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Value co-creation in circular economy business ecosystem

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ABSTRACT

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The purpose of the study is to research how different actors co-create and perceive value in circular economy business system. The value dimensions are categorized in line with triple bottom line in social, environmental and economical benefits.

The study is conducted as qualitative study with case approach. The data is collected by interviewing the actors in the process of CE business ecosystem. The interpretations of the value co-creation activities and value perception have been done according to the interviews. The actors experience that the value co-creation in the circular economy process creates value outcomes for them.

In value co-creation the most significant value co-creation activity is the collaboration between the actors. The collaboration includes activities that enhanced the value co-creation process activities such as learning, information sharing and improving the collaboration. In the results, it is shown that the economic value outcomes are most valuable. Environmental benefits were seen as a necessary response to current responsibility reporting requirements and public accountability. Additionally, it was expected that environmental benefits create cost savings. Social value benefits were recognized but the significance was perceived as minor.

TIIVISTELMÄ

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Tutkielman tarkoitus on kartoittaa, miten eri toimijat yhteisluovat ja kokevat arvoa kiertotalousprosessi ekosysteemissä. Arvoelementit on kategorisoitu triple bottom linan mukaisesti, eli sosiaalisiin, ympäristöllisiin ja taloudellisiin hyötyihin.

Tutkielma on laadullinen ja toteuttu case-tutkimuksena ja aineisto kerättiin haastattelemalla prosessin toimijoita. Haastatteluiden perusteella on tehty tulokset toimijoiden arvon yhteisluontiaktiiviteeteista ja arvon kokemisesta. Eri toimijat näkevät, että kiertotalousprosessi luo heille arvohyötyjä.

Arvon yhteisluonnissa merkittävin aktiviteetti oli yhteistyö toimijoiden välillä. Yhteistyö sisälsi aktiviteetteja, jotka tehostavat arvon yhteisluontia, kuten oppimista, tiedon jakamista, yhteistyön syventämistä. Tuloksista käy ilmi, että taloudellisia hyötyjä arvostetaan eniten. Ympäristölliset arvohyödyt koettiin välttämättömänä vastineena nykyhetken raportointivaatimuksiin ja yleisön vastuullisuusvaatimuksiin. Ympäristöhyötyjen odotettiin myös tuovan taloudellisia säästöjä tai tuloksia liiketoimintaan. Sosiaalisia hyötyjä myös tunnustettiin, mutta niiden merkitys koettiin vähäiseksi.

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In Helsinki, 28.8.2019

Elina Könkkölä

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1 Introduction

In this thesis, the aim is to research how the value is co-created and perceived by the main actors in a circular economy (CE) ecosystem. The argument is that the recognized actors co-create and perceive diverse value in the circular economy ecosystem and the aim is to identify the multiple value outcomes and benefits that are co-created and perceived and the value outcomes that might be missed.

1.1 Background

The investigation Global Footprint Network states that if everybody lived like the average EU resident, there would be a need for 2,8 planet Earths to provide enough resources for the current production of human activity. The date when the humanity's demand of the natural resources exceeds the Earth's capacity is marked every year more and more early. The date is called the ecological overshoot day. Therefore, the natural ecosystem is depleted faster than it can be renewed. (Vandermaesen & Humphries, 2019) In fall 2018 the Intergovernmental Panel on Climate Change's (IPCC) report was released and it stated that the global warming cannot be stopped but it can be reduced to only 1,5 °C compared to pre-industrial period, if radical changes are conducted in our consumption and production (IPCC report, 2018).

The improved awareness of the reached limits of Earths capacity utilized for linear economy settles the need for new design of the use of natural resources. The new design, circular economy, attempts to more efficient use of resources and to limit the negative impact on the environment. Circular economy challenges the linear economy model in which more production requires more resources that are extracted from the nature and what is more, more waste returned to environment. On the other hand, circular economy aims to redesign resources from waste and decrease the use of virgin raw materials. (Bonciu, 2014)

All in all, the resource-scarcity risks have been recognized recently and multiple research have been conducted regarding the circular economy (Kok, Wurpel, & Wolde, 2013). Compared to linear economy, circularity changes the way of how value is generated in companies (Pieroni, McAloone & Pigossoet 2019). Circular economy aims to redesign the usage of the virgin raw materials as Korhonen, Honkasalo & Seppälä (2018, 39) state:

“Once a raw material is extracted, refined and produced with the usual costs, it makes economic and business sense to use the value produced as long as possible, i.e., keep the product function/service and use-value in economic circulation as long as possible.”

Even though the CE is a relatively young field, multiple possibilities and benefits of the CE have been noted, thus CE is a highly topical phenomena at the moment. The institutions, such as the European Union (EU) and other national environmental institutions, have launched programs to find fruitful solutions from the industries and aim to support the companies, municipalities and other users to implement the circular economy business models (Ellen MacArthur, 2015).

Hence, the concept of circular economy is currently discussed in local, national and European level (Commission European, 2014; Sitra, 2016; Syke, 2018). Sitra presents the local projects that are going on regarding the CE around Finland. Finnish environmental institutions take part of diverse national research projects to contribute CE solutions in different business sectors (Syke, 2018). The Commission of the EU emphasizes on facilitating the legislation and finding ways to encourage companies to implement circular economy applications throughout the European Union. For example, commission works with the stakeholders to develop framework that enables partners to implement CE activities and enhance the resource efficiency at the EU (Commission European, 2014). Therefore, it is argued that valuable CE processes require that firms move to do the business in network-centric operational logic (Pieroni et al. 2019).

The report of Ellen MacArthur (2016) provides estimates of the benefits that the CE applications have potential to generate. Those include long-term economic, social and environmental benefits for organizations, groups, individuals, both globally and locally. According to Sitra's investigation, the growth potential of the CE for the Finnish national economy is as much as 2,5 billion euros per year until 2030 (Sitra, 2014). The report of Sitra (2016) evaluates the possibilities of the circular economy in the economic, environmental and social level. On the broad picture, the circular economy is estimated to reduce the carbon dioxide emissions for as much as 296 million tons in the EU by 2050 (Sitra, 2018). The circular economy projects aim to achieve the ultimate objectives of the CE that is ensuring sustained economic development, minimize environmental impact and maximize social welfare (Commission European, 2018).

1.2 Research gap

A plethora of studies have been conducted in China regarding implementation, drivers and barriers of circular economy (eg. Feng & Yan 2007, Geng, Fu, Sarkis & Xue, 2012). Since that the interest towards the CE has spread over the world and numerous industries, such as waste management and energy businesses, aim to implement circular policies in their business (eg. Hellström, Tsvetkova, Gustafsson, & Wikström, 2015; Lieder & Rashid, 2016). On the existing literature, the CE has been researched in different perspectives, for example: CE in supply chain (Govindan & Hasanagic, 2018; Geissdoerfer, Morioka, Carvalho & Evans, 2018), policy perspective (Commission European, 2014), business model perspective (Ranta, Aarikka-Stenroos, Mäkinen, 2018b) and network management perspective (Korhonen et al. 2018; Aminoff, Valkokari, & Kettunen, 2016). However, in the earlier studies the CE is not fully studied from the ecosystem perspective hence this study aims to fulfill this gap.

As mentioned before, circular economy is relatively novel solution for the resource scarcity. Anyway, stakeholders look for concrete value proposition from new

solutions (Lepak, Smith, & Taylor, 2017). Ellen Mac Arthur (2016) argue that there is a possibility for economic development that circular economy practices provide for the stakeholders involved in CE networks. However, Geissdoerfer, Savageta, Bocken & Hultinkb (2017) write that the actual impacts of the CE initiatives are appropriate to be analyzed through how the initiatives perform against the triple bottom line and what are the consequences for the business. Hence, the value outcomes of the CE value creation are divided in this study according to the triple bottom line -approach which includes the value dimensions of economic, environmental and social characteristics (Elkington, 1997) to gain holistic view of the outcomes.

The circular economy aims to perform the total net value by maximizing positive value and minimizing negative value (Zhu, 2013). Maximizing value to the stakeholders is not straightforward as there occurs value that is missed the in the CE networks (Aminoff et al. 2016). Ranta, Aarikka-Stenroos, Ritala, Mäkinen (2018a) address that in some cases, positive value can be missed in the CE application if the value of recyclable is lower than the cost of producing the recyclable. The study conducted by Iacovidoua, Millward-Hopkinsa, Busch, Purnella, Costas, John, Hahladakisa, Zwirnerc & Brownc (2017) study recognize the value created, destroyed and distributed to the stakeholders in pathway to circular economy but a *comprehensive understanding of what kind of value might be missed has not been built in the circular economy context* and this study aims to fulfill the gap.

1.3 Purpose of the study and research questions

The purpose of this study to research how the value is co-created and perceived by diverse stakeholders through CE process in one industry ecosystem. More precisely, the aim is to study how different stakeholders co-create and perceive value in such network. In this study the value dimensions are understood through triple bottom line, which covers environmental, social and economic value elements. To conclude, value co-creation and perception by the stakeholders is analyzed

through how they produce value in triple bottom line. Additionally, there is an aim to understand what value might be missed in value co-creation process in order to better understand the nature of value co-creation in circular economy.

Therefore, to sum up the purpose of the thesis, this study aims to answer the following research questions:

RQ1: How different actors co-create value in the CE ecosystem?

RQ2: How different actors perceive diverse value outcomes?

The sub-question is:

SQ1: What expected value outcomes are missed?

1.4 Theoretical framework of the study

The framework of the research aims to connect the concepts of circular economy ecosystem, value co-creation and perceived value in the circular economy ecosystem context to gain holistic view of how the value is co-created and perceived in a CE network. The research framework is presented in Figure 1. The framework deals with value which is understood as social, environmental and economic dimensions.

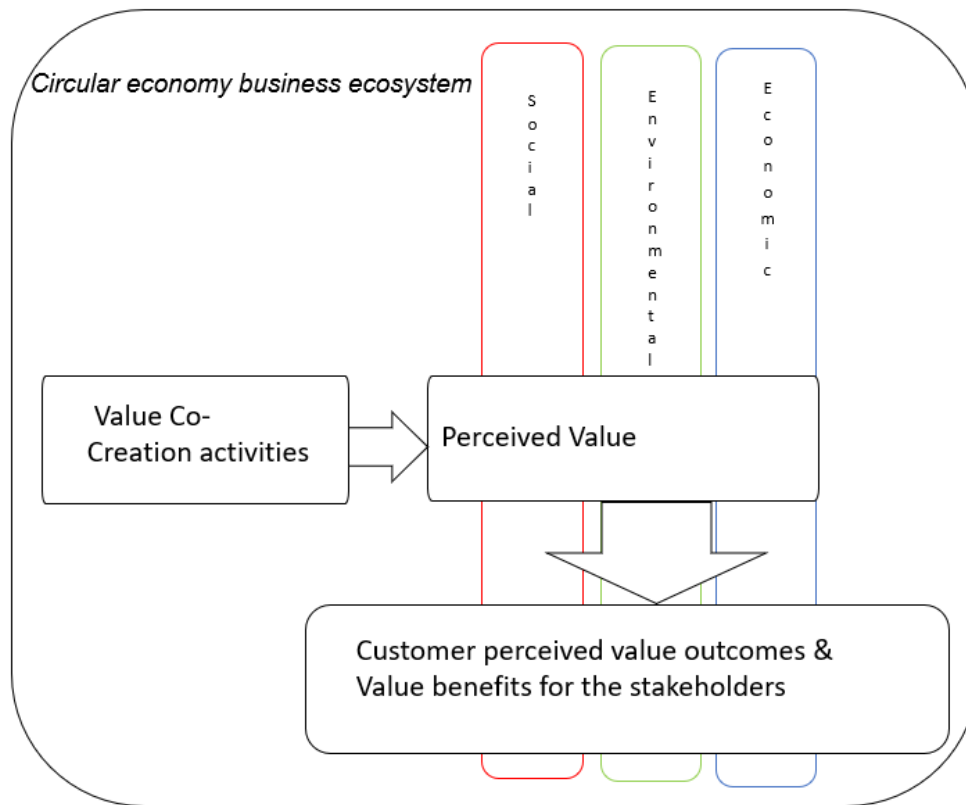


Figure 1: Theoretical framework of the study

The framework aims to find out the outcomes that are produced through the value co-creation and then perceived by the actors in the ecosystem. Hence, the aim is to identify the theoretical attributes that are the core for creating the outcomes.

1.5 Definitions of the key concepts

The key concepts of this thesis are defined in the table below (Table 1). The concepts are defined according to the main authors of the literature. The concepts include the main topics of the thesis and there are altogether six concepts that are circular economy, triple bottom line, value co-creation, customer value perceived, value missed and business ecosystem.

Table 1: Definitions of the key concepts of the thesis

Concept	Definition	Author(s)
Circular economy	A regenerative system in which waste and resource input, energy leakage and emissions are reduced by narrowing, slowing and closing energy and material loops. Can be accomplished by through maintenance, reuse, repair, recycling, remanufacturing and refurbishing.	Geissdoerfer et al. 2017; Ellen MacArthur, 2013
Triple bottom line	Dimensions of economic prosperity, environmental quality and social justice. Shortly conceptualized economic, environmental and social dimensions to business.	Elkington, 1997
Value co-creation	Value co-creation is a process where value is created through open dialogue with the customers and other stakeholders.	Saarijärvi, Kannan & Kuusela, 2013
Customer value perceived	The difference between the benefits and the sacrifices customer perceives from the product or service.	Ravald & Grönroos, 1996
Value missed	Stakeholders activity when they fail to capitalize on existing asset, resources or capabilities.	Aminoff et al. 2016
Business ecosystem	Multilateral group of partners that has interaction between each other to create materialization of value proposition.	Adner, 2016

1.6 Research method and data

The research is conducted as a qualitative research. Circular economy networks are complex real-life structures that include different actors with diverse experiences. Qualitative research does not aim to statistical generalization instead it aims to understand and describe the complex phenomena and provide a theoretically reasonable interpretation (Tuomi & Sarajärvi, 2018). Additionally, qualitative research allows study the object comprehensively (Hirsjärvi, Remes & Sajavaara 2007) and thereby to establish theoretical picture of the current state of CE phenomenon in this study.

Qualitative research method is complemented with case study approach. Case study approach enables the researcher to answer questions like “how” and “why” simultaneously considering how a phenomenon is influenced by context within it is situated (Baxter & Jack, 2008). Because CE is quite novel and context specific phenomenon the case study offers possibility to accomplish the understanding of CE business network specific context and its specialties. The data is collected from different actors that are represented at a CE network by interviews. The interviews were conducted as semi-structured interviews.

1.7 Limitations

The thesis focuses on one theoretical circular economy process in a one industry. Also, the focus is on the recycling of phosphorus and how that would benefit the ecosystem. The thesis examines the apparent actors that are part of the ecosystem but additionally aims to recognized actors that are necessary for such ecosystem to work and benefits that they are expected to gain. The actors that are aimed to recognized among the ecosystem are limited to actors directly related to ecosystem and actors that occur in the literature. In other words, all kinds of actors that might be somehow related to ecosystem are not noted and limited from this study because otherwise there would be excessively of actors.

Value co-creation is handled as the activities that the actors have between each other. Hence, the conditions occurring from outside the actors are not analyzed. The value perception is understood by the triple bottom line theorem and therefore the outcomes are categorized as social, environmental and economic benefits. Therefore, other types of possible beneficial attributes are restricted from the research.

1.8 Structure of the thesis

The study aims to attain an understanding of how value is co-created in circular economy network. So, in the first chapter the background and the research questions are represented, and theoretical framework of the study is formed. The framework shows the connections of the main concepts in the research context, in other words the CE network context. The second chapter is the theory chapter. The concept of value co-creation is handled. The concept of circular economy is presented more comprehensively. Also, the three different value dimensions that exist in CE literature are handled. Lastly, in the second chapter value perception is noted.

In the third chapter the case study is described. More closely, the actors of the ecosystem are depicted. To gain understanding of the topic the data is analyzed with qualitative case study method. The empirical results are analyzed in the chapter four. In the fifth and last chapter of the thesis the conclusions are drawn to accomplish the understanding of the objective. In other words, the results are discussed, and the research questions are answered. Finally, suggestions for the future research are proposed.

2 Value co-creation in the context of circular economy ecosystem

The following part of this thesis moves on to describe in greater detail the definition and objectives of value co-creation in circular economy ecosystem context. Additionally, it is noted how circular economy model differs from the traditional linear business model. Also, the knowledge of the value dimensions is gained and the relevant actors and their role in circular economy network are identified. Finally, the customer perceived value is handled in the last part of this chapter.

2.1 Value co-creation

Value is not anymore created by firms acting by themselves, but the paradigm has changed more towards acting with firms external to the firm (Beattie & Smith, 2013). Earlier the concept of value creation was seen as a value which occurred inside the firm and consumers were outside of the firm (Prahalad & Ramaswamy, 2004). The concept of value co-creation tackles the traditional view of how the value is transferred from the company to the customer (Prahalad & Ramaswamy, 2002).

In the literature the concept of value co-creation is addressed to have multifaceted nature (eg. Jaakkola & Hakanen, 2013). Prahalad & Ramaswamy (2002) introduce the definition of value co-creation: it means that a company creates value with its consumers through open dialogue. This requires that the company actively tries to understand the consumer's interests and needs they set to the product or offer. To gain more comprehensive view to the topic, Prahalad & Ramaswamy (2004) describe value co-creation as joint creation of value, because it involves the parties that experience the value. Value co - creation has evolved, and multiple approaches occur nowadays (Saarijärvi et al. 2013). The concept of value co-creation is distinguished from the concept of value creation through its applications that are utilized in value co-creation activities: for example, exchange, production and use of the goods (Prahalad & Ramaswamy, 2018). The concept of value co-creation is conceptualized in this study as continuous dialogue and innovating environments of

experience for new co-creation experience. The important factor is that the offer is co-constructible so that the offer fits to one's context (Prahalad & Ramaswamy (2004).

Saarijärvi et al. (2013) dismantle the term "value co-creation" and clarifies the nuances of the concept into three phases (Figure 2). The first phase of the concept aims to put emphasis on the question if the value creation is understood as customer value, firm value or both and for whom this value is created. Second phase "co" concentrates on the actors that are part of the value co-creation process. There are different actors that are put together to enhance the value co-creation. Therefore, it is important to recognize who are involved in joint creation of value as a resource and what resources are deployed. Finally, the phase three aims to the following: *"Creation refers to the process of integrating different resources from different actors in order to actualize their value potential"* (2013, 11). In other words, "creation" perceives the activity provided by the actors and integrates them into value creation process through mechanisms. Mechanisms can be firm-, customer- or community - led activities such as co-development, co-design or co-distribution. Additional resources are provided through the actors and offered to be used by other actors. (Saarijärvi et al. 2013)

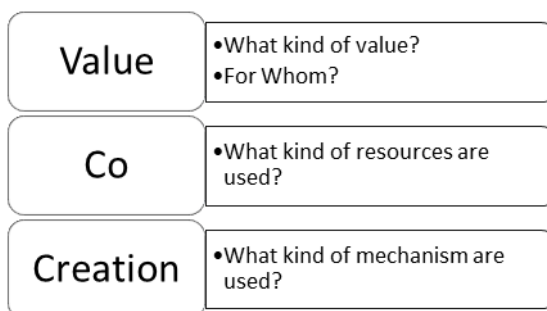


Figure 2: Value co-creation dimensions according to Saarijärvi et al. (2013)

Prahalad & Ramaswamy (2002) address the building blocks that companies should recognize when aiming to build value co - creation culture in their business. There are four building blocks that are critical for value co-creation. The blocks are dialog, access, information of risk and goods of the services and transparency of

information (Prahalad & Ramaswamy 2002). Dialog means sharing the information and more precisely creating understanding between the company and consumer. Most importantly dialogue allows consumers to present their view of value creation. When it comes to access, for customers multiple access points of exchange enhances companies' ability to broaden their view of the opportunities for creation of value and good experiences. As consumers are involved in value co-creation, they will demand information of the risks of goods and services. Last, transparency of information is necessary to create trust between the counterparts (Prahalad & Ramaswamy 2002)

As Parahalad and Ramaswamy (2002), authors Gummensson and Mele (2010) note similar issues significant for value co-creation process (Figure 3). In the figure 3 the importance of resource integration and interaction is highlighted. Anyway, the figure shows that value co-creation occurs through integration and interaction in accordance with needs, expectations and capabilities. According to Gummensson & Mele (2010, 193) there are different forms of resource integrations which are categorized as following: complementary, redundancy, mixing.

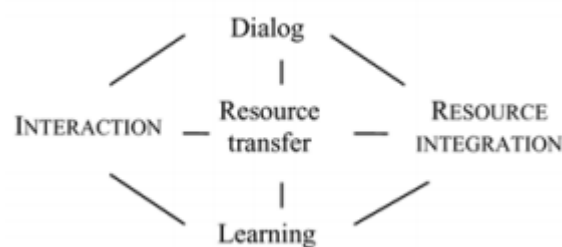


Figure 3: Value co-creation through integration in the network according to Gummensson & Mele (2010)

In the latest literature related to value co-creation, the interaction is emphasized (Prahalad & Ramaswamy 2018). Authors note that the networked interactions are the core for the value co-creation. They address that the digitalization with rapidly evolving interfaces based on various applications, machine learning, artificial intelligence and cloud computing brings heterogeneous relations that generate

multitude value creating environments for the stakeholders. Additionally, according to Gummensson & Mele (2010) interaction gives access to process of socialization which allows actors to evaluate and compare resources to potential contribution to value creation. Additionally, interaction with the consumers provides fruitful opportunities to companies, hence the awareness of the opportunities should exist (Prahalad & Ramaswamy 2002).

Value co-creation processes involve number of diverse set of stakeholders. The stakeholders form a network and in such network the resources are integrated and applied by the interaction between the stakeholders (Lusch, Vargo & Tanniru, 2010; Jaakkola & Hakanen, 2013). Multiple stakeholders are contributing to value and simultaneously expecting to be offered value in return in the networks (Gummensson & Mele 2010). Each stakeholder has an impact on the level of reuse and circularity of the natural resources, which requires that the actions need to be coordinated to result positive benefits (Bajada & Brown, 2018). Lusch et al. (2010) state that firms have to recognize and work for value creation in the network context because firms are integrating and transforming micro-specialized competencies into value propositions with potential partners of the market. Additionally, Reypens, Lievens & Blazevik (2016) note that it is important that the organizations that are part of multi-stakeholder network, possess with a clear understanding of value outcome types that can be created and perceived. In the circular economy network existing and new actors will each have to clarify their own role and potential for the value creation (Aminoff et al. 2016).

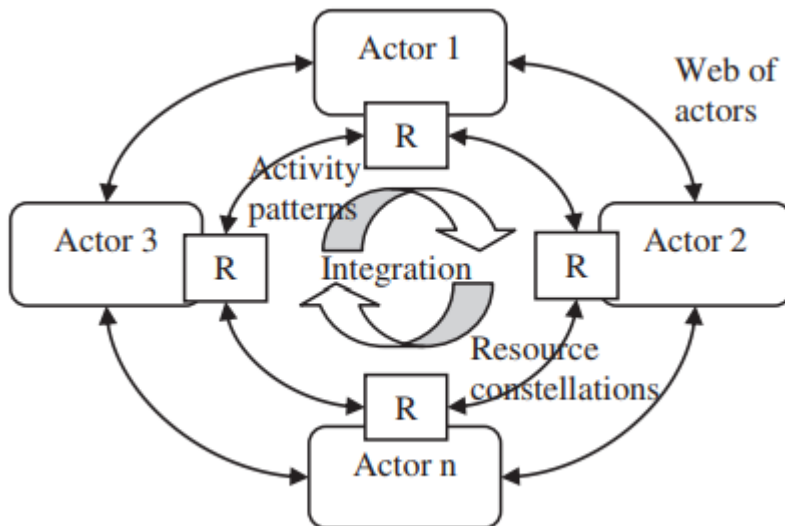


Figure 4: Value creation at network level according to Jaakkola & Hakanen (2013)

In the Figure 4 actors possess with resources and activities which are integrated to co-create value for the network. Actors control the resources, but to become valuable, the resources need to be integrated (Vargo & Lusch, 2006). Additionally, Jaakkola & Hakanen (2013) note that individual actors' value processes impact on value co-creation at the whole network level. To facilitate the integration of more intangible resources, the parties' trust between each other is beneficial. Gummenssons & Mele (2010) address that interaction between the actors is precedent for resource integration because the activities will become valuable in the end. More precisely, actors are the resource integrators who enhance the other actors to become part of the network by the culture and social process.

2.2 Value co-creation in business ecosystem

Business ecosystem is related to the perspective of value orientation for company networks. In a way, ecosystem points out how the business is organized. Business ecosystem contains number of stakeholders which can be classified according to their roles: suppliers, competitors and customers. In the end, business ecosystem is formed through transactions between the stakeholders in the value-oriented network. (Adner & Kapoor 2010) Adner and Kapoor (2006) address that the

companies that are members of the ecosystem are able to create value that a single firm could have not created alone. There are different stakeholders which have their role in an ecosystem (Peltola et al. 2016).

When it comes to ecosystem value co-creation in business environment Ben Letaifa (2014) describes three capabilities that are needed in building an ecosystem mindset. The first needed capability is utilizing the ecosystem management. The second is developing social community for the business actions. The third and last needed capability is to embrace the ecosystemic mindset. In practice, value creation among the community members requires close collaboration for developing new technologies and business models or services that are beneficial for the members. Additionally, Reypens et al. (2016) note that for the creation of innovative value diversity among the stakeholders is required, however, too large diversity limits the value creation opportunities.

The aspect of value co-creation in ecosystem has a focus on improving the customer value creation and service provision between the actors (Aarikka-Stenroos & Ritala, 2017). Industrial ecosystems include complex systems which are challenging to coordinate (Tsvekova & Gustafsson, 2012). If the common perspective among the ecosystem is unbalanced, there is a risk that it causes weak value creation processes. Therefore, it is important that the vision is adopted by multiple stakeholders (Ben Letaifa & Reynoso, 2015).

Van der Borgh, Cloudt & Romme (2012) identify two types of value drivers emerging in ecosystems. First, they mention that the ecosystem enables innovation processes of the individual companies. Second, the ecosystem develops the community of innovations. Van der Borgh et al. (2012) state that there are three features of the value creation in the ecosystem. The features are dynamic processes, exchange between the individual companies and the management of the ecosystem. The objectives of the individual companies are heterogeneous, and they aim to be driven by business model, not only by one product. The final value creation feature is the

management which focuses on the growth and viability of the entire ecosystem and therefore the activities of the ecosystem can be seen as business activity.

2.3 Circular economy

This chapter handles the concept of circular economy. The first section presents the development of the concept of CE. The second chapter defines the concept and the value creation mechanisms are represented. Also, the actors in the CE ecosystems are recognized and classified according to the literature.

2.3.1 Development of the definition of circular economy

The term circular economy embodies a multitude of concepts which are represented next. Lieder & Rashid (2016) list theories relevant to circular economy into six themes: transformation of economic structures and business rationales, critical materials and regenerative design, industrial ecology, remanufacturing and closed-loop supply chains, resource conservative manufacturing and governmental CE initiatives. In addition to these theories, there exist the following concepts that are proposed in the literature that embody to development of the CE concept. They are cradle-to-cradle, industrial ecology, natural capitalism, eco-industrial parks and networks and system thinking.

First, the so-called cradle-to-cradle seeks to redesign the systems: “*cradle-to-cradle posits a new way of designing human systems to eliminate conflicts between economic growth and environmental health resulting from poor design and market structure*” (McDonough, Braungart, Anastas & Zimmerman, 2003, 436). Industrial ecology references to the idea that the industrial systems are not viewed in isolation from their surroundings but as a part of it (Lieder & Rashid, 2016). Natural capitalism incorporates that business strategies should be built on much more productive use of natural resources so that the environmental problems can be solved at a profit by eliminating the concept of waste. (Lovins, Lovins & Hawken, 1999). The concepts of eco-industrial parks and networks are related to collaboration areas in which water, energy, information and materials are exchanged in order to minimize

resource use and build sustainable relationships in a certain business area (Winans, Kendall & Deng, 2017). Systems thinking is based on systems that consist of elements, interconnections and a purpose. Systems thinking is used to address the challenges faced in the world (Rammelt & Crisp, 2014). According to a definition provided by Arnold & Wade (2015, 675) systems thinking is defined as following: *“Systems thinking is a set of synergistic analytic skills used to improve the capability of identifying and understanding systems, predicting their behaviors, and devising modifications to them in order to produce desired effects.”*

2.3.2 Definition of circular economy

CE replaces the traditional “take-make-use-dispose” system (Ghisellini, Cialani, & Ulgiati, 2016). In linear system, production and consumption of goods are based on manufacturing from virgin raw materials which are sold as products, used and finally discarded as waste (Figure 5) (Lieder & Rashid, 2016). However, linear system faces challenges as it is one of the major waste generator and environmental pollution results negative influences on natural environment (Murray, Stene & Haynes, 2017). In linear system pollution generation can occur at the stage of resource acquisition, which can be replaced by utilizing CE practices (Murray et al. 2017). Companies have noticed that for more efficient growth the traditional gains are insufficient to generate competitive advantage (Ellen Mac Arthur, 2014).

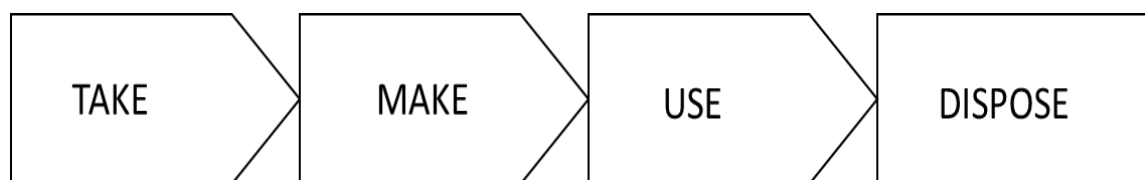


Figure 5: Traditional linear business system

Previous studies mostly define circular economy as an industrial system which is restorative or regenerative by intention and design (Ellen Mac Arthur, 2013). The word circular is related to cycle which can have two meanings: biogeochemical cycles and the recycling of products (Murray et al. 2017). To create value in circular

economy context, materials and products circulate in loops for as long as they provide value and simultaneously materials improve activities that lower the need for virgin raw materials per unit of the produced value (Ranta et al. 2018b). As the materials circulate in loops, it enables keeping the products, materials and components longer in use (Ellen Mac Arthur, 2015). The circulation is presented in the Figure 6 above.

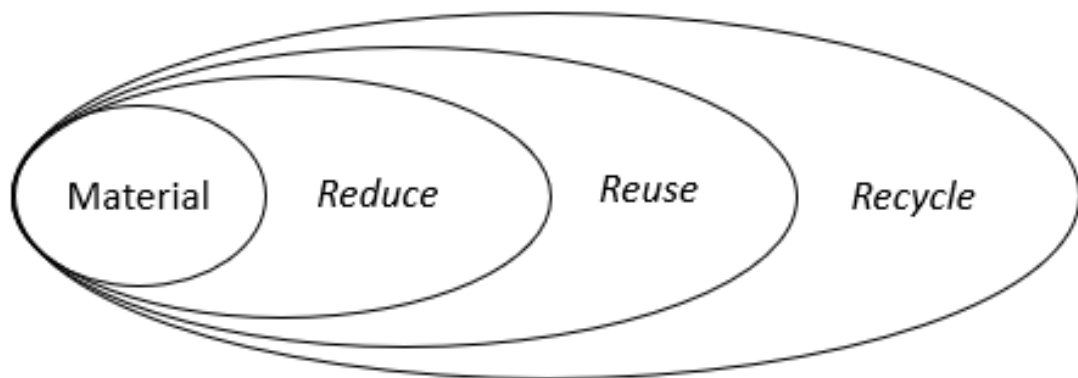


Figure 6: Circular business model

Mechanisms that enable materials to circulate in loops follow 3R principle which are reusing, recycling, and reducing resource use (Ghisellini et al. 2016). Ranta et al. (2018) note that adoption of the 3R principles enable organizations to generate value and revenues in a business context. The aim of the 3R principle is ecological circulation of natural materials: *reuse* refers to reuse the material or product as other facilitation after its initial consumption instead of allowing it to become toxic waste (Feng & Yan, 2007). *Recycling* means the use of a material many times as its primary use rather than one-time use (Houshyar, Houshyar& Sulaiman, 2014). The third principle *reducing resource use* means that the production and consumption of raw materials and energy is planned to increase according to target by reducing pollution (Feng & Yan, 2007).

3R model is completed in the literature with three more principles *recover*, *redesign* and *remanufacture* which is called 6R -model (Aminoff et al. 2016). *Recover* is action to collect reusable products and components and disassemble, sort and clean in the end of usage of the product (Houshyar et al. 2014). *Remanufacturing* is a process where an asset is disassembled and recovered at a component level and after that reusable parts are taken and rebuilt into another product (Ellen Mac Arthur, 2016). The principle of *redesign* involves activity of designing next generation products which use materials, components and resources from recovered products used previously in products (Jawahir & Bradley, 2016).

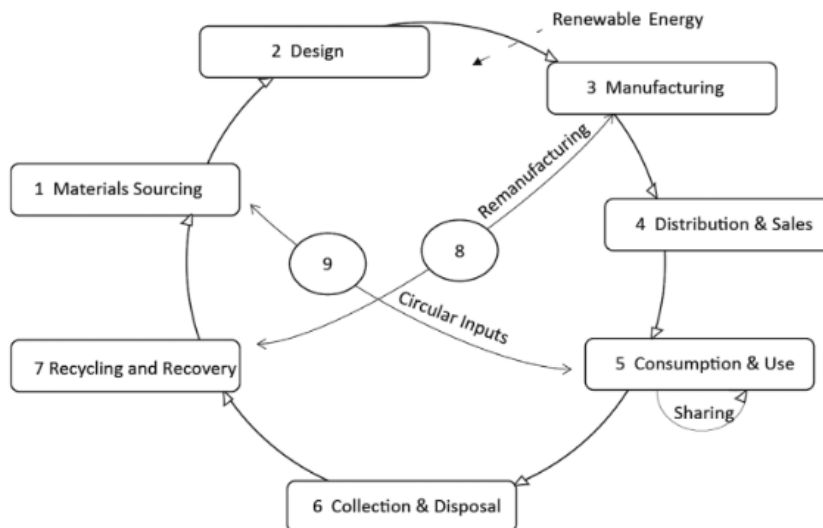


Figure 7: Example of circular activities on manufacturing system (Kalmykova, Sadagopan & Rosado, 2018)

CE promotes continuous economic development and simultaneously decrease the environmental and resource challenges (Zhu, 2013). CE aims to minimize the damage done in resource acquisition by restoring the resources circulating as raw material simultaneously with ensuring that the production process generated as little waste as possible (Murray et al. 2017). The value of the material can be increased in the CE process and Antikainen & Valkokari (2016) explain that CE preserves or even upgrades the value of the materials through services and smart solutions as seen in the Figure 7.

2.3.3 The roles and objectives of the actors in CE

The mechanisms of CE provide value creation opportunities for the companies as well as various other stakeholders. (Ellen Mac Arthur, 2015). Actors in CE context network are diverse and are proposed in several researches. The role of the public sector, such as government, regional authors and different kinds of regulators, is highlighted in the studies (Aminoff et al. 2016, Bajada & Brown, 2018, Manninen et al. 2018). The role of the public institutions and regulators is seen remarkable because waste regulation is strict in Finland and in most areas and CE applications might require modifying for the regulation and policies or licenses from public authorities are required (Manninen et al. 2018, Aminoff et al. 2016). The lack of governmental interest and activity hinders the CE advances and at same time the full benefits of CE are not reached (Ranta et al. 2018a)

Manninen et al. (2018) state that the customer is a key stakeholder in a CE business because customer's role is essential for the business to be vital. Customers perceive the use value and the actual benefits of it (Bocken, Short, Rana & Evans 2013). Additionally, customers play a critical role in performing reuse, recycling and repair because products need to be returned from customers to manufacturer or service supplier (Manninen et al. 2018). Additionally, Manninen et al. (2018) identify potential partners as important stakeholders. Other main stakeholders are universities, the environment and waste management companies (Manninen et al. 2018, Ranta et al. 2018a). Cities are consuming 75% of natural resources globally. At the same time many cities are in a promising stage for handling the structural waste and perceive residual value from material streams. Therefore, cities are evident stakeholders in the circular economy network (Ellen MacArthur, 2016).

Iacovidoua et al. (2017) address that stakeholders can be classified in groups of top – down and bottom – up according to stakeholders' inverse motivation (Figure 8). Top- down includes public institutions such as governmental bodies and policy makers are closely tied to CE as they possess with consciousness about the environmental matters and carry interest of societal benefit of industrial activities. Bottom up – group consists of manufacturing companies which have knowledge about the environmental impacts of the industrial activities.

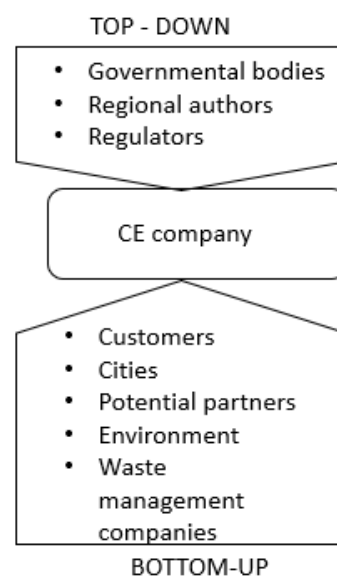


Figure 8: Actors classified into top-down and bottom up categories

Stakeholders have been mapped in sustainability related literature and Bocken et al. 2013 classifies the stakeholders in four groups: customers, network actors, society and environment. Geissdoerfer et al. (2017) note that CE is a subset of sustainable development and circular economy have complementary strategies that can be adopted by the business.

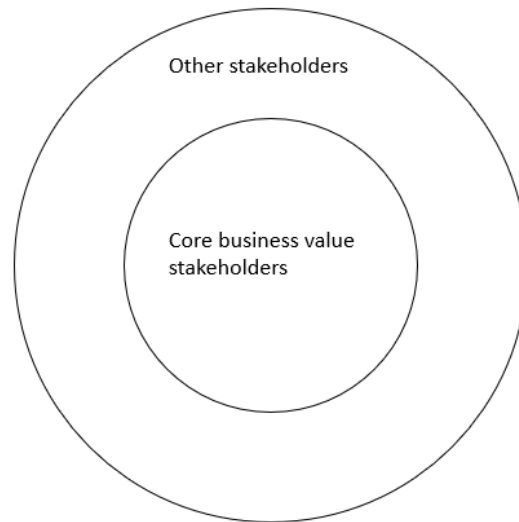


Figure 9: Stakeholders classification according to their role in CE network adapted from Aminoff et al. (2016)

Aminoff et al. (2016) do the classification of the different kinds of stakeholders in manufacturing environment according to the importance of the actor for the CE process in the network. Actors in the network are shared in two main types: actors in the core of the network and other stakeholders (Figure 9). Characteristics of the core actors include activities of defining preliminary value proposition and exchanging multiple dimensions of value with the case company. Such actors can be for example distributors and supplier of raw material. Other stakeholders consist of actors that are not straight linked to value proposition for example government and investors represent the group of other stakeholders.

2.4 Triple bottom line value dimensions in the circular economy context

By implementing circular economy practices companies are looking forward to perceiving diverse kinds of business benefits, typically economic, environmental and social (Ellen MacArthur, 2015). Elkington (1997) created a framework for evaluating the business performance. The model is called as triple bottom line. The framework consists of three value dimensions that are economic, social and

environmental (Elkington, 1997). A more detailed account of the triple bottom line value dimensions in the CE context is given in the following sections.

2.4.1 Economic value dimension

Circular economy is expected to establish economic growth while being environmentally effective (Ellen MacArthur 2015). However, environmental gains reached by improved resource efficiency are offset by overall economic growth (Korhonen et al. 2018). First, according to Richardson (2008) the prerequisite for CE business implementation is that CE should produce revenue and provide a profit margin over the costs. In their article Ranta et al (2018b) research if CE practices produce economic value for the actors. It was found that by replacing virgin materials with cost-efficient recycling materials companies were able to gain economic value. In other words, circular economy can lower the unit cost of a product in the long run (Teekasap, 2018). Korhonen et al. (2018) argue that the increase of CE's production efficiency will decrease the production costs which will eventually be seen in the end products' prices.

Investors are also looking for more sustainable investments and new responsible business image originating from CE attracts investments. (Korhonen et al. 2018). Additionally, the firm's environmental investments enhance the overall public image (Korhonen et al. 2018) and better environmental reputations cause better intangible assets (Konar & Cohen, 2001). By highlighting the company's own investments on more environmental business and the impacts of environmental practices i.e how they improve the quality of life and the condition of environment, the company may attract skilled employees and enhance the quality of the labor input (Azadegan, Golara, Kach & Mousavu, 2018).

In the literature there are recognized activities produced by CE that have potential to improve companies' business growth. Those contain for example new product designs that allow new market opportunities (Korhonen et al. 2018). Other economic

objects refer to improvements of the existing business processes. This includes activities such as reducing emissions control and waste management costs, reduction of the use of raw material in production-consumption system (Korhonen et al. 2018). By these processes there is a possibility to reduce the risks arising from new and strict environmental legislation. Later when the knowledge of building successful circular economy processes is gained, it is also proposed that knowledge export provides growth opportunities for the national economy (Bastein, Roelofs, Rietveld & Hoogendoorn, 2013).

2.4.2 Environmental value dimension

The dimension of environmental value aim to identify the best practices and simultaneously cut the negative impacts of the firms' business on the natural environment and yet contribute the competitive advantage (Christmann, 2000). Hänninen & Karjaluoto (2017) address that the industrial companies who possess strong environmental value operations, also possess a strong environmental image from the stakeholders. However, it is important to understand environmental value as an absolute value and not only find it as a tool to create economic value (Stubbs & Cocklin, 2008).

Environmental impacts of CE practices refer to reduction of the use of virgin raw material which aims to lighten the environments burden. The key to environmental improvement is the renewables-based energy cascades. In other words, the environmental relief is twofold (Figure 10). First, to reduce the use of physical raw materials in productions. Second, the environmental gains are reached by minimize the system's waste and emissions outputs, including CO₂ emissions (Korhonen et al. 2018; Bastein et al. 2013).

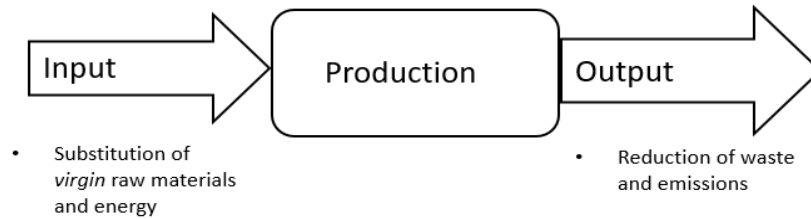


Figure 10: Expected environmental impacts in production process

Manninen et al. (2018) study the characteristics of environmental value creation in circular business. Their framework enables the companies to perceive the environmental value and observe the operations through the environmental lenses. Instead of creating the value directly, the authors argue that circular economy activities create the environmental value to the stakeholders indirectly. Indirect environmental value can be gained from reduced emissions, the use of carbon dioxide neutral fuels and reduction of waste (Korhonen et al. 2018).

In the CE ecosystem the aim is to achieve win-win setting that intends to find a balance between the involved actors' self-interests in order to act cooperatively (Antikainen & Valkokari 2016). Anyway, there might occur conflicts in achieving win-win situation between environmental and economic objectives as Hoffman, Moore, & Wade-Benzoni (1999) discuss about the win-lose and win-win outcomes relationships in their article. "A mixed-motive perspective on the economics versus environment debate". Win-lose model relates to situation where environmental benefits are understood to be able to gain only by imposing an economic cost. Whereas win-win situation is described as mixed-motive situation in which parties are balancing between the economics and environmental overlap, the interests are not only purely competitive or purely cooperative. However, the CE win-win potential is created through emphasizing CE type arrangements eg. recycling or reducing (Korhonen et al. 2018).

2.4.3 Social value dimension

Social value outcomes are less studied in the context of circular economy (Geissdoerfer et al. 2017). However, some social outcomes are identified to enhance the social consequences. Social impacts are understood as consequences of positive or negative state on social endpoints. Social impacts are consequences of social interactions in the context of activity such as production or preventive actions. Preventive actions contain activity such as enhancing safety (UNEP & SETAC, 2009). According to previous studies in the CE context, potential social benefits include improved social relations between industrial sectors and community cooperation (Korhonen et al. 2018). Interaction between the actors of the network establishes the community cooperation which can offer unique social opportunities in the future (Korhonen et al. 2018).

Public health and safety are important social factors to reach according to Gregson and Crang (2015). Public health is upgraded by reduction of the emissions which enhances the air condition of the area and simultaneously improves the living standards (Ghisellini et al. 2016). This is notable for example in the residential districts located close to manufacturing areas. CE can also improve the public environmental awareness (Ghisellini et al. 2016; Korhonen et al. 2018). Other social outcomes include job creation (EllenMacArthur 2015). CE provides employment opportunities by increased economic growth (Ghisellini et al. 2016, Korhonen et al. 2018). Also, the working conditions are possible to create more safety by replacing the raw materials by non-dangerous materials.

2.5 Customer perceived value

Zeithalm (1988) defines perceived value as customer's overall valuation of the product, based on one's perceptions of the benefits that are received, and what sacrifices are given. Other widely used definition is: "The difference between the benefits and the sacrifices including the total costs, both monetary and non-monetary perceived by customers" (Ravald & Grönroos 1996, 21). Non-monetary

costs can include time, effort, energy and conflict which are invested by the customer (Lapierre, 2000).

However, customers cannot be handled as generic group as Ravald & Grönroos (1996) argue that the customer perceived value of an offering is highly situation specific because the perceived benefits are related to customer's position in the value chain. Perceived benefits include service attributes, physical attributes, technical support related to use of the product and quality regarding to these attributes (Ravald & Grönroos 1996). More precisely, benefits of perceived value context can be alternative solutions, product quality, responsiveness, flexibility, technical competence in the industry level (Lapierre, 2010). When it comes to soft elements of the perceived value, noteworthy is that perceived values include also social elements (Anderson, Thomson & Wynstra 2000) and the environmental value perceived by the customer is playing a critical role in value evaluation (Hänninen & Karjaluoto, 2017).

Holbrook's (1996) classifies the different kind of customer values in three dimensions: 1. extrinsic versus intrinsic 2. self-versus other -oriented and finally 3. active versus reactive. By this the author provides the initial basis for customer value perception studies. Coutelle - Briller, Riviere & des Garets (2014) utilizes Holbrook's framework and form a model for recognizing perceived value in B2B – context (Table 2). The framework represents non-cumulative value approach which means that the value mostly deals with the value of the product or service. The approach is considered in the literature for example through Zeithaml's benefit/cost analysis which evaluates the customer's perceived benefits in relation with the sacrifices from the customer. The cumulative approach refers to perspective of "value of relationships" in which every exchange between the seller-buyer accumulates value, which is conceptualized as value co-creation.

Table 2: Analytical framework of the perceived value in a B2B context adapted from Coutelle- Briller et al. (2014)

	VALUE OF THE CLIENT/OFFER INTERACTION		Value of interaction between actors	
	Extrinsic	Intrinsic		
RECIPIENTS OF THE VALUE DELIVERED	Company/ Staff members	<ul style="list-style-type: none"> ▪ Excellence value ▪ Efficiency value ▪ Social value 	<ul style="list-style-type: none"> ▪ Emotional value ▪ Ethical value 	<ul style="list-style-type: none"> ▪ Interactional value
	Organization as a whole	<ul style="list-style-type: none"> ▪ Excellence value ▪ Efficiency value 	<ul style="list-style-type: none"> ▪ Emotional value ▪ Ethical value 	
	External stakeholders	<ul style="list-style-type: none"> ▪ Excellence value ▪ Efficiency value 	<ul style="list-style-type: none"> ▪ Emotional value ▪ Ethical value 	

The Table 2 shows how the perceived value is categorized according to Coutelle-Briller et al's (2014) investigation. The parties that perceive typically the value are shared in three recipients: company, organization as a whole and external stakeholders. The value dimensions are either extrinsic or intrinsic. Extrinsic dimension relates to the value that is used for the means to an end. Whereas, the intrinsic dimension relates to action where the consumption experience is valued for its own sake. All the value outcomes are not tied to the offering hence the table include interaction value. It aims to identify the value that comes from the interaction between the humans. Such value may for example be improved customer knowledge. Efficiency value is related to monetary and non-monetary costs and excellence to functional value. Both concepts relate to economic dimension of the value perceived. Emotional and ethical values are more experiential and symbolic by nature. (Coutelle -Briller et al. 2014)

2.6 Summary of the value co-creation and value perceived in the CE ecosystem

Activities that lead to value co-creation and how the value outcomes are perceived by the different actors in the CE context have been described previous parts of this thesis. According to the literature the main activities that are critical for the value creation are interaction and it was noted that the collaboration between the actors around the new process would possibility even enhance the dialog and overall interaction. Interaction improves also the resource transfer between the parties. Learning and resource transfer were also identified as important value co-creation activities.

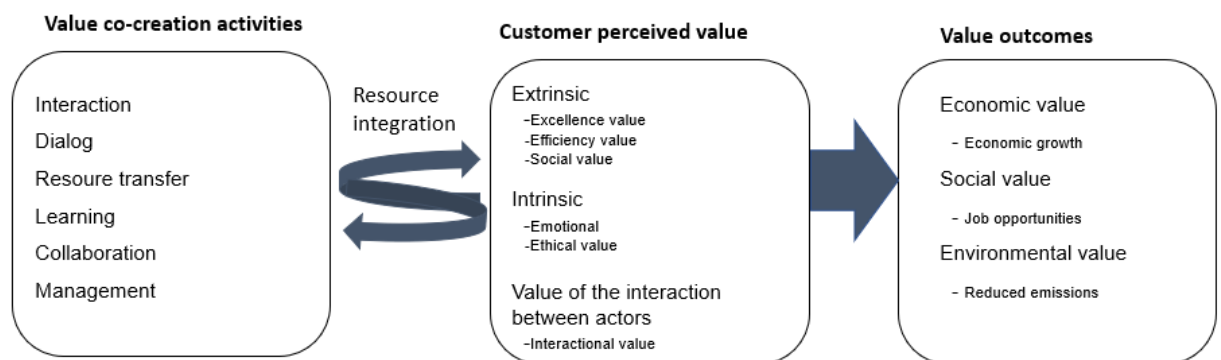


Figure 11: Research framework of the thesis

Altogether the value co – creation activities form a process of resource integration which generates different customer value perceived – dimensions. The dimensions are classified into three that are extrinsic, intrinsic and value of interaction between actors according to how the value perceived is experienced in B2B context in the literature. To match the results better to CE context the perceived value dimensions are categorized into triple bottom line value dimensions to make it possible to find the solutions to research questions.

3 Research method and data

The next chapter describes the research methods used in this study. The case is introduced holistically, and the actors of the business ecosystem are described. After that the data collection is also described more comprehensively. Finally, the data analyzing process is explained, and the empirical results are handled.

3.1 Case description

The thesis aims to research the CE ecosystem which is located in Finland. The ecosystem is built around the hypothetical CE process where chemical virgin raw material, that is used in industrial manufacturing process, is replaced with recycled material which is sorted and collected from wastewater plant. The process is not in operation yet, hence the case aims to find out the possible outcomes that would occur in a such network that is built for this research. The ecosystem consists of actors with diverse roles in the ecosystem. The actors are recognized in the first state according to the literature and common understanding of the necessary actors in the process. As the aim is to gain holistic view of the value outcomes some additional stakeholders might occur in the ecosystem. Additionally, the aim is to reveal if there are some possible benefits that are missed in the process.

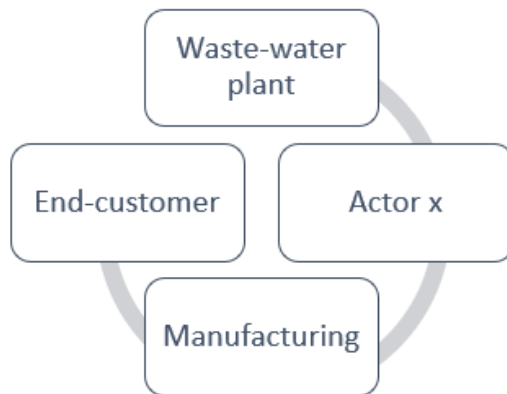


Figure 12: Actors in the CE business ecosystem

The Figure 12 shows the relationship between the actors. It should be noted that the circle is not complete, because the material does not cycle in a perfect circle, i.e. it is not returned to this same circle. The figure is built according to the literature. The circle shows the order in which the material is cycling from the actor to actor.

Manufacturing is the place where the non-virgin material is finally used. Before that the transportation carries the raw material from the wastewater plant to manufacturing. In this scenario the delivery company is added to process as a coordinator between the manufacturing site and other stakeholders to gain the realistic picture of the process. Some industrial processes require that the legislation is modified. Therefore, due to strict legislation in Finland the government site is added to scenario to gain holistic view of the benefits and activities among the society. As the CE is quite a novel phenomenon the end customers role is also researched as it is the party that finally uses the product. Wastewater plants are in Finland ran by the municipal or municipal consortium plants. In the case it is assumed that the raw material is suitable for the use of manufacturing. Furthermore, the target is to find, what benefits the actors would create in such a network. On the other hand, the aim is to find out how the benefits produced by the network are perceived by the actors.

Manufacturing

The manufacturing company was chosen because of its aim to replace the virgin raw materials with non-virgin raw materials. Additionally, the company has an apparent interest towards the CE solutions as it has already implemented some CE practices in its business. The manufacturing company's main raw material is wood, which is naturally cycling material. The company is committed to follow the international United Nations Environments environmental instructions and has review period of every 18th month. As the company is highly committed to environmental development and aiming to find non-virgin raw material options it is suitable for this study. The company also uses the virgin phosphorus in their manufacturing process, and they are doing development work for substitute the virgin raw materials. In the company the interviewee works in a position of director of strategic partnerships in technology function. He has responsibility of CE business opportunities development at the company and collaboration management and development. Additionally, he is also participating in EU level innovation development. Therefore, he has broad experience and knowledge of the CE solutions in the company and is therefore suitable as an interviewee.

Waste-water plant

Waste-water plant is the source for phosphorus and also other nutrients that are separated from waste-water. Therefore waste-water plant was recognized as an important actor. In Finland waste-water plants are governed by public sector actors, mostly by municipalities or consortiums of municipalities. The waste-water plant in this case is a consortium of municipality. The waste-water plant has developed its water treatment devices for treatment of phosphorus. The department manager of the waste-water plant was interviewed for this study. She has long experience from water treatment sector, and she has been part of national and international nutrient circulation projects. Therefore, she has wide knowledge of the nutrient circulation.

A research institute and government agency

As the legal perspective was is rather unavailable due to the EU presidency period in Finland, a professor of circular economy was interviewed to provide a perspective from the academia and to better understand the benefits that might occur from the ecosystem. Additionally, the professor has deep and wide special knowledge of the nutrient's circulation. The interviewees background is from research and she was able to offer thoughts and knowledge as a research point of view. She is also in close collaboration with the Ministry of environment and is aware of the legal area too.

3.2 Research methods

This thesis is carried out as a qualitative single case study approach by semi-structured interview. The aim of the qualitative analysis is to describe the real-life phenomena (Hirsjärvi, Remes & Sajavaara, 2007). In qualitative analysis data is perceived as an entity that aims to understand the object by describing the structure of internally logical entity (Alasuutari, 2011). Conversely to qualitative approach, there is a quantitative approach which deals with argumentation that is carried out by statistical analysis and the target is to find statistical regularity from the data that is numerical and numerous (Alasuutari, 2011).

In this study the data is collected by conducting interviews and hence the qualitative approach is a proper method. Additionally, the research questions of this study seek to build exploratory and inductive picture of the case ecosystem, hence qualitative approach is suitable for fulfilling this target. Eskola & Suoranta (1998) state that qualitative research concentrates also on relatively small amount of cases with intention to carry out thorough analysis. As there are one case to be researched which is based on real-life situation, qualitative research method is utilized.

Case study is a qualitative study design (Hirsjärvi et al. 2007). A Case study can be defined as an empirical study that researches currently existing phenomenon at real-life situation in its natural environment (Eskola & Suoranta, 1998). Theoretical framework indicates what method will be applied and what kind of data should be collected (Alasuutari, 2011). The CE is a novel phenomenon being implemented especially among the industry companies but simultaneously affecting the whole ecosystem. This ecosystem is assumed as one unit and forms the case of this study. This ecosystem forms a fruitful case object being studied and achieved holistic understanding. Its activities are interconnected and linking different actors' interests and activities. However, to understand the linkages and the nature of its benefits for stakeholders requires that the phenomenon is analyzed holistically. Single case study is appropriate approach for this study because the idea of the case approach is that collected material from the case enables the generalization of the complex concepts (Eskola & Suoranta, 1998). Moreover, the phenomenon is still quite unknown, and the target is to form perception of the attributes that generate the outcomes of the phenomena. Therefore, to gain an understanding of the factors the case study was used. Additionally, in a single case study there is typically only one answer to the research questions (Dubois & Araujo, 2007). This one answer is aimed to be figured out by conducting the single case study.

3.3 Data collection

Qualitative type of data collected is typically complex, manifold and expressive. (Alasuutari, 2011). In this study the primary data is used. Primary data means the empirical data that is collected by the researchers (Eriksson & Kovalainen 2008). To understand better the underlying complex occurrence of the attributes of the concepts of CE, value creation and value perceived, the primary data is collected by conducting interviews for the people relevant to the case.

Interviewees are used when the researcher seeks to gain deeper understanding of a certain phenomenon. Moreover, interviews allow the researcher to ask additional questions to establish a comprehensive picture of the case. (Hirsjärvi et al. 2007)

Interview is suitable for this case because it enables the interviewees to provide multidimensional answers. For qualitative research, it is typical that the target group is chosen appropriately according to the phenomenon that is under research (Hirsjärvi et al. 2007).

In this study the interviews are conducted as semi-structured type of interview which can include both what and how questions and it outlines the topics and themes but has variation in wording. The advantage of semi-structured interview is that the material collection is systematic, but it simultaneously lets discussion to be conversational and informal. The challenge is that the interpretations can vary between the responds which complicates the comparing of the empirical material. (Eriksson & Kovalainen, 2008). The what and how -questions enable us to understand deeply the complex issues that exist. Because the interviewees are a part of the environment where the phenomenon is located, they have the best knowledge and experience of the attributes that forms the whole objective. To collect the comprehensive knowledge, the interviews are an adequate method.

The group of interviewees was chosen according to their role in the ecosystem. Only the business-to-business actors are interviewed. In other words, private people are not considered, even though they are part of the markets, but in this study, they are not part of the ecosystem. To research the ecosystem process properly, relevant actors were identified according to the literature. The literature recognized the source of non-virgin raw material and the user of the recycled raw material as important actors. In this case it means the waste-water plant and the manufacturing company. They are interviewed to provide their experience among the topic. The interviewees were chosen by the writer of the thesis. The relevant actors are the following: waste-water plant, manufacturing and public site. All of the interviewees work in a leader positions in their companies/ organizations. They have experience of their field of work for about 5-10 years. Previously they have gained various working experience from different jobs. Because there is not yet recognized multiple manufacturing use opportunities for phosphorus the interviewee possibilities are limited.

Table 3: Interview information

INTERVIEWEE	PRIVATE / PUBLIC	POSITION OF THE INTERVIEWEE	CODE
Manufacturing	Company	Director of the strategic partnerships	H01
Waste-water plant	Public consortium	Head of department	H02
A research institute and government agency	Public institution	Circular economy expert	H03

The interview is divided into themes that follow the topics of the thesis. The themes were same for all the interviewees, but some questions were adapted to be more suitable for the interviewee which represent the society. The topic of the interview was described already in the original message for the candidates. The background of the study, execution and the handling of the material and information were mentioned in the cover letter. That enabled that the defined questions could be asked. The questions of the interview were divided into four themes. In addition, the background information of the interviewee was asked as well as if there was anything the interviewee would have liked to add regarding something that had not occurred during the interview. The themes and the order of the interview are presented in the Figure 13.

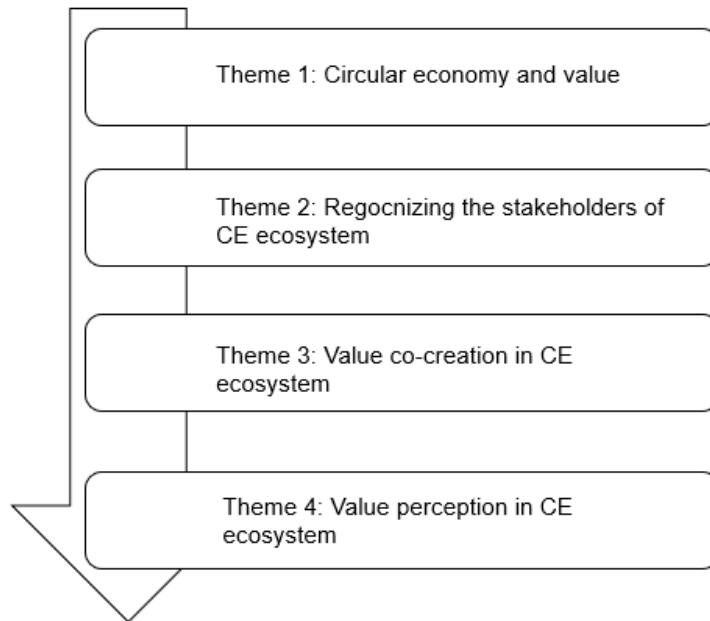


Figure 13: Themes of the interview

The interview questions were sent beforehand to the interviewees so that there was a chance to get to know the subject and if necessary, candidates could refuse from participating in the interview. Interviews were held during the June 2019. Two interviews were conducted face-to-face at the interviewees' company/organizations offices in Helsinki and one was conducted over the phone. The recordings were done by one device. All the interviewees allowed the recording, hence extra notes during the interviews were not taken.

Table 4: Interview dates and durations

INTERVIEWEE	DATE OF THE INTERVIEW	DURATION
Manufacturing	12.6.2019	40:46
Waste-water plant	19.6.2019	56:53
A research institute and government agency	24.6.2019	26:58

The discussion proceeded freely but the order of the interview questions was followed and when needed the additional questions were asked to deepen the knowledge of the topic. If the discussion was drifted to totally different topic, the interviewer returned the focus back to the topic or it was asked how the interviewee saw the subject from the topic. The interviews are presented anonymously so that interviewees were able to freely express their thoughts and knowledge of the topic. The interviews lasted approximately 40 minutes (Table 4).

3.4 Data analysis

The data was recorded and transcribed to get all the possible knowledge from the interviews. The aim was to have fruitful discussion around the four different themes to broaden the understanding among the theme. All of the recordings were transcribed within two weeks from recording. The recordings were listened approximately three times and the transcriptions were done word by word. The recordings are transcribed literally, but the breaks or non-verbal voices were not indicated because those have no contribution for the research in hand. Transcribed material is altogether 34 pages. The transcriptions enable the thorough review of the replies and allows the researcher to better analyze the answers.

The data analyzing process proceed first by reading the transcribed material and making the side notes at the same time. After that the material is re-read so that the researcher can gain more comprehensive understanding of the different topics, categories and additional themes that occur from the interviews. During the re-reading of the material some of the key words are recognized. The coding continues by using specified notes and underlining the logically corresponding topics that are found critical in the analysis. By that single sentences or paragraphs are divided from the material. Some of the material that is not corresponding with the interest of the research is ignored. That enables the researcher to conduct the analysis and connect categories with each other (Dubois & Araujo, 2007). Last, the relevant material is categorized as suggested by Dey (1993). The categorization is done into

groups that first, follow the thematic order and second the triple bottom line. The analyzing of the data is conducted to make generalizations from the data.

4 Empirical analysis

In this part of the thesis, the empirical findings are expressed and analyzed. The aim is to form understanding of what features are critical in value co-creation in circular economy ecosystem. The material gathered from the interviews is utilized and transcribed version thoroughly reviewed. All of the interview themes are handled in own chapters.

4.1 Value co-creation in linear economy vs circular economy

Circular economy business models are seen highly important in the current businesses. The manufacturing company describes the environmental targets by noting that they have implemented 2030 commitment which means that the company aims that by 2030 there would not be trash carried to landfills. In other words, for every material, nutrient or product a new use would be designed. That is a clear difference compared to traditional business models. The manufacturing company states the importance of the pre-design as a value opportunity for the company. The interviewees see that the CE processes produce concrete value opportunities to their organization.

“It is important that the processes are designed beforehand so that they are efficient and the different kinds of cycles of nutrients are working. It is also notable to design precisely the products’ end-use, recycling, the use of nutrients and materials.” (H01)

The waste-water plant also addresses that circular economy processes are already part of the business in their organization so the value that the CE processes bring is noted. The value that is gained through CE activities are emphasized to be highly important. Therefore, for example the CE is integrated tightly in the organization’s strategy. In the strategy, high targets are set for the phosphorus, to find ways to

extend its usage possibilities in various ways. Therefore, the strategy targets aim to high class circulation of the nutrients i.e. broaden the circular economy processes. Anyway, the interviewee pointed out that they expect circular economy processes to be strengthened in their field of business. The interviewee addresses that the difference compared to previous business is that today there is concept (circular economy) for the process. Hence, the core of the strategy is based on CE development.

“In the new strategy, the circular economy is visible, and for example, our strategic goals are to find higher refining rates for phosphorus, than we do today. So, we create a mould product, by composting molding the sludge, into a market that is sold to the market as a mould product -- but it's our strategic goal of finding alternatives, where the amount of phosphorus in a mould product can be reduced.

“(H02)

The value from circular economy process is understood through creating higher refining rate for phosphorus. The traditional business models were handled on quite briefly in the interviews. It was noted that the CE business applications have somehow been part of business for a long time, and they are under continuous improvement. In other words, the paradigm has been changing for a long period. The difference is that currently the CE gains more attention than previously. All in all, the viewpoint was that all the business process development projects target to CE process development.

The value of circular economy processes was experienced to be necessary for the manufacturing company (H01). Whereas, waste-water plant's representative notes that CE value opportunities will be accelerated in the future. Interviewees held it obvious that provided values were various types and provided for different stakeholders. In addition, the manufacturing company underlined that they have implemented eco-design practices in their business development to improve the cycles of the nutrients that are used in production. The value is aimed to be gained through by planning carefully the reuse, recycling, usage of nutrients, the end-use of the product.

‘Well, I would say that if a product has values that are concrete, that are able to scale it out like carbon footprint, water footprint, this type of thing, then it creates value.’ (H02)

The institutional interviewee notes the governments support for the CE processes. That shows how the society values the CE applications and is willing to support the business around the CE applications. In the long run, the society expects to receive value from new applications. The activity of the development and innovation of the CE applications is currently highly topical and the value from the applications is expected. The society’s interest towards CE innovation can be seen from the following:

“Indirect investment support, or temporary investment support and this type, is presented in the government program. Not at least in the near future, within a few years, you will probably have much support for circular economy activity in Finland.” (H03)

The value pursuing from the CE applications and innovations is highly recognized in company, organization and societal level. The value is expected to bring concrete value benefits. The benefits are so significant that there is process development under planning and research. The paradigm is changing from linear thinking to CE models thinking and the values from it are expected to be perceived.

4.2 Identifying the actors in the CE ecosystem

There are recognized actors of circular economy ecosystem in the literature. From the theory the researcher can build relatively complete picture of the actors that are part of the ecosystem. Anyway, to build a coherent picture of relevant actors of the ecosystem in this case, the interviewees are asked of their view of the ecosystem’s structure. First, interviewer showed the examples of the interviewees that were identified according to the CE literature and asked their view of how the structure would look like.

The replies were aligned between different interviewees, hence some views varied depending on the placement in the value chain in the ecosystem. In general, all of the interviewees mentioned the following actors: origin of the material (waste-water plants), refiner/producer, the utilizer, public authority and universities. In other words, the participants of the order to delivery chain were classified. These were the actors that were first mentioned. The actor between the source of non-virgin raw material and the user of the material was found critical. Also, the interviewees H01 and H02 have different kinds of views of the actor in this gap. H01 had clear vision of how the nutrient is about to be delivered and refined with the help of a network. To create such a network was found important.

“-- that we find the partner who produces the phosphorus. Whether it's the biogas manufacturer or the wastewater association that isolates it, it's sure it's the most important because we don't really get to build that network without that operator. When it is not our core business and we may not want to concentrate on it, we wouldn't send that process and know-how out.” (H01)

When discussing the topic further the interviewees mentioned multiple different actors that are somehow related in the ecosystem. These were financing, ministries, research organizations, political decision makers, residents. Also, the EU level decision making was mentioned as well as fishing and agriculture.

The role of the authorities and public law plays a very important role. In all the interviews it was emphasized that the regulator is an important actor in the CE businesses and processes. The role of the regulator was described to be the enabler of the processes and innovations. The development was expected but only if the collaboration with regulator is working. The nature of the circular economy is that all the innovations depend on the current legislation, because the material that is used is classified as waste. Hence, the regulator acts as an obstacle in many places where waste is aimed to be utilized.

“Authorities are a very important stakeholder because it is a pretty big hurdle in many places that whatever waste, by-stream can be properly utilized.” (H01)

“It is really important to work with the authorities to enable the circular economy processes, -- or that regulation is good and enabling, but you will be able to create such generally accepted practices and standards on how to act and how the circular economy will be investigated.” (H02)

Secondly, the interviewees were asked to classify the actors identified in the previous question into two groups: the core business value stakeholders and other stakeholders. The remarkable notion is that even though the importance of the regulator occurred, it was not settled in the core stakeholder group figure. Other actors placed as other stakeholders are researches, ministries, polytechnics. In the core business stakeholder’s group were placed the actors that are directly linked to core business. The interviewees have general idea of the core business actors which were described as the order-to- delivery actors. In that case those are the waste-water plant, refiner/producer/operator and the user of the product.

4.3 Value co-creation in the CE ecosystem

In this part the aim is to recognize which activities produce diverse benefits between the different actors of the ecosystem. At first, the interviewees did not understand what was meant by “activity”. The interviewer mentioned examples from the literature. After that, the interviewees understood the idea and presented their point of view to the topic.

When it comes to the co-creation of value, collaboration between the actors and stakeholders was the main attribute. When discussing about the collaboration, it was mentioned that it develops as well in the long run as in the short run. The co-creation requires different resources and mechanisms from the counterparts of the ecosystem. Anyway, it was noted that the intention of the collaboration is to sustain company’s/organization’s core business. Waste-water plant described that their role in the ecosystem is to collect the nutrient and either spin it to loop outside of the organization or to keep it spinning inside the organization. Manufacturing describe

their role as that they are willing to replace the virgin raw material, in this case phosphorus, with non-virgin raw material and by that being part of the spinning cycle.

“But, as well, circular economy processes that are either going out of our way to spin the loop, or they are spinning inside of us, are equally sought after.” (H02)

The actors of the ecosystem emphasized that they have their core business which is the focus in their work. By that they underlined their participation in the business ecosystem and the need for other actors and stakeholders. The interviewee of waste-water plant address that the core business of the organization is defined in the environmental permit governed by regulation. Hence waste-water plant’s role is naturally the collection of the phosphorus. The manufacturing company also states that they have their core business and they are aiming to create business partners in the ecosystem to enable the process to work. In other words, they do not look forward to building new business areas by investing new service concepts. However, manufacturing is willing to support the development of the ecosystem. The concentration on the core business is shown on the following citations:

“I see it being created that ecosystem or that network, because it adds knowledge, it adds activity, it enables it to start new business.” (H01)

“When it is not our core business and we don't necessarily want to focus on getting started building that process and our expertise” H02

“But that phosphorus has to be taken out of the water anyway by our environmental permit and that is our core activity. -- But without stakeholders, we cannot bring added value, we alone cannot bring it (the process) to the end.” H02

As a result of concentrating on the core business, actors seek to find and form co-operation with other companies and counterparts to build new processes.

Collaboration requires that the core business works among the ecosystem. It was noted by the manufacturing firm and the waste-water plant, that collaboration works as a source of the nutrient, that they do not have resources for refining the non-virgin raw material. The interviewee from waste-waste plant notes the following:

“And now when we have this XY project (governments financed process), that’s our own development, that is, when there was no product on the market that responds to the phosphorus recovery from this type of purifier like ours, we started to develop this type of process and in the development phase, we need to outsource even more.” H02

Hence, the actors need resources for development and to maintain cooperation in the ecosystem. The resources that are needed for that activity are defined as ability to create encounters that are not self-evident in the company’s/organization’s everyday business. This is also related to the ability to change and modify the cooperation so that it is corresponding with the needs that occur from the ecosystem. More closely, the representative of waste-water plant argued that the collaboration with a refiner is important. In other words, the order-to- delivery chain needs to work flawlessly.

“I see it building a network of partnerships that it is also good to try to expand, but it will surely compact and expand to become so powerful that this type of consortium and the current buzzword ecosystem that they are definitely needed , so that we can take this circular economy forward and expand it.” (H01)

The mechanisms of a firm to be able to reform are also found to be an important resource to be a part of a circular economy process. As it is a wider change in the business paradigm it requires transformation from the companies and in the ecosystem. That requires active work from the companies and organizations to stay vital and in a continuous improvement process. The concrete activities the interviewees mention for reforming are finding new channels and gaining legislative support from the authorities. Also the innovativeness was found important.

“Likewise, identifying new channels, in a way, to keep that user base wide enough to create new potential applications and networks. That sort of renewal. If we now recognize the few, then we need to be able to innovate and find new alternatives so that it stays wide enough.” H02

“It is likely that, at least in the near future, within a few years such circular economy activity and its different support will be at least strongly on the surface in Finland.” H03

4.4 Value perception by the different actors

Different actors were asked to consider different kinds of outcomes that they face in a circular economy process. There came out multiple types of outcomes and benefits that the interviewees expect to occur. First, the economic outcomes are described. After that, the environmental aspects are handled and lastly the social outcomes. Additionally, from the discussions the ‘missed value outcomes’ occurred. That is categorized in its own part in this chapter to gain a clear picture of the category.

Economic

From the process the main expectation is that it will lower the costs. The interviewed actors of the ecosystem noted that they are not about to do charity, instead they expect to receive economic outcomes that are measurable. As the company interviewed is a publicly traded company it underlined the cost efficiency. However, interviewee found that even the word “circular economy” includes the idea of economy and that the concept in its roots involves the target for economically profitable activity.

“That's why I like the term circular economy, because it has the word economy, that the goal is that it doesn't rotate with a support money or incentives, but that it really creates a new business and it is a prerequisite for the whole chain that it is

going to be something for everyone that our costs do not increase, but of course, preferably create something useful.” (H01)

The cost efficiency benefits are gained through lower costs. The costs of non-virgin raw materials are assumed to be lower than the virgin raw materials. Manufacturing company’s representative explains that the company seeks opinions to lower the costs of production and the usage of recycled materials is a promising solution for that purpose. Different actors experience the cost efficiency in different ways. On the first hand, manufacturing expects to buy cheaper raw materials. On the second hand, the waste-water plant’s economical interest comprises that it could gain additional revenues by selling the residue phosphorus to be used in production or in other use. This is found notable, because the phosphorus is anyway collected from the waste-water, because of the regulation, so by selling the product the organization can gain additional value.

“Yes, the number one benefit is that we are aiming for lower costs. It is clearly the number one benefit, and alongside it, responsibility.” (H01)

*“Then on the financial side, of course, hopes that there is something more than minus or zero coming in that it has the potential to do something as it adds value”
(H02)*

Business opportunities and business development opportunities were named as economic benefit of circular economy process. Especially the waste-water plant emphasized the significant benefit of the continuous development. That was not similarly emphasized by the manufacturing representative. Interviewee H02 mentioned various business opportunities that they have envisioned. Recycling of the phosphorus is one of the main projects which is also financed by the government. Waste-water plant pointed that the circular economy requires continuous development already from the starting point when it is about to be built.

However, interviewees see that the continuous development is required thorough the business along the time. That was regarded as a great benefit as it obliges the organization into a state where it has to reform and evaluate its processes. That was seen as a notable benefit overall to any organization or company. That can be interpreted from the interviewees following though:

“And the circular economy is, of course, a very neutral topic, what is true through them, but also by itself, but not the fact that at best it can find new paths for business, an organization and grow, and if you think about an organization doing good for the organization, that it is in a state where it has to develop new.-- Often, those who are in the forefront will also gain more in the long run, because then they are ahead of the others in exploiting, creating and developing, that is to say, that being in the forefront in the long run will also add value to that business.

Develops the organization to face the next turn.” (H02)

The encouragement to develop the firms provides benefits that occur from new innovations. As it was found in the literature, circular economy interests different countries and the implementation of it is in varying states. New technology and good practices provide also possibility for commercialization and export. That it is also related to imago issues, which are handled in the following chapters.

“If that process worked well in Finland, then it would have the potential to be sold and commercialized and to have similar benefits elsewhere.” H03

Circular economy processes were seen also part of the risk management. The risks that are expected are twofold: first risks related to tightening regulation and second the risk of scarce sources of virgin phosphorus. All of the interviewees stated that the regulation will become more and more strict in the field of environmental legislation due to the growing pressure from the ordinary citizens. The actors experienced that it is better to take a step forward before the regulator by developing

and building the business that corresponds with the upcoming regulation. The scarcity of phosphorus includes the risk that the source from nature will be used up. However, the scarcity will be shown in increasing market prices. Especially the manufacturing company stated that there is the risk that the raw-materials prices will increase significantly. Hence, the risk mapping and management enables the business to be profitable in the future, too. The risks are describe as following in the interviews:

“One concrete thing is that because it is very likely that the regulation will become tighter and there will be constraints that no stuff will be dumped or that it will be getting very high waste charges, so do not strongly but also responsible but also proactive work in the sense that we have the solutions to it and I think certain areas need to be tightened up” (H01).

“Because, yes, at some point it starts to happen that, for example, in the case of phosphorus, that virgin raw material starts to become more expensive. Whether it's going to happen at that point is such a good question, but it's not that phosphorus will end up there tsup but it will probably start to evolve in the market so that it will tend to drive interest in other solutions. -- I'll dare to say that, the cost of raw materials has risen and then of course, at the moment, in very unstable areas such as Morocco and North Africa in general, Finland is an exception to the fact that we have a mine like this, which increases the likelihood that the price may change in the future” (H02)

As can be seen from the citations the interviewers are highly aware of the risks that come from resource scarcity. The virgin raw materials are under the threat to be used up. The actors have noticed that and to prepare for the risks is topical for the firms. Therefore, especially the manufacturing firm aim to find replacing options for the virgin raw materials used in their production. By that the continuous business is secured.

Environmental value outcomes

When discussing about the environmental outcomes, various aspects occurred. It was noted that the environmental outcomes have multiplicative effect, if there are numerous of stakeholders or other actors included. Additionally, companies' responsibility reporting is gaining more attention and the environmental impacts are measured more specifically. Circular economy improved the company's and regional authority's environmentally friendly activities. Environmental impacts were described also from the onlooker's point of view, which showed that the surrounding environment is taken closely into the consideration when analyzing environmental outcomes. Hence, this is also related to firm's imago outcomes.

Carbon dioxide emissions were mentioned due to the recent debate of the state of the planet Earth. The possibility to cut to carbon dioxide emissions by innovative circular economy process was discussed. However, the interviewee mentioned cutting carbon dioxide in the same context with emission trading system. So, in the long run, the economic value outcomes are the main driver. However, environmental value outcomes were appreciated and in general held necessary for the company's business to continue.

“I would say the most important thing is to act more responsibly, when we are affected not only by the circular economy, but indirectly also by climate change, and when we report and monitor carbon dioxide activity and our entire suppliers and our customers to work with the whole chain on how we can overall reduce our emissions and our impact on the climate.” (H01)

The waste-water plant representative saw the environmental benefits more from the aspect that it is governed to be their main duty. Originally their operation's main driver has been the environmental target, as their aim has been minimizing the emissions that end up to nature's water systems. As the phosphorus is collected efficiently from the waste-water it prevents it from ending up to Baltic Sea or any

other body of water. When it comes to natural biodiversity and natural ecosystems, it is beneficial for restoration of nature and an environmentally important issue.

The circular economy operations have broadened the environmental outcomes to cover retaining natural resources by replacing the virgin raw material with non-virgin raw material. But notable here is that spinning the “residue nutrients” into the loop of circular economy is just an extra activity for the waste-water plant. The interviewee also includes cutting the carbon dioxide emissions as a part of the benefit for the environment that is generated through the CE process.

“When you mention those carbon dioxide emissions, the production of nutrients and nutrient products always has a climatic effect and it is of course possible to take it out of the chain now, ---.” H02

The interviewees are aware of the fact that business cannot anymore utilize natural sources forever. Especially it was mentioned that phosphorus is a relatively scarce chemical element and there is a threat that it will be used out. Therefore, the scarcity of resources were mentioned and found notable environmental value benefit if the chemical element managed to retain:

“The ultimate purpose of the circular economy, in my opinion, is not just recycling, but to avoid and reduce virgin extraction. It's that life cycle consideration.” (H03)

However, it was added that the material extraction probably cannot be decreased from the level what is appears now. Anyway, interviewer believes that the increase of the use of virgin raw material can be avoided in the future. There occurs the risk that the resources will be used up which might be the more considerable driver for CE applications. Anyway, the environmental impacts come along when aiming to the economic benefit.

Social value outcomes

The social value outcomes are mostly understood through job opportunities and other issues that are related to employment. The employment outcomes are noted to be straight to the firm and to overall society. However, the representative of the research institute questions if the circular economy brings any increasing impact to employment in societal level.

“So surely closer co-operation and closer cooperation per se will be related to the economic, because it enables these new business models and new business to create and share such an ecosystem and, of course, on the social side, we can create new jobs and improve our operations and recycle.”(H01)

“In Finland, the price level is relatively high, so it is important for the factories in the Finland if we are able to utilize all of the side streams, co-create value through that, decrease the costs and by these acts increase the competitiveness and furthermore enable to keep the factories in the Finland.” (H01)

Interviewee of the manufacturing company underlines the contribution for the society caused by the decreasing costs. In other words, if the raw material costs can be held in affordable level there is no pressure for moving the factories to cheaper countries. That has contribution to the Finnish labour markets as the jobs stay in Finland. When the company is able to keep the factories and by that the jobs in Finland, the benefits for the society are multiplied.

“ I might say that it attracts workers at all because it is quite a challenge, how to get people to work (other than Helsinki), then yes, such responsibility, circular economy, environmental care are quite big value factors. What is seen from the young is so high. We do not get hired engineers in city X (city in Finland). It is one of those values. It could also attract better employees”. (H01)

The transformation for a more circular economy based working place is supposed to keep the work meaningful for the ones involved. Additionally, to work with circular economy related activity is believed to increase the willingness for working in the company. The manufacturing firm's representative noted that they have difficulties to find employees to some municipalities where the factories are placed. So, to provide meaningful work is notable benefit to gain knowledgeable employees. It was also believed that environmentally friendly processes will attract better workforce. The representative of waste-water plant emphasized the importance of keeping the job description motivating for the employees. She believed that to work with CE applications keeps the organizations developing and simultaneously challenges the employees so that they will not get tired in their job:

"I think a person likes it in the long run, that they see their work evolve -- that the days are long if everything stays the same." H02

Missed value benefits

First, unrealized benefits were regarded as imago issues. The CE processes were seen to be good for the company's reputation. Anyway, the interviewees questioned how much the customers are ready to receive company's CE related content without finding it annoying. Interviewees were afraid that the customers become doubtful and the imago benefits are missed. Hence, it was mentioned that when communicating about the CE activities the messages need to be considered and realistic in a way that the customers and other stakeholders can accept them to be real.

What we told to the consumer, that what the circular economy reputation is, that it is not --, no green washing but 'circular economy washing'. (H01)

Second, the regulation also sets challenges for value outcomes to be realized. The development of the regulation that enables the processes to work is general and covers all the companies. Therefore, it was mentioned that some regulation is not

necessarily supporting enough the process. The representative of the waste-water plant noted that the regulator might regulate the nutrients cycle in a way that forces the actors to change their processes so that it is not the most efficient from the processes point of view. That can run the process into a state where it is not ran in economically most profitable way and therefore some of the economic profits might be missed.

Also, it was argued that it should be avoided that things are done only because the current trend of the circular economy requires it. This can happen by any actor, anyway the role of regulator was highlighted. It was also found that when the circular economy processes are developed, the regulation can change over time. Therefore, greenwashing was doubted to be done also by the regulator. There is pressure that the regulation should be developed more flexible.

5 Discussion & Conclusions

In this part the research questions are answered and conclusions drawn. Additionally, the limitations of this thesis are presented and the future research opportunities are proposed.

5.1 Discussion

The circulation of the materials is a target for the company and organizations. Altogether the different ways to implement the cycling of materials is done. The CE includes circulation of materials in different ways. In this thesis the focus is on recycling the phosphorus. According to Ellen Mac Arthur (2015) companies have notices that the traditional business model is insufficient to generate competitive advantage. This notion becomes also evident according to interviewees. The interviewed actors have active ongoing projects to accelerate the CE processes. The paradigm has changed towards the assumption that the business growth should be based on the applications of the CE.

The role of the regulators and public authorities is highly underlined when discussing a seamlessly working process. The role of the regulator is considered important because it is the enabling body. In the interviews it was revealed that every activity of the CE is depended on action by the regulators. In the theory this is shown by that the regulators are described as top-down stakeholders (Iacovidoua et al. 2017) that control the activity of the bottom – up's group. The bottom up- group actors are seen similarly with the theory and interviews. Also, the classification into core business actors - and other stakeholders' group is done in accordance with Aminoff et al. (2016) proposition so that the core value chain actors are in the middle and the supporting actors are in the outer arc. The classification into two groups is shown in the Figure 14

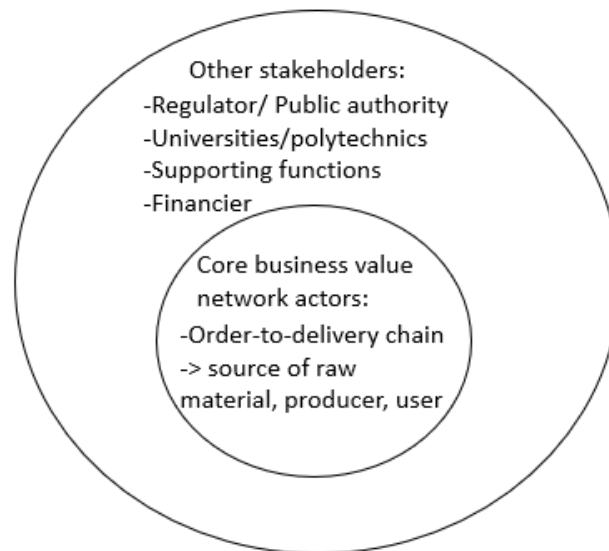


Figure 14: Classification of the different actors into core and other stakeholders' groups

The interviewees mentioned that the collaboration in value co-creation is necessary activity in the ecosystem. All of the interviewees noted that the firms or organizations do not have resources or knowledge of their own to form process for cycling the phosphorus. Hence the collaboration is important for all of the actors. This is in line with Adner & Kapoor (2010) that being part of the business ecosystem provides value co-creation possibilities that a single firm is not able to do alone. The close collaboration is significant also because if the common objective of the actors in the ecosystem is unbalanced, it can cause weak value co-creation outcomes (Ben Letaifa & Reynoso, 2015).

Industrial ecosystems include complex systems which are challenging to coordinate (Tsvekova & Gustafsson, 2012). That supports the need for close collaboration among the ecosystem so that the actors of the ecosystem are able to manage the activities and systems. That is supported by the empirical part as the interviewees are looking after actor/ service provider which works as operator in the process. That is highly important also because if the common objective among the ecosystem is unbalanced, there is a risk that it causes weak value creation processes, therefore

it is important that the vision is adopted by multiple stakeholders (Ben Letaifa & Reynoso, 2015).

The solution for the efficient co-creation of value outcomes in the CE process was to find an operator or service provider which would be the manager of the process. Especially the service attribute was emphasized. That would enhance the information sharing when there is an operator whose main duty that would be. In the literature it is noted that the features of the value co-creation in business ecosystem are dynamic processes, exchange between the individual companies and the management of the ecosystem (Van der Borgh et al. 2012). Hence, the operator should note these issues for successful value co-creation. Critical here is that the other actors would be able to concentrate on their main business.

As the interviewees note that the collaboration is notable activity in the value co-creation process. The collaboration can be interpreted to mean integration of the resources of different actors. This is seen for example from the following citation: *I see it (as important) being created that ecosystem or that network, because it adds knowledge, it adds activity, it enables it to start new business” (H01)* To conduct business activities in the ecosystem, the interaction is necessary. The interaction is described to allow the companies and organizations to create unexpected encounters that otherwise would not have been possible. As Prahalad & Ramaswamy (2018) note, the interaction that comes up within the network is the core for value co - creation activities. Precisely, the interaction activities contain dialog, resource transfer and learning (Gummensson & Mele, 2010). The concrete activities mentioned that are thought to create value in the ecosystem were the following: recognizing new channels, broad the userbase, create different kind of contacts, match various actors work, improving the ecosystem and sharing the information. In other words, these are the mechanisms that produce the value co-creation process by the actors (Saarijärvi et al. 2013). The concrete examples are classified into interaction categories as in Table 5:

Table 5: Value co-creation activities recognized from the empirical part

Dialog	Resource transfer	Learning
<ul style="list-style-type: none"> • Regocnizing new channels • Sharing the information 	<ul style="list-style-type: none"> • Improving ecosystem • Broadens the userbase 	<ul style="list-style-type: none"> • Matching various actors

The value outcome dimensions that are presented in the literature are highly in line with the aspects that raised from the interviews. As Ghisellini et al. (2016) state, the CE produces economic, environmental and social value outcomes. The same issues were recognized by the interviewees. Economically it is held important that the CE produces economic outcomes for the actors. The aspects such as cutting carbon dioxide emissions, reducing the usage of raw materials and improving the state of the natural ecosystems were the main environmental points that raised from the interviews. Social outcomes that were mentioned were new job opportunities and cleaner environment for example close to manufacturing areas.

An interesting point is how the outcomes are perceived by the different actors. The empirical part showed that the cost efficiency is the most important value outcome that different actors are aiming to perceive. In the theory it is described that the main target of value creation in circular economy according to Ghisellini et al. (2016) is decrease the pressure on the environment that it faces when the companies are striving to economic growth. Anyway, from the interviews it can be interpreted that the actors in the ecosystem aim to prepare for the upcoming risks. Hence, the economic growth was found more important than the environmental outcomes. In other words, more strengthened environmental legislation was seen as a risk and by preparing to face the risk is aimed to secure the future revenues. This shows that the pleased outcome expectations for circular economy process are more extrinsic type of value perceived. In other words, the excellence and efficiency value outcomes are appreciated over the ethical and emotional value outcomes.

Excellence and efficiency value perceived include the monetary and business functionality value elements (Coutelle – Briller et al. 2014).

The environmental value outcomes perceived includes the decrease of dioxide emissions, decrease of using virgin raw materials and other environmentally friendly activities. The environmental value perceived has a critical role in value evaluation (Hänninen & Karjaluoto, 2017). That was noted also in the interviews as the environmental issues were considered to be meaningful in the business. However, in the interviews the environmental outcomes were connected to gains in the profitability. For example, by reducing the dioxide emissions means that the company does not need to buy as much emissions allowances as earlier. Hence, the environmental value perceived serves the actors economic efforts. Therefore, the environmental value perceived by the core chain actors is classified as extrinsic efficiency value. Additionally, when it comes to the core chain actors' CE targets, the environmental outcomes were held supporting the corporate social responsibility that are set in the companies' strategy or responsibility reports. Environmental value is intrinsic by its nature for the society, because it produces ethical type of value perceived for example as better environment for the residents.

Social value outcomes that the actors perceive include closer collaboration between the actors. 'Value of the interaction between actors' means the perceived outcomes that occur from the interaction between the people (Coutelle-Briller et al. 2014). Closer collaboration was emphasized as a perceived benefit of an ecosystem. The closer and broadening collaboration was producing the knowledge sharing and possibilities for further development.

If the value does not produce the wanted outcomes, some value outcomes might be missed. The missed value outcomes were related in the situations where the actors were afraid that the CE processes are run only to fulfill the desired imago outcomes or due to common pressure. In addition, that can create weak practices that do not enhance the chances to achieve efficient value benefits.

5.1 Conclusions

Value creation dimensions are not fully researched in the CE ecosystems as previous studies have focused on value creation in linear way in value networks and the dimension of circularity is not fully studied (Aminoff et al. 2016). Hence this study aims to broaden understanding the value dimensions that exists in circular economy ecosystem and the value outcomes are co-created. Next in this study follows the responds for the two main research questions and one sub-question.

The first research question is: “How actors co-create value in CE business ecosystem?” The main actors in the value co-creation are the bottom-up actors. That is because they are part of the value chain. In this case the main value chain actors are waste-water plant, service provider and manufacturing firm. Together these actors co-create value in the CE ecosystem. The role of the regulator is important, because it is the enabling party whose role is critical in enabling the processes and the CE business model. The mechanisms of the value co-creation cannot be achieved in the full benefits if the legislature is rigid.

The ecosystem forms an interface for the actors be able to value co-creation activities. Business ecosystem indicates how the business is organized among the ecosystem (Adner & Kapoor, 2010). In the case the ecosystem is necessary for the actors to be able conduct the CE activities and produce value outcomes. In the ecosystem the management of the activities that focuses to growth and viability is an important feature of value co-creation in the ecosystems (Reypens et al. 2016). The activities that are managed are represented in the following two chapters.

Generally, the most notable activity is the collaboration between the actors. It was stated that the collaboration is prerequisite for the co-creation of value. In the literature it was also noted by Ben Letaifa (2014) that value co-creation in the business ecosystem requires close collaboration between the ecosystem’s members. The collaboration also ensures the requirements for successful

management in the ecosystem stated by Ben Letaifa & Reynoso, that the actors in the ecosystem share the same perspective for acting in the ecosystem. The collaboration offers various mechanisms to the actors to co-create value among the actors.

More closely the value co-creation activities can be classified in more detailed way according to the literature and empirical findings. The value co-creation activities are categorized into three groups: dialog, resource transfer and learning. The dialog includes activities of recognizing new channels for cycling the phosphorus and sharing the information. Resources transfer comprises improving the ecosystem and broadening the userbase of the recycled phosphorus. Learning contains the co-creation activity of matching the various actors. Last, by integrating these activities the ecosystem forms the collaboration by which the value will be co-created by the different actors.

The second research question aims to find out how different actors perceive diverse value outcomes. The different outcomes were perceived in different ways by the actors. The outcomes are summed up in the Table 6. In the table, the categorization from Coutelle-Briller et al. (2014) of the types of perceived value is utilized. The table is used to gain understanding of the nature of the outcome. The table is represented more closely in the following chapters.

Table 6: Perceived value outcomes by different actors in the ecosystem

Value dimensions	Actors in the ecosystem		
	Manufacturing	Waste-water plant	A research institute
Economic	<u>Efficiency value</u> <ul style="list-style-type: none"> Lower costs of raw material Cost efficiency Additional revenues <u>Excellence value</u> <ul style="list-style-type: none"> Risk management Risk mapping 	<u>Efficiency value</u> <ul style="list-style-type: none"> Revenues from selling the recycling phosphorus Development of the service's in the ecosystem <u>Excellence value</u> <ul style="list-style-type: none"> Continuous development Risk management (i.e.increase of the price of raw material) 	<u>Efficiency value</u> <ul style="list-style-type: none"> Commerization opportunities Export opportunities
Environmental	<u>Efficiency value</u> <ul style="list-style-type: none"> Cutting carbon dioxide emissions Decrease of the waste (lower waste management costs) <u>Excellence value</u> <ul style="list-style-type: none"> Improved imago issues 	<u>Efficiency value</u> <ul style="list-style-type: none"> Decrease of the use of virgin raw-materials <u>Excellence value</u> <ul style="list-style-type: none"> Better state of natural eosystem (ie. Baltic Sea) 	<u>Excellence value</u> <ul style="list-style-type: none"> Avoid and reduce virgin raw material extraction
Social	<u>Efficiency value</u> <ul style="list-style-type: none"> Improved collaboration Attraction of better employees Enabling the jobs to stay in Finland <u>Excellence value</u> <ul style="list-style-type: none"> New job opportunities 	<u>Efficiency value</u> <ul style="list-style-type: none"> Possibility for various encounter <u>Excellence value</u> <ul style="list-style-type: none"> Improv working motivation for employees 	<u>Efficiency value</u> <ul style="list-style-type: none"> Job opprtunities <u>Excellence value</u> <ul style="list-style-type: none"> Cleaner environment for residents

The different perceived value outcomes are summarized in the Table 6. From the table it can be concluded that the manufacturing firm values the economical outcomes more than the outcomes by themselves. This can be seen from that the 'efficiency value' -category includes more attributes than the 'excellence value' – category. Ravalid & Grönroos (1996) stated that the value perceived is the estimation of the relation between the sacrifices and benefits perceived. Hence, the monetary value is emphasized by the manufacturing and they expect that their sacrifices are responded by monetary outcomes. Therefore, the perceived outcomes of the CE process of publicly traded company culminates in the economic outcomes in everything they do or are expecting to receive from the CE business model. This is also supported by Richardson (2008) who states that the CE application should produce a profit margin over the costs. In other words, the

processes and benefits are seen through the economical lenses. The environmental issues were also held important but more like fulfilling the responsibility reports requirements by the manufacturing firm. The environmental benefits were the side benefits that can be described in the sustainability section in the responsibility report. Also, the imago issues were important perceived benefit that occurred from the nature of circularity of the process.

The social elements were more valued by the waste-water plant as the organization expects that the working motivation among the employees will increase due to development of the organization. The straight monetary benefits were not highly emphasized although they were mentioned. The continuous development of the ecosystem and that way development of the organization is highly valued. Hence the social benefits that are brought to the work and the content of work are seen as great benefits. It was believed that the new processes will enhance the significance of the work for the employees. The waste-waste plant expected that value benefits on more environmental level. The environmental benefits are valued in social level. Such as environmental wellbeing enhances the residents' living conditions in areas where the environment is cleaner. Also, the decrease or stopping the increase of resource extraction was noted, as a possible benefit for the environment. The economic outcomes are valued too, but according to the interview their importance was secondary.

Therefore waste-water plant's perceived value is more like a combination of the efficiency and excellence value outcomes. They do expect that their sacrifices are responded by the monetary value outcomes. Anyway, the excellence value outcomes were also stated to as important. Especially, the development of the organization is held as an important outcome that will cause that the company is up to date and is able to meet the challenges it faces. It was also noticed that the nature of the organization is reflected to the valued outcomes. Therefore, for example cleaner waters were highlighted as a benefit that is notable for the organization. That is so because of the official duty of the organization is to improve the cleanliness of the environment.

Governmental actor sees important the benefits that are beneficial in the societal level. In the economical level there are prospects for export after the process has been developed in the ecosystem. This is excellence value, as the monetary outcomes for the society are underlined. The actor also expects outcomes on environmental level include better state of the natural ecosystem. Due to recent debate on the state of climate change and the warming of the planet the environmentally outcomes are important benefit for the humanity. On the personal level the environmental outcomes are for example cleaner sea or other water systems. The surroundings of the factory areas can become cleaner if for example the smell problems of wood industry related factories can be cut.

The aim of the sub-question was to study what value outcomes are missed. By this question it is not assumed that all of the expected outcomes will exits. Hence the missed value outcomes are investigated, too. When it comes to the imago issues, if the positive outcomes for the society and environment that occur from the CE are not communicated appropriately the efficiency and interactional perceived value dimensions can be missed. The efficient processes require comprehensive dialog and that is necessary for the companies to achieve the full potential of the value co-creation activities.

All of the interviewees were worried about that the CE process activities are categorized only as intention to improve the brand. The concept called "*circular economy washing*" was used in connection of the topic. This can reduce the imago issues that raise from the CE business processes. Also, it was noted that the actors are afraid that things are done only to fulfill the requirements of common pressure. At worst, this can create inefficient activities that do not meet the real demands. Hence, missed value outcomes can include efficient processes and therefore economical losses. Also, in such case, the learning outcomes can occur as partial.

5.2 Reliability, validity and the limitations of the thesis

According to Seuring (2008), ensuring the validity and reliability of the research is important and should be taken into consideration when conducting a research. In this thesis the validity is tried to be ensured by conducting the interviews anonymously to encourage the interviewees to be open and honest when describing their aspects. Also, the best fitting interviewees were tried to be reached. The interviews were recorded so that it was possible to make transcribes and therefore the precision of the data was secured.

Due to the fact that only three actors were interviewed the results can be generalized only to other ecosystems which appear to be rather similar as the case in this thesis. However, the results can be generalized in other similar industry ecosystems in Finland because the legislation and waste-water business are similar. Furthermore, the interviewed actors are the biggest in their fields in Finland and therefore they have large resources to act in an ecosystem and have negotiation power. That can affect the outcomes if the results are applied to ecosystem with smaller firms.

The thesis covered only one case and therefore it cannot be directly generalized to other CE processes. The other cases are restricted from this research because this case represents the forerunner of this fields and they have visions for such activity in their ecosystem. The case is placed in Finland so internationally generalization might not be possible as the legislation and other practices might vary. Also, the emphasis is on industrial process in business-to-business markets and therefore private people's perceptions are not included. As the process is not yet running, the results might differ from the real concrete process.

5.3 Future research propositions

In the future it would be an interesting topic to compare which outcomes concretize from the process and which were missed. Since now, great expectations towards the circular economy have been created. Therefore, it would be interesting to search

the root reasons for why the outcomes stated here have not actualized or what have been the drivers and competencies for successful operations.

An other interesting topic is the services' role in the circular ecosystem process because it the actors emphasized that they are keen on concentrating on their own core business. Therefore, the CE process applications requires services providers. The benefits from the CE process were expected and believed that they will occur. Anyway, the role of service provider was emphasized and certainly needed. So, the research that has focus on the service provider's role and services in the CE ecosystem would be beneficial in the future.

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APPENDICES

Appendix 1: Interview questions

I Kiertotalous ja arvo

1. Kuinka tärkeitä kiertotalousprosessit ovat tulevaisuudessa liiketoiminnalle/organisaatiolle mielestänne?
2. Miten näätte kiertotalouden arvon luonnin verrattuna perinteiseen lineaariseen malliin?
3. Miten koette arvon, jota kiertotalous voi tarjota organisaatiollenne?

II Kiertotalousekosysteemin sidosryhmien tunnistaminen

4. Voisitteko kuvailla omin sanoin, mitä sidosryhmiä kuvailtuun kiertotalousprosessiin voisi kuulua?
5. Jos katsotte kuvaa 2, mitä sidosryhmiä luokittelisitte ympyrän sisälle ja mitä ympyrän ulkokaarelle oman organisaatiosi näkökulmasta?
6. Miten yhteistyö näkyy sidosryhmien kanssa prosessin ympärillä?
7. Mitkä sidosryhmät olisivat tärkeimpiä teille tässä prosessissa?
8. Miten koette julkisen sääntelyn roolin tässä prosessissa?

III Arvonluonti kiertotalousekosysteemissä

9. Miten sidosryhmät luovat arvoa näkemyksenne mukaan toisilleen tässä prosessissa?
10. Minkä aktiviteettien kautta kiertotalous voisi luoda arvoa teidän liiketoiminnalle/työlle?
11. Mitkä aktiviteetit ovat merkittävimmät arvonluonnin kannalta teille?
12. Entä asiakkailten/ lähisidosryhmälleen?
13. Mitkä arvonluontiaktiviteetit ovat mielestänne merkittävimpiä verkoston kannalta?

III Arvon kokeminen

14. Mitä hyötyjä odottatte, että prosessi tuottaisi?
15. Mitä todellisia hyötyjä/tuloksia/ vaikutuksia oheinen prosessi tuottaisi teille?
16. Mitkä olisivat prosessin vaikuttavimmat hyödyt
 - Sosiaaliset? -esim. Tiiviimpi yhteistyö
 - Taloudelliset? – esim. Uudet liiketoimintamahdollisuudet
 - Ympäristölliset? – esim. Hiilidioksidipäästöjen väheneminen?
17. Miten hyödyt konkretisoituvat liiketoiminnassanne?
18. Jos mietitte kymmenen vuotta eteenpäin, mitä teoreettista hyötyä kiertotalousprosessi voisi tarjota, joka ei ehkä lähitulevaisuudessa vielä ole mahdollista?
19. Onko jotain hyötyjä kiertotaloudesta, jotka voisivat jäädä realisoitumatta? Jos on, niin -mitä?
20. Onko vielä jotain muuta, josta haluat kertoa, joka ei ole tullut ilmi?