TOWARDS THE CIRCULAR ECONOMY

- CASE STUDY IN WASTE MANAGEMENT

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ABSTRACT

Academic research related to Circular Economy (CE) from the relationship perspective is scarce, and specifically empirical case studies are missing. In this working paper, we report on a pilot study conducted in waste management context in Finland, with a waste management company as a focal actor. Our intended contribution relates to the industrial network literature by taking the ecosystem view and by conceptualizing the current CE ecosystem to understand how it could be reconfigured to meet the CE challenges. In this task, we utilize three different literatures: 1) interaction approach, 2) circular economy, as well as 3) inter-organizational networks and ecosystems. Our results highlight the necessity of exploring and building new value propositions across actors within ecosystems, and the challenges related to the process.

Key words: Circular Economy, inter-organizational networks, ecosystem, value proposition.

INTRODUCTION

The inclusion of resource efficiency as one of the key agendas within the Europe 2020 strategy (European Commission 2011[1]) is an indication of the concerns related to resource use and consumption, and the urgency for solutions that will enable the transition towards sustainability. Policy makers are identifying transition pathways that will influence a fundamental rethink on the role and function of resources in economies, how these resources could be managed in order to deliver solutions that are sustainable. The suggestion being that, there needs to be an alternative to the primary economic development model of 'take, make and waste', as the negative effects of this system are destabilizing economic systems and destroying the natural ecosystems that are crucial to survival (Scott 2013; Bonviu 2014; Gregson et al. 2015; Antikainen and Valkokari, 2016; Bocken et al. 2016).

Firms are realizing that such limitless exploitation of resources for stimulating economic activities is no longer feasible, and the Circular Economy (CE) has emerged as a viable model that proposes to 'design' waste out of the production and consumption systems by designating materials as nutrients within an interlinked cycle of usage. Transition to CE requires commitment and collaboration from a variety of different actors. Organizations will need to be open to cooperate with actors beyond their usual collaborators, and in doing so create new value networks. From a focal firm's perspective, reconfiguring its existing business networks, and adapting resources and activities to develop new business models is important. New actors and/or changing roles create a need for reconfiguring existing value networks and related business models (Antikainen and Valkokari, 2016; Bocken et al. 2017).

Networks include direct and indirect ties between actors, and a network is composed of these actors and their linkages where resources are linked and controlled by the actors (Håkansson, 1982; Möller, 2013). Aarikka-Stenroos and Ritala (2017) argued recently that in relationship and network studies, a different and a broader theoretical and empirical approach, the ecosystem approach, is needed due to "*the increased connectivity, interdependence, and co-evolution of actors, technologies, and institutions*". Ecosystems do not include only the actors that are directly (or indirectly) connected to a network, but there are also the actors that are interdependent with less formal and looser way, including also technologies, and institutions (ibid).

Although examples of CE models are emerging, academic research related to CE from the relationship perspective is scarce, and specifically empirical case studies are lacking. In this working paper, we report on a pilot study conducted in waste management context in Finland, with a waste management company as a focal actor. Our intended contribution relates to the industrial network literature by taking the ecosystem view and by conceptualizing the current CE ecosystem to understand how the ecosystem could be reconfigured to meet the CE challenges. In this task, we utilize three different literatures: 1) interaction approach and ARA-model, 2) circular economy, as well as 3) inter-organizational networks and ecosystems. Our results highlight the necessity of exploring and building new value propositions across actors within ecosystems, and the challenges related to the process.

[1] Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions. Roadmap to a Resource Efficient Europe. COM 2011, 571 Final European Commission, Brussels, Belgium.

CIRCULAR ECONOMY (CE)

Natural systems offer valuable insights into efficient management of resource cycles, where the concept of waste is redundant and everything is an input to another process in the life cycle (Meadows et al. 2004). This is the driving force behind CE, an idea that looks at designs of products or services from the perspective of minimal waste by allowing for easy repair, or materials to be upgraded and reused, thus building value creation on longevity and new forms of consumption (Schulte 2013). More specifically, circular business models have a few simple principles: minimize waste in the product and system design, understand the ecosystem of the business by incorporating transparency in the business model, build flexibility through design to facilitate repair, modifications and replacements, use renewable energy sources, and maximize energy efficiency by minimizing total energy content of products and services (Schulte 2013). MacArthur (2013) define CE as: '….*an industrial system that is restorative by intention and design. It replaces the end-of-the-life concept with restoration, shifts towards the use of renewable energy, eliminates the use of toxic chemicals, which impair reuse and return to the biosphere, and aims for the elimination of waste through the superior design of materials, products, systems and business models*.' These models imply adoption of cleaner production, increase in consumer and producer responsibility and awareness, use of renewable materials and technologies, while simultaneously adopting tools and policies that support this (Ghisellini et al., 2016). Spring and Araujo (2017) called for a CE perspective that is able to visualize products within a distributive network instead of being defined by the final producer, thus presenting entrepreneurial opportunities at various stages of transition from singular materials and components into objects and vice versa. This view also distributes the responsibility of the final product through the entire value circle making each entity a stakeholder in the process. It ties in with Murray, Skene, and Haynes' (2017) description of CE within the context of sustainable business and thus linking it to systems thinking and the need to consider businesses as part of a wider system of stakeholders with distributed responsibilities. This idea of distributed responsibility implies network building that is geared towards sharing responsibilities for products across the supply and opens up business opportunities for collaborative and shared models for achieving CE objectives.

INTER-ORGANIZATIONAL NETWORKS AS ECOSYSTEMS

In a business network view, resources and activities are controlled by a network of actors (Ford et al., 2011). The network approach developed by the IMP group views the network relationships from three perspectives: (1) the activities carried out, (2) the resources used to carry out these activities, and (3) the actors that control the resources and carry out the activities. Together these perspectives form the ARA-model, which provides a holistic view of the business ecosystem where the actors have some access to each other's resources, and where business relationships play important roles. In reality, these three dimensions are inseparable, but they provide an analytical standpoint, where each dimension contributes its particular perspective. The activities are linked, resources are tied together and actors are related to each other through these relationships. In addition, as business relationships are connected, one relationship will have an impact on the other relationship (Walter et al., 2001).

Inter-organizational studies use different terms to describe the market. Markets are defined as a more integrated organizational form than the market. However, markets are seen as more loosely coupled than the organization. The network form of organization has been coined as an inter-organizational network, strategic network, organizational network, business network, value network or a value net, with varying definitions. In recent years, studies have started utilizing the concept of business ecosystem. The ecosystem approach includes a broader range of relevant value creating actors, than the typical definitions of a business network (Frow et al., 2016). Aarikka-Stenroos and Ritala (2017) define ecosystem as "*a co-evolutionary business system of actors, technologies, and institutions*", where actors consist of the end-users, customers and user communities, developers and research organizations, competitors, and complementors, as well as institutional actors (ibid.). To create an attractive CE ecosystem, we need to understand and map the interplay between the actors, resources and activities, e.g. how actors create and appropriate value by utilizing variety of activities that take place in company, relational, and ecosystem levels. This is important when building systems and capabilities for sustainable ecosystems.

RESEARCH DESIGN AND DATA COLLECTION

The empirical part of this working paper reports on a pilot study connected to a larger research project, which started during the spring 2017[2]. In this paper, we apply a single case study (Yin, 1994) to conceptualize the CE ecosystem. The data consists of thematic and semi-structured interviews with the focal actors of the ecosystem (see Table 1).

Table 1. Data collection methods.

Thematic interview	Waste incinerator	CEO	20.6.2017	2 hours
Thematic interview	Waste incinerator	CEO	22.2.2018	1,5hours
Semi-structured interview	Waste incinerator	CEO	16.3.2018	2,5hours
Thematic interview	Waste incinerator Waste management company Company managing special and hazardous waste	CEO CEO CEO, Chief Operating Officer	6.4.2018	2 hours

As the unit of analysis, the present study will use 1) the ecosystem, 2) relationships between the actors, and then 3) the actors. The waste management company was chosen as a focal company because it is located at the end of the linear economy path. Furthermore, waste management companies are seen as forerunners in CE, and in the context of our study, the role of waste management companies in transition towards CE becomes important. Further, focusing on how these companies interpret their roles within the traditional 'take-make-waste' system could provide important insights into the transition process and reveal gaps in network building for moving up the waste management hierarchy.

[2] SHARE - Industry sharing platform for boosting transition towards CE, financed by Business-Finland.

WASTE MANAGEMENT AS THE EMPIRICAL CONTEXT OF THE STUDY

The industrial revolution accelerated the manufacturing of products with the explicit purpose of disposal after use, also referred to as planned obsolesce, which has played a part in normalizing a throwaway-mindset leading to linear consumption behaviour (Leider and Rashid, 2016). The waste we generate is perhaps the most striking and visual manifestation of this behaviour and in that sense, perhaps, it is fitting that waste management becomes the most important arena for initiating discussions about CE. It is not surprising that whenever governments around the world look at tackling issues relating to environmental pollution and landfills, it is waste that they turn their focus on (Leider and Rashid, 2016).

Our empirical study within the context of waste management offers an interesting opportunity to understand the issues around waste, how CE is understood in the present system and in what way this understanding is instigating managers to think about building new strategic networks for moving up the CE value chain. More precisely, we focus on a waste management ecosystem from a waste incinerator (WI) point of view by analyzing its CE related activities within the ecosystem. In the modern waste management ecosystems, the use of incinerators is among the "last" phase of waste management value chain, where the non-recyclable waste is incinerated to produce energy.

In the EU policy and legislation on waste, the waste hierarchy is key to the transition to CE and the primary purpose of this classification is to establish an order of priority that minimizes environmental impact and optimizes resource efficiency in waste prevention and management (see fig 1).

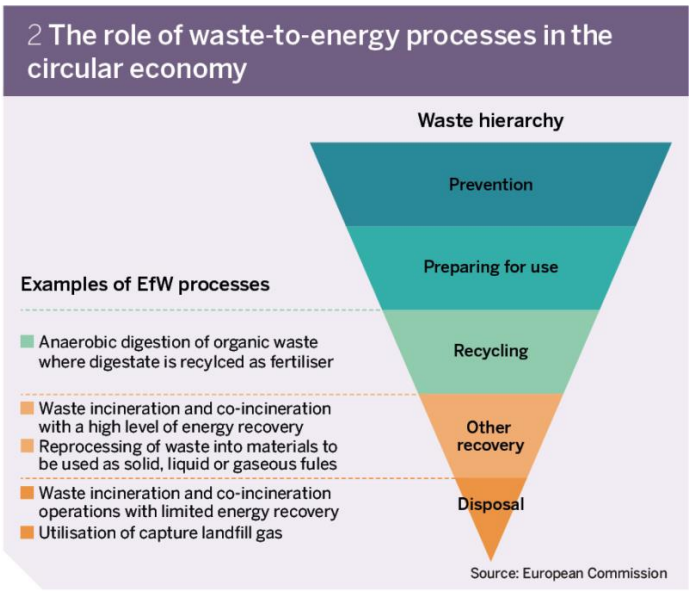

Fig 1: The Waste Hierarchy as indicated by the EU

It is important to note that WIs in general have limited impact on CE outcomes due their position in the value chain, and additionally they are "threatened" by increased taxation when the CE objectives related to decreased amount of waste are not met. However, their business models are closely linked to increasing the quantity of waste and the amount of energy they can recover from

the process. In this context, the manner in which WIs build and develop their business networks in order to respond to these challenges provides an interesting arena for this study.

PRELIMINARY FINDINGS – CONCEPTUALIZING THE CE ECOSYSTEM

Five local municipal waste management companies established the focal company, the waste management company (WI) in 2013 when the local landfills were closed due to regulation. WI's main function is to convert combustible, non-recyclable, mixed waste to energy with high-energy recovery. The ecosystem of WI consist of multiple key actors including its owners, i.e. municipal waste management companies (WAM1-WAM5), electricity district heating company (EDH), company specialized to hazardous and special waste treatment (SHW), a waste processing company in the Netherlands (NED), the municipality (MUN) where the WI and WAM1 are located, and a regional development company (RDC). Moreover, the ecosystem includes institutions related to national and EU level regulation and policymaking, which are framing and shaping the WI's business environment. In the current study, these institutions are excluded from the analysis. The ecosystem is illustrated in the Figure 2, and described in detail below.

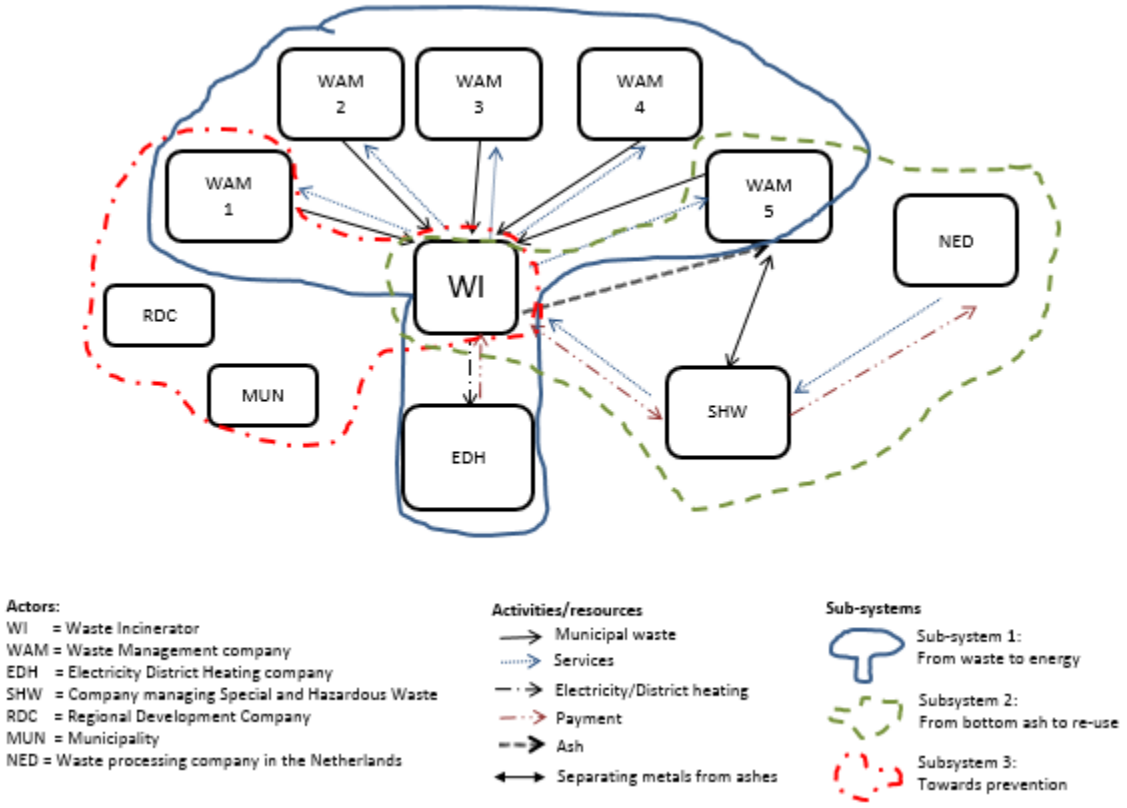

Fig 2. The ecosystem and sub-systems of the WI.

In our analysis, we identified three different sub-systems, which are closely linked to CE. Next, we will illustrate WI's ecosystem within waste management context, and describe how it relates to the concept of CE, and more precisely to the EU Waste Hierarchy (Figure 1).

Sub-system 1: From waste to energy (WI – WAM1-WAM5 – EDH)

The first sub-system consists of the WI's main business, i.e. *recovering* energy from waste. The network needed to complete this activity consists of the WI, its owners (WAM1-WAM5), and electric district heating company (EDH). WI provides incineration services to WAMs, and the WAMs' role is to provide waste to WI. The relationship between WI and WAMS can be described as formal and contract based with mutual dependencies, because the WAMs have a regulated responsibility to take care of municipal waste management within their geographical areas, whereas WI depends on the WAMs as waste sources. As pointed out by WI's CEO, "*WI's function is to provide efficient, cost effective and environmentally friendly incinerating services for its owners*".

EDH is a local utility company, and its core functions include electricity and district heating sales and distribution. As an output of the incineration process, WI produces electricity and district heating from steam, and sells it to EDH, based on the EDH's needs. The relationship between the WI and WAM1-WAM5 can be described as formal and contract based with mutual dependencies: WI provides approximately 30% of all the district heating delivered by EDH, and EDH is the WI's only customer regarding steam-based energy.

Currently, the network related to waste incineration and energy recovery activity is stable and well-functioning. Ruled strictly by the law, WI can incinerate only small amount of waste that originates from other municipal waste management companies than WAM1-WAM5. However, this "additional" waste comes through WAM1-WAM5, and the WI does not interact directly with other municipal waste companies. Thus, the quantity of external waste WI can incinerate is governed by law and organized by its owners.

While efficient energy recovery from waste can be considered as accepted and even favored option to get rid of non-recyclable municipal waste in the current waste management ecosystems, the current situation does not fulfill completely the CE principles. In order to improve the CE implementation means that the quantity of the incinerated waste should continue to decrease over a period. While the drastic drop in waste quantity is not probably going to happen in the near future, the possibility of over capacity of waste incinerators at regional level in the long term should be taken into account. This would require a close collaboration between local waste management companies, waste incinerators as well as policy makers, to estimate the optimal capacity for incinerators. From the individual WI point of view, there probably will be a need to re-think how the network should be re-configured to ensure they have access to sufficient waste flows in the future, while developing innovative new business models to create alternative revenue sources.

Sub-system 2: From bottom ash to re-use (WI – SHV –WAM5- NED)

In the sub-system 2, the bottom ash (the environmentally harmful outcome of incinerated municipal waste when located to landfills) is processed to separate re-usable metals, minerals, and road construction material. Sub-system 2 aims at subsidiary levels of waste hierarchy, mainly to *recycling and re-using* of waste from incineration process in the EU Waste Hierarchy.

This sub-system consists of four actors, including WI, SHW, NED and WAM5. WAM5 receives and stores the bottom ash provided by WI. SHW is a company that manages special and hazardous waste. SHW is located approximately 400 kilometers from WI and the other ecosystem actors. SHW tries to invent different kinds of products and new use-context for bottom ash. SHW owns a removable equipment that is used to separate the valuable ingredients from the bottom ash. Once a year SHW brings this equipment to WAM5's premises to process the bottom ash. SHW is not able to handle the process totally by itself, and part of the processed bottom ash is sent to the NED in Netherlands for further procession. When the process is completed, WI receives a payment from SHW from the metals and minerals that are of high value. However, WI has to pay SHW for the ash procession services. Currently, the costs are higher than the payment received from the separated metals and minerals. The role of WAM5 is mainly to store the bottom ash.

This subsystem has been functioning for a couple of years, and as stated above, it is not yet profitable business for WI for three main reasons, First, the amount of the valuable ingredients of WI's bottom ash is relatively small. Second, the quantity of bottom ash is so small that WI stores it for one year before forwarding it to SHW for processing. Third, the separation process itself is not yet optimal, because part of the bottom ash travels to and returns from the Netherlands, which creates costs and environmental impacts. Moreover, the sub-system 2 does not support the idea of locality. While our pilot data does not include yet SHW interview, we speculate that SHW would need larger quantities of bottom ash in order to invest on more complete technology. From the network configuration perspective, it would require most probably the business commitment from several WIs as bottom ash providers as well as the byers of their processing services to manage the risk related to the investments.

Sub-system 3: Towards prevention (WI – WAM1 – RDC – MUN)

The third sub-system reveals an initiative and ambition that WI has towards CE. This initiative aims at building a CE cluster in an industrial area with close proximity to WI and WAM1. The initiative is put forward in a form of a development project, and it consists of loose relationships between WI, WAM1, RDC and MUN. From CE perspective, this project can be linked to the *prevention* principle in Waste Hierarchy, where the companies from different industries would form symbiosis and close loops what comes to material flows between them.

MUN has an important role in this project as a lot provider. Currently it has appointed 11 lots where companies can build their premises and runt their business. RDC is the responsible executor of the project, and its role is to collect and analyze data in order to understand current material flows within a certain geographical area. Moreover, its task is to bring together experts in different fields, to produce marketing material, and to contact, attract and engage companies to establish their business in the lots provided by MUN. Additionally, RDC is actively in touch with the local university in order to reach a broader view and to produce knowledge in form of thesis work. WAM1 and WI are part of the project's steering group. WI has an informal relationship to RDC, where the WI's CEO provides its knowledge and ideas to RDC, and organize meetings with different actors to move the project towards its goal. Moreover, WI shares ideas about the cluster through informal relationship with the local university.

Currently, the progress of the project and the development of the CE cluster depends mainly on RDC. However, the CEO of WI clearly states that the current activities are not enough to drive the

project. To proceed with the project would require more active and intensive collaboration with different actors including education institutions, regional development organization, and municipality. Importantly, it would also require dedicated financial resources and the employment of 1-2 persons whose main task would be dedicated for the project – building the network, and a concept that can be used in marketing purposes.

CONCLUSION AND FURTHER RESEARCH

In our empirical pilot study, we have conceptualized the ecosystem and sub-systems related to waste management from a Finnish waste management company's perspective. Our analyses relates the activities in the sub-systems to the waste hierarchy, and reveals how the focal firm either conducts or explores new CE related opportunities in three different levels: *recovering energy* from waste, *recycling and re-use* of waste, and *preventing* waste. From a focal firm perspective, such exploration requires innovative thinking and ability to re-think own position and value creation logic in the ecosystem. In general, our results highlight the necessity of exploring and building new value propositions across actors within ecosystems, and challenges related to the process. Especially the value creation within the new relationship constellations as well as the ability to engage new actors pertaining accurate resources, seems to be crucial, but at the same time challenging.

Encouraged by the preliminary findings, we will continue our reach by exploring more thoroughly the waste management ecosystem. We will focus especially on innovative value propositions, and how actors across ecosystem interact and build new kinds of relationships in order to create value in CE related business opportunities.

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