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A case study on industrial collaboration to close material loops for a domestic boiler

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Abstract

This paper presents a practical implementation of circular principles in a case study on domestic boilers. The manufacturer and a recycling company collaborated by performing pilot studies on closing the aluminium cycle. The case study proved economically viable and not limited by technical or practical aspects. Additional benefits for both companies have been implemented and additional insights on the circular economy were observed. The results indicate that this form of sustainable manufacturing quickly transcends the boundaries of individual companies, which confirms the necessity of close collaboration with stakeholders in the value chain.

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1. Introduction

This paper describes a practical case study in industry to illustrate how two companies can collaborate to discover the opportunities of implementing principles from the circular economy. The companies requested transfer of knowledge about the circular economy tailored to their specific industrial context, supported by a practical pilot case to investigate the actual opportunities and the necessary operations to realize the proposed benefits.

The two involved companies, Van Gerrevink and Remeha have been engaged in business relations throughout their existence. Both companies see the circular economy as an opportunity for securing their long term interests. A joint effort using the principles of the circular economy would allow for a unique opportunity for a circular collaboration with leverage on two ends of the chain.

After explaining the problem statement in section 2, details about the involved companies and a succinct description of the framework supporting the case study are mentioned in section 3. In the subject of study, section 4 a typical domestic boiler and its life cycle is illustrated. In section 5, the case

study is described, including the set-up and the application of the framework. To implement the selected principle, a pilot case for reverse logistics and a second pilot case for material reutilization have been developed. The evaluation of the case study follows in section 6. Additional outcomes of the case study are discussed as insights in section 7, followed by conclusion and future research.

2. Problem statement of case study

Despite interest in the application of circular principles, both companies realized that their knowledge and experience was not yet sufficient for successful implementation. Therefore, they decided to request the assistance of the University of Twente in developing a practical case study to illustrate how principles of the Circular Economy can be applied in an industry context, cumulating in knowledge transfer and shared experiences.

From discussing the objectives, the following main questions have been identified for this project:

- What are the opportunities of applying principles from the Circular Economy for both companies?

- How can the collaboration between Remeha and Van Gerrevink be intensified and prepared for the circular economy?
- How can the transition towards the circular economy be illustrated by a practical show case?
- Which insights can be derived from the implementation of circular principles in an industry specific context?

By resolving these questions through a practical case study, industry is provided with an illustration of initial steps associated with the transition towards a circular economy.

3. Background

3.1. Van Gerrevink BV

As a recycling company, Van Gerrevink BV is already involved in material recycling through their conventional commercial activities. Collection, destruction, separation and trading of material waste streams for recycling is their core business. Van Gerrevink is a five generations old family business with approximately 30 employees, located in the city of Apeldoorn, in a central region of the Netherlands. The daily operations of Van Gerrevink depend on the dynamic and unpredictable international market for secondary material streams. Dismantling and separation efforts need to be balanced against the expected profits from selling that particular waste stream to recyclers and traders. Van Gerrevink is mainly interested in the opportunities engendered by closer collaboration with its clients with regard to sustainability and resource conservation. By developing the collaboration with business relations, embedded within the circular economy, Van Gerrevink is provided with ample long term business opportunities for a sustainable future. The close collaboration between Van Gerrevink and Remeha is an example of a sustainable business relation.

3.2. Remeha BV

As a formerly family-owned business, Remeha is historically bound to Apeldoorn, where its production facility is located. Remeha employs over 500 people, and is currently part of a larger international holding called BDR Thermea, with a total of around 6500 employees in Europe. Remeha is one of the major manufacturers of boilers in the Netherlands for domestic, commercial and industrial usage. Although Remeha started with an on-site smelter and foundry for cast iron products, they have outsourced all the parts manufacturing and focus on the development and assembly of boilers. Boilers for domestic use are sold predominately through wholesale channels to installation companies and housing associations. As a traditional manufacturing company Remeha is not involved in the use and end-of-life phases of their boilers. For this case study, is Remeha primarily interested in improving the sustainability of its products and organization. Remeha applies the knowledge and recommendations from this case study in the development of its future generation of products and business practices.

3.3. Framework for circular life cycle planning

In order to implement the principles of circular economy in industry a framework has been developed [1] to support this transition towards a circular economy. The ideas of the circular economy, as described by the Ellen MacArthur Foundation [2], have been summarized in a couple of principles:

- Closing material loops
- Functional life extension
- Cascading
- Using renewable energy sources
- Performance Economy

Application of these principles should lead to solution directions in line with the circular economy. Combining the circular economy with the approach of Life Cycle Engineering [3] results in a framework suited for industry-specific contexts, as represented in figure 1.

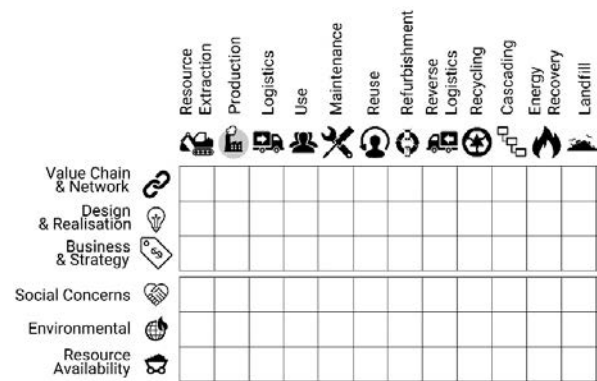


Fig. 1. Morphological matrix for circular development.

This morphological matrix displays the different phases of a product lifecycle on one axis while on the other, three organizational categories of business development are paired with three categories of sustainability, in accordance with the LCE definition by Jeswiet. For each application in industry, the aforementioned principles can be matched with certain combinations of lifecycle stages and categories. Together they form a context specific solution space.

In order to generate a solution space matrix, a thorough understanding of the product (or material) lifecycle is required together with the stakeholders of the value chain. The suggested solution directions, derived from the circular economy principles, transcend the traditional boundaries of individual companies and require close cooperation between multiple stakeholders. This requires development of new business models to redistribute costs & profits and shared responsibilities amongst the stakeholders. Legal matters, such as ownership of the material and resources within the closed loop, have to be resolved as well.

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