

SUSTAINABLE DEVELOPMENT AND DILEMMAS IN SUSTAINABILITY MEASUREMENT¹

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ABSTRACT

The Regional LCA Competence Laboratory – established in the Institute of World and Regional Economics - is recently working at the elaboration of a demonstrative project which can serve the ambitious goal to find the way to develop a methodology for measuring regional sustainable development on LCA basis. As new approach, we make efforts to fulfil the requirements of broader sustainable development concept, somehow combining it with the product-specific, plant-level modelling techniques of LCA analysis.

Both of the new approach elements are challenging, during the elaboration we had to face with severe problems. In this paper we gather the most relevant dilemmas of sustainable development measurement. After briefly summarising the current trends in SD measurement we define the problematic factors which have not been yet solved, and create the general dilemmas of SD measurement.

INTRODUCTION

Our research aim is to develop a new methodology that can combine the advantage of a life cycle and input-output analysis to evaluate environmental, social and economic performance at regional level. The novelty of the research on the one hand is that only the U.S. had such research programs, in Europe similar, complex economic, social and environmental LCA approach has not yet been made. On the other hand this research can serve as an impetus for the domestic LCA research that is only in their infancy. The Laboratory aims within this project: to develop a new methodology, which can give a reliable evaluation for the regional environmental performance; to assess the sustainability of the region and to support strategic decision-making with developing optimisation scenarios for the region. So high value added can be realized on both the methodological (development of research potential) and practical application side (contribution to decision making). Our research has the following steps:

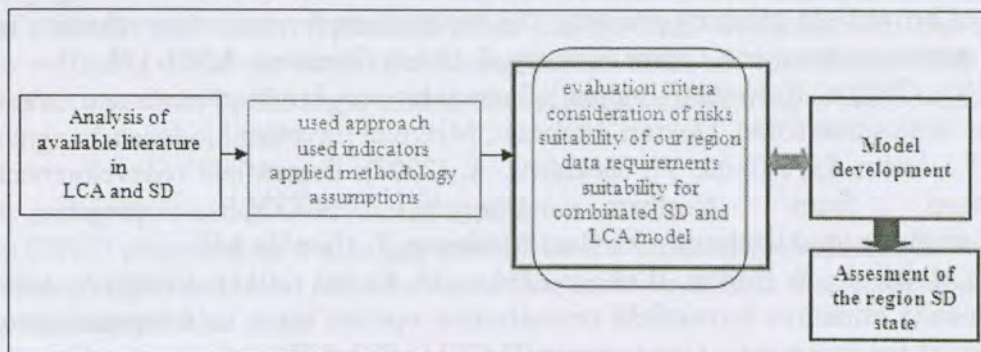


Figure 1: Research process

Source: Own compilation

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As a starting point we analyzed the current available methods of SD measurement and selected those LCA methods that can be suitable for a broader concept sustainable development measurement. The harmonization of the two levels – the macro, top-down approach of SD measurement, and micro, plant level LCA – is not easy to achieve. We have to solve the problem of data requirements, appropriate evaluation criteria, consideration of the risks of the assessment, the level of simplification and therefore possible the distortion of the results. Here in this paper we summarize all difficulties and considerations, which we have to face with. Those factors which raise questions not only when we combine the above two direction in SD measurement, but in case of a simple, one-way SD approach too.

ABOUT SUSTAINABLE DEVELOPMENT AND LCA

The concept of sustainable development and the recognition of the interdependence between the economic system and the environment got in the centre of interest during the 1970s by Meadows and her collaborators (Meadows, 1972). According to the idea asserted by them continuous economic growth will result in serious deterioration of environment unavoidably, which, in turn, may cause global scale collapse of societies eventually (Pezzey, 1992). Finally, this thought ended up in recognition that economic *development* can be sustained without limits but only in such a case when developing process is modified to take into consideration the dependence on natural environment. Unsustainability of economic growth got more attention when Brundtland published its Report in 1983 (WCED (1987)). So, the concept of sustainability has been present long ago, but its sense is unclear: diversified and even conflicting meanings attach to the concept. Hediger (2004) states that sustainable development is much more than sustainability of natural environment. So, such an approach can be qualified as a more complex interpretation of sustainability that meets the requirements of environmental, economic and social sustainability. All three aspects of this newer, complex approach are needed to judge the sustainability of a given development process (Goodland, 1995; van den Bergh, 1997). However, overstressing any of these pillars may end in a one-sided attitude. So, sustainability of development cannot be judged merely on the basis of the sustainability of the natural environment, in the same way as an economically sustainable economic process is not necessarily sustainable environmentally on long term. The independency of the points of view can ensure the possibility of a careful judgement. Moreover, complex indices, such as HDI, applied generally, cannot correct the shortages of one-pillar models, since they assume some substitutability among the components they measure.

The importance of environmental protection is becoming increasingly prominent in all spheres of human society while more and more environmental impact analysis method tried to give a reliable and coherent estimation (Fullana et. al, 2009). Among others life-cycle assessment (LCA) became a widely used tool in the last decade to estimate environmental effects of the entire life cycle of products and services. The Life Cycle Assessment (LCA) is a comparatively recent tool that has rapidly grown to become a standard procedure for environmental scientist and engineers alike to investigate and assess the environmental performance of a wide range of human dominated processes. As the concept of three-pillar sustainable development became widely accepted the LCA approach has been also widened with these new aspects. The goal is to get a more consequent picture and evaluation from ongoing human and natural activities. As LCA models typically use product-specific, plant-level data one of the biggest challenges among LCA researchers is to develop new model based upon general macro or regional (meso) level economic datasets. The aim is to indicate

regional economic and environmental effects from the production of goods and services and to support the regional policy makers.

MEASURING REGIONAL SUSTAINABLE DEVELOPMENT

According to our literature review we grouped the current SD measuring methods into three groups. All of it has some characteristic feature.

1) Econometric modelling of SUS development

The econometric models, although often appear as a model of sustainable development, but mostly seeks to forecast only the positional evolution of economic growth. Examples can be mentioned here like **PANTA RHEI and SuE models** (Bockermann et al., 2000), or **FUGI model** (Brettel, 2003).

2) Indicator based statistical methodology

Those models belong in this group which address the sustainability dimensions and apply a chosen structural criteria for selection of a core set of indicators, in order to assess sustainable path. As example the EPSILON project can be mentioned, where the sustainable development are benchmarked in European regions the on DPSIR framework (Blank et. al, 2005)

3) LCA based approaches

Researches proved that problemsolution applying life-cycle approach do not only have importance in assessing environmental impact and environmental performance or food safety but play a key role in measuring eco-efficiency. Moreover with the development of IO-LCA, if we can link the dynamic moving of material- and energyflows to economic data LCA creates the possibility for complex, new econometric measurement. (Tóthné Szita, 2007). This kind of application are the EVR modell (Hendriks és Brezet, 2009), CALCAS model Klöpffer (2008), EIO-LCA and REIO- LCA (Horváth és Hendrickson (1998)

All these models had considered the different dilemmas of sustainability measurement. The next figure represents the map of characteristics features of the analysed methods.

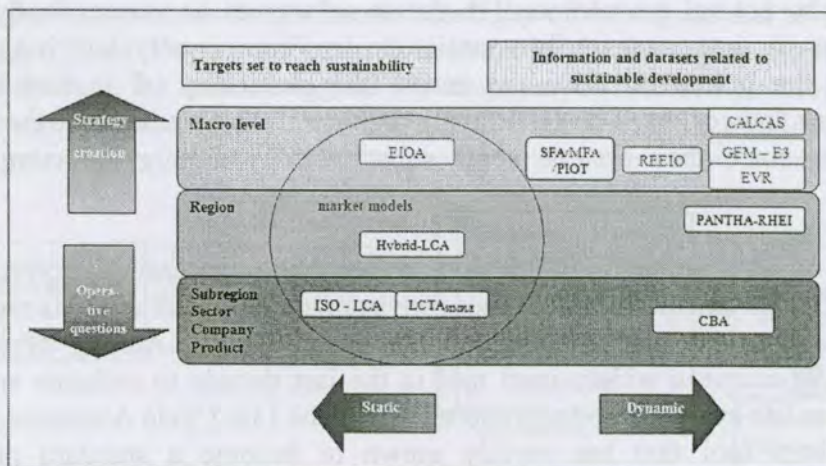


Figure 2.: Overview of sustainable development analysing models

Source: Own compilation

DILEMMAS OF MEASURING SD

Unfortunately there is no methodology without uncertainty factors, or suspected inaccuracy. The characteristic dilemmas and uncertainties of the given estimations can be grouped into the following categories (see figure 2.)

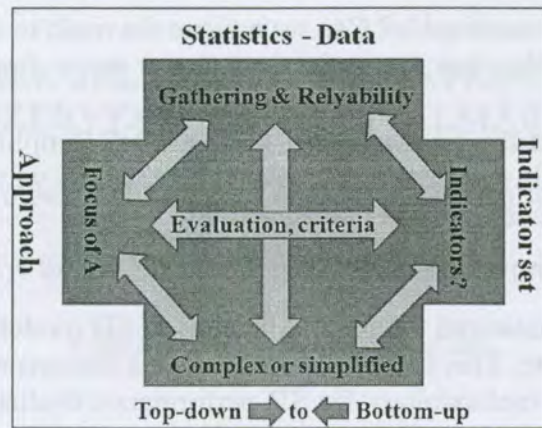


Figure 2: Main factors of sustainability dilemmas

Source: own compilation

Approach: Before developing the methodology and select the analysed dataset or choosing the appropriate indicators the clear definition of the sustainability is needed. While there are still arguments over what constitutes sustainable development indicator selection and development has started. By choosing a given approach led us to make decision about the scales or weighting of the different pillars, the complexity of the model, the level of the measurement, analysed indicators or required dataset. It also determines the limitations, the thresholds and the final results of the sustainability status.

Indicators: There are number of initiatives working on indicators and frameworks for sustainable development (SD). Indicators and composite indicators are increasingly recognised as a useful tool for policy making and public communication in conveying information on countries' performance. Index formulation raises the question of the method of normalisation, weighting, aggregation and in most cases answered by subjective judgments.

Statistics – Data: This factor includes the dilemmas of data collection, availability, aggregation, lack of data sources, and uncertainty of data. These are mainly generated by the following mentioned problems:

- Lack of data – esp., environmental performance data: mapping the significant polluters in the region is time-consuming and expensive, so there is no complete, available data for the environmental pillar
- There is no reliable data series for material and energy flows at regional level only at macro level, where the flows are measured only in monetary units. Input-output tables can be transformed to regional level by carefully selected methodology but it can be also the source of further risks.
- Data gathering in case of company level - esp. in case of material and energy flows – can involve subjective data and opinions,
- Administrative system border different than territory of environmental data collection
- Administrative system border often changes and often different the territory of environmental and economic, social data collection

Criteria of evaluation

According to Kates (2001) and Snigh et al. (2009), the purpose of sustainability assessment is to provide decision-makers with an evaluation of global to local integrated nature–society systems in short- and long-term perspectives in order to assist them to determine which actions should or should not be taken in an attempt to make society sustainable (. But if we get the final (number) result of our analysis there is two question:

- What can be considered sustainable? Can we assign the result to our country's targets? Do we know the thresholds, can we point out limits as a framework for the wrong development path?
- How can it be translated for the decision making actors? Simplification, communicative and easily understandable sustainability assessment is the only way to make them consider the predicted limits of economic and human activity.

CONCLUSION

In this paper we briefly summarized the main dilemmas of SD model development based on the current available literature. This helped us to elaborate a demonstrative project to develop an LCA based I-O analysis methodology for SD performance evaluation. These are the two newest directions of the recent environmental performance analyses, so we can say that completing our mission the Hungarian LCA research can get in to the blood stream of LCA researches. The practical advantages also promising: the consequent environmental, social and economic evaluation of regional performance can support the regional decision making policy to help the region to catch up in a more sustainable route.

However the way to develop future scenarios for the region poses difficulties we have to face with the usual uncertainties: the lack of reliable statistical data, methodological implications the need for simplification.

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