

# The challenge to overcome institutional barriers in the development of industrial residue based novel symbiosis products – Experiences from Finnish process industry

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## ABSTRACT

The sustainable utilisation of natural resources requires a new focus on optimal material cycles and material efficiency. Recycling and sustainable industrial development through improved process design are therefore key in this context. In this study, we assessed the potential barriers within the Finnish legal framework regarding the development of novel residue-based industrial symbiosis products. A review is also made of the UK based Waste and Resources Action Programme (WRAP) and Finnish MOTIVA initiatives both of which aim at promoting sustainable and efficient use of materials focussing on the examination of End of Waste (EoW) approaches and quality protocols that guide residue recovery. The research approach was based on both legal review and analysis of relevant policy instruments. The research material includes interviews of actors in both operations and environmental management in various process industry companies in Finland. An industrial symbiosis case study is presented based on previous research and close collaboration between the metals and forest products process industry. The main research question is “does EU policy and the legal framework at the national level create barriers to the development of innovative residue based symbiosis products despite the fact that achievement of the stated goals of ‘recycling society’ and ‘sustainable industry’ require sustainable use of natural resources and high level of material efficiency such as enhanced waste utilisation and prevention?” The results suggest that an innovative approach to environmental permitting and a comprehensive approach to recycling, encompassing new quality and environmental compliance criteria for certain recycled materials, should receive more focus in future decision-making. Material and energy efficiency, as well as life-cycle and systems thinking are all found to be essential elements of this new approach to inter-industrial residues streams. We find that the institutional status of one of our case study products in particular (a fertiliser product, based on multiple residue stream derived raw materials), should be clarified. This paper focuses on Finnish domestic framework issues. It is continuation of the article [Watkins et al. \(2013\) Overcoming institutional barriers in the development of novel process industry residue based novel symbiosis products – case study at the EU level](#). However, it can be read as an individual research paper.

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## 1. Introduction

### 1.1. Background

The world's economy is typically based on growth and technical superiority, with economic development correlated with material consumption. The availability of natural resources and raw materials, including metals and minerals, are often taken for granted in today's society. The great challenge faced by the world's economies

is to integrate the paths of environmental sustainability and economic growth. Sustainable development has become a fundamental political objective for example in the European Union (EC, 2003b). Material efficiency (MEf) should be given a high priority as a part of these new strategies.

Future sustainability management incorporates all dimensions of sustainability – i.e. not just the economic and environmental ones. The sustainable management of all renewable and non-renewable energy sources is a high priority for sustainable industrial development (Ginley and Cahen, 2011). Climate change mitigation means that the sustainable management of renewable resources is receiving more and more attention at the global level. The role of life cycle methodology, redefinition of system

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boundaries, exergy analysis (Husgafvel, 2012a; Päällysaho, 2011) and social indicators are all growing in importance. The recycling and efficient utilisation of waste materials is among the new priorities in this field (Dewolf and Van Langenhove, 2006).

If we consider the historical development of regulatory approaches then environmental legislation includes both traditional categories such as environmental protection, pollution control, environmental assessment and waste, and new categories such as emissions trading and environmental based taxes. The traditional regulatory approach is one of command and control with regulation by legislation expected to be as efficient as possible (Tala, 2005). A legal system is effective, if it is achieving its objectives at reasonable cost. However, a principal question in the development of legislation is how the effectiveness of an environmental legal system can be evaluated; is it effective if it is achieving its objectives at reasonable cost or should we ask if there is any other way to achieve the same objectives without legislation, at lower cost? What is the optimum way to control the system? Legislation is one of the main drivers in improving material efficiency, but it may also become one of the main barriers as seen in the residue or waste or by-product question (Allen, 2002; Pajunen, 2011; Wierink et al., 2010). The most important barriers to environmentally friendly innovations seem to be the investment cost, the high risk involved in committing capital to unproven technology. Other drivers, like corporate social responsibility, stakeholder pressure and general public pressure, will also affect the final decision.

## 1.2. Rationale and objectives

This study aimed at determining the latest national level focus areas in the approach to sustainable and efficient use of materials and their associated links to the implementation of the EU Waste Hierarchy and End of Waste (iearchy EoW) legislation and criteria (see Fig. 1). The general objective is to identify the possible institutional barriers in the legal framework that have to be addressed to promote the development of novel symbiosis products as well as to make recommendations on how to overcome these barriers and on how to design new approaches that support industrial symbiosis and contribute to progress towards more sustainable societies. The rationale is based on the idea that the existing institutional framework for the utilisation of cross-industrial residues may create institutional barriers, which may lead to unsustainable prac-

tices, which serve the interests of neither the industry nor society at large.

## 1.3. Material and methods

This research was accomplished through a review Finnish legislation and initiatives such as the Finnish MOTIVA initiative which promotes material and energy efficiency on a national level in Finland (MOTIVA, 2010a) and of the UK based Waste and Resources Action Programme that aims to help support and develop recycling in the UK and to create a market for recycled materials (WRAP, 2011). The UK WRAP initiative was chosen for comparison to the situation pertaining in Finland (from amongst other EU initiatives) on the basis of its relative maturity in terms of institutional arrangements and also ease of access to its policy and practice.

Finnish instruments reviewed comprised the National Waste Plan (Ministry of the Environment, 2009); Waste Act (646/2011), Waste Tax Act (2010/1126), Environmental Protection Act (86/2000), Fertiliser Product Act (539/2006) and the Chemical Act (744/1989).

The research material is based on interviews of actors in both operations and environmental management at different process industry companies in Finland, and on literature. The research methods were qualitative interview, participatory workshops and literature research (Alasuutari, 1993; Eskola and Suoranta, 1998; Denzin and Lincoln, 2005). The research material, especially concerning experiences in the metal, mining and forest sectors, is based on semi-structured interviews of industrial actors and several participatory workshops held both in the metals and mining industries.

Methodologically, the project was based on participatory and case-study research approaches. In participatory research (Cornwall and Jewkes, 1995; Macaulay et al., 2011) where the participants have an active role in the research and lay people are involved to generate knowledge about issues, drivers, benefits, and challenges that affect them in their daily lives. The participatory research approach regards people as agents rather than objects by affirming the value of people's own knowledge. The interviews were more discussion-based than of an enquiry type. The literature research is based on public documents and other relevant texts.

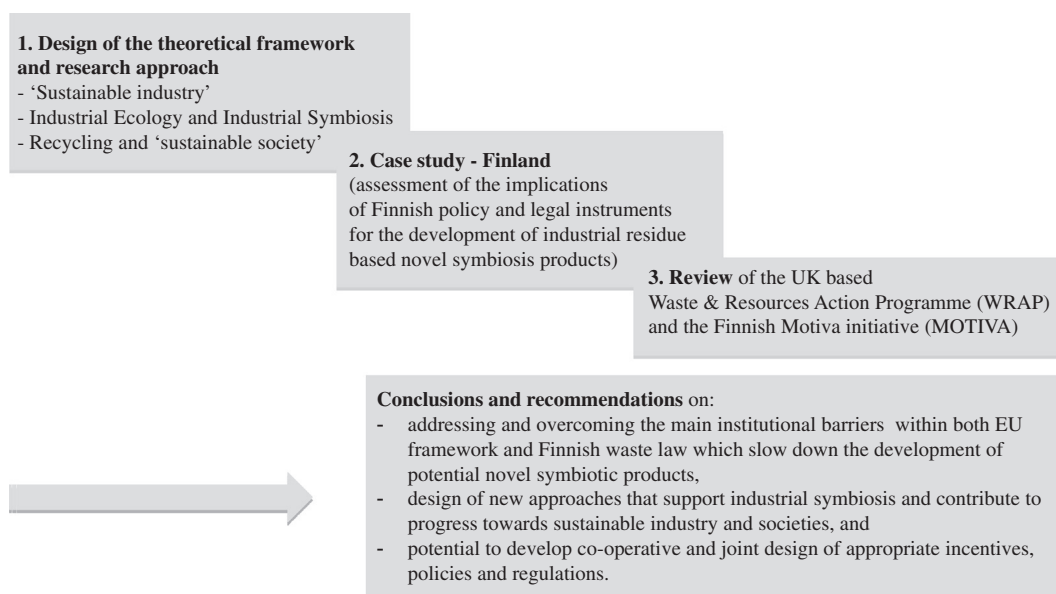


Fig. 1. Framework of the article.

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