Available online at www.sciencedirect.com
SCIENCE DIRECT®
Resources, Conservation and Recycling 43 (2005) 189–208
Resources Conservation & Recycling
www.elsevier.com/locate/resconrec

A model for integrated assessment of sustainable development

Damjan Krajnc, Peter Glavič*

Faculty of Chemistry and Chemical Engineering, University of Maribor, Smetanova 17, PO Box 219, SI-2000 Maribor, Slovenia

Received 8 December 2003; accepted 8 June 2004

Abstract

The focus of the paper is on consideration of how to use indicators to monitor sustainable development in a relevant and useful manner. Integrated information on sustainable development of a company is very essential for decision-making since it is very difficult to evaluate the performance of the company on the ground of too many indicators. The objective of the work was to design a model for obtaining a composite sustainable development index (I_{CSD}) in order to track integrated information on economic, environmental, and social performance of the company with time. Normalized indicators were associated into three sustainability sub-indices and finally composed into an overall indicator of a company performance. This was applied by determining the impact of individual indicator to the overall sustainability of a company using the concept of analytic hierarchy process.

The demonstration of the model used data for a case study company, Henkel, and a set of sustainable development indicators that were classified using the currently most widely accepted approach of the Global Reporting Initiative (GRI). Case study was used to measure I_{CSD} and sustainability sub-indices of the company over the time interval of 6 years. Interpretation of results is given and the utility of I_{CSD} with its relevance for decision-making is pointed out. Using a case study, the paper demon-

Abbreviations: AHP, analytic hierarchy process; AIChE, American Institute of Chemical Engineers; COD, chemical oxygen demand; CWRT, Center for Waste Reduction Technologies; EMAS, eco-management and auditing scheme; EUR, euro; GRI, Global Reporting Initiative; IChemE, Institution of Chemical Engineers; ISO, International Organization for Standardization; SD, sustainable development; UP, unit of production; VOC, volatile organic compound; WBCSD, World Business Council for Sustainable Development; WCED, World Commission on Environment and Development

* Corresponding author. Tel.: +386 2 229 44 51; fax: +386 2 252 77 74.
E-mail address: glavic@uni-mb.si (P. Glavič).

0921-3449/$ – see front matter
doi:10.1016/j.resconrec.2004.06.002

strates that the model can be applied to deliver composite indicators of sustainability performance of companies.

Keywords: Sustainable development; Sustainability indicators; Composite index; Sustainability assessment; Multi-attribute decision-making

1. Introduction

Sustainable development (SD) is the concept that plays important role in business and industry of the 21st century. Industry sector is responsible for appreciable material flows within human society as well as the exchange of material and energy with the environment.

Nomenclature

Symbols

I_A^+	indicator whose increasing value has positive impact in the perspective of sustainability
I_A^-	indicator whose increasing value has negative impact in the perspective of sustainability
$\overline{I}_A^+$	average value of indicator with positive impact in the period selected
$\overline{I}_A^-$	average value of indicator with negative impact in the period selected
I_{CSP}	composite sustainable development index
I_{min}^+	indicator with minimum value and positive impact on the sustainability
I_{min}^-	indicator with minimum value and negative impact on the sustainability
I_{max}^+	indicator with maximum value and positive impact on the sustainability
I_{max}^-	indicator with maximum value and negative impact on the sustainability
I_N^+	normalized indicator whose increasing value has positive impact on the sustainability
I_N^-	normalized indicator whose increasing value has negative impact on the sustainability
I_S	sustainability sub-index
r_{ECN}	rate of economic development of the company in the time interval
r_{ENV}	rate of environmental development of the company in the time interval
r_{SOC}	rate of social development of the company in the time interval
r_{SD}	rate of sustainable development of the company in the time interval
W	a priori weight of indicator

Indices

i	sustainable development indicator
j	group of sustainable development indicators
t	time in years (other indices are explained in Tables 3–5)