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Value in sustainable materials management strategies for open economies case of Flanders (Belgium)

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ABSTRACT

Sustainable Materials Management (SMM) strategies, such as reuse, recycling and energy recovery aim, to capture more of the embedded resource or material value in products and waste streams. Reuse, recycling and energy recovery are existing activities in every society but they are poorly reflected in official statistics. Reaching higher levels of reuse, recycling and energy recovery may provide economic and environmental opportunities (i.e., in terms of GDP, jobs, reduced impacts), but not all options will have a net win–win–win property in practice, as they reduce the need for producing new commodities. In open economies, many primary resources, components and products are imported from abroad, and many goods produced are exported abroad.

This paper describes a top-down methodology for estimating the substitution potential of intensifying specific SMM-strategies and material efficiency strategies. We combined both regional and multi-regional EE-IO (environmentally extended input–output) models to link industrial sectors to SMM-strategies. Our method enables us to compare the different SMM and material efficiency strategies in terms of the maximum available budgets for reaching them on a break even basis, maximum savings in global warming emissions and substituted employment effects, both through a regional and global perspective.

We add a case on Flanders (Northern region in Belgium) to illustrate the methodology. Flanders is currently developing a policy for SMM. Selecting new regional actions for a Sustainable Materials Management policy can benefit from a good understanding of the international entangled value chains. It is important to understand how much of the chain is within reach of domestic policies and also to assess the consequences in terms of potential winners and losers, regarding GDP, jobs and environmental impacts, both domestically and abroad.

We illustrated the potential outcomes for Flanders from four generic SMM-strategies: energy recovery, food waste prevention, recycling and reuse. From a strict regional self-interest perspective, it is preferable to substitute foreign value chains with local economic activities. Reuse creates by far the largest budget for new activities to realize the strategy (31.2% of Flemish GDP compared to 8.3% for food waste prevention, 6.2% for energy recovery and 4.2% for recycling). All four strategies have similar and significant potentials to reduce greenhouse gas emissions. However, food waste prevention and reuse have higher potentials to reduce Flemish territorial GHG-emissions. From a pure Flemish employment perspective, the energy recovery and recycling strategies could replace the fewest Flemish jobs, and from a global perspective, all strategies most likely imply losses of jobs abroad.

1. Introduction

In the EU policy context, natural resources have a wide scope; raw materials (minerals, biomass, metals and fossil energy carriers) environmental media (air, water, soil), flow resources (wind, geothermal, tidal and solar energy) and space (land area) are all included in the term ‘natural resources’. The ‘media’ resources are both a source for use and a sink for absorbing emissions. For several

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years, the political and research interest in the area of the so-called "material" resources has been growing for several reasons: (1) a strong EU dependency on supply from abroad, especially when certain resources are supplied by only a few countries, which may pose security risks for their supply (COM, 2011); (2) a scarcity of finite resources not only raises their price or creates high price volatility but can also force producers to extract and produce materials from lower ore grades, leading to higher environmental impacts; and (3) changes in energy systems, such as photovoltaic or windmills, will require many more scarce materials (Kleijn and van der Voet, 2010).

At the international level, UNEP's resource panel has dedicated a specific focus on scarcity, and the OECD has developed a strategy for Sustainable Materials Management (SMM) (OECD, 2012) with an integrated view on raw materials. At the national level, the German resource programme 'ProgRess' (BMU, 2012) has placed a focus on abiotic raw materials that are not used primarily for energy production (ores, industrial minerals, construction minerals). In addition, biotic raw materials are also included when they are used as physical materials in goods. All of these initiatives, although restricted to the perspective of physical materials, also consider the linkages with other (fossil) resources.

Strategies, that have existed for 100 years through continuous improvement efforts that aim for the production of materials with lower emissions are complemented by a related field of research called "material efficiency", defined as "delivering material services with less overall material production". Material efficiency can be considered to be a set of strategies for using less material, complementary to strategies focussing on more efficient production of materials (Allwood et al., 2013).

Political interest for converting waste into a resource is reflected in the EU Directive 2008/98/EC on waste, which EU Member States are obliged to transpose into national policy. In the Belgian policy context, with the three regions of Flanders, Walloon and Brussels, waste policy is a regional responsibility. The Flemish region created the so-called "materials decree" in 2012, delivering both the transposition of the EU Directive 2008/98/EC, as well as providing foundations for a framework for an enhanced policy on Sustainable Materials Management in Flanders. The SMM-policy in Flanders is designed as a general framework and provides a basis for implementing measures after the analysis of existing material flows and impacts and the consultation of stakeholders. This policy demand has led to the selection of Flanders as a case study for this paper.

Sustainable Materials Management strategies, such as reuse, recycling and energy recovery, aim to capture more of the embedded resource or material value in products and waste streams (Benton and Hazell, 2013). These SMM-strategies are closely related to the EU Directive 2008/98/EC, which states the waste management hierarchy: 'Waste legislation and policy of the EU Member States shall apply as a priority order the following waste management hierarchy: (1) prevention, (2) preparing for reuse, (3) recycling, (4) other recovery, e.g., energy recovery, and (5) disposal'. The economic losses and environmental gains of diminishing the current production are partially or fully countered by increased reuse, recycling and energy recovery activities carrying economic gains and environmental costs (Corsten et al., 2013). Reaching higher levels of reuse, recycling and energy recovery may provide economic and environmental opportunities (in terms of GDP, jobs, reduced impacts), but not all options will have a net win–win–win property in practice, as they reduce the need for producing new commodities. In open economies, many primary resources, components and products are imported from abroad and many goods produced locally are exported abroad. Selecting new national or regional actions for SMM-policy can benefit from a good understanding of these internationally entangled value chains. It is important to understand how much of these chains are within reach of regional policies and to know the consequences in terms of winners and losers, regarding GDP, jobs and environmental impacts, both domestic and abroad.

Detailed statistical information on recycling activities and on the level of reuse (such as second-hand markets) is currently relatively poor in all parts of the world, making it difficult to assess the actual level of circularity. Understanding the levels of recycling would benefit from so-called physical input–output tables at a detailed sectorial level. It is not highly likely that these data will be collected soon based on real bottom-up statistics collected in the same way in all relevant countries and regions of the associated value chains. Haas et al. (2015) applied a sociometabolic approach to assess the circularity of global material flows presented for main material groups for the year 2005. Their estimate shows while globally 4 Gt/year of waste materials are recycled, this flow is of moderate size compared to 62 Gt/year of processed materials and output of 41 Gt/year. They recognize that the level of uncertainty of specific materials may indeed be considerable, but assume that, for the overall aim of their article, the reliability of the data and estimates is sufficient. Today, models and statistics containing information on added value are considerably better developed as reflected in monetary input–output models. These models have been extended with satellite tables for environmental extensions, resource use and jobs. The recent development of EE-MRIO (environmentally extended multiregional input–output) tables covering the majority of the economically contributing countries in the world and their trade relations offers new basic data for analysis of internationally entangled value chains.

This paper sets out a methodology for answering the following questions relevant for further policy development of Sustainable Materials Management in open economies from a value chain perspective:

(1) How much value from primary sectors is an economy importing from abroad either directly or embedded in products, compared to the value from primary sectors[1] produced domestically?
(2) How much primary, secondary and tertiary sector value produced within or imported by an economy is exported abroad as materials or embedded in products?
(3) How is the primary, secondary and tertiary sector value in an economy distributed across final consumption from households, NPISH (non-profit institutions serving households), governments, investments and changes in inventories?
(4) What is/are the maximum substitution potential/effects of intensifying generic SMM-strategies for food waste prevention, energy recovery, reuse and recycling (in terms of jobs, value added and GHG-emissions) for a regional economy and the rest of the world? In other words, what are the potential losses in current GDP (and GHG-emissions and employment) due to intensifying SMM-strategies and determining the budget for new SMM-strategies?

Answers to the first two questions will illustrate the openness and dependence of a regional economy on foreign primary resources and related trade importance, as well as the material value flowing abroad through exports and thus no longer available for domestic reuse, recycling and energy recovery. The answer to question 3 provides insights into the primary material dependence of specific regional consumption categories, which helps prioritize future policy actions. The answers to question 4 are relevant for policy makers as they provide the potentials of different

[1] Throughout this paper we classify sectors listed in NACE Rev. 1.1: 01–05 in the primary sector. Likewise we define the secondary sector based on NACE Rev. 1.1: 10–45 and tertiary sector based on NACE Rev. 1.1: 50–99.