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Capturing uncaptured values — A Danish case study on municipal preparation for reuse and recycling of waste

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ABSTRACT

The current call for a transition towards circular economy is often accompanied by the assumption that there are value creation potentials to be captured along with increased resource efficiency. In this study, we aim to provide more detailed knowledge about the size and characteristics of the potential value to be captured from the resources embedded in waste. In order to investigate circular economy potentials in a real-life context, we apply case study research. The case is a municipal waste management company collecting and managing household waste. A number of initiatives are employed to collect as much waste for reuse and recycling as possible. The waste fractions with the highest collection potential are identified as being cardboard, plastics, waste wood and items for reuse. The subsequent processes of preparing these waste types for reuse and recycling are analyzed in the perspective of circular economy value creation. The data include waste amounts, the company's economic accounting, interviews and observations. From the perspective of the municipal waste authority, the largest value creation potential (economically, socially and environmentally) lies in preparing waste for reuse. Secondly, cardboard for recycling has an economic value potential. The collection, preparation and sales of waste wood and plastics constitute an economic deficit and hold limited environmental and social value. The findings suggest that the current regulation of the waste sector does not sufficiently support a transition to circular economy. From a focus on cost-effectiveness, waste managers must additionally change their mindsets towards a focus on value creation and increase reuse related activities.

1. Introduction

Circular economy highlights the need for waste management with the aim to recover the resources in waste. As the concept of circular economy has come to play a guiding role in contemporary EU waste legislation (European Commission, 2017), EU member states are required to collect and prepare 50% of household waste for reuse and recycling by 2020 (EU, 2008). However, circular economy is often conceptualized as more than a material resource-recovering strategy. In addition, circular economy places emphasis on value creation where products keep their value for as long as possible. Circular economy can be defined as:

“Circular Economy is a regenerative system in which resource input and waste, emission and energy leakage are minimized by slowing, narrowing and closing material and energy loops. This can be achieved through long-lasting design, maintenance, repair, reuse, remanufacturing, refurbishing, and recycling.” (Geissdoerfer et al., 2017)

The value in circular economy is therefore associated with, e.g., the re-use of materials; products that are used more optimally and products

that are designed to have a long life cycle.

For waste managers, this perspective on value implies a shift from a focus on cost-effectiveness in waste collection and management to a focus on creating value from waste (Stahel, 2016). As a core principle, circular economy assumes that large value creation potentials are associated with extending the lives of products and their components (Macarthur, 2013). This can be done through different measures such as maintenance, repair, refurbishment and remanufacturing. All these can be seen as a way of capturing value at the end of the product life when usable products are discharged by the consumers. These measures correspond to “prepare for reuse”, which is one of the top priorities in European waste management (EU, 2008). Circular economy ranks different resource strategies in the same order as the waste hierarchy, following this order of priority:

- 1 Prevention
- 2 (Preparation for) reuse
- 3 Recycling
- 4 Energy recovery

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(EU, 2008).

Thus, circular economy and the EU regulatory frameworks for waste management apply the same basic priority principles for waste management.

Denmark is assessed as having a potential for improved utilization of resources in waste, as more than half of the country's waste from households is currently incinerated (Danmarks statistik, 2015). Denmark has a well-established waste collection system with one point of pickup for citizens' waste and sound data on the collection of household waste and its treatment. Landfilling with household waste amounts to 1.7%, and 44.7% is collected for recycling (Danmarks statistik, 2015). The amount of waste, if any, that is prepared for reuse is not accounted for in the statistics. This means that most of the waste materials currently returned to the material loop from the established waste management system are recovered as materials or energy, not as products in their original form. Following the circular economy principles, there can be a potential for waste managers to extract more value by collecting more materials for recycling (rather than incineration) and more products to be prepared for reuse.

Municipal household waste is a challenging and costly type of waste to collect and manage due to its heterogeneous character (Hoorweg and Bhada, 2012). Hence, in Denmark, as in many other countries, the management of household waste is a public task financed by citizen fees and organized by the municipality. This study deals with this first part of the waste management system, i.e., the municipal waste authority that collects and prepares waste for reuse, recycling, incineration and disposal. Municipal waste authorities hold an important key for transforming the waste regime into a more circular and sustainable one, as they are involved in developing the infrastructure which facilitates recycling. In recent decades, there has been a move towards increased recycling, but recycling solutions have not yet been deemed economically sound to the extent that disposal and incineration have been completely eliminated. Rather it is the government-imposed taxation on incineration and disposal that has driven the development towards increased recycling. The movement up the waste hierarchy has thus been more a push away from disposal and incineration than a pull towards recycling (Gregson et al., 2015). Currently, the 2020 targets for collection and preparation for reuse and recycling are pushing the municipal waste authorities in Denmark to develop new solutions to replace the thus far predominant incineration (Miljøstyrelsen, 2014). Municipal waste authorities have a monopoly on household waste; thus, they have the legal obligation to ensure that these EU recycling targets are met.

Municipal waste management operates on non-profit terms. This implies that the citizens' fees are continuously adjusted on the basis of the economic performance of the waste management. Consequently, cost-effective management should be pursued in order to keep the fees at a minimum. This logic regarding waste management is different from the circular economy logic. Circular economy aims to extract the highest utility or value of products, components and materials at all stages of the value chain (Stahel, 2016; Webster, 2015), including the end-of-life stage. Of interest to the present study is how a municipal waste management company can make this shift in logic towards a more explicit focus on extracting value from waste.

The aim of this research is to identify the actual value creation potentials of increased sorting, preparation of waste for reuse and recycling in a municipal waste management company in Denmark.

The study presents a practical example of the potential for capturing value from increased collection for reuse and recycling within the established waste management system. The purpose is to investigate how the circular economy concept applies at a practical level from the perspective of municipal waste management. We analyze if the uncaptured value potential emphasized in circular economy literature is also valid for a municipal waste company and discuss whether the benefits of an improved collection of waste products and materials are

commensurate with the additional efforts and expenses required for its implementation.

2. Values in waste

As we aim to explore value capture potentials from increased reuse and recycling, the concept of value is central to this study.

(Yang et al., 2017a) found that a more comprehensive understanding of value can be applied in order to promote sustainability. They propose a concept of "value uncaptured" as a perspective for sustainable business model innovation, including value for both the company and its stakeholders. They work with four forms of uncaptured value: value surplus, value absence, value missed and value destroyed (Yang et al., 2017a). Value surplus (VS) is value that is not required but exists. Value surplus is waste of resources in a company or unnecessary value delivered to stakeholders. It includes both tangible and intangible waste, e.g., the underutilization of human resource (Yang et al., 2017a). Value absence (VA) is required value that does not exist, such as needs that have not yet been met or a resource that is needed but does not exist (Yang et al., 2017a). Value missed (VM) is value that is not exploited even though it exists and is required, and therefore could create more value. It thereby reduces value that could be created (Yang et al., 2017a). Value destroyed (VD) is value that causes negative effects. It is a negative outcome of an existing business model (Yang et al., 2017a).

Geissdoerfer et al. (2017) found that most conceptualizations of circular economy place emphasis on economic value potentials and job creation potentials.

Whether and how waste materials/products are recirculated is often determined by their economic value. Value, however, is not a constant. It is often the perceived value or valorization potential that determines whether a material/product is considered waste or not (Barr et al., 2013). The user discards a product once (s)he no longer appreciates it. Yet, for another person, the value of the same product could be high. The dynamic character of the value of a product during its lifetime is illustrated in Fig. 1. By the time a product is discarded as waste at the local recycling center, the value of the product is at its lowest. The mix of materials in the product is a hindrance to the utilization of these materials. The challenge, or opportunity, for the waste management company is to extract as much value from the waste materials as possible. Products generally have a higher value than the materials of which they consist (Macarthur, 2013). Hence, it ought to be an uncaptured value to bring used products back into use and it might be the recovery route with the highest uncaptured value.

Ideally, the materials and products travel from consumer to collector to secondary processor and back into consumer products (private as well as business consumers). However, there is a market in between every step in the chain (Zink and Geyer, 2017). The markets for secondary materials and products are often ignored in discussions on closing the loop of materials (Baeyens et al., 2010). This is problematic because the market forces determine the fate of the materials and products. Secondary products and materials compete with new products and materials, and there is a sensitive relationship between supply and demand for materials. Any attempt to make business from the outset of a municipal waste collection would be restricted by the fact that the supply of materials (the collected waste) is fixed. The value creation process thus begins in the supply, not the demand. Contemporary business model innovation theories emphasize the importance of creating and delivering value to a market (the demand) and adjusting the supply to this (Chesbrough, 2010; Magretta, 2002; Teece, 2010). This challenge is a core to understanding the value creation from waste. The market thus plays an important role in whether the loops will actually be closed in a way that displaces the use of new raw materials (Zink and Geyer, 2017).

More broadly, values also have to do with the relative importance, worth or usefulness that individuals or groups attach to things (Chan

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