

The Environmental Sustainability of Production Chains in Concrete Industry. An Enterprise Input-Output Approach

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Abstract

In the last decades, environmental sustainability has become one of the most important issues because of global growth and non-renewable resource scarcity resulting in severe environmental issues (see also WCED, 1987; IPCC, 2007).

Not only the reduction of Greenhouse Gas (GHG) emissions and of fossil energy utilization, but also the efficient use of materials are the most important aspects that need to be taken into account in production chain analysis.

Recently, the most material-consuming industries are considered by researchers, policy makers and environmental agencies in order to redesign production chains aiming to reduce their environmental impact. Clinker, cement, and concrete production represents a set of processes characterized by high CO₂ emissions, huge energy consumption, and intensive utilization of natural resources (WBCSD, 2002; Italcementi Group, 2006).

In this paper, the enterprise input-output approach is adopted to describe the production processes in concrete industry located in a specific region. An enterprise input-output model is proposed to account and plan materials-energy flows in the production chains. Then, chain performance measures including environmental impacts and natural resource consumptions are defined and evaluated. In particular, CO₂ emissions, mined natural resources, and energy sources for one ton of concrete are considered.

To reduce mainly the natural resource consumptions different production chains whose by-products can substitute natural materials mixed with cement and/or concrete are investigated and, then, modelled. Hence, concrete and by-products production chains are jointly modelled to evaluate comprehensive and environmental benefits, the effective design of linked production chains, and to compare different economical and technical solutions. For instance, materials resulting from building demolition are proved to be effective also in terms of reduction of landfill space consumption.

A case example is presented and investigated to show how enterprise input-output models can be applied to linked production chains in a given area. Design and plan issues are discussed and some

environmental policies at the region level are recommended. Finally, case-specific solutions are described.

Keywords: enterprise input-output, environmental sustainability, concrete industry.

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