TALLINN UNIVERSITY OF TECHNOLOGY
School of Business and Governance

Arseni Kotov

EXPLORING THE POSSIBILITY OF CIRCULAR ECONOMY ADOPTION ORIENTED BY OPEN INNOVATION AMONG ESTONIAN SMES: POTENTIAL INSPIRATION FROM EXPERIENCES IN AUSTRIA

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Supervisor: Wolfgang Dieter Gerstlberger, PhD

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I hereby declare that I have compiled the thesis independently
and all works, important standpoints and data by other authors
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The document length is 11152 words from the introduction to the end of the conclusion.

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ABSTRACT

In the world confronted by rapidly increasing consumption of natural resources and threatening ecological, economic and geopolitical crises, there is a need for a model to handle the resources in a more efficient way and benefit businesses, society and the environment. The concept of circular economy (CE) is gaining momentum among industries, politics and academia by promising a model to confront today's challenges and improve environmental protection. However, limited attention has been given in the literature to the exploration of transformation from linear economy to CE by collaboration and knowledge sharing, in particular by utilizing open innovation (OI). OI is a systematic approach to opening the boundaries of organizations in order to share and generate new knowledge and skills to develop new products or services. Especially small- and medium-sized enterprises (SMEs) are dependent on external knowledge to foster their innovation activities. Therefore, the aim of this master's thesis is to integrate OI and CE and to explore the possibilities of CE adoption oriented by OI among SMEs by conducting qualitative research.

Keywords: circular economy, open innovation, small- and medium-sized enterprises, sustainability

INTRODUCTION

The need for transformation from the traditional linear "take-make-use-dispose" economy towards sustainable CE has been widely recognised by both governments and businesses (Bocken et al., 2017; European Commission, 2020). This topic may be considered as an important one especially today, as we are confronted with shifting global contexts. Covid-19 pandemic, geopolitical tensions, technological change, along with the environmental problems like global warming, climate change, air and water pollution, unsustainable economic growth, resource scarcity, waste disposal, overpopulation and other social and environmental challenges, which considerably alter the global landscape. Numerous sources suggest that individuals, companies, and governments around the world are reshaping their behavioural patterns and strategies to step up to these challenges and try to avoid any sort of irreparable damage. The transition towards more sustainable society and economy implies the reorientation of organizations and is crucial for companies, customers, and other relevant stakeholder, but at the same time achieving the sustainability goals should not mean sacrificing profits (Przychodzen et al., 2016). From author's perspective, if companies can respond to present and future challenges with new innovative forms of value creation, then along with gaining benefits of improving sustainability, new products and services can be created, new customer segments and markets seized. However, many companies are still struggling to readjust their business behaviour and face difficulties in transforming themselves towards CE (Mauss et al., 2022). This shift is even more complex in case of SMEs mostly due to lack of resources, smaller market presence, limited expertise and capabilities to adapt to new technologies (Garrido-Prada et al., 2021).

In this light the author of this master's thesis intends to explore a way to enhance the transformation towards CE among SMEs. This intention is based on his participation as a student assistant in the course MMK5330 Development Trends in Business Environment during spring semester 2022 at Tallinn University of Technology, during which he has worked on sorting, translating and presenting to students the results of the research "Enablers and Barriers to the Introduction of Circular Economy Practices" (Research). Research was conducted from the 8th of September till the 12th of December 2021 by the Tallinn University of Technology Sustainable Value Chain

Management working group on behalf of the Estonian Ministry of Economic Affairs and Communications with the aim of analysing the status quo and the dynamics needed to transform linear business models towards circular business models (CBMs) among Estonian SMEs in four industry sectors: computers, electronics and optical equipment industry; chemical industry, electrical equipment industry and metal industry. As per Research, in many cases CBMs are still not relevant for the Estonian SMEs and have not been adopted at large scale, as the level of awareness on the topic is relatively low and companies are facing a number of barriers e.g., lack of governmental support measures, own resources and interested cooperation partners, but also company size, low spread of social innovation practices and limited knowledge. Nevertheless, Estonia has a potential of implementing changes in the direction of CE and many companies have expressed their willingness to adapt CE practices, therefore it is necessary to further encourage the transformation to CBMs, but also to share knowledge and expertise (Gerstlberger et al., 2022).

Some of the barriers to CE mentioned in Research, specifically lack of resources, knowledge and information, can potentially be overcome by practices recommended in the OI literature, namely by opening organizational borders in order to collaborate, exchange and integrate ideas and knowledge with relevant external partners, such as other companies, suppliers, customers, consultants, agencies, universities or research institutions (Jesus & Jugend, 2021). By intensifying collaboration between parties, companies gain the ability to boost their innovative capabilities, which may lead to new product developments and process improvements (Clausen, 2013). According to the literature review done by Jesus & Jugend (2021), the adoption of CE oriented by OI is still a recent phenomenon and there is a gap in research literature to understand the influence of culture, economy, and politics of different countries on this process.

In this work the author has decided to look into Austria to get the insights on the possibility of CE adoption by utilization OI, as this country has been the first one in the EU and one of the first in the world to develop and implement an Open Innovation Strategy in 2016 with the aim to promote openness and collaboration between business, research institutions, universities and members of general public to establish an efficient open innovation system (Austrian Federal Ministry of Education, Science and Research, 2021). Main strategy areas concern development and teaching the OI culture, creation of multi-sectoral OI networks and partnerships, activation of resources needed for the successful implementation of OI (Open Innovation Austria, 2021). Moreover, Austria can be characterized as a model for sustainable development in Europe (Gerstlberger,

2004), a country that has an outstanding innovation capacity and is ranked among the leading research countries in the EU (Austrian Research and Technology Report, 2022).

The aim of this thesis is to explore the possibilities of CE adoption oriented by OI on the example of Austria and answer the main research questions: how may OI favour the adoption of CE among SMEs? From authors point of view the research findings may complement Research and add insights on the possible collaboration between companies and governmental institutions alongside the innovation path to CE in Estonia.

To be able to achieve the aim of this thesis, several tasks should be conducted. Namely:

- provide a thorough theoretical background on the research topic and highlight the integration of two themes – CE and OI.
- formulate the research questions.
- design the research and conduct preparations for the data collection.
- conduct semi-structured interviews.
- analyse derived qualitative data and discuss the research findings.
- propose recommendation for further research.

This thesis is divided into four parts and has following structure:

- first chapter begins with theoretical background review and basic definitions, including a brief description of SMEs, innovation and Open Innovation Strategy for Austria, following by a detailed dive into CE and OI concepts, and contribution of OI to CE.
- second chapter presents the research methodology and design.
- third chapter introduces the summary of qualitative data derived from the interviews, including description and discussion of research findings.
- the fourth part consists of conclusion, limitations and suggestions for further research.

It is important to note that the author's objective is not to compare Austria with Estonia, but to collect and analyse qualitative data derived from semi-structured interviews with different actors related to OI and CE in Austria for further contribution to the adoption of CE in Estonia.

1. THEORETICA BACKGROUND AND BASIC DEFINITIONS

The aim of the first chapter is to give an overview of the theoretical foundation upon which this research has been built on. In the following theoretical concepts of CE and OI are presented, as well as the contribution of OI to the adoption of the CE. The reader's attention is also drawn to the characteristics of SMEs, innovation and Open Innovation Strategy for Austria

1.1. Innovation

The ancestor of the concept of innovation was Professor Schumpeter, who has given the impetus to the theory in the first half of the twentieth century (Louçã, 2014). From Schumpeter's view, the process of economic development is a dynamic process triggered by inventions, some of which become innovations and spread throughout the system enabling the innovators and their followers to make profits and putting at risk of non-survival the others (Kurz, 2008). The modern concept of innovation is based on the effective utilization of new ideas and technologies aiming at performance improvement and advancement of business processes, products or services (Adam & Alarifi, 2021). In order to stay competitive and go with the times, companies must constantly adjust their activities, develop and utilize their innovation potential (Fey & Kock, 2022). Countries that put more emphasis on the development of innovative programs, investments in technological progress, exploit scientific and industry collaborations, but also bring to life norms, policies and institutions that foster the innovations, enjoy higher levels of competitiveness (Hervas-Oliver et al., 2021). In the context of SMEs, the innovation is also contributing to the creation of opportunities for the entrepreneurs by allowing to introduce new products, services or raw materials to the market (Sahut & Peris-Ortiz, 2014). The entire chain of actions from the idea generation to its implementation is defined as innovation process, which includes following stages: "opportunity identification, ideation and idea management, concept development, product development, testing and validating, and launch" (Zaverzhenets & Lobacz, 2021). One of the most important factors that encourage the innovation process among SMEs is the region, because of the influence of collaboration with external partners and knowledge transfer, local institutional setting, structure of the economy and the regional innovation policy (Kaufmann & Tödtling, 2002). SMEs show positive significant impact on the innovation process derived from the collaboration with other companies and knowledge centres e.g., universities or research institutes, hence this factor should be stimulated by the policy (Radas & Božić, 2009).

1.2. Small- and Medium-Sized Enterprises

European enterprises are classified into SMEs and large enterprises. The main criteria that determine this classification is the size of an enterprise, specifically the number of employees, and either turnover or balance sheet total. The European Commission Recommendation 2003/361/EC defines SMEs as enterprises that employ fewer than 250 persons and have an annual turnover not exceeding EUR 50 million, and/ or an annual balance sheet total not exceeding EUR 43 million. Also, the ceilings are set to determine company categories within SMEs.

Table 1. Classification of SMEs

Company category	Staff headcount	Turnover or	Balance sheet total
Medium-sized	< 250	≤ € 50 m	≤ € 43 m
Small	< 50	≤ € 10 m	≤ € 10 m
Micro	< 10	≤ € 2 m	≤ € 2 m

Source: European Commission Recommendation 2003/361/EC (Article 2)

The economy of the EU consists of 25 million SMEs, which count for 99,8% of all enterprises and makes the largest group in the business system. SMEs play a decisive role in the EU's economy and society. They significantly contribute to the European economic growth, job creation, poverty alleviation and social stability. SMEs contribute more than 66% of total EU employment, account for more than half of Europe's GDP and play a key role in adding value in every sector of the economy (Rotar et al., 2019). In most of the cases a single SME is not responsible for the big impact in terms of sustainability, but altogether SMEs are in charge of the major part of resource consumption and waste generation, and account for approximately 70% of industrial pollution in Europe (Cantele et al., 2020). Generally, SMEs do not tend to utilize sustainable solutions and are less inclined to perform transformational changes in comparison to large enterprises (S. Mitchell et al., 2020). The adoption of sustainability measures among European SMEs is mainly hindered by the economic, organizational and regulatory barriers, and fostered mostly by the influence of external pressures, organizational and regulatory drivers (Neri et al., 2021). European SMEs innovation is dependent on the internal sources from R&D activities, but to a greater extent on the external drivers, like collaboration with other enterprises or research institutions, and on the influence of regional institutional architecture and context (Hervás-Oliver et al., 2021).

SMEs make a significant part of Estonian enterprises and have a great importance for the economic growth (Dickinson, 2013). The number of SMEs in the structure of Estonian enterprises in 2020

has accounted for the total of 98853 enterprises or 98.7% of all companies (Statistics Estonia, table EM001). On the contrary, Austria belongs to the top countries within the EU with SMEs amount for 99.6% of all companies, employ over two million employees, generate around EUR 535 billion turnover, have a higher than the EU average innovation rate (61% vs. 49%) and show strong tendency to utilize sustainability measures (45% of Austrian SMEs vs. 34% Europe average) (Austria Federal Ministry for Digital and Economic Affairs, 2022).

1.3. Circular Economy

Extensive consequences of environmental pollution, that has been caused by the human activities, are forcing economies all over the world to re-think the current economic approach and develop new methods to act in a more sustainable way. CE is a recent paradigm that promises more sustainable approach towards production and material usage. This model can be roughly characterized as a model, which is based on the creation of closed production cycles, in which raw materials and energy are neither disposed, nor emitted immediately after the usage, but recycled and reused within the cycle for as long as possible (Chauhan et al., 2022). This way of thinking completely differs from the classical linear model, which still dominates most industries around the world. Therefore, a transition towards circular economy may require more than just an effort from the business side, but the active participation of all stakeholders: companies, customers, societies, and governments in both industrialized and developing economies. There is an obvious need in switching from the current linear model of economy and introducing and promoting circular economy principles to a wider range of stakeholders, in order to favour the sustainable development and reduce the negative impact on the natural environment (Lewandowski, 2016).

1.3.1. Concept of Circular Economy

The concept of CE can be considered as countermovement to the traditional “take-make-use-dispose” linear model and can be characterized as “an industrial system that is restorative or regenerative by intention and design” (Ellen MacArthur Foundation, 2013). The utilization of CE concept is based on lessening the impact on the environment and is motivated by the consecutive improvement of resource usage, and reduction in emissions by adapting innovative circular systems, along with gaining economic benefits and efficiency (Geissdoerfer et al., 2017).

The Ellen MacArthur Foundation is a significant encourager of CE contributing to the development of circular practices in different sectors of global economy. According to the Ellen MacArthur Foundation (2015), the concept of CE is based on three main principles and forms two cycles of slowing and closing the loops: biological and technical cycles, as shown in the butterfly diagram in the Figure 1.

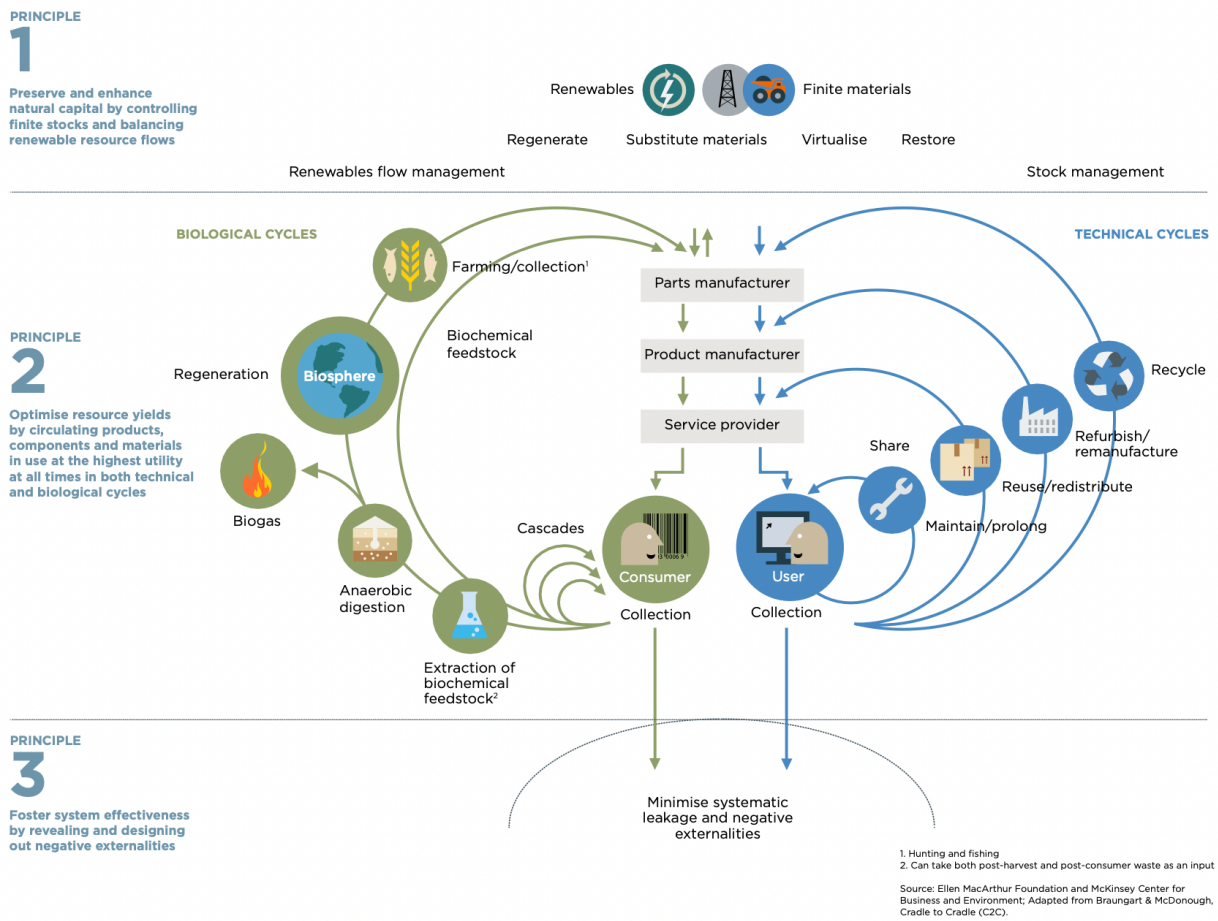

Figure 1.: Principles of Circular Economy
Source: Ellen MacArthur Foundation (2015)

This diagram depicts the continuous flow of materials within the CE system. The concept of CE is defined as restorative and generative economy (Morseletto, 2020). The concept strives to reach the state when materials are not exhausted but managed and used in cycles for as long as possible, in which connection the meaning of biological cycle is based on the management of renewable materials flow in natural cycles within the biosphere and technical cycle is based on the circulation of non-biodegradable and finite materials within the technosphere, which is made by humans (Ellen MacArthur Foundation, 2015).

By reading many recent articles on CE, you may get an impression that CE as a concept has moved from the minor signal to a hot trend. Even though the concept of circularity is not new but has already been used before the industrial revolution to respond to the waste management or recycling during those days, there is still a considerable lack of information that has not been yet explored within the field of CE (Lieder & Rashid, 2016), the necessary shift towards the circularity has not yet taken place, hence the positive sustainable impact is not achieved (Lawrenz et al., 2021). However, due to growing environmental and societal problems, but also global economic challenges, the importance of CE gains momentum on the local and international levels for the science, politics and economies, which results in the growing number of academic research with the focus on different concepts of closed loops (Geissdoerfer et al., 2017). The concept of CE is gaining in popularity among European companies, although many companies resist to change and there is a lack of awareness of opportunities that come from the CE (Kevin van Langen et al., 2021). CE involves a number of concepts, most prominent of those are cradle-to-cradle (Ünal & Shao, 2019), circular bioeconomy (Ali et al., 2022), industrial ecology (Graedel, 1996) and blue circular economy (Naddeo & Taherzadeh, 2021). Since the concept of CE is being used by a great number of stakeholders for various reasons and in different geographical areas, many critics claim that the meaning of the concept is blurred and definition is interpreted in many different ways, hence the perception of CE is different (Kirchherr et al., 2017). And in most of the cases the intention to become circular is still premature and companies need support and guidance to start their circularity path, whereas shared values with the stakeholders are the key to enable and stimulate the transition towards CE (Bertassini et al., 2021).

1.3.2. Circular Business Models

Business models are concerned with how companies do business, and depict how the design of value creation, proposition, delivery and capture is employed (Teece, 2010). Technological and social innovations that are aimed at preserving and improving the environment by creating new systems and change at the core of the business models to seize the unsustainability at its source, are driven by sustainable business models (Bocken et al., 2014). CBMs are a particular type of sustainable business models that align with the principles of CE and aim at keeping the value of products at the highest possible level by slowing, narrowing or closing the loop of resources, and minimizing environmental impacts from the economic activity (Santa-Maria et al., 2021). CBMs can lead people, companies and markets towards sustainability and, in comparison to traditional business models, can be more effective and efficient (Fehrer & Wieland, 2021). Decisive factor of transformation towards CBMs is the rethinking of how a company creates, delivers and captures

value (Lüdeke-Freund et al., 2019). However, despite its wide recognition, research interest, opportunities and benefits, the implementation of CBMs approach is still challenging and uncommon in practice (Linder & Williander, 2017).

1.3.3. Circular Business Model Innovation

The process of changing existing business model or replacing with a completely new one is defined as business model innovation (D. Mitchell & Coles, 2003). Based on this understanding, process of changing or re-designing existing linear business model with CE components to implement CE practises is characterized as CBM innovation (Nußholz, 2018).

In many cases adopting new business model may be hindered by the lack of resources, conflicts with prevailing business models or managers resistance to change (Chesbrough, 2010). As well as the implementation of CBMs has been low and is no exception to barriers, which are detected on all four socio-technical levels, that's barriers at the market, the institutional and the value chain level, the organisational and the employee level (Guldmann & Huulgaard, 2020). Efficient tools and methods to overcome these barriers are still scarce and many of them are generic in essence lacking clear environmental impact (Bocken et al., 2019).

Sustainable business model innovation implies collaboration with social and economic actors outside the company in order to identify new business approaches, including new forms of learning and diffusion to external partners (Roome & Louche, 2016). Due to peculiar properties of CBMs, cooperation and co-creation may be considered as a prerequisite for a sustainability transition of companies (Bocken et al., 2018).

1.3.4. Barriers to Circular Economy

Although the concept of CE has been widely accepted in the economic and political environment, in most regions all over the world the progress of change from liner to circular business models is still rather low (Ghisellini et al., 2016). According to the Circularity Gap Report the global economy was only 8.6% circular in 2020 (Circle Economy, 2022). The shift towards circularity can be achieved by going through the fundamental change along the production and consumption patterns, but this is not an easy task, because the process of transformation is hindered by many barriers to CE. Kirchherr et al. (2018) distinguish between four main categories of barriers, namely

cultural, regulatory, market and technological barriers; and also 15 sub-barriers, all of which are listed in Table 2.

Table 2. Barriers to the Circular Economy

Cultural	Lacking consumer interest and awareness
	Hesitant company culture
	Operating in a linear system
	Limited willingness to collaborate in the value chain
Market	Low virgin material prices
	High upfront investment costs
	Limited funding for circular business models
	Limited standardization
Regulatory	Obstructing laws and regulations
	Lack of global consensus
	Limited circular procurement
Technological	Limited circular design
	Too few large-scale demonstration projects
	Lack of data, e.g. on impacts
	Ability to deliver high quality remanufactured products

Source: (Kirchherr et al., 2018)

If to look at the main barriers in more detail, cultural barriers refer to the consumers perception, e.g. limited consumer awareness or acceptance, and companies internal culture, which is not integrated with the CE principles, but adhere to the linear models; market barriers hinder the transition by availability of materials at low prices and high initial investments for the switch towards CE; regulatory barriers arise due to lack of supportive policy measures and insufficient government interventions, e.g. in the field of financial support; and technological barriers emerge when relevant technology for the CE is out of reach (Kirchherr et al., 2018).

Therefore, the transition towards CE requires a significant change and holistic integration of economy, politics and society as a whole, including regulatory measures, subsidies, financial support and removal of existing barriers.

1.4. Open Innovation

OI can be characterized as a successful approach to make the use of external or internal knowledge flows as a mean of accelerating innovation processes and is based on sharing the competencies and collaboration (Bogers, 2019).

1.4.1. Open Innovation Paradigm

During last several decades there has been a change of attitude towards innovation and its creation within the companies, that is the transformation of models of innovation process that has shifted the traditional linear model of innovation, which was based on company's own resources and ability to use these resources, towards non-linear, dynamic and knowledge-based models (Alekseevna, 2014). The tendency of acquiring and using external knowledge from other organizations has begun since the 1980's (Lichtenthaler, 2008, 154). Since its first introduction in 2003 by Henry Chesbrough as an opposite to closed innovation, OI has received a great interest from scholars and practitioners and can be defined as "the use of purposive inflows and outflows of knowledge to accelerate internal innovation, and expand the markets for external use of innovation, respectively" (West et al., 2014). OI can be characterized as the organizational ability to use internal and external ideas as companies strive to stimulate their potential to innovate, advance technological base and create value, while they need to overcome resource, capability or institutional constraints. Simply put, at the centre of OI concept is how companies absorb and utilize knowledge and ideas from the outer world in their innovation process. This leads to the understanding that valuable ideas can originate from inside, as well as from the outside of the companies. Therefore, in order to gain more success companies should be more flexible and open to the outer world. Especially now OI can be considered as crucial, because today there are many companies that stagnate in development and do not improve in productivity, which in turn leads to inequality, wasted potential and wasted resources (Bogers et al., 2018, 9). Limited openness and bounded collaboration with the external environment may restrict innovative activities, lead to organizational myopia and increase probability of missing opportunities (Bogers et al., 2018).

From a process perspective, OI is classified into three categories, namely outside-in process, inside-out process and coupled process (Enkel et al., 2009), wherein the main difference lies in the direction of knowledge flows. The outside-in process has the focus on enriching the company's own knowledge base and innovation capacity through acquiring competences and resources from external sources, for example from suppliers, customers or partners through integrations, co-

operations, user involvements or in-sourcing. The inside-out process is characterized by commercializing internal knowledge and ideas, as well as know-how, IP rights or technology, through licensing-out, open-sourcing or other means of transferring competences to the outside environment. The coupled process can be seen as a combination of both, the outside-in and inside-out processes, and refers to the knowledge exchange and co-creation with complementary partners through structured cooperation, for example through strategic alliances, cooperation or joint-ventures (Ahn et al., 2014). These strategies are referred to in the literature as the three core open innovation processes (Gassmann & Enkel, 2004), and their influence is widely discussed among researchers.

In the beginning, the OI paradigm has mostly been explored from the perspective of large multinational enterprises, while small companies have received only moderate attention (van de Vrande et al., 2009). But due to characteristic of SMEs, such as flexibility, less formalized approach and theirs strive to be innovative, but at the same time lack of capacity and scarce resources, they can benefit from using OI strategies (Lee et al., 2010). Therefore, the more open SMEs are towards external environment, the greater potential they must generate new knowledge and implement innovations (Stanisławski & Lisowsk, 2015). Utilizing OI approach may help SMEs to overcome internal and external barriers, create and maintain relations with different market actors, save resources, gain new knowledge, but more importantly innovate at lower costs and achieve better market position (Odriozola-Fernández et al., 2019). Although three core open innovation processes benefit companies in their own way, most SMEs focus on outside-in process (Parida et al., 2012). On the assumption of prevalence and applicability of outside-in process among SMEs, this direction is set out to continue the literature review.

1.4.2. Outside-in Process

The outside-in process can also be found in the scientific literature under the name of inbound open innovation or inward-oriented open innovation. It describes the possibility of bringing the innovations into the company by opening its boundaries for the information inflow from external environment. The openness in the company's outside-in process towards external sources may result in higher innovation performance, in particular, openness towards universities and customers is likely to increase product innovations and positively influence sales; and openness towards universities, competitors and suppliers may lead to increase in process innovation (Inauen & Schenker-Wicki, 2011). Utilization of outside-in OI helps to improve new product development process and increase the overall performance of the company (K.V & Hungund, 2021). When costs

make an important obstacle to innovation, then there is a greater probability that companies tend to cooperate with universities (Veugelers & Cassiman, 2005). Several studies have indicated that SMEs can benefit from utilizing outside-in OI approach. For example, in another example, Parida, Westerberg, Frishammar (2012) have included 1,500 Swedish SMEs in their study of outside-in OI and confirmed that companies can greatly benefit from the utilization of OI activities and positively influence their innovative performance. In another example, Fatur, Likar, Ropret (2010) have studied 2,503 Slovenian SMEs (92%) and large companies (8%) with the aim of finding the impact of innovation on the company's performance, and as a result they have found out that if a company's innovation processes are open to the external environment, then this correlates with the growing tendency for innovation and consequently improvement of financial performance in terms of higher financial returns.

1.4.3. Actors and Sources

OI process involves the interaction between different actors, who cooperate with each other in order to open opportunities and obtain mutual benefits, although may be motivated by different factors (Hinojosa et al., 2019). Companies that seek to get access to new knowledge, capabilities and resources in favour of stimulating internal innovation processes, may include external stakeholders in the R&D activities, plan and coordinate their engagement, but also maintain these relationships and obtain stakeholders satisfaction (Urbinati et al., 2020). Number of authors have described and analysed different stakeholders and their influence on OI processes, either outside-in, inside-out or coupled. Universities, customers, suppliers, competitors, NGOs, research agencies and others can enter in the stakeholders list. One way to categorize these actors is to divide them into two categories according to the type of ownership and the profit-non-profit orientation of organizations: industrial partners (customers, suppliers, competitors and other extra-industry companies) and knowledge partners (universities, research institutions, government agencies, technology intermediaries and intellectual property organizations) (Huang et al., 2018). Laursen and Salter (2006) have focused on the search channels that companies use in search for different sources of knowledge and have introduced the concepts of external search breadth (number of external sources) and depth (level of knowledge drawing). As a result of the analysis of 16 external sources of knowledge and 13 industrial sectors in the U.K., they have acknowledged that companies widely open to external sources can improve their technological base and exploit innovation opportunities (Laursen & Salter, 2006).

Researchers have also paid attention to the drivers and barriers of relationships between OI actors. If the organization is open to OI, then employees should also have the capacity and motivation to engage in knowledge sourcing from external environment, and this reflects in the importance of relational leadership that may enhance individual interest to increase engagement, collaboration and creative work, but also establish a culture of learning and development (Engelsberger et al., 2021). On the other hand, limited connections between partners within the supply network may lead to lower level of trust and higher opportunistic behaviour, which consequently may hinder resource and knowledge sharing, and as a result prevent innovation output from the relationships (Bellamy et al., 2014). If R&D collaboration as a form of OI is hindered by low commitment and missing trust, this may stimulate tensions between knowledge sharing and protection, and as a result harm the development of new technologies (Bogers, 2011). Organizational inertia can also limit OI, meaning that internal environment and old processes within the company, if not changed or eliminated, can block the flow of innovation from the outside, and hence the organization will not be able to use ideas coming from the outside of the company (Moradi et al., 2021). Lack of communication, differences in motivation, strategies and general attitudes may weaken relationships between companies and universities, and hence can complicate technology transfer (Collier et al., 2011).

1.4.4. Open Innovation Strategy for Austria

Since the 2016 Austria has been the first country in the EU and one of the first in the world to develop and implement its national Open Innovation Strategy that serves to promote openness, reduce barriers to collaboration between different stakeholders and lessen the fears of knowledge sharing, all with the aim of increasing Austria's innovative strength and competitiveness by means of OI (Open Innovation Strategy for Austria, 2021).

1.4.5. Contribution of OI to CE

Collaboration can be argued to be crucial in the transition to the CE (Berlin et al., 2022), and, at the same time, collaboration is an inherent part of OI, because it's aim is to be open to the external environment, build and maintain mutually beneficial relationships with each other. Moreover, collaboration is a common characteristic of social innovation, and it can complement both concepts – social innovation and OI, when it comes to interaction between different actors aiming at capturing knowledge to create better solutions for social needs or overcome societal challenges, but also to mitigate risks and replicate innovations on different societal levels (Martins & de Souza

Bermejo, 2014). Also, according to the Eionet Report (2021), development of CBM is dependent on the social innovation strategies, along with the technical innovation, and consequently social innovation significantly contributes to the transition towards CE. Berlin, Feldman and Nuur (2022) have studied Swedish steel recycling supply network and confirmed that collaboration can be crucial in transition towards CE, and found out that the access to external knowledge, information sharing, and mutual organizational support are the drivers for collaboration in the steel industry, which may reduce complexity and increase efficiency of the projects. CE strategies and different collaboration practices are interconnected with each other across the supply chains, which in turn improves the sustainability performance (Sudusinghe & Seuring, 2022).

1.5. Research Questions

Results from the literature review have given a rise to the following main research question for the empirical study:

How may open innovation favour the adoption of circular economy among SMEs?

This research question has an exploratory character and is designed to understand more about the possibility to enhance the adoption of CE by utilizing OI approach among Estonian SMEs on the example of Austria. Based on the main research questions, the author has derived following sub-questions:

Block 1.: The influence of Austrian institutions on the adoption of Open Innovation practices
How effective is state innovation support for SMEs in Austria?
What state initiatives aim at promoting and accelerating the utilization of OI?
How does the Open Innovation Strategy promote the transition towards CE?

Block 2.: Circular Economy and Open Innovation in Austria
What is the overall acceptance of CE among SMEs?
What are the drivers and barriers to transition towards CE?
What role plays OI in the transition towards CE?
What are the main drivers and barriers to transformation towards CE by OI?

These questions inform the direction of this thesis, build a bridge between the theoretical background and empirical investigation, and help to create focus for data collection (Agee, 2009).

2. RESEARCH METHODOLOGY

The objective of this chapter is to describe the research method that has been applied for conducting this research. The main aim of this work is to explore the possibility of CE adoption oriented by OI among Estonian SMEs. To do this, the author intends to analyse the Austrian approach towards fostering the innovation process and CE, in particular investigate the impact of the Open Innovation Strategy for Austria. To achieve this, author has chosen the method of qualitative content analysis of the data, which is drawn from the semi-structured interviews with Austrian government and SMEs representatives. To accompany the empirical investigation and strengthen the findings, a thorough and detailed literature research and analysis has been performed in advance, which has allowed to gain better understanding of CE and OI contexts. Following table graphically illustrates the structure of the research:

Table 3.

PLANNING PHASE
Literature and online sources research with the focus on CE, OI, Austria
Definition of status quo and setting the objectives
Constructing the research questions
Planning the empirical study
DATA COLLECTION PHASE
Creation of pre-determined set of open questions
Selection and invitation of interviewees
Conducting semi-structured interviews
RESULTS EVALUATION
Import and transcription of the data material
Categories formation
Coding system creation

Results processing and interpretation
Answering the research questions
Discussion

Source: composed by the author

Consecutive chapters explain in more detail how the empirical data was collected, and which method was used for the data analysis.

2.1. Research Design

The research design covers the strategy and mode of how the research has been conducted. The research design enables the author to set out the components, which are required for the optimal conduction of the research (Maxwell, 2016). On the basis of different contexts and research questions, research in the social science is grounded on two research methodologies: quantitative and qualitative research methods (Lo et al., 2020). Quantitative method is related to quantitative analysis and interpretation of social phenomena by developing mathematical models, theories or hypotheses (Mccaffrey, 2022). Qualitative method does not rely on numerical analysis and is based on observation and interpretation in natural settings and understanding the data from the insider's perspective (Ahmad et al., 2019). Qualitative research enables international business researchers a deeper understanding of cross-cultural phenomena and secure fewer cultural bias (Giroud, 2005). Depending on the purpose and goal, the research can be categorized into exploratory, descriptive, or explanatory study, and have inductive, deductive, or abductive character (Makri & Neely, 2021). The research design of this work is guided by the concern about low utilization of CE principles among Estonian SMEs. The research questions formulated in the previous chapter can hardly be answered on the basis of measurable and standardized data, but information must be extracted to determine the behaviour patterns. This work follows the exploratory mode of analysis aiming at getting qualitative data by conducting semi-structured interviews Austrian government and SME representatives to understand what is happening and seek new insights, without offering any conclusive and final solution to the issue but contributing new knowledge to the existing CE and OI literature and providing recommendations for the further studies. The qualitative data extracted within this research is analysed by using qualitative content analysis method, by using which the researcher attempts to discover similarities and differences in the data, which are included in categories on various levels of interpretation (Graneheim et al., 2017).

2.2. Data Collection

In order to become answers to the research questions and create a basis for further discussion, the author has decided to complement the results from the literature review with the qualitative data extracted from the expert interviews. Expert interviews refer to the qualitative empirical research method with the aim of collecting specific knowledge or data about certain field of interest with the purpose of developing a better understanding of the reality (Döringer, 2021). Data collection has followed the qualitative research approach, in particular, the semi-structured interviews were conducted with the Austrian government and SME representatives. Conducting semi-structured interviews is the most popular method of data collection in the qualitative research, and it has proven to be the most flexible, accessible and effective mean of gathering information, especially in the cases when researchers are willing to capture the full picture of the social happening (Qu & Dumay, 2011). In total, the author has conducted n=7 semi-structured interviews. The interviews lasted between 16:04 and 51:49 minutes and were conducted online via Zoom or MS Teams communication platforms. Complete list of interviewees can be found in the Table 4., the list of interview questions used is available in the Appendix 1.

Table 4.: List of interviewees

Nr.	**Interviewee**	**Organization**	**Position of the Interviewee**	**Duration**
1	I1	Austria Wirtschaftsservice Gesellschaft mbH	International Marketing Manager	16:04 minutes
2	I2	Austrian Federal Ministry for Climate Action, Environment, Energy, Mobility, Innovation and Technology	Consultant	23:09 minutes
3	I3	Bertalanffy Center for the Study of Systems Science (BCSSS) and Circular Economy Forum Austria	Director	51:49 minutes
4	I4	Circular Economy Forum Austria	Advisor	21:43 minutes
5	I5	RepaNet Austria	Director	34:29 minutes
6	I6	Blün GmbH	Project Manager	17:40 minutes
7	I7	Uptraded GmbH	Director	23:10 minutes

Source: composed by the author

The semi-structured interview focuses on asking the predetermined set of open-ended questions within the research framework. Developing such interview guide is of great importance, as preparing questions ahead enables the interview to flow naturally and allows the interviewer to elicit more elaborate responses (Barclay, 2018). The interview guide consists of a combination of main and sub-questions that help directing the interview in accordance with particular situation, and the interviewee's willingness to communicate and readiness to enter into discourse. Set of predetermined questions have a focus on the research questions and enable the interviewer to hold on to the given thematic line during the interview and can adapt to the individual characteristics of each interviewee (Ryan et al., 2009). The questions were designed to obtain information on the promotion and implementation of OI strategies and the role of OI in utilization of CE principles.

The interview guide begins with short introduction of the interviewer and thesis and follows with the warm-up questions referring to the overview of the interviewee's current position and main responsibilities, but also general definitions to the concepts of CE and OI. Subsequent questions touch on the utilization of CE and OI, and state support for the innovation in Austria in more detail. The interview guide ends with an open-ended question related to any missing information or additional points related to this work.

The selection of interviewees was based either on the position, or an organization/ company relation to this works research questions. The interviewees are people who through their scientific or professional activities deal with the concepts of OI and CE. Most of the contacts were recommended by the Austrian Federal Ministry for Climate Action, Environment, Energy, Mobility, Innovation and Technology. In addition, the Austrian Open Innovation platform http://openinnovation.gv.at was used to gain more interviewees related to the research topic. All contacts were made by e-mail.

2.3. Qualitative Data Analysis

Qualitative method used to evaluate the expert interviews is a qualitative content analysis, which has been performed using program MAXQDA – computer software for qualitative and mixed method data analysis, which was used in accordance with the instructions given in the book Analysing Qualitative Data with MAXQDA by Udo Kuckartz and Stefan Rädiker (2019). Qualitative content analysis is a flexible method of analysing data, which allows to summarize raw

data into categories or themes and uses inductive and deductive approaches in data analysis (Shava et al., 2021). In order to perform the content analysis, audio and video recordings taken during the interviews were imported, transcribed, categorized and coded in the program MAXQDA. The categories are built upon the research questions. The formation of categories is based on inductive category formation, meaning that categories were developed on the basis of empirical data. Inductive category formation offers a faster and more specific procedure of content summarizing and aims at data description without bias to preconception of the researcher (Mayring, 2014). Categories consist of individual words, as well as from a combination of words. Some of the categories were slightly adjusted or optimized in the course of data elaboration in order to correspond to the research questions in the best possible way. Based on the research questions, the author has built three main categories, four sub-categories and thirteen categories, which are described in the Table 5.

Table 5.: List of Categories

Main Category	**Sub-category**	**Category**
Perception of CE and OI	Concept of CE	Definition of CE
		Acceptance of CE
		Drivers and barriers to CE
	Concept of OI	Definition of OI
		Role of OI
		Drivers and barriers to OI
		Promotion of OI
CE adopted by OI	Transition to CE	Role of OI in transition to CE
		OI strategies for CE
		Barriers
State initiatives on CE and OI	Actions	Government support for innovation
		Measures to adopt OI and CE
		Opportunities and obstacles

Source: composed by the author

These categories are built with the aim of reducing complexity, organizing and systematizing the data with regard to the research questions (Kuckartz & Rädiker, 2019). Categories were assigned to certain text passages with corresponding codes in the MAXQDA: after importing qualitative interview data to the program and working through the texts, certain text segments were coded one after another (see Appendix 2).

3. FINDINGS AND DISCUSSION

This chapter presents the research findings derived from empirical investigation, as well as discussion of results and outcomes of the research findings.

3.1. Research Findings

In the following sub-chapters, the qualitative data derived from the interviews is summarized according to the categories in Table 5. and corresponding research findings are described.

3.1.1. Perception of Circular Economy and Open Innovation

Definition of Circular Economy

All interviewees are well aware and have a common understanding of the CE concept and its necessity when referring to sustainability challenges and finding new ways of using resources in a more effective way. Similar interpretation results from the fact that interviewees are connected with CE in one way or another. Nevertheless, during the interviews a number of interesting opinions were expressed.

I3 defines the CE in two ways: firstly, CE is a way to regenerative economy, and we are at the very beginning of this new economic paradigm; secondly, through CE we can increase the material efficiency by extending the life cycle: from longer use, re-use, refurbishment and to recycling. I5 has a very progressive view on CE and pointed out that this concept is not just about recycling, how it is perceived by many, but forms a completely new economic model "where you work with what you already have and scale it up with knowledge and ideas, networking and collaboration, but not with the material stream". From the I7 perspective the role of an external expert may play an important role in raising the awareness and understanding the working mechanisms behind CE. This opinion is confirmed by Kirchherr et al. (2018), since many barriers to the transition towards CE cannot be overcome alone and may require external support.

Acceptance of Circular Economy

Most of the interviewees agree that many Austrian SMEs are trying, but they can do better and work a little harder towards circularity (I2, I5, I6). Same opinion was expressed by I3: "CE is unfortunately not present as we would like it to be". The education of the public decision-makers,

policy-makers and companies is in progress, as CE is still not understood (I5). However, the I4 has stressed that CE is pretty popular among Austrian SMEs and has pointed out that according to the latest study, done by Altstoff Recycling Austria, which is Austria's leading collection and recovery scheme for packaging and a non-profit organisation, the utilization of CE principles has grown in 2022 significantly and already 85% of Austrian companies are using or planning to transform towards CE, which is relatively more than in the previous year and above the Covid pre-crisis level, however there is a reason to believe that there is a big lag between those who have implemented CE and those, who are still planning to do it. However, the level of acceptance may vary between the regions as well (Hervás-Oliver et al., 2021), and this has been confirmed by the interviews, for example, in the region of Tyrol, which is more traditional one, the CE awareness is quite low, and it is quite complicated to find innovation partners there, but on the opposite side – in Vienna, the city that has set high objectives on the utilization of CE and aims to become the first circular city, there are many programs and initiatives aimed to fostering ideas towards CE (I5, I7).

Drivers and Barriers to Circular Economy

One of the main drivers to the transition towards CE is that the current system we are living in is not sustainable, and already now we see the impact in the face of the climate, energy, resource and social crisis, especially climate and energy crisis force economic actors to be a lot more flexible and resilient relying on new business models and partners (I3, I5). In many cases these limitations have become the enabler and now SME have a new commitment that they need to re-organize and re-design, find a new and different approach of sourcing materials or creating value in the chain (I3). But only if the industries, governments and society altogether push towards this transformation, then we can successfully adapt CE (I4). The strongest enabler for the government system is the European Green Deal, which forces all European governments deliver particular strategies and action plans aligned to this initiative (I1, I3).

The Circular Economy Forum Austria enables companies to adapt to CE by providing online courses and organizing round tables, where business present their business models and openly share the benefits they have gained through utilization of CE, and also the obstacles they have faced (I3).

The main barrier for SMEs is the lack of knowledge, and even if there is a basic knowledge on the CE and "it is drive by the development of the past and the idea that recycling is the thing we should concentrate on; this is followed by the lack of monetary resources, as most of CE projects involve

high initial investment" (I3). "How do you get so many people to rethink the linear economic system?" – is the biggest concern of I7. Also, financial uncertainty cannot be compensated by price adjustment, as in most of the cases SMEs do not have the possibility to increase the prices, because consumers simply will not buy the products (I5). Moreover, the uncertainty is so high that SMEs are afraid of investing their own resources into circular business models, so the first thing that SME do is call for the public money, for which they can apply within the funding schemes provided by the government, but these schemes are highly competitive and already the initial investment you need to make for the application are not available in many SME (I3, I5). Another barrier for the utilization of CE are inflexible supply-chains and unpredictability of the material supply (I6). Adapting logistics is not an easy task, because our whole economic system is based on scaling up the material streams and create a financial income at the end (I5). Also, from the interviews came up that Austria would need to improve inter-sectoral partnerships between different ministries in order to promote and push CE forward, as different parties have different political interest (5), and that does not correlate with sustainability issues. I6 has summed up the barriers to CE in Austria by pointing out that these kinds of barriers can occur at the beginning of every new industry, and "SME are getting better every year, but there are still many things they need to overcome".

It was also highlighted by the interviewees (I5, I6, I7) that it is important to have funded projects, but the financial rules may be very restricted, and the funding authorities are inflexible, which leads to the fact that a huge proportion of the project is related to administration: preparing the application, negotiating the project action plan, conducting relevant meetings.

Definition of Open Innovation

It is important to mention that all interviewees had a common understanding and defined OI concept in a similar way. OI is a particular innovation strategy that implies opened barriers of organizations and the flow of knowledge in two ways: either inside-out, or outside-in (I2, I3, I5). The presence of OI is an integral part of most of the projects, as per I1 "every research or innovation is to a certain extent done in a collaborative way, and there is always an outside perspective". OI strategies are widely used in the community, and if a company goes to the conference or is looking for a cooperation partners, then

Role of Open Innovation

In order to be able to cope with many new challenges, like digital transformation, climate change or the speed of change in the technology, companies need to innovate, connect and collaborate

with the outside world, therefore it is important to utilize OI strategies that enable the strategic opening of innovation processes in different organizations under diverse contexts (I1, I7). According to I3, in a perfect world "OI generates abundance of knowledge, which creates abundance of value for all participants".

Drivers and Barriers to Open Innovation

One of the drivers to follow the OI strategies is that the collaboration and sharing the insights can trigger the innovation process, and through this leads to a profit maximisation (I2).

Intellectual property rights are considered to hinder the utilization of OI, that is to whom belongs the research and development output, therefore Austrian institutions put a lot of effort in order to support companies to learn more and deal with this issue (I1). In some cases, companies are not ready to conduct collaborative research, so, as noted by I1, it is "important to create an open innovation readiness within the company".

Promotion of Open Innovation

Austria is on the right track of promotion OI and Austrian government has managed to successfully promote the basics of OI among a variety of stakeholders, ranging from companies to research institutions in order to foster the innovation initiatives (I1, I2). In the beginning of Open Innovation Strategy implementation, Austrian research institutions, that are funded by the ministries, were brought together and connected with the SMEs, that were funded by the governmental agencies, so the first step towards the promotion of OI was to bring together people and companies and create a community in order to consult with each other, share best practises and ideas through meetings on an annual basis (I2). Also, OI has been promoted within a variety of workshops for SMEs and research institutions with the purpose of creating synergies between different actors and programs (I7).

Worth mentioning the diversity of different projects for different stakeholders that are created under the roof of Open Innovation Strategy. You may find open spaces for innovation and experimentation all over Austria, which can be used free of charge, independently or linked to specific research institution (I2). A number of organization and projects are involved in the promotion and providing free open access to the research data and scientific information across the industries, as open data is an important advantage for the companies (I3). OI is also being promoted in the special interest media, in particular in special business outlets, with the focus on

environmental issues and energy (I3). I1 has pointed out that OI is promoted for all age groups: "we try to arouse interest and teach the ability to work with different partners within different groups from kindergartens and schools, as these abilities are essential prerequisites of OI". Within the Open Innovation Strategy of Austria pervasive approach is being promoted:

"Growing OI competences requires us to develop concrete solutions for all related stakeholder groups and the society as a whole, as OI plays an increasingly important role in the research and innovation process across all industries" (I2).

According to I1, most of the OI projects and programs are being constantly revised, developed and improved. However, despite the fact that much has already been done, Austrian SMEs need to utilize OI more, which should be promoted via research institutions and funding agencies (I2).

I1 has emphasized that it is important to support SMEs with issues related to intellectual property rights and align them to the OI:

"It is important to consider the intellectual property rights in OI processes, that is why we have developed a number of projects for start-ups and SMEs to raise awareness on the topic of intellectual property rights and how to protect them, but also mediate, test and use different strategies of intellectual property rights exploitation" (I1).

3.1.2. Circular Economy Adopted by Open Innovation

Role of Open Innovation in the Transition to Circular Economy

According to I7, "CE is a topic that you can't solve alone". According to I5, OI plays a big role in implementing CE principles, as most of innovative companies have contacts with research institutions, consultancies, scientists etc. This is a way to develop new projects and cases, and it is well established in Austria. Also, many funding projects have a prerequisite that a company has a collaboration with a scientific organization. According to I3, OI plays crucial role for the R&D, because development of networks, products and circular processes requires a cooperation with a variety of stakeholders involved.

Collaboration is the key in many CE projects, and it is important to have an expert to support in identifying the opportunities and finding the right partner for the particular project (I7). OI plays and important role in CE when it comes to the consumer goods sector, where you have consumers

as co-designers, or in the supply chains (I3). The utilization of OI may allow companies to scale up CE activities across the industries they are active in (I5).

I2 has mentioned that the role of OI for the companies that tend to adapt CE may vary according to the maturity of the comp

Open Innovation Strategies for Circular Economy

The utilization of a particular OI strategy in many cases depends on the size of the company, in particular large enterprises usually follow the outside-in strategies, while start-ups and SMEs use both: outside-in, inside-out and coupled (I1). I5 has expressed the opinion that most of the companies in any case tend to utilize outside-in strategies for the CE-related projects in one form or another, at least for a small number of products in their portfolio.

Barriers to the Adoption of Circular Economy by Open Innovation

The aspect of ownership and sharing the rights to a particular innovation is one of the barriers to the adoption of CE by OI, as according to I3 “most of the companies follow the classic capitalistic monetary system, which means allocate the resources as much as possible, but keep them under your control”. The fear of losing information advantage, in particular technological know-how, or the information asymmetry, hinders the establishment of OI processes (I3). Also, the barriers can include the risk that the CE project is not successful, and SMEs cannot bear this risk, especially when the projects are not funded (I5).

3.1.3. State Initiatives on Circular Economy and Open Innovation

Government support for innovation

Austrian government fosters the innovation by funding the projects, along with providing consultancy and support, but also establishing communities of research institutions and business to share knowledge and ideas (I2). According to I3, in order to strengthen the economic system, the government support for innovation among SMEs has roughly two instruments: state agencies and funding, whereas funding is executed on the European, regional and cross-regional level. Agencies provide SMEs not only with consulting of funding schemes, but also information on CE, between information and education services. Also, the Austrian Chamber of Commerce, which is structure on the national and regional level, brings a variety of programs on CE and OI between information, consulting and education for all businesses. However, the I3 has highlighted that the

government measures to support the innovation have a diverse impact on the market and can strongly depend on the local context of particular region.

Measures to Adopt Circular Economy and Open Innovation / Promotion

The adoption of CE and OI is promoted through off- and online channels: conferences, forums, round tables, websites and webinars (I1, I2, I3). For example, the Circular Economy Forum, which is the largest multi-stake platform in Austria, has established a network consisting of business, science and research, politics, government and other support structures, both on national and regional level (I3).

Opportunities and Obstacles

I3 has highlighted the opportunities in two directions: business and government. From the business perspective, by opening internal boundaries SMEs have the opportunity to overcome the lack of resources and today's global challenges, like disrupted supply chains, growing costs or energy crisis, and transform their business towards CE, but also become more sustainable and create less exploitable business models. One of the strongest enablers for the governmental system is the European Green Deal, which forces European governments to deliver strategies and action plans.

I2 has expressed the opinion that governmental funding schemes hide a number of obstacles, like the high level of bureaucracy and initial costs to start the project, also there are a lot of limitations and misuse of funds – all in all this hinders the road to CE and "best ideas are being generated outside the funded projects". Also, I6 has criticized the funding schemes, because "getting funded can be really difficult and time-consuming, not even worth to try".

From the I7 perspective, governmental programs might be more modern and include hackathons "as in Israel, where the culture of innovation is stronger than in Austria".

3.2. Discussion of Research Findings

Many companies, from start-ups and SMEs, to established ones, are in need for more information and consulting about the possibilities and opportunities of CE. Therefore, in order to accelerate the transition, it is important to develop and promote public initiatives and funding schemes that

enable the utilization of CE. Among such initiatives, support for collaboration of different stakeholders and knowledge sharing may be considered as an important one.

In the course of writing this thesis, the author has gained an understanding of the essential importance of collaboration and openness for the sake of successful utilization of CE principles. Although this topic is still in its infancy, little is known about the integration of CE and OI, and the number of scientific works that study the pros and cons of this theme relatively low, the author believes that it is necessary to further pay attention and encourage the collaboration and co-creation among partners and boost the use of OI for the CE. In particular this is relevant for SMEs, as they are dependent on external knowledge, because of the size and resource scarcity.

The main research question appeals to the adoption of CE by OI among SMEs. Based on the literature review and empirical research findings the author can conclude that in many cases OI can be considered as an inherent part of the innovation process and contribute to the development of many CE projects. The empirical research has revealed that overall acceptance of CE among Austrian SMEs is on a high level and almost 85% of Austrian companies are using or planning to use CBM. This comes with the fact that many companies still face a number of barriers to the transformation towards CE, in particular the lack of CE-related knowledge and monetary resources. Transformation towards CE is linked to the openness and the ability to collaborate with other stakeholders, build networks, acquire external knowledge and skills, bring innovations into the company by opening up its internal boundaries for the absorption of external information flows, but also share internal knowledge with related parties.

Utilization of national strategy for OI in Austria can be considered as a challenge and opportunity for the transformation towards CE. The Austrian public institutions have built a solid portfolio of projects that promote and secure the adoption of OI and facilitate the overcoming of barriers associated with the opening of companies for the external knowledge, ranging from various funding opportunities, to consulting agencies, cross-sectoral OI platforms, events and forums. This has the influence on the transition towards CE, as companies have access to support when it comes to overcoming barriers to CE, like dealing with intellectual property rights, insufficient resources or financial obstacles. In this sense, Austrian institutions have effectively developed a comprehensive support network for the companies of all range. However, the efficiency of these actions varies from one region to another depending on a local context and demand for innovations.

The findings from the empirical research indicate that there are a number of barriers to the adoption of CE oriented by OI. It has been revealed that sharing of knowledge and experience between the companies might be hindered by the fear of losing strategic competitive advantage and technological know-how. Hence, the companies tend to share only carefully selected portions of knowledge in order to be able to protect their insights and maintain competitive advantage. This creates a paradox, considering the paradigm of OI, openness and access to knowledge, because even if a company follows the inside-out OI strategy and commercializes internal knowledge or skills, in theory there will always be a consideration of a trade-off between sharing that knowledge or keeping competitive advantage inhouse. In this regard, it is important to further work on forming OI systems to allow safe knowledge exchange backed up by legal and financial frameworks.

Despite the barriers, there are numerous good examples of how SMEs moving in the direction of utilization of CE by adoption OI. They not only establish their business models on openness and knowledge sharing, but also influence other companies by inspiring and setting precedents.

Taking into consideration the research findings of this work, one way of fostering the transformation towards CE among Estonian SMEs might be to promote and raise the awareness on the concept of OI, establish OI platforms and events, but also inform about the benefits of collaboration and knowledge sharing. The utilization of OI leads to stimulating innovation and change and can contribute to the acceleration of CE.

CONCLUSION

This master's thesis aims at learning more about CE adoption oriented by the means of OI on the example of Austria and to answer the main research question: how OI may favour the adoption of CE among SMEs. The author's ambition was to extract insight on this topic for the Estonian audience by conducting semi-structured interviews with Austrian public and private sector representatives, as enhancing growth through the innovation is a priority for the Austrian policy makers and this country has been the first in the EU to develop and utilize national OI strategy.

The empirical research was carried out using qualitative method by conducting semi-structured interviews. This study presents the importance of transformation towards CE, as by following this concept companies can contribute to the sustainable development of our society and help meet many of today's challenges. CBMs aim at slowing down the material flows, closing the loops and intensifying the re-use of resources, which gives an opportunity to reach a fundamental change of value creation, capture, and transfer in the economic system. The research findings shed light on the peculiarities of promotion and adoption of OI, but also on facilitation of CE by OI, in which case collaboration and usage of external knowledge can be considered as an integral part of most innovation processes, especially among SMEs, meaning that OI can contribute to the transformation towards CE. However, there a number of barriers that must be considered in case of the adoption of CE by OI. Hence, these findings may complement the Research by addressing suggestions on enhancing the implementation of CE in Estonia.

This work provides only a holistic understanding of utilization of CE by OI and is not free from limitations, which need to be highlighted. The major limitation is the selected research methodology, in particular semi-structured interviews, which have given a feeling of sharing more subjective knowledge and opinions, rather than objective knowledge, and relatively small number of respondents. For further development of this topic and verification of research findings it is desirable to conduct a survey with a higher number of interviewees. Another limitation is the selection of the interviewees, as to be able to get more business-oriented detailed perspective on the research questions there is an obvious need in interviewing more representatives of start-ups and SMEs.

Despite its limitations present work offers opportunity for further research, as this work has represented only an exploratory study roughly investigating the possibility of CE adoption driven by OI, which is a still quite new research field of CE. Future research could focus on conducting quantitative studies and applying statistical methods to question the relation between OI and CE. It would also be interesting to focus in more detail on the context of Estonian and investigate how Estonian institutions may favour the adoption of CE by utilizing OI. And exploring the best practises of the transformation towards CE by adoption of OI among European SMEs from the scientific point of view would be very welcome.

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APPENDICES

Appendix 1. Interview questions

Warm-up questions

Q1:	Please describe your current position and main responsibilities.
Q2:	What does circular economy mean to you?
Q3:	How would you define open innovation?

Innovation and SMEs

Q4:	How effective is state innovation support for SMEs in Austria?
Q5:	What role does external support play to innovation practices? Here external support can be expressed in the form of consultancy, training, or finance.

Circular Economy

Q6:	What drivers and barriers can you think of in a transition to a circular economy?
Q7:	What state initiatives aim at accelerating the transition towards a circular economy?
Q8:	What is the overall acceptance of circular business models among SMEs in Austria?

Open Innovation

Q9:	What role does open innovation play in a sustainable development in Austria?
Q10:	What are the drivers and barriers of utilizing open innovation strategies?
Q11:	Do you feel there is a change after adoption of Open Innovation Strategy in 2006?

Circular Economy adopted by Open Innovation Strategies

Q12:	What role does open innovation play in the transition towards CE in Austria?
Q13:	How the concept of open innovation promotes the transition towards CE? What open innovation methods and tools are being used?
Q13:	What are the main facilitators and drivers that contribute to the CE when oriented by open innovation?
Q14:	If you are to consult a company to transform to CE, would you suggest following open innovation strategies and why?

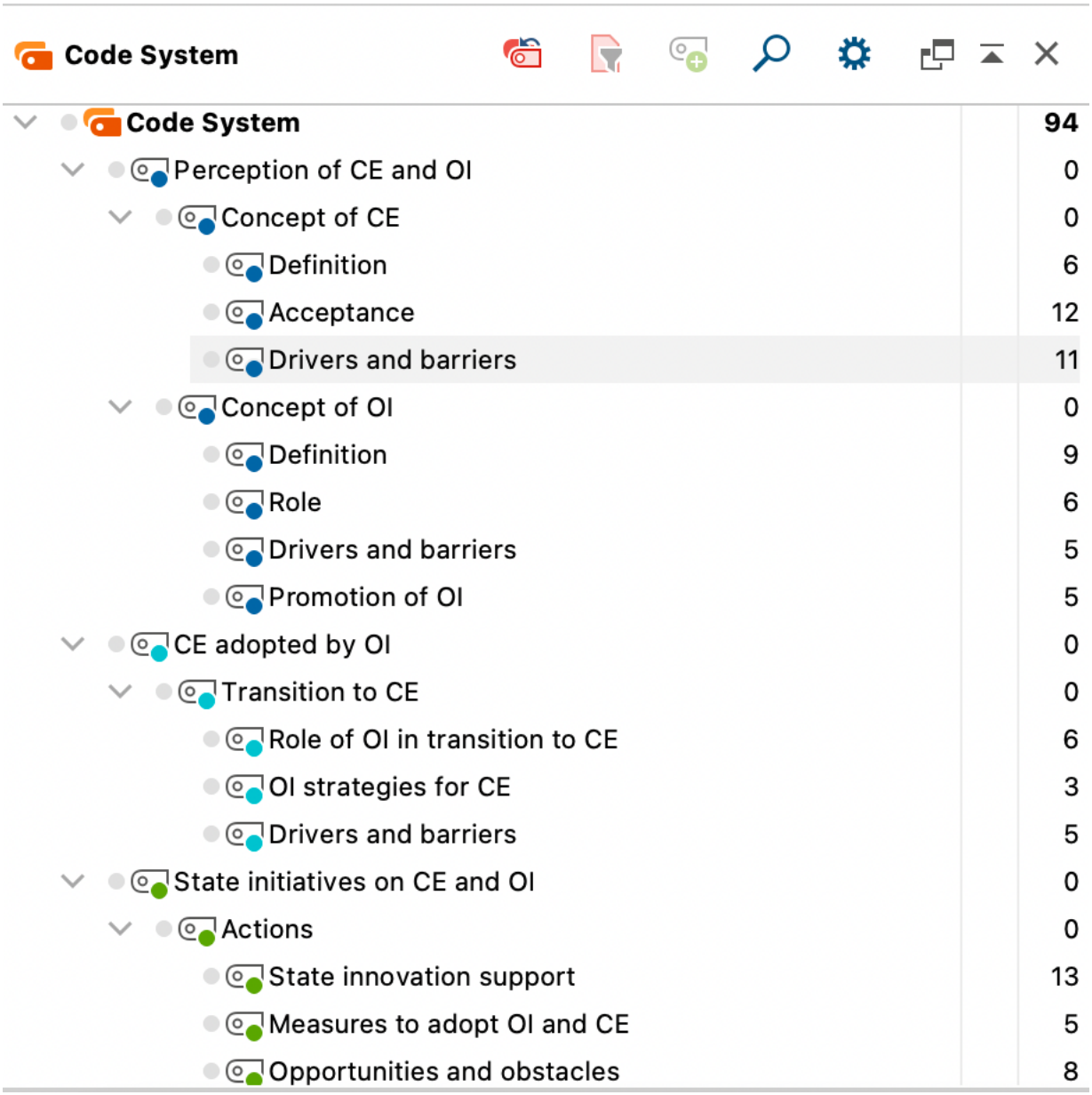
Concluding question

Q15:	Are there any other important points you would like to add that would be important for my investigation?

Link to interview transcribes:

https://drive.google.com/drive/folders/1nSxzWirqNYVfq4tKVyDZEXNNZlsmj6hX?usp=sharing

Appendix 2. Overview of the codes



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