Social indicators for sustainable project and technology life cycle management in the process industry

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Abstract

Industry has experienced a shift in stakeholder pressures from environmental to social-related concerns, where new developments in the form of projects and technologies are undertaken. However, the measurement of social impacts and the calculation of suitable indicators are less well developed compared to environmental indicators in order to assess the potential liabilities associated with undertaken projects and technologies. A Social Impact Indicator (SII) calculation procedure is subsequently introduced based on a previously introduced Life Cycle Impact Assessment (LCIA) calculation procedure for environmental Resource Impact Indicators (RIIs). The practicability of the SII procedure is demonstrated in the context of the process industry in South Africa. The case studies establish that social footprint information as well as project- and technology social data are not readily available in the South African process industry. Consequently, the number of social categories that can be evaluated are minimal, which results in an impaired social picture when compared to the environmental dimension. It is concluded that a

quantitative social impact assessment method cannot be applied for project and technology life cycle management purposes in industry at present. It is recommended that checklists and guidelines be used during project and technology life cycle management practices

1. Introduction

The World Commission on Environment and Development officially defined the term "sustainable development" in 1987 [1]. Since then the concept has shaped the political, economic and social environment in which all businesses operate [2]. However, the concept of sustainable development is inherently vague [3] and although it is understood intuitively it remains difficult to express in concrete, operational terms [4]. In 1992 there were already more than 70 definitions for sustainable development [5], but most agree that the concept comprises social, environmental and economic dimensions with equal importance [6]. In order to assist business, the International Institute for Sustainable Development (IISD) has defined sustainable development in business terms as: "*adopting business strategies and activities that meet the needs of the enterprise and its stakeholders today, while protecting, sustaining and enhancing the human and natural resources that will be needed in the future*" [7].

The last decade of the twentieth century marked some significant steps that were taken to draw the social dimension of sustainable development into the open [8]. However, the inclusion of social aspects in the sustainability debate and practices has been marginal compared to the attention that the other two dimensions are receiving, especially from a business perspective [8, 9, 10]. It is believed that the state of development of indicators or measurements for social business sustainability parallels that of environmental performance about 20 years ago [11]. This is mainly due to the problematic nature of social indicators and measurements, which can be attributed to two principal reasons:

- Social issues do not have any underpinning in an objective speciality such as ecology, and
- Social issues have a much higher cultural content, and various perspectives can thus feature in one issue [12].

2. Social criteria framework

In order to assess sustainability performances in industry, a framework of appropriate criteria and associated indicators has to be defined. A number of current integrated frameworks, which are used to assess sustainability at an international, national, local or company level, have been reviewed to determine the relevant aspects (or criteria) that should be considered when assessing industry sustainability [13].

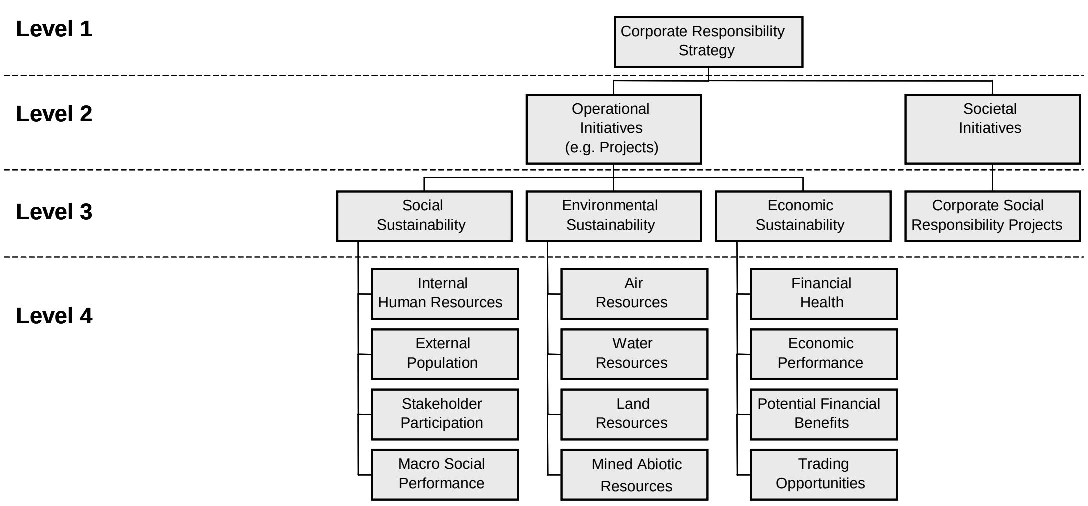

Fig 1. Levels 1 to 4 of the proposed framework to assess the sustainability of operational initiatives [13]

The proposed framework of appropriate criteria to assess the sustainability performances of operational initiatives in industry is shown in Fig. 1 [13]. The framework is divided into different levels to address the separate aspects of corporate responsibility strategy in terms of sustainability. The rationale of these levels has been described in detail elsewhere [13]. The framework has been validated and verified by means of case studies [14].

3. Indicator development

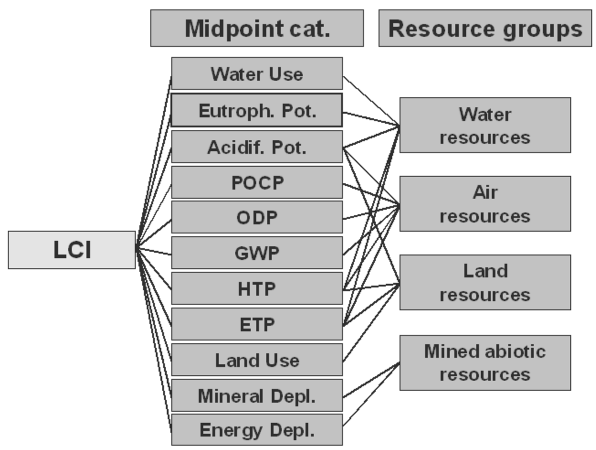

Fig. 2. Casual relationship between environmental LCIs and the resource groups of Fig. 3

Case studies used for verification of the social criteria [14] have also been used to compile a list of possible social interventions, i.e. for a social Life Cycle Inventory (LCI) of assessed operational initiatives in the process industry. A Life Cycle Impact Assessment (LCIA) approach has been proposed before for the evaluation of the social impacts of life cycle systems from compiled LCIs [15, 16]. An established LCIA methodology for the four environmental resource groups is subsequently used as basis for the development of social indicators. The environmental LCIA methodology, termed the Resource Impact Indicator (RII) approach (see Fig. 2), considers the current and target ambient state or ecological footprint through a conventional distance-to-target normalisation and weighting calculation procedure [17]. A similar calculation procedure is proposed for Social Impact Indicators (SIIs) with the four main criteria of Fig. 1 as Areas of Protection (AoP). The general calculation procedure is described through the following equation:

$$SII_G = \sum_C \sum_X Q_X \cdot C_C \cdot N_C \cdot S_C \qquad \mathbf{1}$$

Where: SII_G = Social Impact Indicator calculated for a main social group through the summation of all impact pathways of all social interventions of an evaluated life cycle system.

Q_X = Quantifiable social intervention (X) of a life cycle system in a midpoint impact category C.

C_C = Characterisation factor for an impact category (of intervention X) within the pathway. As a first approximation no characterisation factors are assumed and social LCI interventions are considered separately.

N_C = Normalisation factor for the impact category based on the social objectives in the region of assessment, i.e. the inverse of the target state of the impact category.

And; $S_C = \frac{C_S}{T_S}$ = Significance (or relative importance) of the impact category in a social group based on the distance-to-target method, i.e. current social state divided by the target social state.

In order to follow the calculation procedure, midpoint categories had to be established. For this purpose, the compiled list of social interventions was mapped against the social criteria at various levels within the framework (see Fig. 1). A casual relationship diagram was consequently established whereby midpoint categories were defined. More information on the development methodology and midpoint categories are discussed elsewhere [18].

From the definition of the midpoint categories it is evident that the normalisation and significance steps will be constraint by what is practicably measurable within a society where an operational initiative (from an industry perspective) will typically occur. In this regard the availability of information will most definitely differ between developed and developing countries. Furthermore, the projection of the social interventions of a project or technology may be problematic or at least differ from case to case. Case studies have confirmed that information availability and standardisation of midpoint categories are problematic [18].

4. Conclusions

A calculation procedure has been introduced in order to calculate Social Impact Indicators (SIIs) for evaluated technology systems in the process industry. The calculation procedure follows a conventional Life Cycle Impact Assessment (LCIA) approach, and specifically a distance-to-target methodology whereby the social footprint is considered in the region where an operational initiative is to be implemented. However, although the calculation procedure has been demonstrated through a case study, many of the defined midpoint categories for the approach show certain limitations in terms of the practicability of their use in the process industry. Further case studies are therefore required in order to:

- Identify the kind of information that is typically available at the point of assessing the sustainability performance of specific operational initiatives in the early life cycles stages of projects in the process industry.
- Refine and establish the SII scientific methodology to translate the available operational initiative information for sustainability performance assessments.
- Demonstrate the incorporation of the SII approach together with LCA and LCC results for internal decision-making.

Also, subjective weighting values, based on the judgements of company-specific decision-makers in the process industry, is required for the four main social category groups, in order to establish the overall social performance of evaluated operational initiatives.

5. References

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