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ANALYSIS

Combining economic and environmental dimensions: Value chain analysis of UK iron and steel flows

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Abstract

This paper presents the methodology of value chain analysis developed for a study which combined a material flow analysis of the UK iron and steel sector with a consideration of the economic dimension of those material flows, in order to shed light on concepts such as resource productivity and dematerialisation of the economy. The methodology is used in this paper to map the current value chain of iron and steel flows through the UK, noting the high value of scrap arisings at different stages of the production and use chain, and the substantial cost of disposing of iron and steel as waste; to examine the residual outputs generated by this industry and the value of applying industrial ecology principles; to contrast the environmental impacts of different categories of materials with their values; and to discuss the findings in terms of the global environmental burden of this sector of the economy, with particular attention paid to international trade aspects. It was found that while imports are substantial, *net* imports are, in terms of both weight and value, a rather small part—just under 20%—of total UK iron and steel production and use (defined as domestic production plus net imports). The findings show that value chain analysis is a robust methodology for exploring various aspects of the economy–environment interface, and a useful complement to material flow or life cycle analyses with a potentially very widespread applicability. The value chain analysis also provides a framework for coherent and integrated responses by industry as well as policy-makers, through its focus on linkages within different stages and actors in a chain and on the potential for systemic efficiencies.
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Keywords: Iron and steel; Value chain analysis; Material flow analysis; Global environmental burden

1. Introduction

Sustainable resource use, which concerns ensuring adequate supplies of renewable and non-renewable resources and managing the environmental impacts associated with their processing and use, is gaining importance both at the level of individual companies and industries, and as a policy issue. In the UK, it is a firmly established concept, as prudent use of resources and effective environmental protection are key objectives of the national sustainable development strategy (DETR, 1999), and as UK policy is increasingly

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driven by European initiatives. The current EU Sixth Environmental Action Programme (European Commission, 2001a) identifies sustainable use of resources and management of waste as one of four priority areas for action, and the Commission is working towards a thematic strategy on the sustainable use of resources.

Information on the quantities of resource flows related to the extraction, production, consumption or use, and disposal of materials and products, and derived indicators, are vital for sustainable resource management. While such information is forthcoming, particularly at the national level through increased uptake of materials flow accounting, it is the analysis of specific material flows or flows relating to specific economic sectors that will be most relevant for specific policy making (Moll et al., 2003), or for action at the sectoral or industrial level. In addition to calls for more and better quality information on material flows, there are also calls for an increased linkage of material/environmental and economic dimensions of resource flows (OECD, 2004), to further enhance the policy and business relevance of the data.

This paper reports on research undertaken as part of a larger study (detailed in Dahlström et al., 2004), which combined a material flow analysis (MFA) of the UK iron/steel and aluminium sectors with a value chain analysis (VCA) of the same. The purpose of the MFA was to provide a reliable set of time series data on the flows and stocks of these two metals as they pass through the UK economy, and to model the stocks in use according to the average life-spans of broad product categories to estimate end-of-life scrap arisings. The parallel VCA established a methodology for relating these material flows to economic variables, in order to shed further light on concepts such as resource productivity and dematerialisation of the economy.

Concepts of 'value chains' can be traced to different sources and applications. However, in its most common application it is a strategic management or cost accounting tool used to diagnose and enhance a company's competitive advantage. The analysis does this through a breakdown of an organisation's strategic activities (so-called value activities), an examination of their costs, and the streamlining and coordination of the linkages of those activities within the 'value chain' (Porter, 1985). This exercise can enhance the efficiency of a company's internal operations as well as the efficiency of the operations of several actors in an industry-wide value chain, sometimes referred to as a 'value stream' (Womack and Jones, 1996).

The concept has also been applied to studies of international trade from a political economy framework of development and underdevelopment (see e.g. Gereffi and Korzeniewicz, 1994; Girvan, 1987), with a focus on the different actors in a chain and their differential capacities for wealth appropriation within the chain. Both types of applications of VCA however are concerned with identifying ways in which incomes or profits can be sustained over time.

The value chain analysis developed for this project starts with the explicit recognition that the stocks and flows of materials have associated economic values. As materials are transformed and passed along a chain of production, fabrication, use/consumption and reuse or disposal, the value of the materials is either enhanced or reduced. Note that 'value' here refers only to actual monetary values of materials, and does not attempt to put a value on any externalities.

This paper will present the methodology of value chain analysis developed, and then show how it can be used to map the UK iron and steel industry's value chain; examine the residual outputs generated by this industry and the value of reusing or recycling those products; explore the environmental impacts per tonne of material produced in relation to the value; and discuss the findings in terms of the global environmental burden of this sector of the UK economy. The methodology can of course also be used to analyse trends in resource efficiency and productivity, which was done as part of the original research study, and has been documented elsewhere (Dahlström and Ekins, in press).

2. Methodology: value chain analysis for iron and steel

Steel is the most common structural metal in the UK, and is produced and exists in society in large quantities. The concept of sustainable development presents particular challenges for primary industries, because environmental sustainability requires the conservation and prudent use of non-renewable resources and the management of environmentally damaging

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