foreseen; the reason of this fact may rely on its approach to the market.

Making a general overview of the results obtained from this analysis, 58% of the companies interviewed are adopting, as indicator of their sustainability strategy, the quantity of CO_2 emission reduced annually. 37% of companies use the Global Reporting Initiative to make their own Sustainability Reports, in order to be able to compare their results with the ones of other companies of the same business. 37% are

also using the Life Cycle Assessment as a methodology to understand environmental impacts of their products and to measure them through the entire life cycle. The remaining companies are using other tools, including: cost reduction, Environmental Performance Index (EPI), Carbon Footprint, Dow Jones Sustainability Index and activities from the Corporate Social Responsibility ethic[1]. Almost all the companies have reached lower costs with their sustainable initiative, making stronger their competitive position in the market. 64% of the companies interviewed, confirmed a higher brand value by fostering their brand images in front of all the stakeholders and especially their customers. Most of the companies pay attention to employees' safety, trying to make as comfortable and safe as possible their workplaces. On the other hand, precautions towards customers' safety are taken into consideration in fewer cases. Other companies prefer to select their suppliers according to a certificate of their sustainability strategy, in order to prevent environmental impacts through the entire supply chain. Finally, there are also cases in which the entire life cycle of a product is taken in to concern within the company's sustainability program.

4 Proposal of a reference framework for sustainability

Before proceeding to cluster analysis, companies have been classified according to 60 variables related to three main dimensions:

- Company dimensions
- Sustainability care
- Sustainability results

The first dimension considers both the total amount of annual net sales and number of employees. The second one is linked with a series of parameters related to sustainability activities. The third dimension considers all the competitive advantages obtained from having implemented a sustainability strategy, as well as the internal benefits reached by the company. Afterwards, with the clusters obtained from the analysis, companies have been classified in a new Reference Sustainability Framework, related to the above three dimensions. Interesting observations can be made looking at the result. In fact, some companies have not achieved the expected results, though their high attention to sustainability issues. This effect depends on some possible reasons, including:

- Business sector
- Low demand of green products
- Green plants implementation problems
- Zero waste and lower spare parts production implementation problems
- Company's brand image

[1] Activities of Corporate Social Responsibility are not properly a sustainability measuring system; by the way, they have been included in this group of arguments in order to classify those companies without a measuring system of their sustainability strategy.

- Company's stakeholders

To better understand how sustainable companies might develop in the next future, two main dimensions, "Boundaries of the sustainability strategy" and "Commitment", have been related in order to fit all the companies interviewed in a position that could explain the actual state of their sustainability strategy. In addition to this, these two dimensions could also foresee the future state of the companies, according to their actual one.

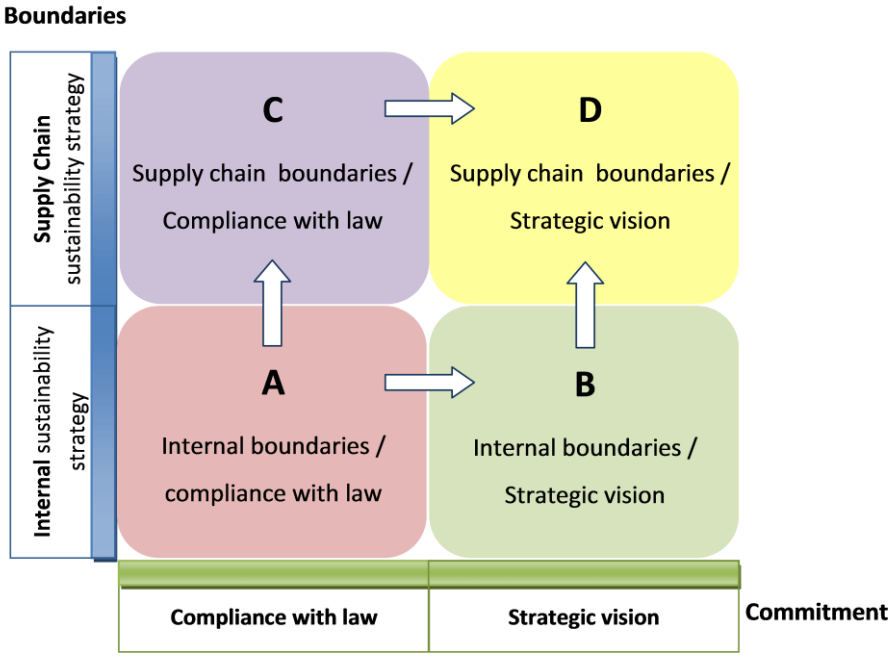

Fig. 1. Preliminary sustainability model

For companies with a sustainability strategy focused only on internal issues, it is possible to extend to the entire supply chain the sustainability's boundaries. For this reason, companies located at the moment in positions A and B can move to position C or D in the next future, by spreading their sustainability principles to the entire supply chain. Looking at commitment of the sustainability strategy, companies that approached to sustainability for being in compliance with legal decrees or normative can include within their sustainable program other sustainable principles, making sustainability an important part of their strategy. In fact, it is possible to assert that some companies have made their sustainability program the focal part of their business strategy, after having reached higher internal benefits and competitive advantages than expected. This way, companies located at the moment in positions A and C can move respectively to position B or D in the next future. Position D represents the best position to achieve for a general sustainable company, but at the same time it costs a continuous improvement of the sustainable principles and higher

control on all environmental and social parameters, in order to monitor the entire supply chain's sustainability program.

5 Conclusions

In conclusion, it is possible to confirm that several companies have already implemented sustainable programmes in order to prevent environmental damages and social diseases. For some companies, despite their high attention towards sustainability, the expected internal benefits and competitive advantages have not been achieved as foreseen. For this reason, the sustainability model developed can help in understanding the actual position of a company and its potential future development, preventing in this way a waste of financial resources and time. Interesting future developments of this research could be to test whether the potential future developments of industrial companies proposed by the sustainability model will be really reached. Starting from the actual position of the companies interviewed, attention should be paid to the development of their sustainability strategy, related also to companies' reaction to the financial crisis. Another future development of this work could be to re-design the proposed model with a higher number of direct interviews, in order to have a more realistic and sophisticated data base for the cluster analysis.

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