

Input-Output Economics of Industrial Ecological Management

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Abstract

Input-Output methods are commonly applied to environmental analyses using the national economy or sector-oriented techniques, which were originally proposed by Leontief. This paper adopts a different approach, in which I-O theory is applied to product-based environmental analyses. I-O tables are made of a product's life cycle, or the life cycles of several products. A product by product (P x P) table in physical quantities is formed. The table is augmented by matrices, which complete the economic variables by indicating effluents and waste generation and virgin material use.

The model fits the basic ecological economics position of man-made capital and natural capital as complements as in Leontief solution all factors of production are each other's complements. In contrast to traditional P x P approaches, the tables are calculated at the detail level of Life Cycle Assessment (LCA). The boundaries of the matrix and the allocation procedures between products are adopted from the LCA standards developed by ISO and the Society of Environmental Toxicology and Chemistry (SETAC).

The P x P matrices and their dynamic versions make possible detailed "from effects to causes" environmental-economic analysis starting from the actual effects contrary to the top-down approach of traditional policy evaluation. The effort is to provide environmental policy maker with a build-up method for policy planning. The P x P can be applied to analyses of industrial ecology (IE). Empirical results are given from the forest industry. The method may be applied also with regional industrial ecosystem or "industrial eco-park" formulations. Combining I-O theory with industrial ecology fits corporate environmental management-theory into conceptual framework of ecological economics. With product-based Life-Cycle Inventories formatted into quasidynamic analysis it is possible to assess different static time periods in a time path study and extent the traditional static LCI. With multiproduct functional unit the analysis of the products of an industry are examined and best economic as well as environmental industrial structures can be predicted. Sustainable development objective of including

environmental, economic as well as social dimensions lacks a method in economics excluding the environmental aspect and in corporate environmental management or material flow management debate, which in turn excludes the economic and social dimension. The ecological economics scale principle taking it as given that the main question is to start with the focus to minimize the environmental variables i.e. input and outputs of economic and industrial processes is difficult to implement when the goals of environmental policy, allocation and distribution and societal stability are examined in isolation. It is shown here that with material flow models it is possible to assess environmental, economic as well as social effects of environmental policies. Acknowledging that input-output economics is in fact Life-Cycle Inventory will enable the further development of ecological economics complementary type production function, which include both the environmental as well as economic variables.