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Futuring in Circular Economy Ecosystems

A case analysis of an emerging circular economy ecosystems' current orchestration and futuring activities

Master's thesis in Management and Economics of Innovation

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Abstract

This thesis explores the integration of futuring techniques in circular economy ecosystems, specifically focusing on their role in ecosystem orchestration. It investigates the complexities and interdependencies inherent in such ecosystems, with a detailed case study of Circular Plastic, an emerging circular economy initiative. The research employs a qualitative research strategy with an abductive approach. Data was collected through a mixed data collection approach, including qualitative interviews with stakeholders and document analysis, and analyzed through thematic analysis to examine the application and impact of futuring activities within the Circular Plastic ecosystem. The study finds that informal futuring practices, such as vision articulation and open discussions, are critical in the early stages of ecosystem development. These practices facilitate alignment among stakeholders, foster collaboration, and build a shared understanding of the ecosystem's direction. Additionally, while formal futuring methods like scenario planning and roadmapping offer structured frameworks for long-term planning, they are less prevalent due to resource constraints. The findings highlight the role of futuring in achieving alignment on a joint value proposition among ecosystem actors, which is essential for successful ecosystem orchestration. By aligning stakeholders around a shared vision and goals, futuring practices enable more effective collaboration and coordination. This alignment is crucial for overcoming challenges related to value creation and distribution, ensuring that all actors benefit from their participation in the ecosystem.

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Keywords: Futuring, circular economy ecosystems, ecosystem orchestration, alignment, joint value proposition

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1. Introduction

As we look towards the future, unresolved challenges continue to loom large. These interconnected challenges threaten not only environmental sustainability but also economic prosperity and social stability, demanding a paradigm shift towards sustainable solutions. In this context, the circular economy emerges as a promising alternative to the traditional linear models of consumption and production. Yet, the transition to a circular economy is filled with complexities and systemic challenges that remain unaddressed, leaving its potential largely untapped. The following sections will explore the concepts, aims, and limitations of the study, setting the stage for a deeper investigation into how circular economy ecosystems can navigate the complexities towards a more sustainable future.

1.1 Background

Today, global society faces numerous challenges, such as climate change and resource scarcity, coupled with a growing population (World Economic Forum, 2022). Therefore, it is crucial to address these challenges for the sustainable future of businesses. Amid these complexities, the concept of the circular economy has gained prominence. This paradigm aims to slow and close resource cycles, thereby reducing the extraction of natural resources, waste disposal in landfills, and greenhouse gas emissions (Kanda et al., 2021). However, Kanda et al. (2021) also highlighted that, although the concept of the circular economy has existed for many years, empirical evidence and case studies of circular business models are limited. Parida et al. (2019) suggests that the transition towards circular economy is too vast for any single organization to do alone, suggesting that an ecosystem approach is essential. However, the ecosystem constellation also brings with it its own set of problems. Pidun et al. (2020) note that only a few ecosystems seem to be sustainable in the long run. Successful business ecosystems necessitate effective coordination and collaboration among the different actors and stakeholders (Reim et al., 2020). The dynamic nature of the business environment also introduces disruptions and constant shifts, making it increasingly difficult for actors and stakeholders within the business ecosystem to align their efforts for the successful orchestration of the ecosystem.

The complexities highlighted above not only make it difficult for individual organizations to thrive in a circular economy, but also create significant challenges in orchestrating successful circular economy ecosystems. Ecosystem orchestration, a strategic process by which an orchestrator aligns and coordinates a diverse set of partners within an ecosystem to collectively deliver a joint value proposition (Jacobides et al., 2018; Adner, 2017), becomes more crucial in this context. One possible way to

achieve this orchestration could be through implementing futuring, using corporate foresight tools. Spaniol and Rowland (2022) found that corporate foresight tools operate as essential elements of ecosystems, transforming the abstract concepts of the ecosystem into a shared, lived reality.

While a wealth of research explores futuring (foresight), ecosystem orchestration and the circular economy individually, a notable gap exists when considering their combined application. Several studies investigates specific areas, for instance foresight in ecosystems or network contexts (e.g., Spaniol and Rowland, 2022; Pombo-Juárez et al., 2017; Heger and Boman, 2014), foresight in the field of circular economy and sustainability (e.g., Bauwens et al, 2020; Wiener et al., 2018; Eames and Egmose, 2011), circular economy ecosystems (e.g., Alet, 2022; Aarikka-Stenroos et al., 2021; Korhonen et al, 2018), orchestration in business and innovation ecosystems (e.g., Sjödin et al., 2024; Autio, 2022; Jacobides et al., 2018; Adner, 2017), orchestration in circular economy ecosystems (e.g., Sandberg 2023; Parida et al., 2019), and futuring as tool for orchestration in business ecosystems (Spaniol and Rowland, 2022). However, there is an absence of research that addresses the intersection of futuring, ecosystem orchestration, and the circular economy ecosystem simultaneously. This gap becomes particularly problematic for emerging circular economy ecosystems, where integrating these three elements is critical for fostering sustainable and resilient business models.

One such emerging circular economy ecosystem facing this challenge is Circular Plastic. This emerging circular economy ecosystem aims to establish a global network of circular microfactories using large-scale additive manufacturing to produce large products from locally recycled polymer waste. Circular Plastic intends to revolutionize manufacturing by implementing a novel microfactory concept, promoting sustainability, resilience, and agility in the industry while addressing challenges related to plastic waste and contributing to the United Nations Sustainable Development Goals. Through empirical research and a detailed case study of Circular Plastic, this thesis narrows this gap in research by examining how futuring can inform the development and management of circular economy ecosystems. Ultimately, by addressing this knowledge gap, the thesis intends to contribute to developing more sustainable, resilient, and thriving circular economy ecosystems.

1.2 Aim

This thesis aims to provide insights into the practical applications of futuring within circular economy ecosystems. The intention is to examine the complexities of orchestration within such ecosystems, and investigate how futuring can facilitate orchestration, thereby fostering effective collaboration and coordination. This aim will be achieved by thoroughly analyzing Circular Plastic's current orchestration and futuring efforts and how they relate to each other.

This research is therefore structured around two main questions:

> RQ1: Why is ecosystem orchestration complex in a circular economy ecosystem?
>
> RQ2: How can futuring be a means of orchestration in a circular economy ecosystem?

1.3 Limitations

While this thesis aims to understand why orchestration is complex within circular economy ecosystems, and how futuring can help facilitate the orchestration, certain limitations must be acknowledged. The thesis primarily focuses on the application of futuring within Circular Plastic and the broader implications for circular economy ecosystems. However, it will not investigate the intricacies of specific technical or operations aspects within large-scale additive manufacturing microfactories. Such details, while crucial for a complete understanding of physical and logistical challenges in the circular economy ecosystem, fall outside the scope of this study, which is oriented towards the complexities of orchestration and futuring practices. Furthermore, while the research on Circular Plastic provides valuable insights, it might not be directly applicable to all circular economy ecosystems. Different industries might have unique challenges and opportunities related to orchestration and futuring.

1.4 Thesis outline

This thesis is structured as follows: Chapter 2 provides a comprehensive literature review, exploring circular economy ecosystems, ecosystem orchestration, and futuring techniques. Chapter 3 details the research methods, including the research strategy and approach, the empirical setting, data collection methods, and data analysis. Chapter 4 presents the results, focusing on the joint value proposition, value creation challenges, and the role of futuring in ecosystem orchestration. Chapter 5 offers a discussion on the complexities of orchestration, futuring's role in facilitating ecosystem orchestration, the role of alignment, and theoretical contributions. Finally, Chapter 6 concludes the thesis, summarizing key findings, implications, and suggestions for future research.

2. Literature review

The emerging interest in sustainable economic models has intensified the exploration of circular economy ecosystems, where the reuse, refurbishment, and recycling of resources are prioritized to create a sustainable cycle of production and consumption. This literature review summarizes a rich body of literature regarding the intricate dynamics of circular economy ecosystems, particularly focusing on the complexities of orchestrating such ecosystems and the strategic planning tool futuring, trying to capture what it is, why it is used, and what empirical outcomes there are from incorporating it in different contexts.

2.1 Circular economy ecosystems

To understand the characteristics of a circular economy ecosystem, it is essential to first understand more about its parts, i.e., circular economy and ecosystems. Below, a brief overview of all parts is provided before wrapping up with circular economy ecosystems.

2.1.1 Circular economy

Understanding what a circular economy ecosystem is involves understanding the interconnected network of stakeholders collaborating to foster sustainable practices. This dynamic ecosystem operates on the principles of circular economy. Unlike the traditional linear economy, characterized by a take-make-dispose approach, the circular economy advocates for a regenerative system (Moreno et al., 2016). Here, resource input, waste, emissions, and energy leakage are minimized by slowing, closing, and narrowing material and energy loops (Geissdoerfer et al., 2017). Geissdoerfer et al. (2017) further propose that achieving this goal involves embracing long-lasting design, maintenance, repair, reuse, remanufacturing, refurbishing, and recycling practices.

Scholars have found that despite the interest and need for a circular economy, the progress towards a circular economy has been slow (Panwar and Niesten, 2020; Parida et al., 2019; Geissdoerfer et al., 2017; Ghisellini et al., 2016). Dagilienė and Varaniūtė (2023) identify five key tensions that companies face when transitioning from a linear to a circular economy. Firstly, there can be tension in goal setting, where organizations need to decide between prioritizing short-term financial or economic goals, and long-term sustainability objectives. Secondly, performance orientation presents challenges, as companies need to deal with tensions between prioritizing technological efficiency and small-scale processes. Thirdly, there can be tension in decisions of compliance, as firms navigate current regulations while also preparing for potential changes in future regulations. Furthermore, in-network collaboration poses its own set of challenges as there can be tension between collaborating within the value chain and with broader society. Lastly, innovation adoption introduces tensions between incremental and

radical innovation, as well as between product design and production process innovation.

Moreover, Siderius and Zink (2023) argue that the current system is ill-equipped to support the circular economy. They argue that the circular economy faces significant hurdles as it is hindered by the existing socio-economic structures, i.e., the market systems. These structures prioritize incentives such as infinite growth and market efficiency, which are antithetical to the goals of the circular economy. As a result, efforts to implement circular economy principles within the current system often led to marginal progress at best and reinforce destructive and destabilizing structures at worst. Siderius and Zink (2023) highlight that fundamental characteristics of market systems, such as private property, competition, a market for labor, and value determined by price, create barriers to achieving true circularity and sustainability.

The transition towards a circular economy demands a fundamental shift in perspective. Dagilienė and Varaniūtė (2023) argue for moving beyond a company-centric focus on the value chain to a broader systemic approach that prioritizes value creation for a wider range of stakeholders. Reinforcing this concept, Hofmann Trevisan et al. (2022) identifies value as the cornerstone among all the circular economy elements. Their research has shown that environmental sustainability can be realized when actors within the ecosystem establish systemic goals and engage in both collaborative value creation and collective value capture, where the latter is crucial for keeping the ecosystem healthy. This emphasis on a systemic approach resonates with the growing recognition that a true circular economy necessitates system-level transformation (Despeisse et al., 2017; Kanda et al., 2021). Parida et al. (2019) further highlight the complexity and interconnectedness inherent in the transition. They argue that the task is simply too vast for any single organization to tackle independently. Ecosystem-wide orchestration is therefore deemed necessary, emphasizing the importance of collaborative efforts across multiple actors within circular economy ecosystems.

2.1.2 Ecosystems

Reeves and Pidun (2022) define an ecosystem as *"a dynamic group of largely independent economic players that create products and services that together constitute a coherent solution."* (p. 90). Korhonen (2001) and Thomas and Autio (2020) elaborate on these actors, characterizing them as part of a heterogeneous community with hierarchical independence and diverse roles within the ecosystem. The actors within these networks are interconnected through interdependencies, including the relationships between the different actors (Jacobides et al., 2018; Adner, 2017), and the exchange of components and materials (Thomas and Autio, 2020). These actors have a need to interact for a focal value proposition to materialize (Adner, 2017; Moore, 1993), as the ultimate purpose of an ecosystem is to jointly create a value proposition that

cannot be done by individual actors in isolation (Jacobides et al., 2018; Decker et al., 2000; Korhonen, 2001: Thomas and Autio, 2020).

Autio (2022) further explores how ecosystems come into being, outlining two different paths: through intentional design or spontaneously without prior planning. In the intentional design approach, a focal firm takes the lead, crafting a blueprint for value and strategically engaging other actors in a top-down approach, giving participants predefined roles. Alternatively, the bottom-up approach involves the focal firm coordinating multiple actors to establish an initially undefined ecosystem, where the value offering, or market emerges gradually during value negotiations as roles and assets of ecosystem actors are identified. Autio (2022) emphasizes that this bottom-up, by-design process can be complex, requiring collaborative efforts among ecosystem actors to co-create value.

Moreover, scholars examining ecosystems seem to agree that, contrary to linear hierarchical business models, ecosystems exhibit distinctive coordination mechanisms that rely heavily on role definition, complementarity, and alignment structures across technological, economical, and cognitive dimensions, striking a balance between adaptability and stability in ecosystem outcomes (Aarikka-Stenroos et al., 2021; Autio and Thomas, 2018; Jacobides et al., 2018). These coordination mechanisms are essential for fostering collaboration, innovation, and value creation within ecosystems, enabling actors to navigate the complex and dynamic nature of ecosystem interactions.

2.1.3 Circular economy ecosystems

The trajectories of circular economy and business ecosystems are intertwined, with each influencing and shaping the other. As organizations embrace circularity, they find themselves operating within interconnected networks of stakeholders collaborating to foster sustainable practices. This transition results in the emergence and recognition of circular economy ecosystems. Aarikka-Stenroos et al. (2021) define circular economy ecosystems as *"communities of hierarchically independent, yet interdependent heterogeneous set of actors who collectively generate a sustainable ecosystem outcome"* (p. 261). These ecosystems operate on the principles of the circular economy, aiming to minimize waste and maximize resource efficiency by keeping products and materials in circulation for as long as possible through strategies such as recycling, reuse, and remanufacturing. In their definition, circular economy ecosystems comprise the physical flow of materials and the exchange of knowledge, expertise, and resources among stakeholders, highlighting the importance of collaboration and co-creation in achieving circularity goals.

Aarikka-Stenroos et al. (2021) outlines three distinct categories of ecosystems, with five total ecosystem types, which can be seen in Table 2.1. Each is defined by their

system interactions, flows, goals, and specific characteristics. Material flow-based ecosystems, includes industrial and urban ecosystems. *Industrial ecosystems* are centered around physical materials within industrial processes, promoting collaboration among organizations to establish closed-loop systems. *Urban ecosystems*, on the other hand, focus on material flows within cities, involving initiatives like waste management systems that convert food scraps into compost or recycle used water for irrigation. The second category is ecosystems based on the knowledge flow, which include entrepreneurial ecosystems and knowledge ecosystems. *Entrepreneurial ecosystems* are designed to nurture the creation and growth of new circular businesses. This involves a collaborative effort among universities, accelerators, and investors to support and develop circular ventures. Meanwhile, *knowledge ecosystems* facilitate the sharing of knowledge and collaboration around circular economy principles, where research institutions, NGOs, and universities come together to establish best practices and educate others in the field. The third and last category are ecosystems based on the economic value flow. These ecosystems involve multi-stakeholder collaborations aimed at co-producing sustainable value propositions related to resource reuse, recycling, or reduction. *Economic value flow-based ecosystems* often have a central actor, sometimes referred to as a hub actor or ecosystem orchestrator, who coordinates the ecosystem to achieve sustainable value outcomes. The other roles within these ecosystems can be shaped by the dominant agent or emerge through ongoing interactions between ecosystem actors.

Circular Economy Ecosystem	Goals	Key actors
Material flow based		
Industrial ecosysten	*Collaboration among companies to establish closed-loop systems cantered around physical materials within industrial processes*	*Manufacturers, service providers, resource providers*
Urban ecosystem	*Initiatives like waste management systems that reuse or recycles waste*	*Local authorities, waste management companies, service providers, consumer-citizen residents*
Knowledge based		
Entreprenurial ecosystems	*Nurturing creation and growth of new circular businesses*	*Accelerators, investors, government, educational and research institutes*
Knowledge ecosystems	*Sharing knowledge and collaboration around circular economy principles*	*Research institutions, NGOs, universities*
Value Based		
Innovation, Platform, Business ecosystems	*Co-producing sustainable value propositions related to resource reuse, recyling, or reduction*	*Focal firm (orchestrator), complementors, supplier, consumer-prosumers*

Table 2.1: *Overview of the circular economy ecosystem types, adapted from Aarikka-Stenroos et al. (2021)*

Operating within circular economy ecosystems poses numerous challenges for organizations due to the interconnected and dynamic nature of these networks. While the circular economy principles provide guidance, implementing them within ecosystems can be challenging. As per definition, ecosystems consist of independent actors, where participation is voluntary, as emphasized by Autio (2022). Each participant must find sufficient reason to join the ecosystem, as the materialization of

benefits relies on the voluntary actions of hierarchically independent actors. Autio (2022) further highlights that these actors must foresee personal gains before committing to contribute, as the benefits are not contractually guaranteed. Consequently, if the ecosystem fails to gain momentum, desired network effects may not materialize, leading potential participants to question the benefits of joining.

As the ultimate purpose of ecosystems is to jointly create value that individual actors cannot do, it necessitates the definition of what value is and what value creation entails in circular economy ecosystems. Autio (2022) highlighted that the concept of value in these ecosystems are not externally determined but rather negotiated and co-discovered internally through multi-sided negotiations among ecosystem participants. This negotiation process determines not only the perceived value of offerings but also the importance of ecosystem roles and assets in generating collective value. In contexts characterized by open technological standards and undefined ecosystem roles, there is significant room for negotiation and collaboration among participants to shape the ecosystem's direction.

When it comes to circular economy ecosystems, value creation extends beyond purely economic considerations to also include societal and environmental aspects. Unlike traditional business ecosystems, where economic value often dominates, circular economy ecosystems emphasize the creation of social and environmental value alongside economic benefits (Korhonen et al., 2018). This holistic approach acknowledges the interconnected nature of economic, social, and environmental factors within the ecosystem, reflecting a need for a more comprehensive understanding of value creation, what value is, and for whom.

Besides value creation, Alet (2022) also highlights value sharing based on a holistic win-win approach as a critical pillar in thriving ecosystems. Value sharing forms the foundation of ecosystem governance, focusing on creating and distributing value among partners to ensure a holistic win-win approach among the partners. Alet (2022) emphasizes that value creation and sharing are paramount in establishing customer entanglement, achieved through aligning partners, activities, and systems. This value-sharing system is based on trust, with a lack of trust cited as a significant factor contributing to ecosystem failures (Reeves and Pidun, 2022). When value sharing is misaligned, participants may not receive their fair share, leading to the collapse of the ecosystem. The concept of value sharing in circular economy ecosystems involves not only the equitable distribution of economic benefits but also the fair allocation of societal and environmental gains. This adds another layer of complexity and responsibility, calling for a more sophisticated approach to orchestration and collaboration within the ecosystem.

2.2 Ecosystem Orchestration

Ecosystem orchestration is the strategic process by which an orchestrator aligns and coordinates a diverse set of partners within an ecosystem to collectively deliver a joint value proposition (Jacobides et al., 2018; Adner, 2017). Orchestration becomes necessary in ecosystems due to their reliance on non-hierarchical ways of coordination, where formal supplier contracts are not predominant (Autio, 2022). To establish a coherent system-level value offering that addresses the needs of a defined user audience (Autio, 2022), the objective of orchestration is to leverage the active contributions of stakeholders towards value co-creation and capture (Dattée et al., 2018).

To achieve the objective of orchestration, scholars highlight the need for one or several focal firms, often called orchestrators (e.g., Lingens et al., 2021; Parida et al., 2019; Hurmelinna-Laukkanen and Nätti, 2018), keystones (e.g., Cui et al., 2022; Iansiti and Levien, 2004), hub-firm (e.g., Shi and Shen, 2021; Jacobides et al., 2018), or ecosystem leader (e.g., Adner 2017). Although much of the existing literature on ecosystem orchestration presents an either-or relationship between orchestrators and complementors, Lingens et al. (2021) argue that the role of the orchestrator involves a firm taking on specific orchestration tasks, which can be distributed among multiple firms. Lingens et al. (2021) further claim that the number of orchestrators in an ecosystem is determined by the possession of critical knowledge related to production, i.e., partners and product development, and consumption, i.e., customer and market. Specifically, if a firm possesses both production and consumption-related knowledge, it is more likely to act as a single orchestrator. Conversely, if a firm lacks either production or consumption-related knowledge, it may delegate tasks to co-orchestrators or participate as a complementor. These findings align with Autio's (2022) findings, where the former could be seen as a more top-down approach and the latter as a bottom-up approach. Additionally, Lingens et al. (2021) suggest that the chosen configuration of orchestrators tends to be path-dependent and not easily changeable, indicating that initial conditions play a significant role in determining the number and roles of orchestrators within an ecosystem.

From the definition of ecosystem orchestration, the orchestrator's role in value creation and sharing is essential for driving collective success (Sjödin et al., 2024; Shen et al., 2024; Autio, 2022). The orchestrator must ensure a fair share of the value created and captured to be shared with the others within the ecosystem to gain acceptance and foster collaboration (Iansiti and Levien, 2004). Moreover, as value is not given, value negotiation and co-discovery with ecosystem participants are essential aspects of orchestrators' responsibilities (Autio, 2022). Thus, orchestrators' ability to facilitate value creation and sharing is vital for aligning stakeholders, driving innovation, and maximizing ecosystem value (Sjödin et al., 2024; Autio, 2022). However, this is not an easy task (Tsujimoto et al. 2018), as the connections between the actors within an ecosystem are affected by different forces that either pull the ecosystem together or

push it apart. Holgersson et al. (2022) define these forces as *centrifugal forces*, e.g., shared objectives and the creation of value, which pull the ecosystem together, and *centripetal forces*, e.g., the dynamics of technology and management practices, pushing the ecosystem apart. Moreover, as ecosystems have several interdependent actors, conflict of interest and opportunistic behavior may occur (Tsytsyna and Valminen, 2023; Holgersson et al., 2022; Jacobides et al., 2018; Adner, 2017). The orchestrators' role is thus to balance these forces and align all interdependent actors for the ecosystem to generate greater collective value than the sum of individual contributions (Tsytsyna and Valminen, 2023). Thus, to succeed, orchestrators must possess orchestration capabilities.

Shi and Shen (2021) define orchestration capabilities as *"the dynamic capability of central actor to efficiently and effectively integrate and coordinate resources and relationships within an ecosystem to adapt to the continuously changing dynamic environment"* (p. 3087). Shi and Shen (2021) further identified two types of orchestration: network orchestration and resource orchestration.

Network orchestration refers to the strategic coordination and management of various actors within an ecosystem (Shi and Shen, 2021). Typical network orchestration capabilities mentioned by scholars are the alignment of goals, objectives, and vision (Sjödin et al., 2024; Adner, 2017), knowledge mobility (Dhanaraj and Parkhe, 2006), governance (Sjödin et al., 2024; Cui et al., 2022; Jacobides et al., 2018; Adner, 2017), and collaboration and coordination efforts (Sjödin et al., 2024; Jacobides et al., 2018). Resource orchestration, on the other hand, refers to the orchestrator's ability to efficiently obtain, integrate, and leverage both internal and external resources to maximize value creation (Shi and Shen, 2021). Hence, resource orchestration encompasses the orchestrator's ability to overcome resource constraints (Cui et al., 2022; Carnes et al., 2017) and increase the collective value of resources through effective utilization (Shen et al., 2024). Moreover, these various orchestration capabilities are context-specific and not universally essential (Hurmelinna-Laukkanen and Natti, 2018).

Besides the above-mentioned capabilities, scholars have identified other essential capabilities for orchestrators. For instance, relational capabilities play a vital role in ecosystem orchestration. These capabilities involve identifying partnership opportunities, aligning stakeholders, fostering relationships, and reconfiguring the ecosystem constellation when needed (Shen et al., 2024; Sjödin et al, 2024; Linde et al., 2021). It also encompasses building trust (Salvioni and Almici, 2020; Dhanaraj and Parkhe, 2006), supporting culture (Shen et al., 2024; Sjödin et al., 2024), and leveraging relationships for advantageous positioning across different contexts (Adner, 2017). Such activities enable efficient partnership formation, contributing to ecosystem stability and sustainability. Similarly, Autio (2022) discusses behavioral orchestrations, emphasizing that as the ecosystem emerges, the orchestrator must be able to influence partners to join, define and reinforce behavioral norms, and shape visions of future

value co-creation. Pomegbe et al. (2021) also emphasize that all partners are different, and thus, orchestrators' relational practices should differ between partners.

Effective ecosystem orchestration further necessitates a dual focus on technological infrastructure and innovation (Shen et al., 2024). For instance, Adner and Kapoor (2010) emphasize the importance of managing technology infrastructure. This could be done by leveraging ecosystem technological practices, including establishing secure digital infrastructure, utilizing big data analytics, and promoting industry standardization (Shen et al., 2024; Autio, 2022). Simultaneously, orchestrators must drive innovation by instilling a culture of collaboration, facilitating the commercialization of projects, and scaling innovative ventures (Shen et al., 2024).

The discussion above has mainly stemmed from the literature on business ecosystem orchestration and innovation network orchestration. In a circular economy ecosystem orchestration, the literature is less developed (Sandberg, 2023). Parida et al. (2019) found three orchestration mechanisms, i.e., standardization, nurturing, and negotiating, in their case study of six manufacturing firms in a circular business-to-business context. *Standardization*, achieved through lobbying and establishing both formal and informal standards, serves to define and validate the objectives of the circular economy for ecosystem partners. *Nurturing mechanisms*, which encompass investment support and knowledge sharing, are employed by orchestrators to equip all partners with the requisite resources and capabilities to pursue circular economy goals effectively. Finally, *negotiating* entails continuously coordinating diverse ecosystem members and their activities toward collective alignment with circular economy principles (Parida et al., 2019). Furthermore, though not explicitly mentioned as an orchestration capability, assessment of the external environment, business model, and ecosystem partners was emphasized as vital to finding circular opportunities, threats, and capabilities missing within the ecosystem (Parida et al., 2019).

Complementing Parida et al. 's (2019) work, Sandberg (2023) investigates orchestration capabilities in circular supply chains within a business-to-consumer context. In his research, Sandberg (2023) emphasizes the role of the customer, highlighting the need for the orchestrator to take these into consideration. This finding, stemming from a business-to-consumer context, could be generalized to the fact that defining the boundaries of an ecosystem is not always clear-cut as other stakeholders could be relevant to include. Other orchestration capabilities discussed were exploration through a learning-by-doing culture, technology scouting, and relational capabilities such as finding and initiating partnerships and fostering collaboration (Sandberg, 2023).

Besides Parida et al., (2019) and Sandberg (2023), other scholars have also contributed to the circular economy ecosystem orchestration literature. For instance, Zaoual and Lecocq (2018) found that a third party could orchestrate the transition toward circularity within industrial ecosystems. Key activities from this third-party orchestrator were emphasizing economic and environmental value, communication and setting a code of

conduct, identifying co-creation opportunities, and sharing success stories (Zaoual and Lecocq, 2018). Hofmann Trevisan et al. (2023) developed their 3i framework, emphasizing that the orchestrator must drive *innovation* and creation of new value for the ecosystem, *invest* in ecosystem infrastructure and offer financial support, and *integrate* new actors and foster win-win relationships. Finally, Gomes et al. (2023) found that orchestrators play a vital role in defining the value proposition, building circular governance, nurturing circular interdependence, promoting circular integration, and generating circular complementarity.

As seen, there is some overlap between the identified orchestration capabilities in the circular economy ecosystem orchestration literature and those discussed above, e.g., relational capabilities (e.g., Shen et al., 2024; Sjödin et al., 2024; Parida et al., 2019; Adner, 2017), technological infrastructure (e.g., Shen et al., 2024; Sandberg, 2023), innovation (e.g., Shen et al., 2024; Hofmann Trevisan et al., 2023), and ecosystem coordination (e.g., Sjödin et al., 2024; Parida et al., 2019; Jacobides et al., 2018). However, both Parida et al., (2019) and Hofmann Trevisan et al. (2023) found the orchestrators' role to bear initial investment costs as crucial, especially to reduce the uncertainty for partners. Other capabilities emphasized in the circular economy ecosystem literature are assessing the external environment (Parida et al., 2019), the role of a third-party orchestrator (Zaoual and Lecocq, 2018), and involving customers in orchestration efforts (Sandberg, 2023).

The literature on ecosystem orchestration, covering both business and circular economy ecosystems, identifies a range of orchestration capabilities. Many of these capabilities exhibit similarities, allowing them to be categorized into overarching groups. An overview of these grouped capabilities is presented in Table 2.2.

Ecosytem orcestration capabilities	
Network orchestration	
Collaboration and coordination	*Strategic coordination (Shi and Shen, 2021); Foster relationships (Shen et al., 2024; Sjödin et al, 2024; Linde et al., 2021); Coordinate diverse members (Parida et al., 2019); Foster collaboration (Sandberg, 2023); Foster win-win relationships; communication (Zaoual and Lecocq, 2018)*
Partnering	*Identify partnership (Shen et al., 2024; Sjödin et al, 2024; Linde et al., 2021); Reconfigure constellations (Shen et al., 2024; Sjödin et al, 2024; Linde et al., 2021); Leverage relationships (Adner, 2017); Influence to join (Autio, 2022); Find and initiate partnerships (Sandberg, 2023); Identify co-creation opportunities (Zaoual and Lecocq, 2018); Integrate new actors (Hofmann Trevisan et al., 2023)*
Knowledge sharing	*Knowledge mobility (Dhanaraj and Parkhe, 2006); Knowledge sharing (Parida et al., 2019)*
Alignment	*Goals, objectives, and vision (Sjödin et al., 2024; Adner, 2017); Stakeholders (Shen et al., 2024; Sjödin et al, 2024; Linde et al., 2021); Shape vision (Autio, 2022); Circular economy principles (Parida et al., 2019)*
Governance	*Build trust (Salvioni and Almici, 2020; Dhanaraj and Parkhe, 2006); Supporting culture (Shen et al., 2024; Sjödin et al., 2024); Define and reinforce norm (Autio, 2022); Culture of collaboration (Shen et al., 2024); Establish formal and informal standards (Parida et al., 2019); Learning-by-doing culture (Sandberg, 2023); Set a code of conduct (Zaoual and Lecocq, 2018); Nurture interdependence (Gomes et al., 2023); Generate complimentarity (Gomes et al., 2023)*
Resource orchestration	
Resource utilization	*Leverage internal resources (Shi and Shen, 2021); Effective utilization (Shen et al., 2024)*
Resource acquisition	*Obtain and integrate resources (Shi and Shen, 2021); Overcome resource constraints (Cui et al., 2022; Carnes et al., 2017); Equip partners with requisite resources (Parida et al., 2019)*
Financial support	*Investment support (Parida et al., 2019); Invest in ecosystem infrastructure (Hofmann Trevisan et al., 2023); Offer financial support (Hofmann Trevisan et al., 2023)*
Technological	*Manage technology infrastructure (Adner and Kapoor, 2010); Leverage technological practices (Shen et al., 2024; Autio, 2022); Utilize big data (Shen et al., 2024; Autio, 2022); Technology scouting (Sandberg, 2023)*

Table 2.2: *Overarching ecosystem orchestration capabilities found in the literature*

As discussed in most of the papers about ecosystem orchestration, the role of the orchestrator(s) has been emphasized. However, Spaniol and Rowland (2022) found in their study of corporate foresight tools within a business ecosystem that the role of a focal firm, i.e., orchestrator, is decentralized. Using foresight tools, they found positive effects of coordination, collaboration, alignment, and a shared vision between participants without an orchestrator. Moreover, it also promoted innovations and partner configurations (Spaniol and Rowland, 2022). Based on these findings, the authors of this thesis intend to investigate futuring as a means for ecosystem orchestration within a circular economy ecosystem, which, to the best of our knowledge, is not previously done. By doing so, the thesis not only builds upon existing ecosystem orchestration literature, especially Spaniol and Rowland (2022), but also contributes to the emerging body of literature on orchestration within circular economy ecosystems.

2.3 Futuring and foresight

Petrakis and Konstantakopoulou (2015) define futuring as the practice of systematically thinking about potential outcomes, envisioning future scenarios, and strategizing for the times ahead. Futuring often adopts a long-term perspective, aiming to envision potential outcomes and opportunities over an extended period. Millett (2006) further underscores the limitations of short-term projections, typically spanning one to three years, which often rely on linear forecasts and assumptions from past trends. Such nearsighted approaches may overlook significant shifts and fail to stimulate innovative thinking. In contrast, based on 84 projects, Millett's research indicates that a ten-year horizon is preferred for futuring ventures. This duration allows for considering substantial changes and encourages stakeholders to transcend immediate operational concerns. However, Millett (2006) also suggests that even more extended time frames can offer valuable insights.

While futuring and strategic foresight share similarities, such as predicting and preparing for the future, where they employ similar methods like trend analysis, monitoring, scanning, scenario planning (Millett, 2006; Schlak, 2020), they exhibit some differences. According to Cornish (2004), the aim of futuring is to develop expectations for the future and identify emerging opportunities and threats, facilitating the implementation of suitable measures to achieve desired outcomes. In contrast, strategic foresight, as described by Iden et al. (2017), involves understanding the future and applying future-oriented insights to an organization’s strategic activities and decision-making. While both involve looking ahead and preparing for the future, futuring pertains to systematic approaches to thinking about the future, while foresight involves the application of specific tools and methods for conducting future work *(A Brief Guide to Futures Thinking and Foresight, 2022)*.

For this thesis, most articles examined focused on the concept of strategic foresight or its variations, such as corporate foresight (e.g., Spaniol and Rowland, 2022), network

foresight (e.g., Heger and Boman, 2014) and open foresight (e.g., Wiener et al., 2018). This emphasis is due to the prevalence of literature utilizing the concept of foresight in various forms. While some articles discuss futuring, they constitute a smaller proportion of the overall body of literature. It is important to note that the articles on strategic foresight included in this thesis meet the criteria for article inclusion, ensuring relevance and reliability. Furthermore, it is worth mentioning that not all steps involved in strategic foresight will be covered in this thesis, as the focus is on specific aspects within the broader framework.

Foresight, as discussed by various scholars, involves the systematic exploration of future possibilities and implications to inform a present-decision-making and planning processes. It involves distinguishing between plausible, probable, and preferable scenarios to guide strategic actions (Bauwens et al., 2020). Corporate and organizational foresight, according to Gordon et al. (2020), refers to the application of future-oriented practices by organizations to advance their goals and navigate changes in their operating environment. It entails identifying factors driving change, assessing the implications for the organization, and implementing appropriate responses. Rohrbeck et al. (2015) emphasize the need for involving multiple actors in order to create value through the preemption of critical resources, preparing the organization for change, and proactively steering the organization towards desired outcomes. Additionally, Georghiou and Keenan (2006) note common goals in foresight, such as *"bringing new actors into the strategic debate"* (p. 764) and *"building new networks and linkages across fields."* (p. 764). They highlight that foresight initiatives vary widely in scope, scale, and participants, spanning organizational, local, regional, and national levels. These initiatives operate across a spectrum of timescales, from immediate concerns to long-term horizons, and involve iterative phases of reflection, consultation, and discussion to collaboratively refine future visions and strategies. Emphasis is placed on joint ownership of strategies to bridge the gap between foresight and implementation. Georghiou and Keenan (2006) further underscore the importance of foresight in addressing system failure and promoting innovation. They stress the need for foresight activities to align with wider socioeconomic trends and engage multiple stakeholders.

2.3.1 Foresight methods

There are many methods used in foresight activities, and each method has its own approach to generating knowledge about the future (Spaniol and Rowland, 2022). When using foresight methods, Saritas and Aylen (2010) advocate that a multi-method approach is appropriate, as complementary effects exist when using more than one. In their study, for instance, they integrated scenarios with roadmapping techniques to mitigate the disadvantages of each method. Moreover, Gordon et al. (2020) emphasize that executing selected methods only represents a preliminary step. To fully realize the benefits, the resultant output must be effectively integrated into the organization, e.g., into the innovation process.

The different types of foresight methods are categorized into three different categories: predictive, normative and explorative (van der Duin, 2016). The three categories reflect different time preferences where predictive is nearest in time and explorative is the furthers apart. The predictive approaches use historical data to projects historical patterns on to the future, while the explorative approaches explores what could happen in the future. The normative approaches, on the other hand, do not aim to predict or explore the future but rather to determine desirable future scenarios and identify the activities needed to realize those futures.

Foresight methods are categorized into three types: predictive, normative, and explorative (van der Duin, 2016). These categories reflect different time preferences, with predictive approaches being nearest in time and explorative approaches being the furthest apart. Predictive methods use historical data to project past patterns into the future. Explorative approaches, on the other hand, investigate what could happen in the future. Normative approaches do not aim to predict or explore the future but instead focus on determining desirable future scenarios and identifying the activities needed to realize those futures.

This thesis will not examine predictive approaches for several key reasons. Predictive methods rely on historical data to forecast future trends, which is less suitable for addressing the novelty concept of circular economy and the dynamic and complex challenges faced by circular economy ecosystems. Instead, this thesis focuses on normative and explorative foresight methods mentioned by van der Duin (2016), roadmapping and backcasting (normative), and scenario planning (explorative). These approaches are better suited to explore potential futures, align stakeholders towards shared goals, and build resilience against uncertainties.

2.3.1.1 Scenario Planning

Scenario planning is a strategic foresight method pioneered by Shell Oil and Gas in the 1970s (Jefferson, 2020). According to Wade (2012), scenario planning does not aim to predict a single, definitive future but rather seeks to explore different realistic possibilities, providing insightful indicators of what could come to pass. Different scholars, as cited by Lindgren and Bandhold (2002), have made their own definitions of scenarios and scenario planning. These definitions emphasize that scenarios are not forecasts or visions but rather internally consistent and plausible narratives that answer questions about what might conceivably happen in the future. As Chermack et al. (2001) highlight, it is necessary to determine the impact that participation in scenario planning can have on business members, decision-making capabilities, and business results. According to Godet (2000), a scenario is the set formed by the description of a future situation and the course of events that enables one to progress from the original situation to the future situation. Godet categorizes scenarios into two main types: exploratory, which start from past and present trends and lead to likely futures, and anticipatory or normative, which are built on alternative visions of the future. Duckett

et al. (2017) emphasize that scenario planning is not about predicting the future but about futureproofing against market shocks and uncertainties.

There are several different methods to conduct scenario planning, involving a series of steps aimed at understanding uncertainties, identifying trends, and constructing plausible future scenarios (Schoemaker 1993; Lindgren and Bandhold, 2002). Schoemaker (1993) outlines a ten-step process that includes defining issues, identifying stakeholders, analyzing trends and uncertainties, constructing scenarios, evaluating their plausibility, and refining them based on stakeholder behavior and further research. Lindgren and Bandhold (2002) describes a similar approach, TAIDA, that involves Tracking, Analyzing, Imaging, Deciding and lastly Acting. Spaniol and Rowland (2022) describe the Intuitive Logics process for scenario planning involving identifying critical uncertainties and juxtaposing them on a 2x2 matrix to create four distinct scenarios. These scenarios are narratives focused on potential future outcomes, each differing significantly from the others.

Despite its benefits, scenario planning poses challenges. It requires extensive time and financial resources, making it accessible primarily to financially secure organizations (Chermack et al., 2001). Furthermore, Raford (2015) acknowledges the challenge of evaluating scenario quality due to the lack of objective metrics. However, Chermack et al.'s (2001) theory suggests that scenarios can enhance organizational learning about environmental change by increasing awareness of external forces and factors, leading to more accurate mental models and better decision-making (Raford, 2015). Increased participation in scenario planning processes could further amplify these benefits, although the specific impact remains subject to speculation (Raford, 2015).

2.3.1.2 Roadmapping

Roadmapping, as defined by Kerr and Phaal (2022), is a strategic methodology that offers practical support for organizations in strategy development, long-term planning, innovation, and foresight. While roadmaps are tangible artifacts, the value of roadmapping extends beyond the roadmap itself (Kerr and Phaal, 2022). It involves the disciplined process of planning and alignment, ensuring the reconciliation of self-interests, a common understanding of deliverables, and the calibration of offerings against future needs and organizational goals.

The distinction between roadmapping and roadmaps lies in their focus. While roadmaps serve as visual representations of strategic intent, the real value lies in the iterative process of roadmapping (Kerr and Phaal, 2022). Participating in the roadmapping process fosters alignment, decision-making, and synchronization across stakeholders, especially senior management, enabling better strategic decisions, resource allocation, and market positioning. However, the roadmapping process is not a simple process (Kerr and Phaal, 2022). Groenveld (1997) highlights the difficulties by noting the differences in the backgrounds, ways of thinking, and working practices of the various

departments as major obstacles that need to be overcome. As Groenveld points out, trust is the foundation of successful collaboration, and management needs to promote trust to foster transparency. Furthermore, as every firm has a different market, culture, and communication structure, customized roadmapping techniques are required, highlighting the necessity of a continuous, flexible process. Meydanli and Polat (2022) further highlights the securing of top management commitment, choosing the right approach, facilitating workshops, ensuring ownership, and integrating roadmaps into technology and strategic planning. Ownership by specific individuals emerges as a critical success factor, ensuring continuity and alignment with organizational objectives (Phaal and Muller, 2009).

Drawing from Krull et al. (2022) and Groenveld (1997), the implementation of roadmapping within organizations involves several key steps and considerations. Krull et al. (2022) emphasize the importance of fostering a shared vocabulary among participants, creating a structured and safe environment for knowledge exchange, and utilizing facilitators to support effective participation. This aligns with Groenveld's (1997) insights, which underscore the necessity of reconciling differences among departments and building trust among stakeholders. A critical aspect of roadmapping implementation highlighted by Krull et al. (2022) is the process of brainstorming, wherein participants generate ideas and perspectives related to the roadmap's focus. This initial step activates the knowledge-sharing process and lays the foundation for subsequent activities. Grouping, as discussed by Groenveld (1997), involves clustering brainstormed ideas into overarching categories, fostering a common vocabulary, and promoting shared ownership among participants. Another essential component of roadmapping implementation, as outlined by Krull et al. (2022), is the rating process, wherein grouped items are evaluated for their relative importance. This activity facilitates the alignment of disparate knowledge domains and ensures that strategic priorities are identified collaboratively. Finally, mapping, as described by Groenveld (1997), involves synthesizing the outputs from earlier workshops into a visual roadmap that captures key events, projects, and interdependencies over time.

Roadmapping serves not only as a strategic planning tool but also as a mechanism for knowledge sharing and integration across organizational boundaries (Krull et al., 2022). By engaging diverse stakeholders in structured workshops, roadmapping facilitates the exchange of insights, ideas, and perspectives on market trends, product features, and technology solutions (Krull et al., 2022). This collaborative approach fosters a shared understanding of strategic goals and challenges, enhancing cross-functional communication and alignment (Krull et al., 2022; Meydanli and Polat, 2022).

Krull et al. (2022) conducted a comprehensive examination of the micro-foundations of knowledge sharing within the framework of roadmapping. They identify five specific mechanisms that influence the behavior of knowledge sharing in the context of roadmapping. One notable mechanism highlighted in their study is the significance of face-to-face interaction as a catalyst for trust-building and the exchange of tacit

knowledge among participants. Face-to-face interactions provide opportunities for individuals from different domains within the organization to come together, fostering a sense of camaraderie and facilitating the sharing of insights and expertise that might otherwise remain unspoken. Moreover, the research underscores the challenges associated with engaging all participants equally across different layers of the roadmap. Participants may have varying levels of affinity or expertise in specific areas, leading to disparities in engagement and contribution. This is particularly evident when attempting to integrate commercial and technology perspectives, which often diverge in their priorities and objectives. Despite these challenges, the study suggests that individual-level action-formation mechanisms can help mitigate disparities in engagement and foster a positive disposition toward knowledge sharing among participants. Furthermore, the study emphasizes the crucial role of effective facilitation in enabling knowledge sharing within roadmapping workshops. Neutral facilitators play a key role in creating a conducive environment for collaboration, ensuring that all voices are heard and valued. By overcoming cognitive and social barriers across knowledge domains, facilitators enhance the effectiveness of roadmapping workshops and promote a culture of open communication and knowledge exchange.

2.3.1.3 Backcasting

Unlike scenario planning, which explores multiple future scenarios, Quist (2007) defines backcasting as a process of generating a desirable future scenario and then working backwards to identify the steps necessary to achieve it. It involves envisioning a future scenario that is considered desirable or sustainable and then identifying the policies, actions, and innovations required to realize that vision. Like the other foresight methods mentioned above, backcasting also places emphasis on envisioning for a long-term distant future (Vergragt and Quist, 2011). One key strength of backcasting lies in its emphasis on radical and disruptive socio-technical changes that may be necessary in order to achieve sustainability goals (Eames and Egmose, 2011). By consciously mobilizing shared visions of the future, backcasting aims to steer socio-technical innovation towards sustainability. Shared visions facilitate the formations of networks, frame priorities, and support the mobilization of resources around common goals.

The development of backcasting scenarios involves envisioning sustainable futures, analyzing trends and uncertainties, and articulating pathways for transition. While experts and stakeholders often struggle to disengage from present constraints during vision development, participatory approaches to backcasting seek to involve a diverse set of stakeholders in the process (Vergragt and Quist, 2011). This participatory approach aims to balance present-day constraints with future aspirations, fostering higher-order learning and adaptive decision-making. However, as with other methods, backcasting also comes with its own set of challenges. One significant challenge is the inherent uncertainty surrounding future conditions and the complexity of socio-technical systems (Vergragt and Quist, 2011). Predicting how various factors will interact and evolve over time poses difficulties, especially when considering long-term

sustainability goals. Additionally, backcasting requires active engagement from diverse stakeholders, each with their own perspectives, values, and priorities (Eames and Egmose, 2011). Ensuring meaningful participation and consensus-building among stakeholders can be challenging, particularly when there are divergent views or power imbalances within the decision-making process. Furthermore, translating the vision and strategies developed through backcasting into actionable policies and initiatives may encounter resistance or bureaucratic hurdles (Vergragt and Quist, 2011). Bridging the gap between vision and action requires effective implementation mechanisms, institutional support, and ongoing monitoring and evaluation. Without robust follow-through, backcasting exercises may fail to translate into tangible results or meaningful impact in real-world contexts. Addressing these challenges demands careful attention to process design, stakeholder engagement, capacity building, and institutional support to maximize the effectiveness and relevance of backcasting as a tool for sustainable development (Vergragt and Quist, 2011).

2.3.1.4 Network and open foresight

Open foresight, as discussed by Wiener et al. (2018) and Gattringer and Wiener (2020), represents a collaborative approach to envisioning future scenarios and trends. This method involves engaging diverse stakeholders, both within and outside an organization, to collectively explore potential disruptions and opportunities. The concept of open foresight emerges as a response to the challenges posed by disruptive changes, particularly in the context of transitioning to a circular economy and addressing sustainability concerns (Bocken et al., 2016; Eames and Egmose, 2011). What research has highlighted the necessity for established companies to recognize and adapt to transformative shifts in their operating environments (Bergek et al., 2013; Sandström et al., 2014). Foresight methodologies are proposed as valuable tools for gaining insight into these changes, as they enable organizations to identify trends, analyze external factors, and facilitate dialogue among stakeholders with diverse perspectives (Cagnin et al., 2013).

The literature also highlights the significance of integrating external knowledge and expertise in foresight activities (Day and Schoemaker, 2004). This acknowledgment reflects a broader trend in organizational practices toward openness and collaboration with external partners. Open foresight, therefore, emerges as a strategic approach for leveraging external insights to inform decision-making and innovation processes (Wiener et al., 2018).

Open foresight, as discussed by Wiener et al. (2018), offers several advantages that make it a valuable approach for organizations. Firstly, Stout (1995) argues that neither individuals nor single companies possess sufficient knowledge to independently shape the future. This highlights the necessity of leveraging diverse perspectives and insights. Schatzmann et al. (2013) emphasize the importance of collaborative activities in exploiting specific knowledge about future matters for the benefit of the organization

as a whole. This collaborative approach allows for the pooling of expertise and resources, enabling more comprehensive foresight. Heger and Boman (2015) further emphasize the value of open foresight in leveraging a diverse pool of people with varied backgrounds and perspectives. This diversity fosters innovation and creativity, particularly for projects requiring new insights and approaches.

The open nature of open foresight helps address typical limitations of corporate foresight projects, such as being confined to existing mental models and power structures within the company (Heger and Boman, 2015). By incorporating input from various stakeholders and companies, open foresight promotes out-of-the-box thinking (Gattringer et al., 2017) and reduces decision-makers' uncertainty about future developments (Daheim and Uerz, 2008). Additionally, open foresight allows for the sharing of resources, including time, budget, methodological knowledge, and expertise (Schatzmann et al., 2013). However, the successful implementation of open foresight hinges on organizational culture, as Wiener (2017) suggests. According to Chaudhuri and Boer (2016), it is important for companies to create suitable organizational contexts to support inter-company collaboration for open foresight to succeed. Furthermore, Wiener (2017) highlights that not every collaboration is value-adding to the participating firms. Although inter-firm collaborations can be a source of creativity, they could also be a source of communicative dilemmas that can lead to conflicts or even process failure (Tidd and Bessant, 2018).

Foresight methods	
Scenario Planning	
Key Features and Benefits	*Focuses on exploring multiple plausible futures to increase awareness of uncertainties and improve decision-making. It enhances organizational learning by highlighting external forces and trends.*
Challenges	*Requires extensive time and resources. Difficult to evaluate scenario quality due to the lack of objective metrics.*
Roadmapping	
Key Features and Benefits	*Aligns strategic goals with tangible actions through visual roadmaps and iterative processes, improving strategic decisions and resource allocation. Facilitates stakeholder synchronization and decision-making.*
Challenges	*Customization challenges due to varying organizational contexts. Difficulties in stakeholder engagement and maintaining commitment from top management.*
Backcasting	
Key Features and Benefits	*Starts with a desired future and identifies necessary steps backwards, focusing on achieving sustainable or ideal scenarios. Stimulates innovative solutions for achieving long-term goals.*
Challenges	*Challenges in engaging diverse stakeholders and moving beyond current limitations. Difficulty in translating visions into actionable policies and overcoming implementation barriers.*
Network and open Foresight	
Key Features and Benefits	*Involves diverse internal and external stakeholders to explore future trends and disruptions. Leverages diverse expertise to foster innovation and facilitates resource sharing.*
Challenges	*Requires a supportive organizational culture for collaboration. Potential communicative dilemmas can hinder process effectiveness and value addition.*

Table 2.3: *Brief summary of each foresight methods' benefits and challenges*

2.3.2 Practical considerations for foresight

As foresight has been conducted in various contexts for many years (Gordon et al., 2020), there are a plethora of cases providing lessons for using different forms of foresight. For example, in determining the number and types of partners in foresight projects, several factors warrant consideration. Some authors suggest that a low number of partners allows for strong integration and ease of coordination and control (Pisano and Verganti, 2008), which can help avoid high organizational costs and risks

(Bengtsson et al., 2014). Laursen and Salter (2006) argue that for radical innovation, deep collaboration with a few key partners is beneficial. However, for explorative innovation, a broad variety of external sources is essential. In terms of partner diversity, it is generally seen as advantageous for generating more ideas and fostering creativity, as it encourages out-of-the-box thinking and offers a broader range of perspectives (Gattringer et al., 2017). Echoing this sentiment, Habicher et al. (2022) emphasize the critical role of interdisciplinarity in foresight activities, particularly in understanding the complex and interconnected nature of future developments. By incorporating knowledge, approaches, and perspectives from diverse scientific disciplines, it becomes possible to develop comprehensive and plausible future development paths.

However, it is worth noting that partners should be similar enough in their knowledge bases to facilitate learning (Baum et al., 2010). Too much dissimilarity may hinder effective communication and mutual understanding as it increases the complexity of coordination and control. In the case of open foresight, the number of partners and the degree of diversity depend on the project's objectives (Wiener et al., 2018), highlighting the importance of strategic alignment in partner selection for foresight initiatives. Nevertheless, Habicher et al. (2022) also acknowledge the challenges inherent in interdisciplinary collaboration, such as breaking down disciplinary boundaries and establishing cross-links between different areas of expertise. Emphasizing collaboration and open dialogue among researchers with varied disciplinary backgrounds is crucial for enhancing the effectiveness of foresight initiatives. Furthermore, in relation to the composition of participants, Eames and Egmose (2011) underscore the importance of managing expectations and addressing inherent challenges when engaging in foresight endeavors. Doing so will give the result a better chance of being actionable. Moreover, the role of a leader who designs the process, recruits participants, and organizes the workshops was also emphasized (Eames and Egmose, 2011).

2.3.3 Insights from applied foresight activities

Marinković et al. (2022), in their systematic literature review of corporate foresight, identify various motivations for using corporate foresight, such as adapting to environmental changes, improving decision-making quality, and shaping innovation and technology pathways. They also highlight potential outcomes, including improved strategy formulation, communication and consensus-building, and assessment of technological and innovation landscapes. Moreover, several authors have also investigated using different approaches to foresight in different contexts. For instance, Rohrbeck and Schwarz (2013) investigated the value creation of using strategic foresight by large firms currently using strategic foresight in various industries. The authors' findings indicated that firms could expect enhanced perception, interpretation, and response capabilities, along with increased organizational learning and influence on other actors. Enhanced perception, particularly gaining insights into environmental changes and reducing uncertainty, emerged as the most prominent value contribution.

Other potential value creation included a better understanding of customers and the market and fostering firm-strategy conversations. Despite the potential benefits of strategic foresight, coordination was not emphasized as a significant contribution, likely due to the limited collaboration between units during the process (Rohrbeck and Schwarz, 2013).

In their cross-case analysis encompassing 19 cases, Rohrbeck and Gemünden (2011) identified three distinct roles that corporate foresight assumes throughout the innovation process: initiator, strategist, and opponent. The *initiator role* involves activities such as identifying customer and market needs, scouting for technology, and assessing competitors. Conversely, the *strategist role* entails assessing and realigning the innovation portfolio, offering strategic direction, challenging existing business models, consolidating viewpoints, and fostering a cohesive vision. On the other hand, the *opponent role* is characterized by questioning assumptions, monitoring potential threats posed by current and future innovations, and scrutinizing ongoing projects (Rohrbeck and Gemünden, 2011).

Other scholars have also investigated the effects of using foresight in ecosystems or network constellations. For instance, Spaniol and Rowland (2022), showcased an innovative application of corporate foresight tools within an ecosystem context, negating the traditional role of the orchestrator, and making the ecosystem more decentralized. Through workshops, the authors observed the adaptation of foresight tools to foster coordination and alignment among ecosystem stakeholders, facilitating the emergence of shared visions and enhancing ecosystem cohesion. Similarly, Heger and Boman (2014) discovered through interviews with foresight practitioners within an innovation network that networked foresight, akin to corporate foresight but conducted within inter-organizational networks with active involvement from network partners and aimed at benefiting both the partners and the network itself, generated value for the entire network, particularly for SMEs. This approach led to a deeper comprehension of the environment, engaged partners in shaping the future ecosystem, and, consistent with Spaniol and Rowland (2022), fostered the development of a shared vision.

Pombo-Juárez et al. (2017) developed and applied the concept of 'multi-layered foresight' to address the various layers of innovation ecosystems, i.e., the organizational, sectoral, regional, national, and international layers. The authors found that despite challenges in coordinating stakeholders across different layers and resource limitations impeding comprehensive engagement, using foresight in the ecosystem yielded benefits such as enhanced understanding, collaborative opportunities, and stakeholder empowerment in navigating future uncertainties and shaping favorable outcomes. Like Pombo-Juárez et al. (2017), Pouru-Mikkola et al. (2023) also looked at the effect of foresight on different layers, however, of the Finnish distributed policy foresight system consisting of a heterogeneous group of institutional actors, with the intention to serve national, regional, and local decision-making and objectives. The authors categorized their findings into knowledge, capabilities, and relations.

Regarding *knowledge*, Pouru-Mikkola et al. (2023) found that the most prevalent method involves collecting drivers of change from within the organization's domain, and the primary sources of future knowledge tend to be proximal to the organization. Moreover, locating relevant information posed a significant hurdle for some actors. Regarding *capabilities*, foresight was mainly conducted to serve organizations' internal strategy and development needs. Furthermore, foresight users emphasized anticipating probable developments and proactively influencing the operational environment, followed by bold visioning and systemic investigation of phenomena as rationale. Pouru-Mikkola et al. (2023) also indicated high performers leveraged diverse methods and sources when conducting foresight. Regarding *relations*, Pouru-Mikkola et al. (2023) identified coordination challenges in the Finnish foresight system, with some advocating for increased hierarchy to address these issues. Additionally, concerns were raised regarding the perceived lack of impact of foresight knowledge, partly attributed to resource constraints. However, participants emphasized viewing foresight as a collective decision-making process rather than solely a knowledge-production endeavor. Despite these challenges, the collaborative nature of the Finnish foresight system was highlighted as a notable achievement, with its openness and capacity for fostering cooperation being key strengths (Pouru-Mikkola et al., 2023). Given the coordination challenges found, Pouru-Mikkola et al. (2023) proposed that there exists a need for an orchestrator when conducting foresight.

Lastly, foresight has also been used within the field of sustainability. For instance, Destatte (2010) concluded that foresight is a precious tool for tackling sustainability, and further connects sustainable values such as equity, solidarity, and proactivity to the necessary elements of a shared vision, i.e., a benefit from using foresight (Spaniol and Rowland, 2022; Heger and Boman, 2014). Moreover, Bauwens et al. (2020) investigated the future of a circular economy using scenario planning, concluding that such scenarios are essential to influence businesses and policymakers by enhancing understanding and anticipation, as well as guiding the development in the right direction. Wiener et al. (2018) explored the benefits of collaborative open foresight with respect to discontinuous and sustainability-oriented innovations. Through a case study of two companies, the authors found that open foresight created substantial value for both companies as it led to enhanced out-of-the-box thinking, identification of disruptive changes fostering innovation, generation of new insights regarding opportunities and risks associated with these changes and facilitated breaking away from path dependency. Thus, similar to Heger and Boman's (2014) findings, Wiener et al.'s (2018) findings suggest that a better assessment of environmental changes could be achieved.

Eames and Egmose (2011) diverged from focusing on business applications of foresight by applying backcasting to community engagement within sustainability. Through this approach, the authors uncovered several findings. For instance, backcasting enhanced learning and empowerment among residents, who actively shaped the research agenda

and engaged in reflexive dialogue. Additionally, the approach promoted mutual understanding among stakeholders and enabled shared discourse across linguistic obstacles. Different perspectives emerged because of this process, which encouraged a group investigation of community goals. The program also made it easier for transdisciplinary networks to emerge, opening doors to larger networks of resources, information, and expertise (Eames and Egmose, 2011).

As shown by the various case studies outlined above, foresight can be a favorable tool to use, given its potential to offer multifaceted benefits to organizations and ecosystems alike. It could provide a better understanding of the environment, e.g., through assessment of technological and innovation landscapes (Marinković et al., 2022; Wiener et al., 2018; Heger and Boman, 2014; Rohrbeck and Gemünden, 2011) and competitors (Rohrbeck and Gemünden, 2011), enhanced understanding of customers and the market (Wiener et al., 2018; Heger and Boman, 2014; Rohrbeck and Schwarz, 2013; Rohrbeck and Gemünden, 2011), and identification of disruptive changes (Wiener et al., 2018). Additionally, it can facilitate relational practices, e.g., enabling communication and consensus-building (Marinković et al., 2022), increasing the possibility to influence and engage actors (Bauwens et al., 2020; Heger and Boman, 2014; Rohrbeck and Schwarz, 2013) and increase the network of partners (Heger and Boman, 2014; Eames and Egmose, 2011), enhance alignment, coordination, understanding; and collaboration of these actors (Spaniol and Rowland, 2022; Bauwens et al., 2020; Pombo-Juárez et al., 2017; Eames and Egmose, 2011) potentially leading to the emergence of shared visions (Spaniol and Rowland, 2022; Heger and Boman, 2014; Destatte, 2010) and enhanced stakeholder empowerment (Pombo-Juárez et al., 2017; Eames and Egmose, 2011). Moreover, it could also enable resource and capability building, e.g., through organizational learning (Rohrbeck and Schwarz, 2013; Eames and Egmose, 2011), and facilitating an expansion of knowledge and resource base (Eames and Egmose, 2011). Lastly, foresight has the possibility to improve a sense of direction for both organizations, networks, and ecosystems, e.g., it can facilitate firm-strategy conversations (Rohrbeck and Schwarz, 2013), insights regarding opportunities and risks (Wiener et al., 2018), enhance organizations to perceive, interpret, and response to signals in the environment (Rohrbeck and Schwarz, 2013), improve strategy formulation (Marinković et al., 2022), and thus, guide the development in the right direction (Bauwens et al., 2020), facilitate breaking away from path dependency (Wiener et al., 2018), and potentially create value for the organization and/or the network of partners (Wiener et al., 2018; Heger and Boman, 2014).

The literature review on applied foresight activities offers a comprehensive understanding of the multifaceted benefits and potential applications of foresight methodologies across diverse domains, summarized in Table 2.4. Through an examination of motivations, outcomes, and case studies, it becomes evident that foresight has the capacity to enhance organizational adaptability and decision-making processes. Additionally, it fosters collaboration, innovation, and stakeholder engagement within interconnected ecosystems. Embracing foresight as a strategic tool

enables organizations and networks to navigate uncertainties and capitalize on emerging opportunities. The insights derived from this review highlight the transformative potential of foresight in guiding informed action and facilitating positive change, both at organizational and systemic levels. Moreover, what becomes evident after this review is that there is some overlap between the identified empirical outcomes from applying foresight in various contexts and the sought after orchestration capabilities outlined in section 5.2. Although only one paper (Spaniol and Rowland, 2022) was found that investigates this relationship in a business ecosystem context, the similarities suggest a connection between foresight activities and orchestration capabilities, motivating this thesis' aim to investigate it in a circular economy ecosystem context.

Summary of findings

Study	Foresight outcomes	Methods used*	Context
Marinković et al. (2022)	*Improved strategy formulation, better communication and consensus-building, and enhanced assessment of technological and innovation landscapes.*	*Literature review of corporate foresight*	*Corporate, cross-industry*
Rohrbeck and Schwarz (2013)	*Gained insights into environmental changes, reduced uncertainty, better understanding of customers and markets, fostered firm-strategy conversations.*	*Strategic foresight, specific methods not specified*	*Large firms across various industries*
Rohrbeck and Gemünden (2011)	*Defined roles of initiator, strategist, and opponent in innovation processes.*	*Corporate foresight, e.g., scenario planning and roadmapping*	*Corporate, innovation-focused across industries and borders*
Spaniol and Rowland (2022)	*Enhanced ecosystem cohesion and emergence of shared visions.*	*Corporate foresight, scenario planning and roadmapping*	*Corporate foresight in an ecosystem setting*
Heger and Boman (2014)	*Generated value for the network, particularly SMEs, and fostered a shared vision.*	*Networked foresight, e.g., scenario planning and roadmapping*	*Innovation networks, single case study*
Pombo-Juárez et al. (2016)	*Enhanced understanding, collaborative opportunities, stakeholder empowerment.*	*Multi-layered foresight, e.g., scenario planning and roadmapping*	*Organizational, sectoral, regional, national, and international dimensions of innovation ecosystems*
Pouru-Mikkola et al. (2023)	*Enhanced knowledge, capabilities, and relations; highlighted coordination challenges.*	*Distributed policy foresight, e.g., scenario planning*	*Finnish policy-making institutions*
Destatte (2010)	*Connected sustainable values with elements of a shared vision.*	*Strategic foresight, specific methods not specified*	*Sustainability-focused settings*
Bauwens et al. (2020)	*Guided development towards a circular economy.*	*Scenario planning*	*Circular economy development*
Wiener et al. (2018)	*Created substantial value for companies, identified disruptive changes, and enhanced out-of-the-box thinking.*	*Open foresight, scenario planning*	*Case study of two multinational companies – initiated collaborative open foresight project focusing on sustainability*
Eames and Egmose (2011)	*Enabled shared discourse across linguistic obstacles, facilitated transdisciplinary networks.*	*Community foresight, backcasting*	*Community engagement in sustainability*

* Specified methods are only those previously discussed

Table 2.4: *Summary of empirical findings from using different foresight methods in various intra- and inter-organizational contexts*

3. Methodology

In this section, this thesis research methods are described. It begins by outlining the research strategy and design, the empirical setting, and how the data were collected and subsequently analyzed to achieve the aim of this thesis and address the research questions. Lastly, ethical considerations and quality criteria are discussed before a short section of methodology criticism is presented. A simplified overview of the research processes conducted is illustrated in Figure 3.1.

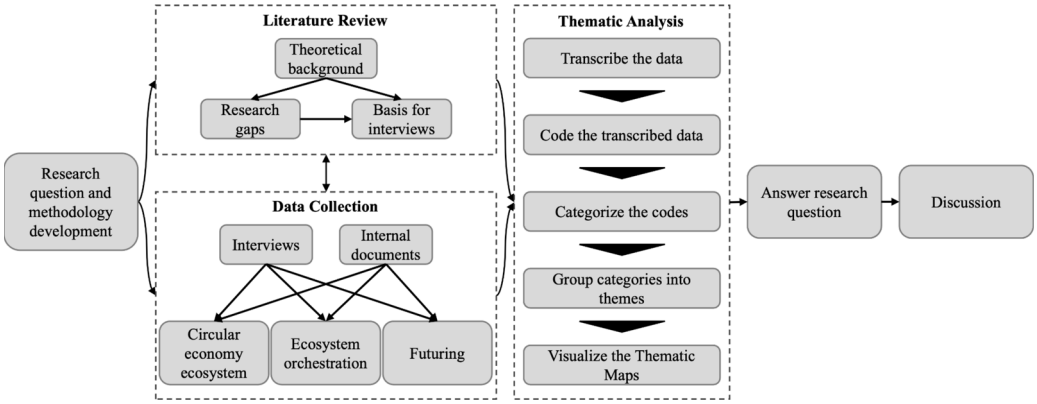

Figure 3.1: *Visualization of the conducted research process*

3.1 Research strategy

Bell et al. (2022) and Bryman (2016) present various strategies and approaches to research. For research strategies, though some argue it to be ambiguous, Bell et al. (2022) and Bryman (2016) argue that it is helpful to distinguish research strategies between qualitative and quantitative approaches. A key differentiating factor, according to Bell et al. (2022), is in the data collection, where a quantitative strategy relies on quantifiable variables, e.g., numbers, instead of words or pictures, as a qualitative strategy does. Bell et al. (2022) further describes that a qualitative strategy, in contrast to quantitative strategy that adopts scientific models to understand phenomenon, tries to capture the complexities of the social world through interpretation and understands social properties as outcomes of interactions. Thus, what strategy is best suited for the research at hand depends on the goal of the research and the nature of the research question. Given the intricate interplay of stakeholder perspectives and relational dynamics inherent in exploring how futuring can be a means of ecosystem orchestration within circular economy ecosystems like Circular Plastic, a qualitative research strategy becomes indispensable. While quantitative strategies may offer quantifiable metrics, enabling increased objectivity, they may not fully capture the complexities and nuances essential to understanding futuring's facilitation of orchestration within circular economy ecosystems. As Bell et al. (2022) emphasize, qualitative research is uniquely positioned to delve into the intricacies of the social world, viewing social properties as outcomes of interactions rather than mere natural phenomena. Therefore, a qualitative

research strategy is warranted to provide a comprehensive understanding of the dynamics between circular economy ecosystem, ecosystem orchestration, and futuring.

For the research approach, Bell et al. (2022) and Bryman (2016) mention three approaches, i.e., deductive, inductive, and abductive, which depend on the relationship between how the data and theory are being used. In research, especially in fields where phenomena are complex or not fully understood, abductive reasoning can be particularly useful (Bell et al., 2022). According to Bell et al. (2022), this is due to the iterative way of reasoning in the abductive approach, where researchers move back and forth between empirical findings and theory to find potential explanations for that particular phenomenon or observation. As circular economy ecosystems are inherently complex, involving multiple stakeholders, dynamic interactions, and uncertainty, the exploratory nature of the abductive approach was therefore argued to be suitable for the aim of this thesis.

3.2 Research design

Bell et al. (2022) discuss five different research designs, where a case study was argued to best suit this thesis's aim and time frame. A case study intensively examines a case that later forms the basis of the theoretical analysis (Bell et al., 2022). Moreover, by utilizing a case study, Saunders et al. (2016) claim a rich understanding of the specific context can be reached, which was of particular importance to the aim of the thesis. Furthermore, a case could range from one specific case to several cases (Bell et al., 2022; Gerring, 2006), where this thesis chose one specific case based on convenience and relevancy to the aim and research questions. Moreover, a case study facilitated the use of multiple data collection methods, enabling several views into consideration when answering the research questions (Bell et al., 2022). This was essential to answer the research questions since the boundaries of an ecosystem are unclear while increasing the validity of the results (Bell et al., 2022; Flick, 2014).

3.3 Empirical setting

The empirical setting of this thesis is the circular economy ecosystem Circular Plastic, representing collaborative efforts involving multiple stakeholders and organizations with diverse backgrounds and expertise. There are three distinct types of organizations in Circular Plastic: Funders, Researchers, and SMEs. Figure 3.2 visualizes these three groups and their relative representation in the circular economy ecosystem.

The SMEs in Circular Plastic are in different industries, with different value offerings, sizes, and expertise, spanning from furniture providers and textiles to pulp and 3D printing technology. As they are from different industries, they also have different rationale for being a part of the circular economy ecosystem. The researchers are from different universities and research institutes around Europe. The individual representatives from these research organizations also have different backgrounds and

areas of expertise, e.g., digital twin, supply chain, entrepreneurship, circular economy, informatics, or civil engineering. Furthermore, among the researchers, there are those that are directly involved, while others are more in the periphery, studying it and offering an objective discussion partner. The funders, however, are not directly involved in Circular Plastic and can be seen as the enablers of Circular Plastic. Even though they are in the periphery of the circular economy ecosystem, they still influence and have different motives for investing in Circular Plastic. Lastly, all these organizations are situated in different parts of the world, thus complicating the collaboration and coordination among them, as most of the interaction between the organizations occur virtual besides bi-annual hybrid-meetings.

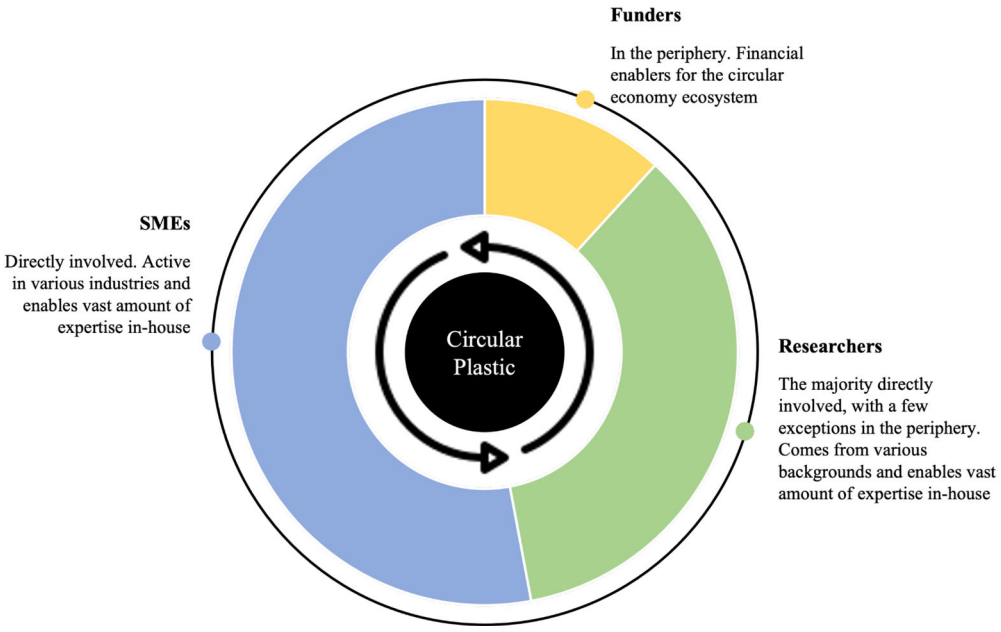

Figure 3.2: *Visualization of the different actors in Circular Plastic*

At the time of writing, Circular Plastic strives to achieve circularity by establishing a network of circular economy microfactories that utilize large-scale additive manufacturing technology to produce large products from locally sourced recycled polymer waste streams. Furthermore, the circular economy ecosystem analyzed in this thesis comprises interconnected levels, each characterized by distinct actors, objectives, and contributions. By exploring these levels, this study seeks to provide a comprehensive understanding of the empirical context surrounding the circular economy ecosystem and its broader implications for advancing circular manufacturing practices. To enable the reader to better understand the circular economy ecosystem studied, a brief description of the different levels seen in Figure 3.3 is provided, which encompasses the circular economy ecosystem.

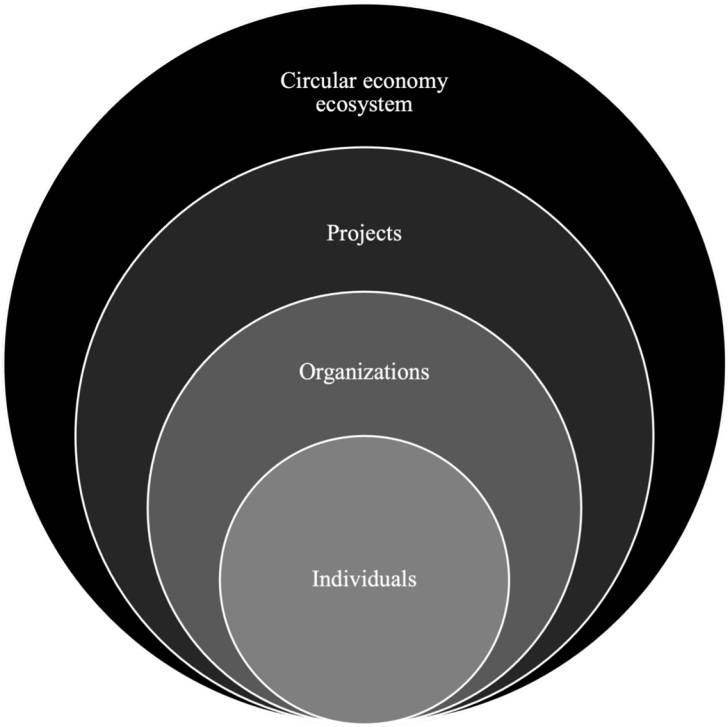

Figure 3.3: *The different levels building up the circular economy ecosystem*

At the individual level, participants in the circular economy ecosystem exhibit a wide array of backgrounds, expertise, and objectives. These individuals bring diverse perspectives and priorities, shaping the direction and dynamics of the ecosystem. Their involvement in the project reflects their distinct visions and focuses within the circular economy framework.

At the organizational level, a diverse array of entities partake in the circular economy ecosystem, each with unique roles and motivations. This includes funders, researchers, and SMEs spanning different industries. These organizations contribute to the ecosystem with varying scopes of engagement, driven by their specific visions and strategies for advancing circularity.

At the project level, there exists a focal project that gathers stakeholders to collaboratively pursue a proof of concept for circular manufacturing. This level entails more immediate and tangible goals, with the project acting as a catalyst for broader advancements in the circular economy. Additionally, subsidiary projects stemming from the main project further enrich the ecosystem, collectively pushing the circular economy ecosystem.

Finally, the ecosystem level serves as the overarching framework that binds together the various dimensions of the circular economy initiatives. It encapsulates the vision of achieving circularity through the establishment of local microfactories engaging in large-scale additive manufacturing with materials sourced from regional waste streams.

Primarily situated in northern and southern Europe, the actors aim to establish and operate these microfactories, thereby closing the loop on material usage and fostering sustainability.

The selected circular economy ecosystem represents a tangible example of circular economy principles in action. Furthermore, as the circular economy ecosystem has different stakeholders from different fields and industries, with various expertise, backgrounds, and motives for pursuing circularity, there exists different orchestration mechanisms that are in play. Thus, as this thesis investigated why ecosystem orchestration is complex in circular economy ecosystems and how futuring could be used to facilitate ecosystem orchestration in circular economy ecosystems, the chosen circular economy ecosystem is argued to be a good empirical setting to analyze and find answers to these research questions.

3.4 Literature

The literature review set the theoretical background for the thesis and served to find research gaps and be the basis for the interviews. Snyder (2019) presents three approaches to ensure quality when conducting a literature review. Of these three, this thesis followed a semi-systematic approach (Snyder, 2019), even though Bell et al. (2022) claim that a systematic literature review is more unbiased and enables the study's replicability. However, as this thesis' research design was a case study, a semi-structured approach was argued to be suitable since Snyder (2019) claims a semi-systematic approach is a good approach when the research includes themes or thematic analysis.

Following Snyder (2019), relevant search terms, valuable databases, and criteria for inclusion and exclusion of the literature review was established beforehand. The search terms were *Futuring, Foresight, Strategic foresight, Corporate foresight, Network foresight, Open foresight, Foresight methods, Scenario planning, Roadmapping, Backcasting, Business ecosystem, Circular ecosystem, Circular economy ecosystem, Circular economy, Ecosystem orchestration,* or any combination. Besides these search terms, snowballing was also utilized, which, according to Bell et al. (2022), refers to looking up relevant literature references. This iterative process enabled this thesis to discover relevant literature that did not appear in the initial search.

The database used was primarily Scopus, and the choice was based mainly on access and the possibility to filter based on criteria. However, relevant AI tools, such as Scispace, Connected Papers, and Perplexity, were also utilized to find relevant literature. Moreover, for the inclusion and exclusion criteria, articles related to, e.g., *futuring and foresight,* with its different varieties, had to be published in journals within the fields of *management, entrepreneurship and small business management, business strategy, and futures* with a ranking of 3s or higher, according to the 2018 Academic Journal Guide, preferably with empirical findings. For the less developed fields of

literature, e.g., *Circular economy ecosystems*, articles from journals with lower rankings or not in the guide were also included. The inclusion of this literature was instead contingent on contribution, number of citations, and the topic related to the thesis' objective. The literature review continued until theoretical saturation was reached, which Bell et al. (2022) claim to be reached when (i) no new or relevant data emerge in a specific category, (ii) the category is well-developed, and (iii) relationships between categories are established and validated.

3.5 Data collection

This thesis used a mixed data collection approach, as recommended by Bell et al. (2022) and Langley (1999), as it enabled this thesis to be more detailed while also increasing the validity through triangulation. According to Bell et al. (2022), triangulation is a method to cross-check results between different data sources and could enhance the credibility and reliability of research results. According to Flick (2014), triangulation is a powerful method but only a method that some studies need. Flick (2014) proposed six guiding questions for determining whether a study should use triangulation. For this thesis, the three questions (i) *Does the research question focus on several aspects or levels of my issue?* (ii) *Do I have several theoretical perspectives on my issue?* (iii) *Are there different levels of information I need to collect to understand my issue under study?* motivated this thesis's use of triangulation.

As depicted in Figure 3.1, the data collection process was divided into two main streams, interviews, and documentation, which will be elaborated on further below.

3.5.1 Interviews

The interviews were semi-structured, where topics and questions were developed beforehand and offered to be sent in advance to the interviewees. By doing so, the dependability of this thesis was increased (Bell et al., 2022), as it ensured that all participants received the same information and those who preferred had also time to reflect on the topics before the interview. Bell et al. (2022) further argue that following a semi-structured format will yield greater flexibility for the interviewee, allowing the interviewee to highlight specifics and thus potentially resulting in nuances to the answers that a more structured approach does not permit. Moreover, as the interview followed a semi-structured format, the interview guide stipulated as a reminder of the topics that should be covered (Bell et al., 2022). Since the interviews were not restricted to the interview guide, it allowed for increased flexibility in asking follow-up questions and digging deeper into interesting deviations to find more nuances or areas of interest. The interview guide could be seen in the Appendix 8.1.

The selection of interview objects was conducted by purposive sampling, a method where the interview objects were selected based on their potential to provide fruitful insights to answer the research questions (Bell et al., 2022). Furthermore, purposive

sampling could be divided into two different types, i.e., sequential, and non-sequential (Bell et al., 2022), where this thesis followed a sequential approach, enabling the inclusion of more objects as additional insights relevant to the aim and research questions came to light. The total sample of interview objects included, seen in Table 3.1, were individuals from almost every actor in the circular economy ecosystem. The goal at the beginning was to have at least one interviewee from each organization in the circular economy ecosystem, as Bell et al. (2022) argues that multiple perspectives strengthen the data collection. Due to unforeseen events and limited time for a few organizations the goal was not met. Thus, some organizations' views were not able to be taken into consideration. However, the interviews held with most actors in the circular economy ecosystem still enabled for a deep understanding of the circular economy ecosystem, and enabled the thesis to reach theoretical saturation, which occurred after a total of 19 interviews.

List of interviewees

Interviewee	Background	Geography	Date	Duration	Means
1	Funder 1	Nothern Europe	06-03-2024	27 min	Virtual
2	Funder 2	Nothern Europe	06-03-2024	27 min	Virtual
3	Funder 3	Nothern Europe	08-03-2024	52 min	Virtual
4	Researcher 1	Nothern Europe	06-03-2024	34 min	Virtual
5	Researcher 2	Nothern Europe	06-03-2024	53 min	Virtual
6	Researcher 3	Nothern Europe	07-03-2024	34 min	Virtual
7	Researcher 4	Southern Europe	08-03-2024	43 min	Virtual
8	Researcher 5	Nothern Europe	11-03-2024	19 min	Virtual
9	Researcher 6	Southern Europe	15-03-2024	27 min	Virtual
10	Researcher 7	Nothern Europe	15-03-2024	36 min	Virtual
11	Researcher 8	Nothern Europe	26-03-2024	24 min	Virtual
12	SME 1	Southern Europe	07-03-2024	37 min	Virtual
13	SME 2	Nothern Europe	08-03-2024	28 min	Virtual
14	SME 3	Nothern Europe	12-03-2024	22 min	Virtual
15	SME 4	Nothern Europe	12-03-2024	42 min	Virtual
16	SME 5	Nothern Europe	13-03-2024	24 min	Virtual
17	SME 6	Southern Europe	20-03-2024	42 min	Virtual
18	SME 7	Nothern Europe	26-03-2024	19 min	Virtual
19	SME 8	Southern Europe	25-04-2024	23 min	Virtual

Table 3.1: *List of interviewees*

3.5.2 Documentation

The second data stream was collected by reviewing internal documentation and records. As the ecosystem progressed over the years, a member of Circular Plastic collected extensive documentation consisting of, for example, communication records and meeting minutes, enabling the collection and analysis of a vast amount of documentation. This type of documentation was essential in mapping out and understanding the complexities in Circular Plastic needed to answer the research questions. However, Bell et al. (2022) and Flick (2014) acknowledge that documents

are often written with a purpose that may not reflect reality. Thus, a quality assessment of the received documentation was conducted, where four criteria need to be met: (i) authenticity, (ii) credibility, (iii) representativeness, and (iv) meaning (Bell et al., 2022; Flick, 2014).

The data gathered from the interviews and documentation served as a ground for developing a deeper understanding of the ecosystem. Furthermore, through the interviews and documentation, insight was gathered regarding the current way of orchestration within Circular Plastic, together with their current methods and views of the future.

3.6 Data analysis

This analysis was conducted by using thematic analysis. According to Flick (2014), thematic analysis involves searching repeated patterns of meaning across a set of data, i.e., identifying, analyzing, and interpreting patterns and themes within data. This approach allowed for qualitative data analysis to be broken down on a practical level. The analysis process is depicted in Figure 3.4.

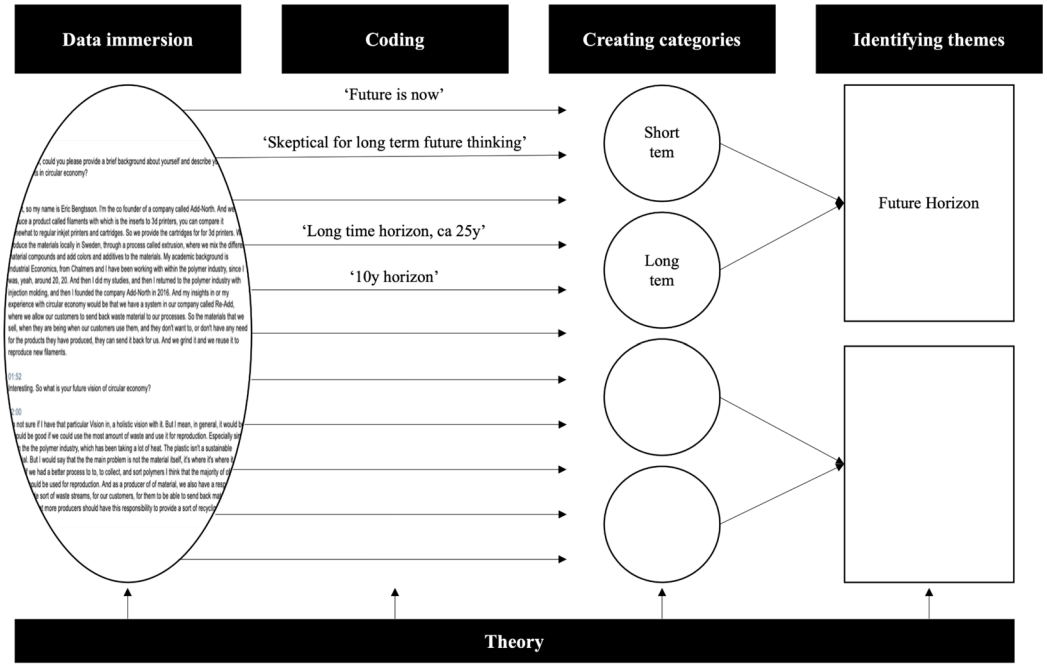

Figure 3.4: *Example of this thesis' thematic analysis, inspired by Green et al. (2007)*

The first step, seen as data immersion in Figure 3.4, involved transcribing the collected data and reading through the transcribed data. In this thesis, the transcription was done using AI tools, after permission was granted by the interviewees. Information regarding the what, how, and why of AI use was disclosed prior to the interview, which allowed the participants to make informed decisions about their data privacy. Recognizing the limitations of AI and the risk for mistranslation, the authors of this thesis also conducted

thorough review and validation of the transcriptions. This first step ensured that both authors became well acquainted with the data collected and gained a clear comprehension of the contents.

The next step was coding, which involved the development of codes from all the materials, a process that was applied to both the case and theory analyses, as described by Flick (2014). Both authors developed codes to ensure a shared understanding and consistency in the interpretation. The authors of this thesis went through the data individually, highlighting statements that were relevant to the research questions. The notes were then compared and discussed, resulting in a first set of 384 codes, where 260 of them were considered as unique codes.

The analysis continued where similarities and differences among the codes were looked at to identify the different categories and the overarching themes. Codes that were deemed as not relevant to answering the research questions were kept separate. After the initial categorization and result writing, the authors went through all codes again to see if some neglected codes were relevant when a better understanding was gained. This process resulted in 16 categories and 7 themes.

3.7 Ethical consideration and quality measures

Within the framework of this master thesis, it is essential to address ethical factors to ensure a responsible examination of Circular Plastic. This thesis followed ethical guidelines regarding research to ensure integrity, transparency, and validity. This involved ensuring the participants' confidentiality, privacy, and consent in the interviews, and other data collection methods. In addition, transparency was maintained in reporting methodologies, data sources, and potential biases. This, to ensure the integrity of the research process.

3.7.1 Ethical consideration

Ethical considerations played a central role in maintaining the credibility and validity of this thesis' research. To ensure a transparent and respectful approach, informed consent was obtained from all participants prior to the data collection. This to ensure that the participants are well informed about the objectives of this research so that they can make informed decisions about their participation, as Bell et al. (2022) recommended.

Following the ethical research practices outlined by Bell et al. (2022), additional steps were taken to increase transparency and participant comfort. Participants that wanted access were provided with the interview guide in advance. In addition, explicit consent was obtained for video recording, and participants were allowed to review the transcript from their own interview if requested, although no such request was made. This practice

is consistent with ethical principles and promotes respondent validation, allowing interviewees to confirm or challenge the accuracy of their statements (Bell et al., 2022).

Respecting participants' privacy is also essential (Bell et al., 2022). Therefore, participants were informed of their privacy rights before each interview and allowed to remain anonymous. This proactive disclosure ensured that undue intrusion was prevented and ensured respectful engagement throughout the research process (Bell et al., 2022). In addition, details about participants, including information about their organizations and roles, was to be anonymized to a level consistent with their comfort and preferences.

As Bell et al. (2022) highlighted, affiliations and conflicts of interest demand transparency in research. Affiliations possess the potential to impact the research process and outcomes. In this context, the examiner also serves as the contact person for Circular Plastic. While the examiner's dual role is acknowledged, clarifying this arrangement is essential to maintain the report's credibility. Transparency was maintained to address potential concerns about bias or influence related to affiliations. Although the examiner's involvement as the contact person for the project could theoretically be perceived as a conflict of interest, the authors firmly assert that it does not undermine the integrity or validity of the research findings. Furthermore, this affiliation was disclosed to all interview participants, informing them of the possibility to exclude parts of the interview in the collected data. It is essential to disclose this relationship to underscore our commitment to transparency and ethical research practices. This disclosure ensures openness and allows readers to assess the information with full awareness. Notably, the examiner's affiliations did not influence the objectivity and credibility of the thesis, as robust methodologies and ethical standards were upheld throughout the research process.

3.7.2 Quality measures

Besides the ethical consideration, quality measures were taken into consideration to ensure validity and reliability of this thesis. To enable the evaluation of validity and reliability of a qualitative study, Bell et al. (2022) propose four criteria for ensuring trustworthiness: (i) Credibility, (ii) Transferability, (iii) Dependability, and (iv) Confirmability.

Credibility, according to Bell et al. (2022), refers to ensuring accurate results. Thus, it involves demonstrating that the research accurately represents the perspectives and experiences of the participants and that the interpretations and conclusions drawn from the data are logical and reasonable. To establish credibility, this thesis primarily employed triangulation during the analysis of interview data. This involved cross-referencing respondents' viewpoints with each other and integrating insights gained from attending meetings and reviewing documented material. Furthermore, the data was collected from different respondents with different backgrounds, e.g., SMEs,

researchers, and funders, to cover different perspectives across organizational boundaries. In this manner, this thesis aimed to validate and enhance the trustworthiness of the findings and minimize the risk of influencing the material with biases.

Transferability, according to Bell et al. (2022), constitutes to what extent the findings can be transferred to another context or situation. As the thesis research design is a single case study, the transferability is arguably limited. However, Bell et al (2022) describes that qualitative studies, such as this thesis, can achieve trustworthiness despite this weakness through thick description, which constitutes as a form of database for others to judge if the findings is transferable to another context. In this thesis, a cohesive depiction of the research context was provided to enable both researchers and practitioners to assess the potential transferability of the findings in diverse settings, drawing upon their own expertise and judgment.

Dependability, according to Bell et al. (2022), entails ensuring the replicability of the research. This is accomplished through what Bell et al. (2022) describes as an auditing process, where complete records of all the steps, from problem formulation to data analysis, are saved. This enables others to conduct the research again and enables auditors to go through the data set to establish if proper procedures were followed. In this thesis, high transparency was provided in describing the research process, thorough documentation of data collection and analysis was kept, and relevant documentation, such as the interview guide, was displayed in the appendix.

Finally, confirmability, as outlined by Bell et al. (2022), pertains to the objectivity of the research. While acknowledging that achieving complete objectivity is nearly impossible in qualitative research, Bell et al. (2022) asserts that researchers must demonstrate that they have not unduly influenced the research and its resultant findings with personal values or theoretical inclinations. To ensure confirmability, diverse data sources with varying characteristics were employed in the identification of specific quotes. Furthermore, findings were analyzed utilizing a structured thematic approach, wherein data coding was grounded in respondents' answers rather than the authors own preconceptions. Moreover, to mitigate the potential influence of researcher bias, extensive discussions were held with supervisors at Circular Plastic and Chalmers, as well as classmates.

3.8 Methodology criticism

The methodology employed in this thesis exhibits a systematic approach to investigating the role of futuring in ecosystem orchestration within circular economy ecosystems, focusing on the case study of Circular Plastic. While the methodology provides valuable insights into the research questions, there still exist some limitations and criticisms warrant consideration.

One key limitation pertains to the generalizability of the findings derived from a single case study, as noted previously. While the in-depth analysis of Circular Plastic offers valuable insights into a specific context, the transferability of these findings to other circular economy ecosystems or broader contexts may be restricted. However, while the direct transferability to other contexts may be limited, the principles and methodologies could be adapted and customized to suit the unique characteristics and objectives of other circular economy ecosystems within the broader landscape of sustainable and circular practices. Moreover, future research could address this limitation by incorporating multiple case studies or adopting a comparative case study approach to enhance the generalizability of the findings. In addition to the inherent constraints associated with focusing on a single case, this thesis employed a qualitative methodology, which comes with its own set of limitations. These limitations encompass factors such as potential researcher bias, sample size, and considerations regarding data quality (Bell et al., 2022).

Despite efforts to maintain objectivity, the potential bias and subjectivity inherent in qualitative research methods remain. The authors' backgrounds, perspectives, and interactions with participants may influence data collection, analysis, and interpretation. To mitigate the potential bias and enhance the credibility and reliability of the findings, measures such as independent coding or member checking was implemented.

Another form of bias in this thesis stems from the use of purposive sampling, as participants were selected based on their perceived relevance to the research questions. This approach may have overlooked diverse perspectives or marginalized voices within the ecosystem. Additionally, the relatively small sample size may limit the breadth of insights gathered, even though theoretical saturation was reached. Future research could consider employing more diverse sampling techniques, such as random sampling or snowball sampling, to ensure a broader representation of stakeholders. Similarly, the study may have faced limitations in the availability and accessibility of data. The depth of the investigation into Circular Plastic's current state and the futuring concepts' effectiveness could be constrained by the extent of available information, especially from the lack of participation from a few stakeholders in this circular economy ecosystem, due to the unwillingness or inability of some participants to engage in interviews.

Lastly, while the mixed data collection approach combining interviews and documentation review offers rich qualitative data, it may lack the statistical rigor and generalizability of quantitative data. Incorporating quantitative methods, such as surveys or quantitative content analysis, could complement qualitative findings and provide a more comprehensive understanding of the phenomenon under investigation.

4. Results

The empirical findings from the abductive analysis conducted in this thesis are presented in two constituent parts following the thematic map in Figure 4.1. First, the underlying analysis of data regarding the circular economy ecosystem is presented, examining three key aspects of the circular economy ecosystem studied. Second, the focus shifts towards the circular economy ecosystem's utilization of futuring activities and how they relate to their current orchestration activities.

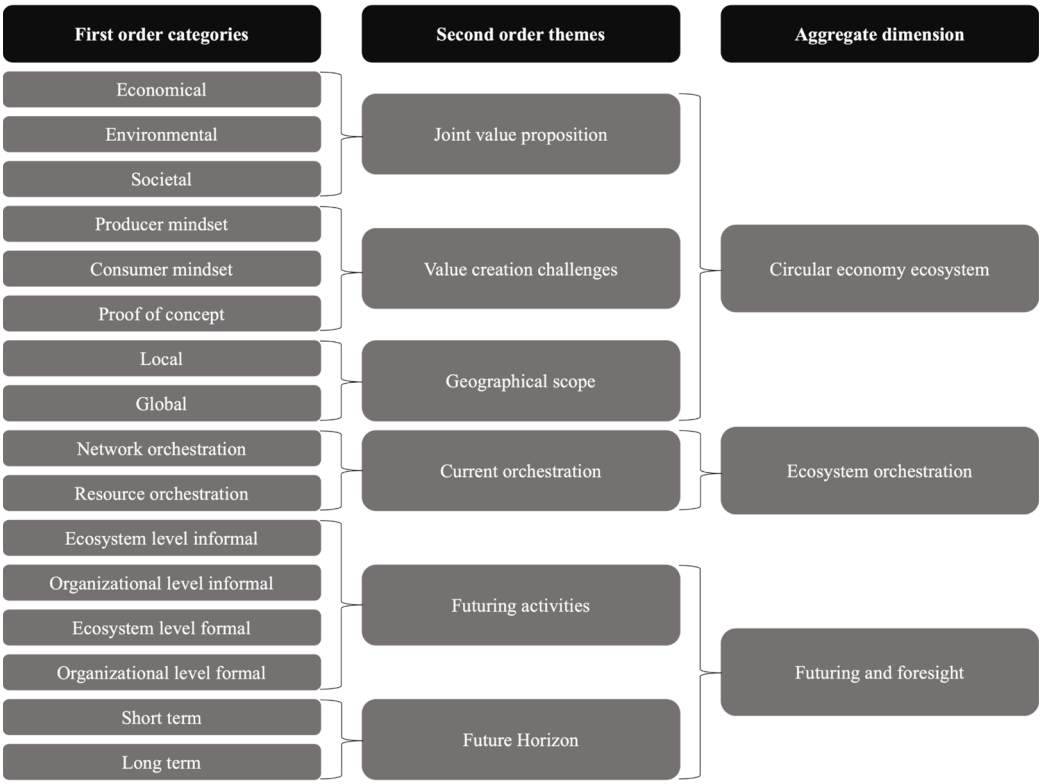

Figure 4.1: *Visualization of the thematic map*

4.1 Joint value proposition

The circular economy ecosystem presents a compelling alternative, tackling the issues that the traditional take-make-dispose model presents. From the interviews with various actors within this emerging circular economy ecosystem, many have noted the interplay between the economical, environmental, and societal value dimensions that make up the joint value proposition of the ecosystem. However, it could be seen that different types of actors have placed emphasis on different aspects of the value proposition.

4.1.1 Economical value

The economical aspect has been recognized as a necessity for the success of the ecosystem and its joint value proposition. This focus on the economic dimension was seen as a cornerstone of the joint value proposition, particularly by the SMEs. For one,

the circular economy ecosystem offers unique opportunities to not only reduce costs, but also to tap into a growing market. As mentioned by *SME 6 "[...] being able to use material that comes from that source is more interesting than using raw material that is made thousands of kilometers away and is wasting resources to get to here."* Furthermore, *SME 3* highlighted that *"there is a totally new drive in general, among in many industries, to implement more sustainable solutions, circular solutions and all of this."*

One critical concern shared by the actors, however, has been the economic viability for the organizations in the ecosystems. As *SME 6* put it, *"I think there will always have to be the economic factor, it can be a burden, but it has to be a burden that is feasible. Otherwise, the company is closed and it's not a circular economy."* Many of the SME actors stress the importance of the commercial success of the circular products and the ventures, for the survival of their own organizations.

"I mean our vision, as a startup, it's important to realize that the main thing that we think about is surviving as a company. And we, of course, have very grand visions and so on, but day to day, it's really thinking about how can we serve people's needs today? And is that going to bring us any money? [...] and I think just because you can print something, it doesn't automatically make it a good idea. [...] even if the vision for a product is great, that it should be circular and so on, pursuing a commercially unsuccessful ideas is a bit dangerous, because you will just at the end decide that this technology doesn't work at all." - SME 2

"Yeah, I would say if it goes too far away from what we're really wanting to do, like selling our furniture in our material, that it becomes too much of a just research project, because we in the end, like still have to be able to make some money out of what we get out of the project." - SME 5

Thus, from the SMEs' perspective, both the environmental aspect and the social aspect seem less significant in comparison to the economic aspect, since from their point of view the other two cannot be achieved without it.

4.1.2 Environmental value

The importance of the environmental value of the circular economy is shared by all the actors that participated in the interviews. However, it could be seen as of particular interest for the funders and researchers in the ecosystem. The actors within the ecosystem share the vision of shifting from using virgin materials to using local waste streams in production, where the resource scarcity has been a frequently mentioned topic as one of the drivers of the circular economy and driver for many of the actors' involvement. *Researcher 7* stated, *"If we look at the use of the Earth's resources, and the amount of people and demand for these resources, we have to start thinking how we can be recycling much more.". Researcher 6* saw the urgent need for circular

economy in combating the finite resource problem, noting *"Well, circular economy is something that will happen whether we want or not, because the resources are finite, so they are not infinite."*

Furthermore, there's a strong consensus on the importance of local production amongst the actors. By reducing the reliance on global delivery chains, the circular economy minimizes the environmental impact of transportation. A *SME 1* mentioned that *"... it really aligned with that vision of having to create local hubs as opposed to centralized big infrastructures, it doesn't make sense that waste gets sent across the world to be recycled and used, why not have local communities handle their own waste streams [...]",* emphasizing the need to produce where the products are going to be used.

4.1.3 Societal value

The societal dimension of value has mostly been emphasized by the Southern European actors within this ecosystem. Mainly highlighting the potential for how the circular economy ecosystem can create positive social value and change within communities. One important aspect brought up during the interviews was the empowerment of local communities through on-demand production. One Southern European actor envisions a future where *"the local community if they have a need, instead of importing products or material from other places, they can go to their nearest microfactory hub and produce whatever product that they need for their community. If the school needs a slide, they can do that there if their local municipality needs benches or bins or whatever that can be produced there." (SME 1).* Thus, allowing them to address their needs without relying on international sources and utilizing the local waste streams. This would enable them to also capture the value that is produced. The same actor also stated that *"...why not have local communities handle their own waste streams, empower them that way, have them process their materials, sell those materials and keep the added value within those communities. Because right now, you know, waste gets sent from Thailand to Switzerland. And all of that added value, additional value stays in Switzerland, and the Thai people that are doing the hard work of collecting and cleaning up their own environment, they don't see any of that added value." (SME 1).*

Another actor, *Researcher 4,* emphasized the potential impact on the coastal communities in the ecosystem. They see the circular economy as a tool for social economical development by giving new life to raw material. This would then create additional income streams for fishers, boosting the local economy.

4.2 Value creation challenges

Value is mentioned as one of the most critical components of ecosystems, where the rationale for ecosystems is to collectively provide a joint value proposition that individual actors cannot do alone. From the interviews, we identified several challenges

that the circular economy ecosystem faces regarding value creation and the capturing of the generated value.

For one, the different value dimensions also lead to different priorities amongst the actors. However, although there is a difference in prioritization of the different value dimensions, there is a shared recognition of the need to achieve all three for the long-term success of the circular economy ecosystem. As *Researcher 3* put it *"[...] because the government can only give grants to a certain extent, but at the end, it needs to be a triple bottom line model that is financially self-sustaining."* Furthermore, the different prioritizations and interests is not necessarily seen as a bad thing, as *Researcher 2* puts it *"it's not a bad thing, it actually these differences should be there so we can reach our goals and see where are the common interests and areas today are need of not wanting recyclability and circularity and sustainability"*. However, the materialization of these values can be challenging.

4.2.1 Changing mindsets

Looking beyond individual priorities within the ecosystem, several actors acknowledge the need for a broader shift in the mindset external to the ecosystem, including both producers and consumers.

4.2.1.1 Producer mindset

Although the environmental and economic benefits are increasingly recognized by producers, there are challenges in overcoming ingrained habits and ways of thinking. A key challenge identified is the difficulty in imagining a new future based on circular principles. As highlighted by *Researcher 1, "people are often stuck in the current way of doing things"*. This mental block makes it difficult for them to conceive of alternative approaches like circular production models.

Another challenge identified in the producers' mindset is the desire for control over production processes. *SME 5* highlights the producer's desire for control over their production processes, as expressed in *"that people want to have control over their own production and their own process, [...] being able to actually bring in other corporations in what you're doing and giving away that responsibility, [...] Can we really trust this other hub to produce something for us?"*

Profitability also plays a significant role. *SME 1* highlighted the profit-driven mindset that persists, *"[...] it's going to take a lot of hard work to change people's mindsets for it. Everybody's still very much profit first. Although they say that they are impact driven, they're not really impact driven, because impact takes a lot of time. Because to have an impact, you need to change mindsets."* Despite their assertions of being "impact-driven," many companies remain profit-focused rather than truly prioritizing impact.

4.2.1.2 Consumer mindset

While there seems to be some growing demand for recycled products, as observed by *SME 7*, *"we see an increasing demand for recycled products. So, I see it as a positive change, that the market really wants these types of products […]",* there are still many challenges in shifting the consumer mindset towards wanting more circular products.

For one, there remains a perception of recycled or used being inferior in quality, *SME 4* acknowledges that customers may be hesitant due to the potential variations in the appearance or even the performance of circular products, stating *"Because the colors [...] difference quite much in the shapes and all that because you can't really like control how it will end up looking. Some customers are okay with that, some are not. [...] they have to accept some maybe more expensive materials, some different or unevenness of the material, maybe."* This hesitancy makes the sales go slow as *SME 1* stated, *"[...] people are still hesitant to use this material, to try this material. And so you know, we don't have a lot of sales, things go slowly."*

Another challenge when it comes to consumer mindset is the cost aspects and the willingness to pay, as circular products tend to be more costly. As *SME 7* pointed out *"...it comes down to the demand. If the consumer is willing to pay the same or at least more for these types of products then it has a bright future. It's sort of like a catch 22 when it comes to recycled materials, because on one hand, you want to recycle materials, but it cannot cost more. And it's not allowed to work worse than the current materials that's out there. So in order to reduce the costs of recycled materials, and also in order to provide a system where you can enhance the properties so that they are similar to virgin products, then you need volume, and you can't get the volume if nobody buys it. So I think that we need to find a sort of middle ground where the consumer accepts the higher cost and perhaps a bit of lower quality, because in time, we will achieve a higher quality and lower price for recycled products as well."*

4.2.2 Proof of concept

From the interviews, there seems to be a common view amongst the actors, that a proof of concept can be a key driver for changing the mindsets of the circular economy. Serving as tangible demonstrations of circular economy principles and benefits.

4.2.2.1 Producer mindset

Demonstrating the feasibility of circular approaches through proof of concept was identified as a way to potentially shift mindsets among the producers. A proof of concept could be used to showcase the feasibility for producers of repurposing waste materials and reducing the environmental impact. As *SME 7* highlighted *"proving that you can use waste and produce new products from it and involve different actors that's responsible for different parts of the value chain to be involved in the same goal to reduce CO_2."* Furthermore, *SME 2,* highlighted the importance of proving this concept and that the technology, 3D printing, can be deployed in small companies, making

circularity more accessible and democratized. Technology that is not accessible to these types of companies otherwise as they require a lot of investments. *SME 2* also highlighted the importance of proving the capability to manufacture quality products from waste materials for their B2B customers, stating *"[...] where it can be proved that it is actually possible to make quality products out of it, that can have a value on the market. Because then we can go to our other customers and say, these guys have basically done it, their products work. And this is the cost involved. This is what material costs, this is where he will get it and so on. That is very powerful. That's my vision for this because now I can change things, I think."*

4.2.2.2 Consumer mindset

A proof of concept can provide more tangible examples of how waste materials can be transformed into valuable products. As *SME 1* puts it, *"we want to show that it's possible to turn what people consider trash with zero value, it's possible to turn it into something incredibly valuable, that then stimulates people wanting to buy it. [...] We can transform that into something of good quality and value."* These initiatives were therefore seen to have the potential to challenge old consumer perceptions of waste and circular products and encourage a shift towards more sustainable consumption patterns.

Moreover, proof of concept can address consumers' concerns about the quality and reliability of circular products. By demonstrating the viability of recycled materials and circular production processes, these initiatives help build trust and confidence in circular products among consumers. *SME 7* mentioned that proof of concept can pave the way for wider adoption by proving that circular products can be both environmentally sustainable and economically viable.

4.2.2.3 Scalability

The interviews underscore the important role of proof of concept in the scalability of the circular economy. *Researcher 5* highlighted the potential for these initiatives to serve as models for transforming manufacturing industries, stating, *"I think that's going to be like a model. Many, many manufacturing industries are going to also transform the narrative of how products or manufacturing must be done."* They envision a future where successful practices can be replicated across different settings, emphasizing the need for sustainable ecosystem blueprints.

Similarly, *Researcher 3* emphasized the importance of establishing reproducible practices, stating, *"The idea of these decentralized microfactories is very good [...] they want to provide a template of reproducible practices that can be copy-pasted."* They envision a future where these practices can be transplanted and repeated in similar settings, ensuring economic, environmental, and social sustainability.

Additionally, proof of concept can instill more confidence amongst investors, policymakers, and other stakeholders by providing evidence of the economic viability

and societal benefits of circular solutions. *Funder 1* and *Funder 2* highlighted the ripple effects of proof of concept, noting how they can pave the way for broader adoption and replication in other contexts. *"[...] we also hope that that will spread its wings, so into new projects, and also, eventually hopefully all being. Well, more like bilateral or even in horizon Europe and globally. So it will, the effects will spread throughout the world and actually have an impact."*

Researcher 1 highlighted the importance of these initiatives as demonstrators and showcases that offer practical examples of how circularity can be integrated into various industries and settings, noting *"[...] by showing, by demonstrating, by experience [...] you can start to change your way of thinking."* At the same time, *Researcher 7* highlighted the significance that the proof of concept can have in expanding the network, noting "*proof of concept that we can make these microfactories work [...] create a network of these."*

4.3 Geographical scope

Another dimension that surfaced from the interviews was the distinction between local and global considerations within the ecosystem. *SME 8* stated *"the goals are very different [...] some of the players involved in the project would like to have the cluster of many available […] when you want to produce a product, you want to produce it locally, with local waste material to have a sustainable product in the market. [...] international players involved in our project, want to have these microfactories available over the world in a way to make their products. […] we initially just wanted to solve the local problem in a way with the microfactory. [...] it varies from a more global perspective, you know, from some players to more local perspective. But the common interest is for this to happen. I think that's the main thing […]"* Reflecting the different priorities of the actors involved. While there is a shared vision among the actors regarding the establishment of a global network of circular economy microfactories, each participant's focus and interests vary based on geographical scale.

Several of the SMEs envisioned replication of successful local models on a global scale. *SME 7* sees the potential in expanding their company's system beyond its current reach. *"it makes sense in Sweden, and in northern parts of Europe. But if you have customers in southern parts of Europe and in the States, then we would like to provide a similar system in those regions. So those types of discussions, we do have how we could sort of collaborate with new actors that could collect the waste for us, perhaps shred the waste, and then resend it to us for production or if we should set up a production unit in different new markets in order to be able to provide a system more globally."*

Similarly, *SME 5* sees opportunities for collaborative production hubs across borders. *"But it also opens up opportunities, normally, maybe we will produce something here, but instead, that opportunity becomes someone else's in another country that they're able to produce for us."* and "*I would see that we could do the same thing with other*

partners and other different parts of the world. Like, for example, in the US setting up hubs there as well."

Furthermore, while many of the actors envisioned a network of interconnected microfactories, fostering local production. As *SME 1* puts it *"My vision of the project is that we can establish a network of these hubs [...] as well, in the sense that a company in Sweden, if they have a client in Brazil, they can get in touch with the microfactory in Brazil and say, We need this material that you need to produce locally, as opposed to having to buy material from South Africa to send to Sweden to make the product to then go send ship it to Brazil, if we can have all these localized microfactories that are interconnected digitally, it will really cut down on so many carbon emissions of transportation [...]"* Other actors are more focused on the immediate collaboration opportunities, while at the same time sharing the vision of the global network of microfactories. For instance, *Researcher 6* has individual goals of learning and developing methodologies to incorporate reusability into a more local perspective within the construction industry. *"So, our research interests are somehow parallel to the results interests [...] we are doing our research, we are doing our developments, but very focused on some aspects of the steel industry, [...] Although I know the objectives of the project, I fully understand the big interest of the approach that's why we are also partners but not providing much input to the to the to the project."*

Another actor within the ecosystem, *Researcher 4,* has a strong focus on the importance of the initiative and its impact on the local community, stating *"I'm involved because with this, we are talking about innovation, we are talking about a new way a new paradigm of the use of marine resources, how can we protect the ocean environment and this is really important this kind of project is really important for coastal village, coastal and fisheries village because there is a stronger and straight connection with the ocean with the activities that are being doing on the ocean. [...] So that's why I'm connected to the project because I can be like a local stakeholder and create the good conditions for the success of these kinds of projects.".*

4.4 Futuring activities in the circular economy ecosystem

From the interviews with various professionals within the ecosystem, it was found that different futuring approaches are used both at the organizational level and at the ecosystem level by most actors. For instance, an example of when futuring is used at the organizational level was mentioned by *Funder 1 and Funder 2*, describing a whole dedicated department working with future thinking. The individuals representing the organization did, however, mention that they were not personally involved with the futuring activities.

Funder 3 further mentioned how they invited 250 people to better understand what future areas of research they should fund. *"[...] we had 250 people from various parts of, you know, big companies, small companies, IT, manufacturing, auto, machine,*

aeronautics, all sectors, plus researchers, we collected all these people at Post Hotellet in Gothenburg 2013, when we started, and it was like the biggest workshop ever, and we've collected 1000s of yellow sticky notes, and we had to process for that. A couple of months later, all of these industry and research challenges were sort of finalized in these six areas." This futuring approach shares similarities with the Delphi method, where the funders invited various professionals in different fields.

These two examples exemplify futuring activities at the organizational level which have clear objectives of what they want to achieve. Moreover, they also use established futuring methods and dedicate a lot of resources to the futuring process. Similarly at the organizational level, two SMEs mentioned how they used roadmaps in their organization to guide decision-making. For instance, *SME 3* mentioned *"[...] it's, you know, we have a general roadmap, but when it goes into details like this would be then we, you know, things can change very quickly, both you know, priority making it more highly prioritized or reducing priority due to that, we have other things, which are more critical at the moment."*

Both further stressed the need to identify immediate priorities within a six-month timeframe while also acknowledging the fluid nature of planning, where details can change rapidly based on evolving circumstances and priorities. For instance, *SME 2* described *"So I think you should always know where you want to go [...] you need to really get to the six-month roadmap and say, okay, if we were to implement this right now, where would it make the most sense? [...] And then pretty soon, we will also have a more clear picture of what that five-year plan could be in reality.",* highlighting that the ultimate goal is to have a clear understanding of where the organization wants to go in the next five years, while remaining adaptable to shifting priorities and emerging opportunities.

These two examples also show how organizations use established futuring methods to guide decision-making at the organizational level. These two examples also had defined objectives and dedicated resources to their futuring process. However, not to the extent as the previous examples from the funders showed.

From the interviews, another form of futuring also emerged, where the organizations utilized a more explorative approach to futuring. For instance, *SME 5* mentioned that they discuss their future activities and responsibilities in the ecosystem at the organizational level. However, they also acknowledge that it is something they need to improve upon. *"Well, we have discussions within our team, like what we, what we got out from the, from the main meetings. And I guess I mean, it's that is a difficult question because I feel like, even though we want to, like work with that, but since it is in the future, like, Okay, what's happening in 5-10 years, it's difficult to actually get down and actions like activities for us to do. So that is something to work on, I think, trying to implement it even more."*

In contrast to the previously described futuring approaches, this approach does not have any established futuring methods. Instead, it rather focuses on a dialogue or discussion about the future with an exploratory nature instead of having a clear objective. In terms of resources, it still requires time and dedication, however, it does not require any former planning and could take place in any meeting.

This distinction can also be seen at ecosystem level where different examples of futuring methods also were found during the interviews. For instance, two partners described how the circular economy ecosystem used futuring through a backcasting approach, where the task needed to reach the vision of the ecosystem was broken down and assigned to organizations.

"[...] it was more about what could the partners do, hopefully to the project, and what kind of output could be done within the project. And then we, of course, try to define what each partner would do and participate." (SME 6)

"It's more like breaking the task down to what needs to be done to achieve this. And then who's going to be responsible for each one of those tasks, and then coming together again, constant communication is important, so that things don't get left behind or misunderstood." (SME 1)

These kinds of future discussions are also planned for. *SME 8* mentioned that the circular ecosystem has different kinds of meetings, one is more about what has been done and next steps while other meetings are more dedicated towards the future of the circular economy ecosystem. *"[...] maybe more dedicated. We have to focus on the project and the meetings we have on our project. And then there are separate meetings for the future, for new initiatives [...]."*

These examples show how the circular economy ecosystem utilizes established futuring methods while also dedicating resources to the process. Moreover, the objective is also clear, as they want to plan for how their vision could be achieved.

As for the organizational level, another type of futuring also emerged from the interview at the ecosystem level. These futuring activities could be seen as open and continuous discussions and brainstorming sessions that engaged the actors in the circular economy ecosystem. For instance, *Researcher 1* highlighted the importance of these informal gatherings within the ecosystem describing them as opportunities for exchanging ideas. *"Yeah, I would say that we do that when we meet. [...] And then we're exchanging ideas. So it's like in a dialogue, that usually happens when we meet in person."*

These discussions also revolve around broader ideas, as noted by *Researcher 8* mentioning that these dialogues are more about prioritizing and establishing core principles and a sense of direction for the circular economy ecosystem rather than

specific details or plans. *"No, it's an open discussion. Since it's so far away. It's mostly about principles and directions."*

These examples highlight a futuring process where there is no clear objective and no established futuring methods are used. Instead, it is a rather exploratory dialogue between the actors in the circular economy ecosystem. Similarly, as it is more of a dialogue, almost no resources are dedicated to this futuring process – it takes place in every discussion.

Worth noting is that even though most respondents described different futuring activities and rationale for using them, there still exist some challenges. *SME 5*, for instance, described how they are very driven by the consumers, thus creating a business environment where the future is hard to envision. *"What can we do within three months, six months? But the difficult thing is there is also like, it's very driven from what our customers want, and like, what are they interested in? And like, it's very driven from that. [...] So it is very consumer driven."*

4.4.1 The formal and informal way of conducting futuring

From the examples above there is a clear distinction between the different futuring activities conducted both at the organizational level and ecosystem level. The three variables that seem to differ the most can be seen in Figure 4.2. These variables are the required resources the actors dedicate, the degree of which they rely on established futuring methods, and the objective of their futuring process.

In this thesis, these distinctions are classified into two different types of futuring, informal futuring and formal futuring. Formal futuring, defined here as *a structured approach utilizing methodologies like scenario planning, road maps, and backcasting, and typically conducted in formal settings with a clear objective,* were found eight times on the organizational level and five times at the ecosystem level. As seen from the definition, the formal futuring approach requires a high degree of dedication in terms of resources. Moreover, the formal futuring approach has a clear objective of why the formal futuring process is conducted, e.g., find future opportunities or action plans, and utilize established methods to achieve that objective.

Informal futuring on the other hand, defined here as *an intuitive, creative, and exploratory process with no clear objective, often involving brainstorming, speculation and articulation of goals and visions, and can take place in everyday discussions*, were found four times on the organizational level and thirteen times at the ecosystem level. As seen from the definition, the informal futuring approach requires less dedicated resources as it is more of a dialogue that could take place in every discussion or meeting. Moreover, the informal futuring approach does not need a clear objective as it has a more exploratory nature. Lastly, as it is more of a dialogue, no established methods are needed – it is more about the conversation than a structured approach.

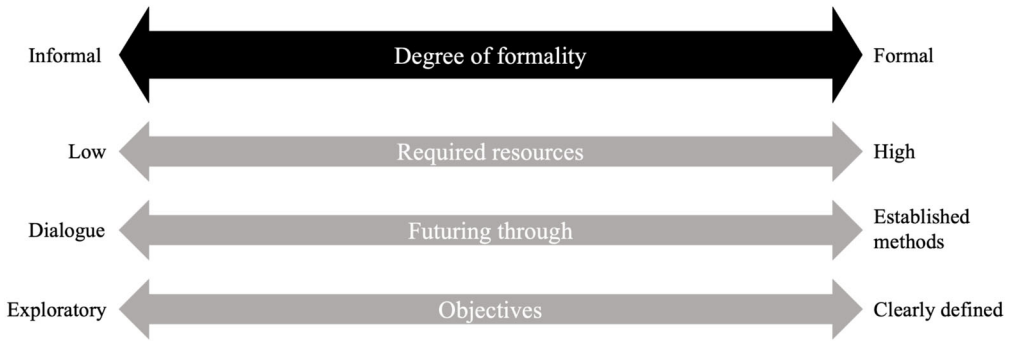

Figure 4.2: *Components building up the definition of formality*

The distinction between informal and formal futuring, however, is not either or, but rather a continuum. As seen in Figure 4.2, there is a spectrum of degrees of formality in these futuring approaches. For instance, one actor can utilize established methods but with no clear objective and in a less structured way, thus, requiring less resources, making it more of an informal futuring approach even though a variation of an established futuring method is used. However, from the interviews, it was found that the more formal futuring approaches took place at specific times, where the interviews could describe exactly when it took place. The informal futuring approaches, on the other hand, did not share this aspect, and was more underlying in the actors' everyday discussion, guiding the emergence of the circular economy ecosystem.

4.4.2 The vision enables ecosystem orchestration

Besides finding futuring activities present at both the organizational and ecosystem levels, the interviews also presented several examples of how these futuring activities on both levels facilitated the ecosystem's network- and resource orchestration without a specific orchestrator. The informal futuring approach of articulating the vision was highlighted as especially important, as several examples of orchestration were facilitated by this approach.

Before moving into how the specific network and resource orchestration capabilities have been facilitated by futuring, it is worth highlighting how Circular Plastic currently orchestrates. Circular Plastic divides its operations into different work packages, each with specific responsibilities assigned to various members based on their expertise. They conduct regular meetings, both bi-annual and monthly work packages, to manage their activities without an appointed orchestrator. During these meetings, members present their progress, share knowledge, and articulate challenges and needs for the future. These meetings are also where most of the ecosystem-level futuring activities take place.

4.4.2.1 Network orchestration

From the previous section describing how different futuring activities have been utilized in the circular economy ecosystem, it was found that these approaches have facilitated in setting a direction for where all partners want to go. This fact has indirectly facilitated the enhancement of the circular economy ecosystems coordination efforts, setting collective action plans and making joint efforts through different collaboration between organizations to drive the circular economy ecosystem forward towards their desired direction. Furthermore, these activities have also indirectly facilitated definitions of shared norms and generating complimentary, i.e., cornerstone in ecosystem governance. Thus, the formal and informal futuring initiatives at both the ecosystem and organizational level could be seen as facilitators for increased coordination and collaboration among the actors, as well as governance, in the circular economy ecosystem.

From the interviews, there are several examples that there exists an alignment of visions for what the circular economy ecosystem should achieve. This holistic vision is shared by many of the actors in the circular economy ecosystem studied, even though there are a lot of different kinds of actors with various expertise. As *Researcher 1* described it *"Yeah I mean, a project usually gathers people with different competencies and backgrounds, which is a good thing. But that also means that people have different experiences and are looking for different things in this project. So but then I think what is a common denominator between us is that we share a common belief that distributed production is good. And then I think we are curious, we want to explore that from our different perspectives."*

Even though the shared holistic vision is present, there still exists some differences. For instance, as previously discussed, there exists different individual visions of being either part of the global network of microfactories or only being a part of one local microfactory hub. This was mentioned by one of the Southern European partners, *SME 8*, however, still emphasizing that the shared holistic vision of what the circular economy ecosystem should achieve exists. *"[...] it varies from a more global perspective, you know, from some players to a more local perspective. But the common interest is for this to happen."*

Even though there exist various actors with their own individual interests in being part of the ecosystem, opportunistic behavior or prioritization of an actor's own agenda seems to be scarce. The alignment of the actors that the holistic vision creates could be seen as a main driver for this. Therefore, the shared vision is vital for the circular economy ecosystem to align all actors in moving forward, which was also highlighted by *SME 1. "We all share the same vision for this because it requires a lot of work not to share the vision."*

The shared holistic vision of the ecosystem could be seen as an outcome of the informal futuring approach of the consistent articulation of the vision through visual tools and consistency, headed by the project coordinator that drives the emergence of the circular economy ecosystem. *"So I try to be very consistent in what I'm trying to go for. I don't branch off and I mean, I have a very clear understanding and I'm always trying to communicate that goal. [...] I always show pictures of what I see as being this, you know, the vision of a microfactory, what are the different components and as well as the global network of microfactories, I'm always talking about that vision and showing pictures of it" (Researcher 7).* Thus, the alignment of actors and visions are facilitated by the informal futuring approach at the ecosystem level.

The shared holistic vision may not, however, extend to the organizational level. As noticed by *Researcher 7,* who stated, *"I think most of the actors do share the vision, definitely. I think, maybe one or two, do not understand this definition of sustainability and really what we are doing at the organizational level. However, I would say at the individual level within organizations, those who are involved in the project do understand."*

This aspect was also highlighted in the interview, where *Researcher 2* mentioned a few challenges that they are currently facing due to some organizations having trouble delivering on their promises. *"I can mention the 3d printer that was delivered to Portugal last week, they had some defects and damages and then they are not, they are not responsive yet. So we are trying to solve this issue for example. And then we have another partner that we are this they are delayed in developing the line for example that they were they got paid to do. So we were hoping to have it in Q1 this year, but they are saying Q3 or even maybe four. That's going to delay the project quite a lot and we cannot extend it for like one year. Maybe we can get an extension from the government for three months, four months, maximum six months, but we cannot get it for one year. So we have to handle this somehow and see what happens."* Even though it was mentioned that these organizations had some troubles, this still exemplifies how these organizations' visions are misaligned to the vision of the circular economy ecosystem. Moreover, even though opportunistic behavior is scarce in the ecosystem, there still exist a few examples. Thus, the informal futuring approach of articulating the vision may not have affected some of the organizations. Therefore, even though a shared holistic vision exists at the ecosystem level, it could still create hurdles for future collaboration. This was emphasized by *Researcher 7*, who stressed that actions for achieving the shared holistic vision at the organizational level should be planned for.

The interviews also present several examples of how the shared vision guides the decision-making in the ecosystem, through an informal futuring process that shares similarities with a backcasting approach. From the discussion of the vision and goals, the members continued with the steps needed to enable this vision. *"I guess one partner is very like driving in that as well, like asking questions and like, where we want to go*

and how, how can we? What can we do to get to where we want to go? And like just having a having discussions about it" (SME 5).

This aspect highlights how informal futuring align the various actors in the circular economy ecosystem towards common steps needed to take to achieve their holistic vision. Furthermore, the discussion not only helps set a direction but also enables a proactive approach that helps guide the decision-making process when, e.g., unexpected events occur. For instance, as *Researcher 7* described *"I think it's, it's always about trying to understand how, how can we get there? And what are the different roadblocks that might come up along the way? And looking around and trying to understand how can one kind of manage those roadblocks before they might become a major roadblock or trying to, if it is arising, seeing how can we reposition or realign or look for other resources, expand the network, to enable that we that we take charge of that, you know that we tackle that challenge that comes up?"*

The informal futuring approach of articulating visions of individual organizations and the ecosystem alike has also facilitated partnering. For instance, the articulation of the ecosystem's vision has enabled expansion over the years. As *Researcher 7 mentioned*, *"So for example, we realized that we didn't have any compounding. The compounding is a huge hole gap that we need to build. And one of the actors said, oh, you should go talk to this CEO at this company, and so we went off in January and spoke with him. And he was completely on board. We discussed the visions of the project and now he is very much on board."*

Similarly, *SME 1* explained how articulating the mission of creating a better blue economy attracted her to join the ecosystem post covid. *"And then in 2020-2021, in the middle of COVID, January 2021, I started working for one of the partners on this project that she has here in Southern Europe. And she told me about her mission of creating a blue circular economy model that could be replicated and implemented in coastal communities around the world. And I felt very passionate about that, as well."* Thus, utilizing these informal futuring approaches within the ecosystem has enabled them to grow and attract not just new partners, but to fill knowledge gaps that otherwise could become a roadblock in the future.

The implementation of informal futuring was also observed during a convened meeting, where a dialogue ensued with a current Southern European partner. Within this meeting, the representatives from the circular economy ecosystem articulated the overarching vision and what current challenges they face for a new representative at the current partner. The discussion resulted not only in a more engaged representative, but also in an invitation to participate in a panel discussion in the forthcoming spring. Consequently, through the articulation of the vision, the circular economy ecosystem garnered a valuable networking opportunity, fostering awareness and potentially establishing new partnerships.

Another interesting example of how informal futuring at the ecosystem level facilitates partnering is exemplified by *Researcher 7 "So I think definitely you're seeing others and another partners and going to other countries. So they are, for example, one of the individuals at one of the partners, as I mentioned, is going to the United States. We were discussing that in the project meeting today, how can we look at developing a project that would include the United States or Hawaii, so that we could pursue further collaboration?"* The loss of a valuable partner did not create a roadblock but rather sparked a future discussion among the members about how this could be seen as an opportunity to expand geographically, and in terms of knowledge and resource base. This opportunistic mindset towards unexpected events is similar to the informal backcasting approach discussed above.

Lastly, in terms of network orchestration, the interviews also showed that through an informal futuring approach of discussing the future and vision at an ecosystem level facilitated increased motivation and knowledge sharing among the members. For instance, as one of the Southern European partners put it, *"During a lot of these meetings, either the monthly work package leader meetings, or when we have a general full team, meeting, a lot of brainstorming, we share a lot of articles, and things that pop up, that we find inspiring, but often it's at these meetings that we brainstorm the future and kind of co-design and inspire each other about, you know, potential leads and other funding opportunities that come up, and how we can enhance that the project." (SME 1).* The meetings with all members become a collaborative discussion, enabling every partner to contribute with their expertise, while also strengthening the alignment of the vision of the ecosystem. Moreover, these future discussions also enable the ecosystem to find what is missing to reach its vision, and thus, enable the ecosystem to discuss opportunities to fill these gaps before it becomes a problem. For instance, *Researcher 2* described *"Because when we talk about the future of the project, usually we focus on the extension to get a continuation or a business, another research project or a business activity. So we try to identify the gaps, for example."*

An interesting finding from the interview was how these future discussions relate to the emergence of the ecosystem. From acknowledging what roadblocks or missing aspects that exist in the current state of the ecosystem, the members try to find solutions by initiating projects. *"[...] so it's discussed and we do discuss to you know, next, how can it be, how can the next phase be developed? So, yeah, we do have a discussion on future projects in a way under the same umbrella if you call it that." (SME 8).* Thus, it seems that an outcome of these future discussions is projects, which can be seen as action plans trying to drive the circular economy ecosystem forward.

In these meetings, the individual organizations also have a chance to describe their organizations' vision, challenges, and needs. By doing so, the ecosystem members could come together and collaboratively help them, either by sharing resources, knowledge, or similar. *"[...] if they come forward with their needs, challenges, and their vision, if we can set it into the project and help it we do. Like this partner, they*

got a lot of equipment by themselves and they did a lot of investment. So we are helping with the knowledge and material and different things, for example now." (Researcher 2). However, even though there is evidence supporting that futuring has facilitated an openness to sharing in the circular economy ecosystem, there still exist some actors that are more hesitant. For instance, *SME 5* described *"I hope so, some are more open and working together sharing knowledge, others are more holding it but it's like in the bigger picture everyone wants to do it just to change the way we produce and become more circular",* highlighting that even though the overarching vision is shared, the commitment towards the vision may differ among the members.

4.4.2.2 Resource orchestration

In terms of resource orchestration, the informal futuring activities by a particular SME opened for one of the researchers to help acquire equipment for a reduced cost compared to the original budget allocation. *"I put one partner into connection with another company a few, two weeks ago, they are going to go buy some equipment from them, for example. So we're helping their future of circular economy with that. And they didn't know that it existed. They went to buy some lines for 600,000 SEK. What I made it they can get it for 100,000, for example. So it's our knowledge that we share with them and transfer it and think of their future how we can help them grow and become more circular for example." (Researcher 2).* Thus, articulating their circular vision to the other actors enabled the other actors in the ecosystem to come forward and utilize their network and resources to acquire the desired equipment and take one step forward to achieving that vision.

Similarly, on the ecosystem level, the overarching vision of the ecosystem creates opportunities for resource sharing. As mentioned by *SME 5 "[...] we work closely with this partner. So like, how can we, there is like really where we give away or not give away, but we teach them to use the 3d printer, and we outsource our production method. And that is one step closer to actually having different hubs producing for us, since we're using 3d printing."* The informal futuring approach of articulating the vision of the microfactories ties the actors in the ecosystem together, thus, creating a mutually beneficial exchange of knowledge and resources. However, even though these examples exemplify how informal futuring have facilitated resource orchestration, there still exists some problems. For instance, as mentioned by one of the researchers in the project, one of the SMEs delivered faulty equipment to one of the partners in southern Europe. *"[...] for example, the equipment that went to Portugal. It already went to Germany for a conference and everything, for show and exhibition. It was not a good act. And then that machine was not brand new anymore, they were using it somewhere for a week or something. Then they sent it to Portugal, and it had some damage." (Researcher 2).* This example shows how a misalignment between the vision at the ecosystem level and organizational level can lead to different prioritization from different organizations, ultimately creating roadblocks for the entire circular economy ecosystem.

4.4.3 Future horizon

As seen, both informal and formal futuring approaches were present in the circular economy ecosystem studied. However, regarding the horizon, a surprising aspect found during the interviews was where in the future the different actors were when they discussed the future.

Future horizons

Interviewee	Background	Horizon	Quotation
4	Researcher 1	+ 25 years	*"But I think when we're talking about the vision, it's 15-20 years or so. And I think I put it there, because I know how long time it takes to make a difference. So yeah, so that's why I'm positioning it is a future idea of how the industry would work than 2040 - 2050."*
10	Researcher 7	5-10 years	*"But in general, just talking about the circular economy, and our overarching goal that we have, I mean, that's, you know, five years, five years horizon, I would say five to 10."*
11	Researcher 8	10 years	*"So we try to look sort of 10 years ahead. And I think that might be a good horizon in that it's in the future, but not in the far future because then it's just you know, science fiction and speculations on such things. So, it needs to be I would say, in a future state which is still achievable"*
12	SME 1	3-5 years	*"So maybe, you know, I'd say, we're about three to five years in the future is what we're thinking, and then in doing those incremental three to five year steps to reach the moonshot."*
14	SME 3	0-1 years	*"No, I would say we're pretty fast moving. So it is more in the range of one year, that kind of that kind of scope or I mean, for us, if it's a good idea, and it's possible to implement, then then we're definitely interested in evaluating it."*
15	SME 4	2-3 years	*"I'm well we have not discussed that so much. I don't know what the time plan was for that, but I am a bit of a pessimist in many cases. So I would not expect this to be completed after one year really, but it will be two-three years at least from the start at least of course"*
16	SME 5	0-10 years	*"I am maybe both like short term, I would say like in what do we want to do in six months in a year like within the project, but also we're thinking like, further along the line as well. Like, where are we in 5-10 years? Like how do we want to produce and be local?"*
18	SME 7	0-1 years	*"Well, for us, it's quite, I think the future is now."*

Table 4.1: *The differences in horizon between some of the respondents*

As seen in Table 4.1, the data revealed a disparity in the envisioned future states within the circular economy ecosystem. Researchers, with a more long-term perspective, project futures ranging from 5-25 years ahead. They recognize the need for substantial timeframes to enact meaningful change, citing the complexity of the industry. In contrast, businesses, particularly SMEs, adopt shorter time frames, ranging from immediate to 5-10 years. They emphasize agility and adaptability in response to the rapidly evolving business landscape. This diversity in perspectives highlights the challenge of aligning visions within the ecosystem and underscores the importance of flexibility in strategic planning. Furthermore, some express skepticism about long-term projections due to the unpredictable nature of today's society. For instance, *Researcher 4* mentioned that it is almost impossible to have qualitative predictions given today's fast moving business environment. *"Well, it depends on different aspects, because the future, at least at this moment of the society we cannot project the future for the long term, because everything is changing very quickly."* Similarly, *SME 2* mentioned the insecurity in the projection of the future, *"I mean, we can always dream about two to*

five years from now. The problem is that what we dream about is not going to be what happens? It might be 10 times better, for example 10 times more achieved in a very short period of time." However, worth noting here is that those expressing skepticism are not those who were found using either informal or formal futuring methods in their organizations, explaining their interpretations of futuring being a prediction method rather than a planning tool setting the direction for the ecosystem.

5. Discussion

Orchestrating circular economy ecosystems involves navigating numerous complexities and challenges. By examining the multifaceted roles of stakeholders, the importance of alignment, and the strategic use of futuring to navigate uncertainties, this discussion highlights key factors that contribute to the success of these ecosystems. The analysis explores the role of joint value propositions, proof of concept, and alignment capabilities in fostering collaboration and achieving sustainability goals. Through this, the authors' aim is to provide a comprehensive understanding of the mechanisms that drive the success of circular economy ecosystems and offer practical insights for practitioners.

5.1 Why is orchestration complex in Circular Economy Ecosystems?

As stated by theory, the transition from linear economy towards circular economy is hard for a single organization to do, as it necessitates a whole range of expertise, resources, and capabilities. Considering these challenges, understanding the nature of certain circular economy ecosystems becomes critical for the success of circular economy transitions. In identifying the type of circular economy ecosystem, insights from Aarikka Stenroos et al. (2021) reveals that this circular economy ecosystem embodies elements from all types rather than fitting neatly into a single category. This complex nature was evident in its goals, including establishing closed-loop systems for local business and communities, knowledge sharing to bridge academia and industry as well as driving new entrepreneurial business models, and to collectively deliver a joint value proposition. This reflects an increase in the interdependencies between actors, highlighting the complexities in ecosystem orchestration to ensure that the different goals of the actors can be realized.

5.1.1 Joint Value Proposition

Considering the complexities that Circular Plastic have, there was a clear need for other expertise, capabilities and funding for the ecosystem to grow. This highlights the importance of clarifying the joint value proposition for both new, and existing actors within the ecosystem. New actors, as well as old actors, need sufficient reason to join. They need to understand what they are collectively creating and the unique value proposition that collaboration offers, but also what they can gain from it. A joint value proposition then plays an important role in articulating the combined benefits and unique value offered by the circular economy ecosystem through collaborative efforts. While the overarching vision sets the direction, the joint value proposition focuses on specific value exchanges and synergies among ecosystem participants, making the vision a tangible reality for individual actors.

For an attractive joint value proposition to materialize, it is essential to first understand value. However, for circular economy ecosystems, this becomes particularly complex, as there are three different value dimensions, i.e., economical, social and environmental. While the importance of value has been discussed in literature, the delineation of what they actually entail for circular economy ecosystems has been scarce.

Looking at the value co-creation side, partners within the ecosystem are interested in generating value across one, two, or all three dimensions of circular economy values. For instance, one researcher may prioritize the potential environmental impact of a project's successful implementation, while another may emphasize the environmental and societal benefits for the local coastal community. However, it is worth noting that all actors see the importance of all values being provided for the success of the ecosystem. These varying prioritizations and focuses can be observed in Figure 5.1, potentially stemming from the diverse backgrounds and interests of individual actors. Southern European partners, for instance, may place greater emphasis on societal value, given its tangible impact on the coastal community, whereas Northern European actors, while acknowledging these benefits, may lean more towards technological advancements and economic values. This is primarily because the waste collection is currently collected in the southern parts of Europe. Furthermore, differences in the interests of actors regarding international collaboration versus local partnerships may also influence where value is created within the ecosystem. This highlights the need for negotiation, where the details of the value offering emerge as the roles and assets of ecosystem actors are identified, as emphasized by literature. Ultimately, the joint circular value created does not lie in one specific, but in many different value dimensions that the ecosystem jointly brings forth. Where different actors are interested in and responsible for creating that certain value or values. It reflects the collective efforts needed to create and capture value across the dimensions, highlighting the holistic approach needed to advance circular economy principles and objectives.

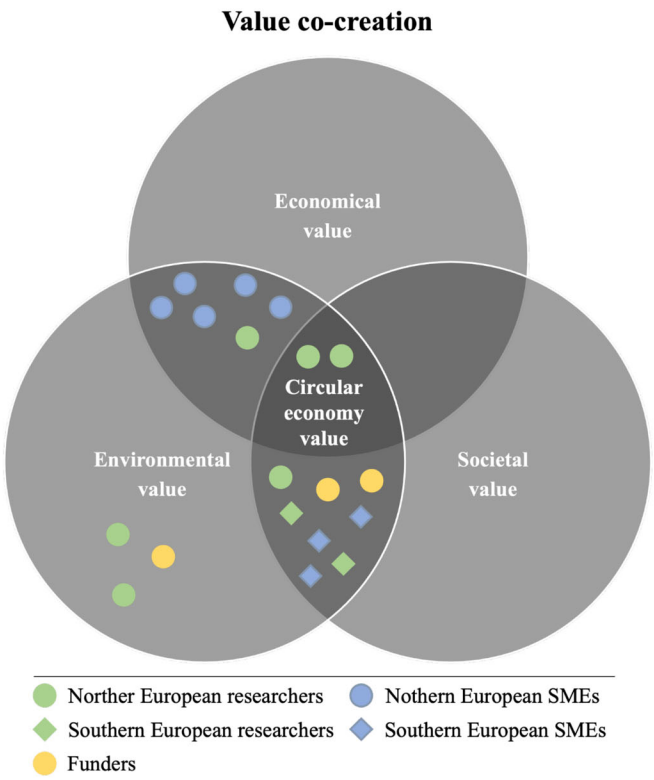

Figure 5.1: *The Circular Economy Value offering*

Regarding the value co-capture side, answering for whom the value is created, the data displayed three types of stakeholders, each with their own demands from the circular economy ecosystem, as depicted in Figure 5.2. Firstly, there is the value for the internal customer, i.e., businesses in the ecosystem. The value proposition must address the needs of the various actors that exist within the ecosystem. For these organizations, it was shown that many of the businesses in the ecosystem aimed to make profit, where the collaboration in the long run would lead to a business case, cost savings, or better production opportunities. Furthermore, the value may not be explicitly monetary values, for instance it could be competitive advantages, new revenue streams or strategic collaborations. Secondly, the value for the broader society includes all three dimensions of the circular economy values, where the activities that generate environmental value will also be beneficial for the local communities as it can generate new job opportunities or revenue streams. Thirdly, the value for the external customer, i.e., consumers, lies in having qualitative products that work as well, or even better than products using virgin materials. All these different demands cumulate into the circular economy demand.

Here, it is worth noting that, in contrast to conventional theory, the data revealed two different dimensions of economic value, one for the broader society and one for the businesses in the ecosystem, aiming to make profit. Additionally, the consumers' demand for quality was also highlighted as a key factor. To address all values, one

critical challenge is the consumer mindset and the perceived quality. As evidenced in the interviews, consumers often express hesitancy towards adopting circular products due to concerns regarding variations in appearance and performance, contributing to slower sales and limited demand. This reluctance perpetuates a cycle where low demand inhibits process innovation for circular products, further hindering their widespread adoption and perpetuating the perception of inferior quality. Thus, when it comes to value co-capture, the collaboration also extends to the external customers, as they have a direct impact on the values that can be created and captured, impacting the performance of all three value dimensions.

Unlike value creation, where actors might contribute different forms of value that combine to form the overall offering, value co-capture emphasizes the indivisibility of the created value. This means that, when it comes to circular economy ecosystems, the value cannot be easily separated or attributed solely to one stakeholder group. While each stakeholder in the ecosystem may have different types of demands, as seen in Figure 5.2, successful value co-capture hinges on meeting the needs of all three stakeholder groups. Looking at the internal customers of the ecosystem, they cannot capture economical value if they do not produce something that the external customers perceive as of quality and value. At the same time, they cannot prioritize the product's functionality if it goes against the circular economy principles, affecting the broader society's demand negatively. Furthermore, external customers cannot get qualitative products if businesses cannot make profit on their investment. At the same time, on the broader society level, the value includes not only the economic benefits acquired by businesses and the quality perceived by consumers but also the broader social and environmental impacts. These impacts include the creation of sustainable jobs, the promotion of local economies, and the reduction of environmental footprints, which contribute to a healthier community and planet. However, these impacts cannot happen if there are no incentives for businesses to drive the change.

Value co-capture in circular economy ecosystems therefore refers to the indivisible process of capturing the created value that benefits all stakeholders simultaneously. This includes the identification of for whom the value is created and necessitates fulfilling the needs of all the stakeholders. In this regard, the value is indivisible as the capturing of one value affects and is affected by the capturing of other values. Each stakeholder's needs and contributions must be considered to ensure that the value generated by the ecosystem is distributed equitably and sustainably. In contrast to traditional business ecosystems, where value co-capture refers to the action where financial and nonfinancial benefits are gained by actors through profits, opportunities, and shared experiences (Saragih et al., 2019). For these values to be effectively captured, there needs to be a balanced distribution or sharing of the value among the ecosystem members based on their respective contributions and resource investment. Value sharing mechanisms are therefore critical mechanisms in enabling the effective co-capture of value (Dai et al., 2024).

Like business ecosystems, circular economy ecosystems also have a need for value sharing mechanisms. However, in this aspect, value sharing is further complicated as there is an indirect aspect to value capturing, where environmental and societal value cannot be measured or does not have any direct traceable impact on the businesses.

Achieving the balance between value creation and value capture in traditional ecosystems relies on aligning the interests of the actors with the collective interest of the ecosystem (Dai et al., 2024). Similarly, the circular economy ecosystem also needs to align the different interests to strike the balance between value co-creation and value co-capture. Here, the concept of negotiating (Autio, 2022) is therefore once again an important aspect of the value co-capturing process. Thus, the value co-capturing process can for instance entail the negotiation for consumers to initially lower their expectations on either price or quality, giving opportunities for businesses to capture economical gains that can drive forward the quality of circular products, creating more demand and so on. When businesses are economically successful, they are better positioned to drive and sustain value across broader societal dimensions, reinforcing the interdependence of all stakeholders in a circular economy ecosystem.

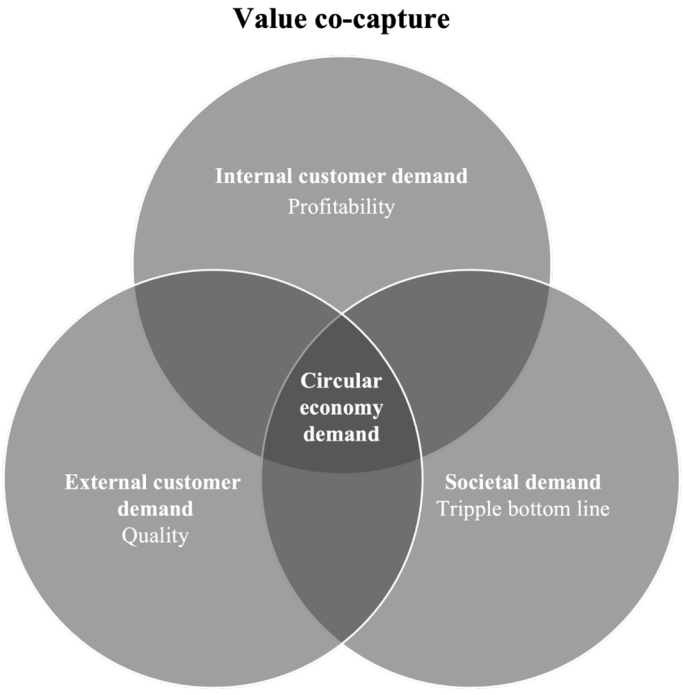

Figure 5.2: *The different demands of the circular economy ecosystem stakeholders*

Observations from Circular Plastic then highlight an important connection between value co-creation and value co-capture, where the joint value proposition acts as a bridge, connecting the two. While value creation is essential for generating benefits across economic, environmental, and societal dimensions, it is equally important to ensure that this value is effectively captured by stakeholders. After all, there is no point

in creating value if it is not captured and utilized. Therefore, the joint value proposition is the outcome of the interplay between value co-creation and value co-capture, as visualized in Figure 5.3. It must address all these diverse values to effectively communicate the combined benefits and unique value offered by the circular economy ecosystem to both internal and external customers, as well as the broader society.

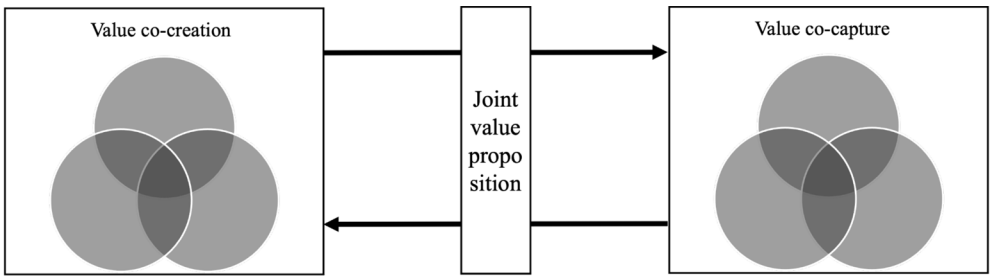

Figure 5.3: *Joint value proposition*

5.1.2 Proof of Concept

As of now, the bridge between value co-creation and value co-capture, i.e., the joint value proposition is not achievable in Circular Plastic. One major challenge for this has been the consumer mindset and the perceived value of products made by recycled materials. Proof of concept was discussed by many of the interviewees as a tool for tackling this particular problem. Proof of concept can serve as a catalyst for changing both producers' and consumers' mindsets, by demonstrating the feasibility and benefits of embracing circular economy principles. It provides real-world evidence on how adopting circular practices can lead to resource efficiency, cost savings, and environmental sustainability. One challenge in achieving this proof of concept, however, can be that different actors within the circular economy ecosystem have different priorities, interests, and different definitions of what proof of concept entails. As seen in the data, while many mentions the proof of concept, the scope of it varies between the different actors. For instance, while one of the actors mentioned the proof of concept to show their own customers that the technology actually works, other actors, primarily researchers, see the proof of concept as more of a template that can be plugged and played in other types of industries or other countries. However, despite these differences in the focus scope, it is important to note that all actors are ultimately working towards the same vision of the circular economy.

5.1.3 The orchestration complexities

Orchestration within circular economy ecosystems like Circular Plastic presents significant challenges, distinguishing it from traditional business ecosystems. Traditional ecosystems generally center around linear processes with value creation and capture concentrated around specific products or services, often under the directive of a hierarchical structure dominated by one or a few firms. This structure simplifies coordination and control and emphasizes primarily economic value. In circular

economy ecosystems, however, the orchestration landscape is different and more intricate. These ecosystems are defined by their non-linear and regenerative processes that aim to minimize waste and maximize the use of resources. The inherent goals of a circular economy demand a more holistic approach to orchestration for the joint value proposition to materialize. Moreover, the traditional model of having a single orchestrator to coordinate activities was not as applicable in Circular Plastic, which could be seen as a consequence because of the non-hierarchical and interdependent relationships between the actors. However, even though there is no appointed orchestrator, the orchestration capabilities are still needed for circular economy ecosystems to move forward.

5.2 How can futuring be a means of ecosystem orchestration in a circular economy ecosystem?

In tackling the complexities in Circular Plastic, futuring emerged as a critical tool for aligning diverse stakeholder activities and visions towards their vision. This strategic anticipation not only prepared the organizations and Circular Plastic to adapt to forthcoming challenges but also steered collective efforts towards innovative solutions. However, the application of futuring varied significantly across different layers of an ecosystem. Moreover, the practical implementation of futuring, differentiated into formal and informal approaches, raised questions about its efficacy and adaptability to the dynamic needs of a circular economy ecosystem. These varying approaches to futuring, each with its merits and limitations, necessitate a deeper exploration to understand how they can be effectively harnessed to foster ecosystem orchestration and drive the transition towards circularity. This section delves into how futuring acts as a mechanism of ecosystem orchestration, examining its application at different levels within the circular economy and assessing its effectiveness in fostering collaborative and strategic alignments.

5.2.1 Futuring approaches at different levels

The circular economy ecosystem shows that futuring was mainly conducted in a formal manner at the organizational level while informal futuring was mainly conducted at the ecosystem level. From the theory on foresight and futuring, denoted here as formal futuring, there is a consensus that these approaches help organizations and ecosystems alike become better prepared for the future, e.g., by guiding decision making, increasing the alignment of vision, or enhanced understanding of the environment and identifying disruptive changes. While established futuring methods involving a diverse range of expertise may theoretically enhance the circular economy ecosystem, practical considerations can make their implementation unfeasible. The circular economy ecosystem faces multiple challenges and demands, leaving little room for the extensive time commitments associated with formal futuring processes. Furthermore, given the current stage of the ecosystem's development, where the primary focus lies on achieving proof of concept, the rigid structure of formal futuring may not align with the

adaptive nature of the ecosystem. Since investing resources and time in adapting formal futuring methods may not only be inefficient but also counterproductive to the ecosystem's dynamic needs, prioritizing informal and exploratory futuring approaches can better serve the ecosystem's goals, enabling it to navigate uncertainties and capitalize on emergent opportunities effectively. Consequently, it is unsurprising that the data reflects this distinction, with formal futuring activities predominantly at the organizational level and informal activities prevailing within the circular economy ecosystem.

What is surprising is that, even though mainly informal futuring methods were used at the ecosystem level, several of the benefits found in the literature were also found for the circular economy ecosystem studied. This highlights an interesting aspect of how only talking about the future in discussions and articulating the vision at both levels can facilitate a shared reality of what the circular economy ecosystem can achieve, and what each actor aims to receive from being a part of the ecosystem. However, even though the informal futuring process showed similarities in potential outcomes with a more formal futuring process, there still were a few of these outcomes found in the literature that were not found in the circular economy ecosystem. For instance, as highlighted in the theoretical background, several scholars mentioned that foresight, i.e., formal futuring, enabled a better understanding of the environment and an enhanced understanding of customers and the market. The latter is an especially important aspect given that a lot of the interviewees discussed the need to understand the consumers as a problem for both their futuring processes and in creating a proof of concept. Thus, on the one hand, there is a possibility that the circular economy ecosystem could benefit from using more formal futuring processes, enabling them to, e.g., get a better understanding about the consumers. On the other hand, as discussed, formal futuring processes are more resource intensive and time consuming, and the circular economy ecosystem has already achieved several benefits from mostly doing the informal futuring. Furthermore, as highlighted by Pouru-Mikkola et al. (2023), formal futuring approaches in an ecosystem setting could require extensive coordination and an assigned orchestrator, increasing resources required. Therefore, there exists a tradeoff between resources and added benefits from incorporating formal futuring practices. Thus, if an organization or an ecosystem has the resources, the rationale from incorporating formal futuring practices increases and vice versa. This relationship is displayed in Figure 5.4 In the case of the circular economy ecosystem, it is suggested to prioritize informal futuring activities as long as resources are scarce.

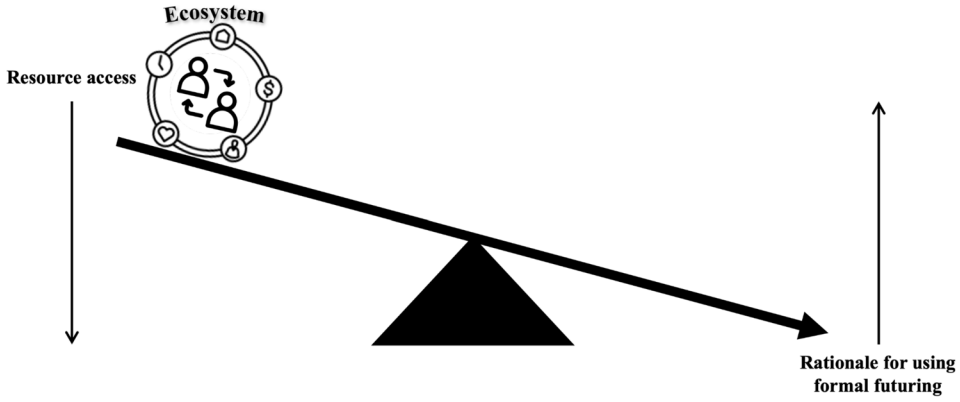

Figure 5.4: *The relationship between resources and the rationale for incorporating formal futuring processes*

Figure 5.4, also implies an interesting example of a temporal pattern of how the importance of formal and informal futuring changes over time, as shown in Figure 5.5. At the beginning, when the resources are scarce and it is more about survival and driving the ecosystem or organization forward, ecosystem orchestration can be facilitated by only/mainly doing informal futuring activities. As the ecosystem matures, and more resources can be afforded to commit to the futuring processes, there is a value in increasing formal futuring activities. However, as Figure 5.5 also shows, the informal futuring activities, given their comparable ease of use, are constantly important independent of time. Worth noting is that the futuring lines in Figure 5.5 are just a visualization, and the line's inclinations may vary depending on the contexts and ecosystem types.

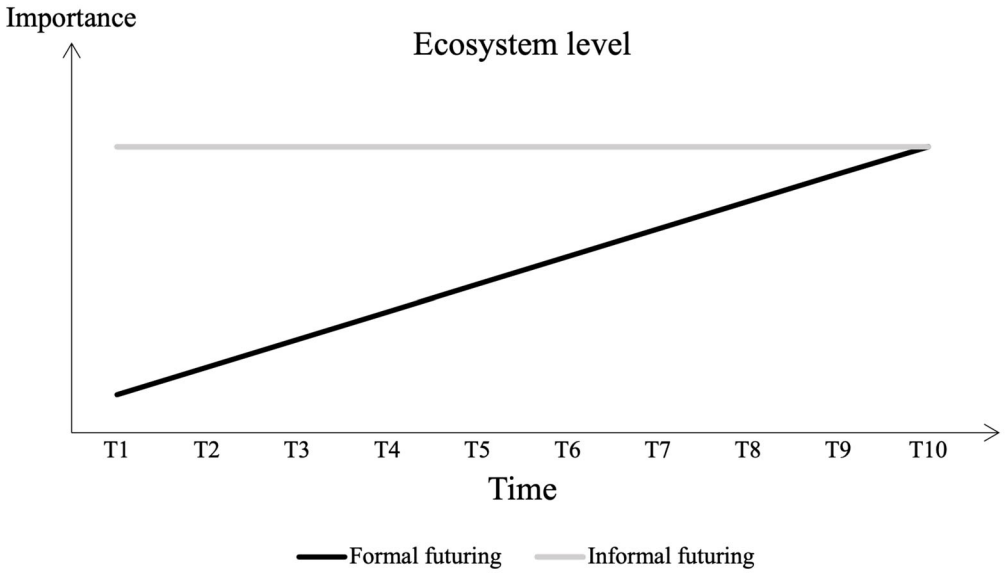

Figure 5.5: *A display of how the importance of both formal and informal futuring changes over time at the ecosystem level*

In the case of the circular economy ecosystem, this aspect can be seen and discussed at different levels. For the individuals in the ecosystem, informal futuring is essential, regardless of point in time. However, formal futuring does not resemble the temporal pattern in Figure 5.5, as formal futuring is unfeasible for an individual alone to conduct. Similarly, at the project level of the ecosystem, informal futuring is essential, as it determines direction, brainstorming new project ideas that ultimately drives the ecosystem forward. As for the individual level, formal futuring does not follow the temporal pattern as projects often are too short to experience the benefits found and discussed in the theoretical background. However, if projects intend to branch out to new projects or get an extension to get a continuum, formal futuring may increase in importance.

At the organizational and ecosystem level, however, the temporal pattern of informal and formal futuring holds. This could be seen as their current futuring activities being mostly informal at the ecosystem level, trying to create an alignment of all actors, fill knowledge and resource gaps, and collaboratively achieve a proof of concept. However, when the circular economy ecosystem achieves a proof of concept and further matures, more formal futuring activities could be adapted in their futuring processes, enabling them to be even better equipped for future challenges, e.g., by understanding the market and identifying disruptive changes, and thus, creating resilience for the circular economy ecosystem. For the organization in the ecosystem, the general trend shows that more formal futuring practices are conducted at the organizational level, though informal futuring is the majority of futuring activities conducted by most partners in the circular economy ecosystem. This is expected given that the organizations within the ecosystem have progressed further on the scale in Figure 5.5, suggesting that formal futuring should be to a greater importance at the organizational level then at the ecosystem level. Informal futuring, as for all other levels, are constantly important, since it does not require the same level of resources, and the mindset of always envision the future, discussing it, and articulating the vision enables the individuals, projects, organizations, and circular economy ecosystems alike to achieve many of the benefits found from using formal futuring.

The theory also suggests that when using established futuring methods, it is often preferred to use more than one. In the case of the circular economy ecosystem, it has been observed that several established methods have been used, e.g., road maps, and scenario planning, however, not at the same time or by the same organization. Thus, at the organizational level, it could be argued that they should be using more established methods in their formal futuring process to achieve a better result. However, at the ecosystem level, one could make the argument that the circular economy ecosystem utilizes the aspect of using several established methods in their formal futuring process, as the contribution that each organization brings to the more formal futuring process done by the ecosystem builds upon their own, where different established methods were used. This aspect highlights an interesting aspect of the possibility to divide the resources that multiple established methods in a formal futuring process would require

amongst the different partners. By doing so, the circular economy ecosystem and the organizational partners could share the resources required while getting some of the potential benefits from using both, thus, shifting the temporal pattern in Figure 5.5, making formal futuring approaches more attractive to use earlier. However, as the organizations' formal futuring processes not only revolve around the circular economy ecosystem, and that the organizational partners in the circular economy ecosystem may not be in the futuring teams of the organizations, the organizational partners contribution to the formal futuring process by the circular economy ecosystem could be skewed. Moreover, it would not enable the same utilization of different expertise as if several methods were leveraged in the formal futuring approach at the ecosystem level, but since the resources are scarce at the stage of the ecosystem right now, it could be a good alternative until a proof of concept is reached.

5.2.2 How futuring has facilitated orchestration

In the circular economy ecosystem, every actor has access to the required production related knowledge described by Lingens et al. (2021). This has come as a consequence from their extensive knowledge sharing in their future discussions, both from what they already know, and what knowledge they lack to push the circular economy forward. However, the consumption related knowledge is limited, with most actors emphasizing consumers' mindset as an inhibitor for consumption. Since all organizations share production related knowledge, emphasizing democratization, while the consumption related knowledge is limited, Lingens et al. 's (2021) findings suggest that there should be several orchestrators. This was seen in Circular plastic, where the data suggested that it was rather a distributed orchestration among the actors with no formal orchestrators. Why this is the case could be appointed to the circular economy ecosystems futuring initiatives, as these initiatives, rather than one or a few orchestrators, facilitated both network and resource orchestration in the circular economy ecosystem, as seen in Figure 5.6. The lines in Figure 5.6 displays direct effects of how formal and informal futuring have facilitated different orchestration capabilities, while the dotted lines resemble indirect effects.

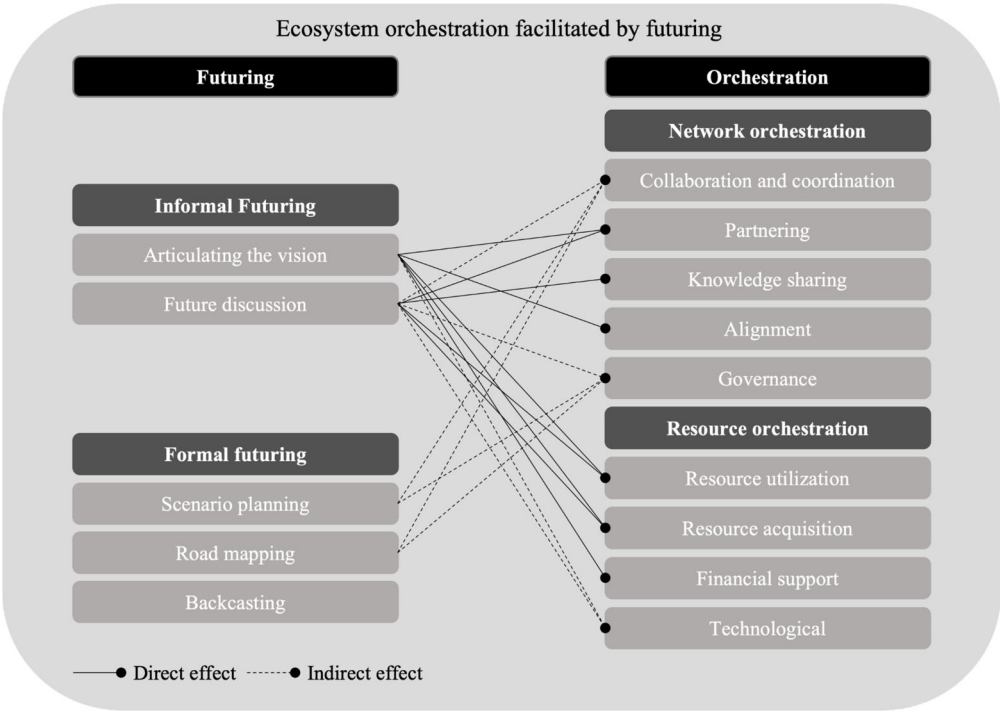

Figure 5.6: *Orchestration capabilities facilitated by futuring*

Formal futuring activities, such as scenario planning, and road mapping, have provided structured frameworks for organizations and the ecosystem as a whole to envision future trajectories and set clear objectives. These formal approaches have required significant dedication of resources but have resulted in well-defined action plans and strategies. For example, the use of roadmaps by SMEs has allowed for agile decision-making while maintaining a clear direction, ensuring alignment with broader ecosystem goals. Similarly, the backcasting approach adopted by the circular economy ecosystem has broken down tasks required to achieve its vision, facilitating coordination and collaboration among partners by assigning responsibilities and fostering constant communication.

The informal futuring activities found, such as articulating vision and future discussions, have fostered a more exploratory and intuitive approach to futuring. While requiring less dedicated resources, these informal activities have facilitated collaboration and coordination by creating a shared understanding of the ecosystem's direction and goals. Through consistent articulation of the vision and ongoing dialogues, actors within the ecosystem have been able to align their individual efforts towards collective objectives. Additionally, informal futuring has enabled partnering by attracting new members to the ecosystem who resonate with its vision, as seen in the case of an academic partner joining to contribute to a mission of creating a blue circular economy model. Moreover, these informal discussions have led to increased knowledge sharing among ecosystem members, as they exchange ideas and identify opportunities for collaboration and resource sharing. Furthermore, the alignment facilitated by informal futuring has supported effective governance within the ecosystem, as shared

norms and principles have emerged from ongoing dialogues and articulation of visions. This alignment has also enabled efficient resource utilization and acquisition by leveraging the network and expertise of ecosystem members. For instance, the informal futuring approach of articulating the vision has led to resource sharing and reduced costs, as seen in the case of an SME helping another partner acquire equipment at a lower cost.

In contrast to Spaniol and Rowland (2022), where they found that formal futuring enabled for resource orchestration, this thesis found that, despite the lack of formal futuring approaches at the ecosystem level, ecosystem orchestration was still facilitated by mainly informal futuring approaches. While informal futuring played a significant role in facilitating orchestration within the circular economy ecosystem, the scarce utilization of formal futuring approaches at the ecosystem level presents a challenge in evaluating the potential benefits of incorporating such formal approaches. It is, thus, unclear whether the integration of formal futuring could enhance the ecosystem's orchestration capabilities. Incorporating formal futuring approaches might enable the ecosystem to achieve even greater orchestration capabilities than shown in Figure 5.6. For example, research by Spaniol and Rowland (2022) indicated that formal futuring promoted, amongst other, innovation, a factor not directly observed within the circular economy ecosystem. However, the consistency in engaging in future discussions and articulating a shared vision could also suffice to align the actors towards a common future. The utilization of these informal futuring approaches has enabled ecosystem partners to commit, collaborate, and share resources effectively. Moreover, it has facilitated the growth of the circular economy ecosystem by attracting partners who resonate with its vision.

One surprising aspect was that futuring facilitated ecosystem orchestration even though not all organizations employed futuring activities at the organizational level, nor was actively driving the futuring activities, e.g., through articulating their vision, at the ecosystem level. Why futuring still could facilitate orchestration is because each actor at the ecosystem level is still indirectly participating through attending meetings and discussions, in which especially the informal futuring activities were held. Thus, it is still an effective means of orchestration with only a few driving the conversations. Moreover, having different actors driving the futuring activities at different points in time could also facilitate coordination, as they could act as the orchestrator of the futuring activity which Pouru-Mikkola et al. (2023) acknowledged to be essential. However, as seen from the interviews, those actors that have articulated their visions have received help from the ecosystem actors, as the vision has given them a better understanding of their needs, enabling them to come forth and help, e.g., in acquiring resources, knowledge, and financial support. Therefore, even though not all actors are actively driving the futuring activities, it is something they should look at incorporating, as it, besides facilitating the ecosystem to orchestrate, also enables actors to get beneficial positions, e.g., in terms of acquiring resources or collaboration opportunities.

Of all orchestration capabilities found in the literature, the alignment capability was, in Circular Plastic, the most essential capability facilitated by the circular economy ecosystem's futuring activities. As seen in Table 2.2, the alignment capability encompasses aligning goals, vision, objectives, and stakeholders, as well as circular economy principles in circular economy ecosystems. From the interviews, both informal futuring approaches were found vital in facilitating the ecosystem to achieve alignment in these aspects, and through this alignment many of the orchestration capabilities followed more easily, highlighting its importance. For instance, it was seen that by having the shared vision, i.e., an alignment, the actors in the circular economy ecosystem could more easily collaborate and coordinate and were more prone to help each other through acquiring resources and sharing knowledge, all since they knew that it was a way forward towards the vision. Thus, in ecosystem orchestration, it could be argued that the most vital capability to obtain is the alignment capability, as it in turn gives the ecosystem a better position in achieving the rest of the different capabilities highlighted in the literature. Futuring is then a great facilitator in achieving this alignment, as it engages all actors in discussing the vision, goals, and objectives to a common understanding.

Partnering, besides alignment, was also one of the most essential orchestration capabilities facilitated by futuring. Generally, for circular economy ecosystems is that to enable to close the loop, every actor in the value chain needs to be on board, i.e., aligned. If one link is missing, the loop is broken. Thus, in contrast to business ecosystems, every actor is needed, even suppliers' suppliers and customers' customers, including second-hand customers. Hence, every actor in the value chain is needed. This highlights the importance of partnering, i.e., to find new partners and get them on board and follow the circular economy principles. A way to facilitate partnering, which was shown to be effective for the Circular Plastic, was the informal futuring approach of articulating the vision. Through their articulation of vision, not only did they find partners that joined, and thus, filled knowledge and resource gaps, but it also facilitated networking opportunities, almost as a snowball effect. For instance, during a meeting with a new representative from one of the partner organizations, one partner articulated the ecosystem's vision, resulting in an invitation to be a part of a panel discussion. This highlights the aspect of being almost visionary in every interaction, could enable new opportunities to articulate the vision in another setting, which could result in a new partner. By treating each interaction, whether with existing partners or potential stakeholders, as an opportunity to communicate the ecosystem's vision has been shown to be effective in attracting new participants and catalyzing collaborative initiatives. This was shown in Circular Plastic initiatives, where they leveraged informal futuring to engage a diverse range of stakeholders, leading to increased awareness, participation, and impact within the ecosystem and beyond. Hence, futuring, and especially informal futuring and articulating the vision, are essential facilitators for partnering, and thus, in turn, also essential to enable circular economy ecosystems to expand.

In Circular Plastic, their offering is contingent upon a high-technological solution, utilizing large-scale additive manufacturing to convert waste into products. This solution comes with its own set of challenges, and as it currently exists few, if any, similar solutions, there is no guide how to make it work. This highlights the need for Circular Plastic to have the technology capability, involving for instance technology scouting (Sandberg, 2023). This capability could be seen to have been facilitated by futuring indirectly, as it has enabled the capabilities of partnering and resource acquisition, filling the gaps as they emerge. However, informal futuring initiatives have also facilitated the technology capability, as the interview highlighted that the actors often discuss how the technology could be implemented in other settings and what other technologies could be beneficial to incorporate to take the circular economy ecosystem a step closer to the vision. Thus, the ecosystem could be seen to possess this capability, and futuring facilitates the ecosystem to have a proactive approach to new technologies.

A question that arises from the technology discussion is how the actors find alignment between the actors in the ecosystem. As many different expertise and many different possible technology trajectories exist, it could be difficult to achieve a shared understanding of what trajectory to pursue. There were no evident findings from the interviews explaining this process. However, based on what was found regarding futuring and its role in achieving alignment of actors, it could be worth exploring in more detail how futuring could facilitate alignment in technology.

The most essential informal futuring approaches found that have facilitated ecosystem orchestration have been articulating the vision and future discussions among the members. As seen in Figure 5.6, these two approaches have enabled the circular economy ecosystem to achieve most of both network and resource orchestration capabilities found by earlier scholars. Why these two approaches have been successful is that they are means of effective communication, which enhance organizational understanding and commitment to the goals and vision of the ecosystem and the ecosystem's commitment to organization’s goals and visions. Hence, it fosters a shared sense of purpose and direction among the actors. Furthermore, these informal futuring approaches, especially articulating the vision, enables organizations to leverage external resources, knowledge, and networks towards its realization. This collaborative approach not only facilitates the pooling of resources but also promotes synergy and collective action. By enabling others to contribute to their vision, organizations harness the collective expertise and capabilities of the ecosystem, enhancing their capacity to achieve outcomes beyond their individual capabilities.

Another reason for why informal futuring has been so successful in facilitating ecosystem orchestration in the circular economy ecosystem is that it does not require any dedicated time by the actors for having these future discussions. As acknowledged during the interviews, communication in the circular economy ecosystem is very time consuming, almost as a full-time job. Since communication is such a vital aspect in orchestration, e.g., to facilitate coordination and collaboration, trust, and articulate

needs, having these informal futuring processes in their regular discussions, in contrast to formal futuring processes, is very beneficial. Moreover, the informal futuring practices do not require any specific means of communication, as it could be done in face-to-face discussions, virtual meetings, or even in social media posts, e.g., show pictures of future scenarios or the vision, further highlighting the accessibility of these informal futuring approaches. Thus, given the current stage of the circular economy ecosystem, with extensive work ahead to reach their goal of achieving a proof of concept, the additional time for formal futuring processes does not make sense as it could put more strain on the communication as it is, making informal futuring processes a better option.

The discussion of how time for communication is a vital part in motivating the use of informal futuring at the early stages reinforces the temporal pattern shown in Figure 5.5**,** highlighting the importance of considering both formal and informal futuring approaches as time progresses. While formal futuring may better facilitate ecosystem orchestration in the long term, enabling a more resilient circular economy ecosystem, informal futuring proves more practical and accessible in the early stages. Thus, all levels should prioritize informal futuring to facilitate orchestration in the early stages, while recognizing the complementary role of formal futuring in facilitating orchestration at the ecosystem and organizational level, as well as setting strategic direction and identifying disruptive trends, as the circular economy ecosystem emerges.

Even though formal futuring approaches were not found in this thesis to facilitate orchestration in the same degree as informal futuring, the temporal pattern discussed still shows that it has its time and place to be incorporated. For instance, more formal futuring approaches could enable the circular economy ecosystem to better understand their customers. Given that Sandberg (2023) found that the customer's role is vital in orchestrating circular economy ecosystems, more formal futuring processes could be beneficial to include as the time progresses. Furthermore, it can also help anticipate future disruptions, enabling ecosystems, such as Circle Plastic, and organizations to be more resilient. Therefore, this thesis underscores the importance of integrating formal futuring processes at both the ecosystem and organizational levels. Formal futuring is recognized as an essential and structured approach to envisioning the future, setting direction, and identifying emergent trends. This necessity was further emphasized by the funders, who exemplified the value of formal futuring processes in enabling projects that drive this circular economy ecosystem forward.

In Lingens et al.'s (2021) paper, they suggested that there seems to be a tradeoff between innovation and coordination depending on the number of orchestrators in the ecosystem, where several orchestrators promote innovation but increase coordination complexities. In the case of Circular Plastic, this observation was not found. Even though Circular plastic’s decentralized orchestration should, according to Lingens et al’s (2021) suggested trade off, strain coordination effort among the actors, there was little evidence that so was the case. It was rather found that the actors were well-

coordinated, with each actor having their responsibility and deliveries in their effort towards Circular Plastic's vision. Here, the circular economy ecosystem's futuring efforts could be attributed to the coordination complexities being mitigated, as future discussion and more formal futuring activities set the direction, aligned the actors, and action plans were set accordingly. Thus, even though this thesis' findings cannot directly answer Lingens et al's (2021) call to empirically prove or disprove the trade off, it answers how these orchestrators could cooperate and how they could manage their potentially conflicting agendas, that is through futuring initiatives. Hence, if the tradeoff between innovation and coordination exist, futuring activities could be a means to manage these effects.

Lastly, to have a resilient ecosystem, Holgersson et al. (2022) described how the centripetal and centrifugal forces affecting ecosystems need to be balanced. In the circular economy ecosystem, the centripetal forces found were mainly complementarity, where the circular economy ecosystem finds complementarity in the current and potential future partners' knowledge and resource base, and the democratization of knowledge which is the opposite to the centrifugal force of distributed knowledge. The centrifugal forces found were mainly network effects in terms of the partners seeking to establish more microfactories in other parts of the world to increase the value of the ecosystem across the three dimensions seen in Figure 5.1, contrary to the business ecosystem discussed in Holgersson et al. (2022) who only discuss the economical aspect. Moreover, another centrifugal force found was modularity, which could be seen in the circular economy ecosystems' efforts to divide responsibilities.

Even though there is a balance of forces, most forces found in the ecosystem were centripetal forces rather than centrifugal forces. As Holgersson et al. (2022) discuss in their paper, strong centripetal forces imply complexities in forms of coordination and control, thus promoting integration towards a single entity. However, as seen in the circular economy ecosystem, the actors are well coordinated, and the control is decentralized. An explanation for this, as previously discussed, is the circular economy ecosystems utilization of futuring, mainly informal futuring, that have facilitated the circular economy ecosystems coordination without a need of an orchestrator. Thus, not only could futuring be considered a means of orchestration, but it also relates to forces affecting the ecosystem, and could be seen as means to find a balance.

5.3 The role of alignment in orchestration

The added value dimensions of circular economy ecosystems have also added complexity to orchestration and collaboration in Circular Plastic. Therefore, to achieve a successful proof of concept and a compelling joint value proposition, robust orchestration mechanisms are essential. These mechanisms can help navigate the complexities arising from multiple value dimensions, ensuring alignment, collaboration, and the efficient utilization of resources. Notably, the alignment

capability in orchestration has been recognized as crucial, where futuring has been vital in achieving that capability.

From the definition of ecosystem orchestration, i.e., "the strategic process by which an orchestrator aligns and coordinates a diverse set of partners within an ecosystem to collectively deliver a joint value proposition" (Jacobides et al., 2018; Adner, 2017), alignment of actors is a vital aspect. What distinguishes alignment from the alignment capability is that alignment refers to a state where there is consensus or mutual agreement among ecosystem members about their roles, responsibilities, and the flow of activities (Adner, 2017). Different actors may have different end states and goals, highlighting the distinction between mere participation and true alignment. True alignment signifies that all actors are not only engaged but are also satisfied with their positions within the ecosystem. This alignment is not something that exists at the ecosystem construct, but is rather something that could emerge over time, by itself or through dedicated actions. A way to achieve this alignment is through the alignment capability, which is a way to create a shared understanding of the vision, goals, objectives, definitions, and principles, from which alignment can emerge. This alignment is, however, not static, as new information and changes in the environment necessitate ongoing adjustments and updates to ensure all parties remain on the same page. Thus, it is rather a dynamic process that requires continuous engagement and communication among stakeholders to address any emerging discrepancies or opportunities for improvement. Alignment capabilities, as discussed previously, are then means to effectively sustain alignment as the circular economy ecosystem progresses.

As alignment is continuously adjusted, so too must the joint value proposition evolve to reflect the current and future realities of the ecosystem. This evolving proposition should consider the feedback from stakeholders, the impact of external factors like regulatory changes or technological advancements, and the overall progress towards sustainability goals. By regularly revisiting and revising the value proposition, the ecosystem can remain relevant and attractive to both existing and potential new partners. Likewise, as the joint value proposition is continuously evolving, it is crucial to ensure alignment through the alignment capabilities so that value can be co-created and co-captured.

5.3.1 Navigating tensions through strategic alignment

Alignment within the individual organizations is important for the adoption and integration of circular economy principles. It provides organizations with a common understanding of their own reasons to join and to actively participate in the circular economy, ensuring that their business strategies and sustainability goals are not only consistent internally but also harmonized with the overarching objectives of the circular economy. As stated by theory, tensions can however arise when organizations start to adopt more circular principles. For one, the data highlighted that there are tensions

between short-term economic goals and long-term sustainable goals of a circular economy. Primarily as many of the SMEs within the ecosystem stress the importance of profitability for their survival. Alignment could lead to organizations leveraging the whole ecosystem's resources, network, and capabilities to achieve profitability. Furthermore, the tension between having technological efficiency and having small-scale processes was softened through resource orchestration in the ecosystem. For example, within the ecosystem, a small-scale organization lacked the resources to invest in more advanced technologies. However, through collaboration with other ecosystem members, they could access shared facilities and expertise, enabling them to implement these technologies on a smaller scale. The circular economy ecosystem also enables actors to simultaneously collaborate with both the value chain and the broader society as a whole, having a more holistic approach. Collaboration with other stakeholders in the ecosystem, like NGOs or research institutions, allows businesses to address broader societal needs, such as reducing waste or creating sustainable jobs, enabling local communities to capture the value of the local waste.

The alignment of actors also enables the circular economy ecosystem to approach more radical business model innovation, while allowing organizations to focus more on the incremental technology innovations. One of the key advantages of this alignment is the ability to pool diverse perspectives, expertise, and resources to tackle complex challenges. By bringing together actors from various sectors, including academia, industry, funders, and civil society, the circular economy ecosystem can leverage a wide range of insights and capabilities to drive innovation. This diversity of viewpoints can spark creativity and encourage thinking outside the box, leading to the development of novel business models. Furthermore, the collaborative nature of the ecosystem encourages experimentation and risk-taking.

5.3.2 Alignment across different levels of the circular economy ecosystem

There also needs to be alignment between the different organizations within the ecosystem. While alignment among actors within the circular economy ecosystem is important for collaboration and achieving shared goals, it may not be necessary or feasible for everyone to be aligned on every aspect. Complete alignment across all dimensions and perspectives can be challenging to achieve due to the diversity of stakeholders, interests, and contexts within the ecosystem. Furthermore, different perspectives can offer unique insights and approaches to addressing complex challenges and driving progress towards the circular economy objectives. However, alignment on overarching goals and fundamental principles is essential for maintaining cohesion and direction within the ecosystem. It ensures that stakeholders are working towards a common vision and are not working at conflicting purposes.

Looking at Circular Plastic it was found that all partners strived towards closing a loop through microfactories. However, their reason for why they all strived towards this vision differed among the actors. Furthermore, the concept of circularity and closing

the loop needs to be understood in the same manner among all the actors to really achieve an alignment. In the circular ecosystem, it was found that there is an alignment between all actors, apart from alignment in definitions for some organizations, facilitated by their informal futuring process. Even though there is a small misalignment in definitions, it has still enabled the ecosystem to orchestrate itself without the need of an orchestrator, which compliments Spaniol and Rowland's (2022) finding of how the role of the orchestrator is decentralized if formal futuring is utilized, with the fact that informal futuring seems to be enough. However, the misalignment in definitions could create roadblocks for the ecosystem in the future as it emerges, as it risks the actors trying to achieve different things. Thus, even though it is not a problem today, it is something that the ecosystem actors should act upon. From the literature, several examples not related to futuring are discussed such as lobbying and sharing success stories. Thus, an example of how the partners within the ecosystem could face this misalignment could be by sharing success stories as the ecosystem emerges, or by inviting the misaligned actors to more future discussions and discuss why the difference matters for the future of the circular economy ecosystem.

5.3.3 Overcoming alignment challenges through futuring

Given that alignment is required across various levels within the circular economy ecosystem, it is inevitable that misalignment may also manifest at these different levels. For one, there could be misalignment between the individual actor's vision and the circular economy vision. For instance, the individual actor participating in the circular economy ecosystem may not align with the vision, but instead only view it as a part of their job. This may slow down or even hinder the progression of the ecosystem. As the value of the circular economy includes much more than only economical value, actors participating in projects aiming to drive the circular economy forward need to be both driven and engaged. Additionally, there can also be misalignment between the organizational and the circular economy ecosystems visions. Without alignment between organizational goals and ecosystem objectives, coordination and collaboration become challenging, impeding the effectiveness of ecosystem-wide initiatives, and diminishing the potential for collective impact. Lastly there can be misalignment between specific circular economy projects and the circular economy ecosystem, potentially driving it in the wrong direction.

Looking at Circular Plastic for instance, while some alignment has been achieved, complete alignment has not yet been realized. As seen in the data, some collaborations and communications efforts have been difficult as organizations may have other priorities, sending damaged machines or promoting the use of bioplastics that are not in line with the circular economy principles. While the orchestration has mostly been working well, these types of efforts have caused delays and disruptions in the ecosystem. Therefore, complete alignment of visions is necessary for the progression of the ecosystem.

Another aspect observed in the data that could pose a potential challenge in creating alignment between the vision on both levels is a vast difference in future horizons. This disparity between short-term and long-term perspectives can create difficulties in decision-making and strategic planning. Actors operating on a "the future is now" mindset may prioritize immediate gains over long-term sustainability, potentially undermining the resilience of the ecosystem in the face of future challenges. Conversely, those with longer-term perspectives may struggle to align their vision, goals, and actions with more immediate needs, leading to disconnects and inefficiencies within the ecosystem. Similarly, challenges can exist regarding the geographical scope. Actors with a local focus may prioritize local benefits, potentially neglecting broader ecosystem goals. Conversely, actors with a global perspective might struggle to translate their vision into actionable steps at the local level.

Futuring plays an important role in achieving alignment within circular economy ecosystems through various mechanisms. Firstly, futuring activities facilitate the development of a shared vision among the actors, by envisioning potential future scenarios and discussing goals for the ecosystem. These discussions help stakeholders identify common goals and objectives, laying the groundwork for alignment. Moreover, futuring promotes enhanced communication among a diverse set of actors, leading to a better understanding of each other's perspectives and concerns. As stakeholders communicate their visions and concerns, alignment naturally emerges, driven by a shared understanding of the ecosystem's purpose and direction. Additionally, futuring activities provide clarity on different actors' roles and responsibilities within the ecosystem, contributing to alignment towards common objectives. Furthermore, the diversity in future horizons and geographical scope also offers a valuable opportunity for prioritization and strategic alignment. By engaging in discussions to establish consensus on future horizons and overarching objectives of the ecosystem, the actors within the circular economy ecosystem can gain a better understanding of the temporal dynamics at play and identify common objectives that bridge short-term needs with long-term sustainability. This process not only facilitates prioritization of actions but also fosters a sense of shared purpose and direction within the ecosystem. Ultimately, by acknowledging and leveraging the diverse range of future perspectives, ecosystem actors can enhance the effectiveness of their futuring processes and maximize their collective impact on shaping a sustainable future.

5.3.4 Articulation of the visions is important for alignment

Articulation of the visions is important for alignment within a circular economy ecosystem. It is essential to note that alignment of vision is not the same as having the same vision. Instead, alignment of visions is about having a shared understanding and purpose, where the visions of the different actors together can drive forward the circular economy ecosystem. For the alignment of actors within the ecosystem and between organizational goals and the ecosystem's goals, clear articulation of goals and visions is essential at both organizational and ecosystem levels. By having individual

organizations articulating their own goals and visions, the ecosystem can collectively orchestrate and coordinate its efforts towards common objectives. This can also ensure that participants have a clear sufficient reason for being a part of the ecosystem as they can see the perceived value of being part of the ecosystem. However, if alignment is lacking, articulation alone may not yield significant benefits, leading to questions about the rationale for participation in the ecosystem and the value that the organization aims to gain from it.

From the interviews, one aspect that was not as prominent in the ecosystem was the sharing of the individual and organizational vision with the ecosystem. It was noted that the communication flow of the vision within the ecosystem was mostly one-directional, moving from the ecosystem towards the organizations. So, while many of the actors seem to share the overarching vision of the ecosystem, there existed different degrees of alignment with the vision. Some seem to understand the purpose of the project and its drive towards a circular economy ecosystem, whereas others acknowledge the importance of circular economy but may have lacked a clear understanding of its intricacies. This highlights that alignment between individual, organizational and ecosystem levels is important for the advancement of the circular economy. From the data, two examples of how actors could leverage the ecosystem's knowledge and resources by sharing their visions, goals, and needs. At the same time, the data also showed the consequences when individual organizations do not have a shared vision, leading to ineffective collaboration and delays for the whole ecosystem.

5.3.5 Vision as the glue

In the circular economy ecosystem, the concept of vision has therefore shown to be of a great importance. It aligns the actors and co-creates a shared reality of what the ecosystem can achieve. Even though everyone has their own goals and interest for the involvement, vision can act as a cohesive and binding element that brings together the goals and visions of both the organization and the ecosystem. The vision unites a diverse set of stakeholders and aligns their effort towards common objectives.

Articulation of the vision leads to a mutual relationship between the organization’s vision of a desired future state and the ecosystem’s desired future state. This dynamic interaction is characterized by two arrows in Figure 5.7, symbolizing the mutual influence and interconnectedness between the visions at both levels.

At the organizational level, articulating the vision involves breaking down core values, missions, and objectives, guiding organizational decision-making and prioritization. As organizations define their desired future state, they may seek alignment with broader ecosystem goals and values, thereby contributing to the shaping of the ecosystem's collective vision. Conversely, at the ecosystem level, vision articulation focuses on identifying interdependencies, mutual interests, and opportunities for collaboration

among stakeholders, fostering alignment and shared purpose. Providing the individual organizations with new opportunities, influencing their goals, vision, and objectives.

The organizational vision is crafted through organizational management, focusing on internal goals, values, and strategies, while the ecosystem vision is crafted through dialogues with all stakeholders, emphasizing collaboration, shared values, and collective objectives. The development of the organizational vision impacts the ecosystem by influencing the priorities, actions, and contributions of individual organizations, shaping the overall direction and dynamics of the ecosystem. Conversely, the ecosystem vision influences the development of organizational visions by providing context, inspiration, and opportunities for alignment with broader societal and environmental goals, fostering a sense of shared purpose and collective responsibility among participating organizations.

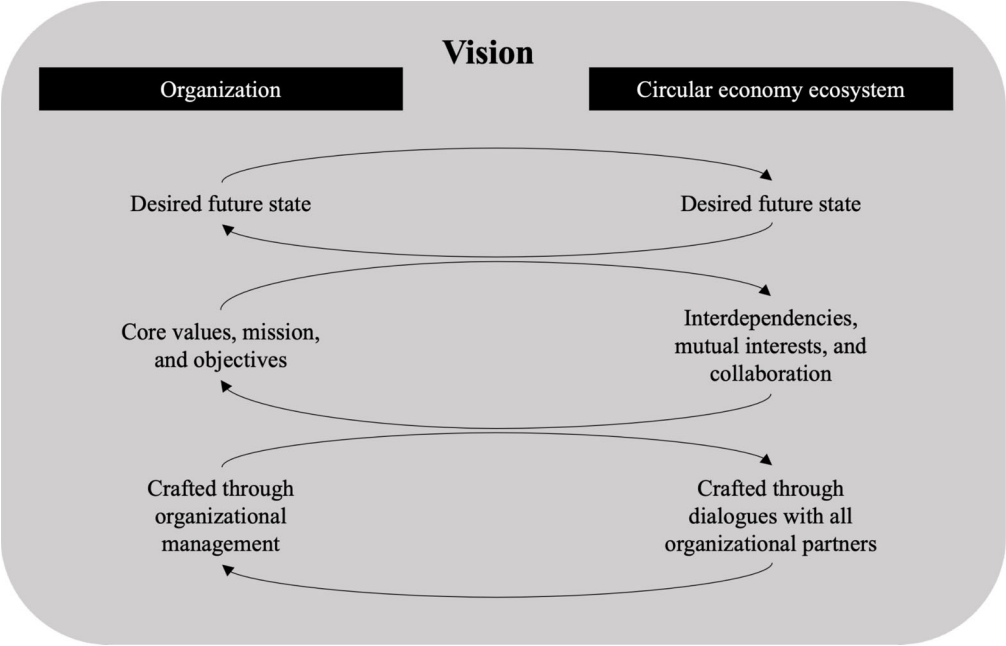

Figure 5.7: *Mutual influence of visions in the circular economy ecosystem*

5.4 Contributions to theory

This thesis provides a few theoretical contributions to the understanding and orchestration of circular economy ecosystems, focusing on the roles of futuring, alignment capabilities, and joint value propositions. These contributions, by incorporating these concepts, expand the existing literature on ecosystem orchestration and value dynamics, as well as providing insights for fostering sustainable and resilient circular economy ecosystems.

5.4.1 The role of futuring in orchestrating circular economy ecosystems

Informal futuring emerges as a key practice in the early stages of ecosystem orchestration by fostering a culture of openness, collaboration, and shared vision among stakeholders. Informal futuring activities, such as articulating visions and future discussions, help create a common understanding and align stakeholders around shared objectives without the need for extensive resources or formal structures. These practices are particularly effective in engaging diverse actors, building trust, and facilitating the initial stages of collaboration, which are essential for the development of a cohesive and resilient circular economy ecosystem. By encouraging ongoing dialogue and iterative learning, informal futuring helps maintain stakeholder engagement and adaptability, which are crucial for navigating the uncertainties and complexities of circular economy transitions.

By highlighting the importance of informal futuring, this thesis extends the existing frameworks on ecosystem orchestration. Previous literature (Spaniol and Rowland, 2022) has predominantly focused on formal futuring methods, such as scenario planning and roadmapping, which require substantial resources and structured processes. However, the findings of this thesis suggest that informal futuring—through activities like vision articulation and future discussions—can achieve significant alignment and strategic coherence among ecosystem stakeholders. Moreover, the integration of informal futuring into the theoretical discourse on circular economy ecosystems underscores its role in enhancing ecosystem resilience. Informal futuring practices enable stakeholders to remain agile and responsive to dynamic changes in the environment, thus supporting the adaptive capacity of the ecosystem. This adaptive capacity is essential for maintaining ecosystem sustainability and fostering continuous innovation.

Besides futuring's ability to facilitate orchestration, this thesis underscores its value in also balancing the centripetal and centrifugal forces within ecosystems, and as a strategic tool to manage Lingens et al.'s (2021) suggested tradeoff between coordination and innovation. Thus, futuring plays a pivotal role in creating a resilient circular economy ecosystem.

A key motivation for the informal futuring approach in the circular economy ecosystem studied is its resource efficiency compared to more formal approaches. However, communication was still acknowledged as very time consuming. Given this fact, a question regarding informal futuring's applications as the ecosystem grows. Thus, future research could investigate the scalability of successful futuring practices from small-scale to larger, more complex circular economy ecosystems. By understanding the factors that facilitate or hinder the scalability of these practices can provide valuable insights for practitioners aiming to expand their initiatives. Furthermore, the thesis findings also highlight the need for further theoretical exploration into the specific

mechanisms and outcomes of informal futuring practices within various types of ecosystems.

5.4.2 The alignment capability as a cornerstone in ecosystem orchestration

This thesis underscores alignment capability as fundamental for developing other orchestration capabilities within these ecosystems. This capability is critical for effective collaboration, resource sharing, and collective action. Without strong and continuous alignment, efforts to coordinate activities, manage resources, and drive innovation are likely to be fragmented and less effective. Developing alignment capability thus enables the ecosystem to leverage other orchestration capabilities, such as coordination, sharing knowledge sharing, and resource sharing, as well as innovation and value co-creation. By fostering a shared understanding and commitment to common goals, alignment could be reached, which ensures that all ecosystem activities are harmonized, leading to more efficient and impactful outcomes.

As circular economy ecosystems are characterized by complex interdependencies between different actors and processes, the alignment capability becomes especially vital. The alignment capability ensures that these interdependencies are managed effectively, with all actors understanding their roles and responsibilities within the larger system. By aligning their efforts, stakeholders can optimize resource flows, reduce inefficiencies, and enhance the overall performance of the ecosystem. An effective way for circular economy ecosystems to achieve this alignment that emerged during this thesis was the articulation of visions. It involves defining the ecosystem's long-term goals and desired outcomes, establishing a shared direction and purpose for all stakeholders. This process aligns various interests and priorities, fostering a unified approach to meeting circular economy objectives.

In the circular economy ecosystem studied, it was evident that many actors were aligned with the common objectives and vision of the ecosystem, even though a lot of the futuring activities were conducted through virtual means. Future research could thus investigate the role of digital tools in enhancing alignment practices, such as the informal futuring approach of articulating the vision. Incorporating digital tools could also be investigated through the lens of how the integration of such in futuring activities could enhance collaboration and efficiency, relating to the time-consuming communication found in this case. Lastly, stemming from the discussion of alignment and its effect on the technology capability, future research could investigate how to achieve alignment in technology and how futuring could facilitate that alignment.

5.4.3 The joint value proposition in circular economy ecosystems

This thesis also contributes by clarifying the relationship between the joint value proposition and the processes of collaborative creation and capture within circular economy ecosystems. Traditionally, value creation and capture have been explored primarily within linear economic models, where value flows are relatively straightforward and unidirectional. However, in the context of circular economy

ecosystems, these processes become inherently more complex due to the involvement of diverse stakeholders with varying interests and goals.

The joint value proposition integrates the different perspectives and resources of the ecosystem actors, facilitating collaborative innovation and the development of sustainable practices. By emphasizing the interconnectedness of value co-creation and value co-capture, this research highlights how stakeholders can simultaneously contribute to and benefit from the ecosystem, thereby promoting a more holistic and sustainable approach to value generation. Furthermore, the concept of the joint value proposition underscores the importance of mutual dependency and shared benefits, which are essential for the sustainability of circular economy ecosystems. It shifts the focus from individual gains to collective outcomes, fostering a collaborative environment where stakeholders are incentivized to contribute to the ecosystem's overall health and resilience. This theoretical framework enriches existing literature on ecosystem orchestration and value dynamics, providing a nuanced understanding of how value co-creation and co-capture can be harmonized in circular settings.

From observations of Circular Plastic, it was seen that the actors had a clear understanding of what types of values that wanted to provide and what the stakeholders' demands were. However, the mechanisms through which these values are co-created and co-captured remain complex and not fully understood by the authors. This gap highlights a potential area for future research to explore the specific mechanisms that facilitate this process within circular economy ecosystems. For instance, partnerships needed to bring forth value, the communication tools needed to communicate value and the joint value proposition that emerges, bridging between different values. Understanding these mechanisms can provide insights into how stakeholders collaborate to create and share value effectively.

5.5 Implications for Practitioners

The findings from this thesis also have a few implications for practitioners that could help them in their orchestration efforts, as well as ensuring that the co-created value also is co-captured by the ecosystem actors, ensuring the value to be shared.

5.5.1 Incorporate futuring in circular economy ecosystem developments

For practitioners, starting with informal futuring activities can be highly effective in the early stages of developing circular economy ecosystems. Informal futuring includes vision articulation, open discussions, and brainstorming sessions which can foster a shared understanding and collaborative spirit among stakeholders. These activities are less resource-intensive and more flexible, allowing participants to explore various possibilities without the constraints of formal structures. Informal futuring can attract diverse members by aligning them with a broad, compelling vision and creating an

inclusive environment for innovative ideas. This approach helps establish a foundation of trust and cooperation, essential for the initial phases of ecosystem development.

As the ecosystem matures, practitioners should gradually incorporate more formal futuring activities such as scenario planning, roadmapping, and backcasting. These structured methods provide detailed frameworks for forecasting and preparing for potential future scenarios. Formal futuring helps in setting clear objectives, defining roles and responsibilities, and creating actionable strategies. This transition from informal to formal futuring ensures that as the ecosystem grows, it becomes more resilient and strategically aligned. Practitioners can use formal methods to continuously refine the ecosystem's direction, ensuring it remains adaptable and focused on long-term sustainability goals.

5.5.2 Foster continuous alignment in circular economy ecosystems

Alignment is an ongoing process that must be continuously monitored and adjusted as the ecosystem evolves. Practitioners should establish mechanisms for regular reviews and updates to ensure that the ecosystem's goals and strategies remain relevant and aligned with the changing external environment. This iterative process involves gathering feedback, assessing progress, and making necessary adjustments to keep the ecosystem on track. Continuous alignment helps in maintaining momentum and addressing any emerging misalignments promptly, thereby ensuring the ecosystem's sustainability and resilience over time.

A clearly articulated vision plays a crucial role in achieving and maintaining alignment within the ecosystem. Practitioners need to ensure that the vision is communicated effectively and resonates with all stakeholders. This vision acts as a guiding star, helping to align individual and collective efforts towards common goals. By regularly revisiting and reinforcing the shared vision, practitioners can ensure that all members of the ecosystem remain focused on the overarching objectives, facilitating coordinated action and collaboration. This clarity and consistency in vision are vital for sustaining long-term commitment and engagement from all ecosystem participants.

Practitioners must also ensure that alignment is maintained across various levels of the circular economy ecosystem, including individual actors, organizational units, and the ecosystem as a whole. This requires regular communication and collaboration to harmonize goals and activities. By understanding and integrating the different perspectives and objectives of each level, practitioners can create a cohesive strategy that aligns the entire ecosystem towards common sustainability objectives. This multi-level alignment is critical for addressing the complex and interconnected challenges inherent in circular economy ecosystems.

5.5.3 Make sure that the co-created value is co-captured

The complex interplay between value co-creation and co-capture in circular economy ecosystems like Circular Plastic underscores the critical need for effective orchestration to ensure that the value generated through collaborative efforts is indeed realized and beneficial across all stakeholders. This orchestration involves negotiating and aligning the diverse interests and expectations of internal and external actors to foster a sustainable, regenerative business model. These complexities bring forth specific implications for practitioners aiming to navigate and succeed in such ecosystems.

For practitioners, it is essential to not only focus on co-creating value but also on co-capturing this value within the ecosystem. The realization of a circular economy's benefits hinges significantly on how well the ecosystem can convert the co-created value into tangible outcomes that meet the diverse needs of all actors involved. This process requires a detailed understanding of the different value dimensions – economic, social, and environmental; and the stakeholder demands – quality, profitability, and the triple bottom line. Moreover, it requires the ability to communicate and align these values effectively among participants, consumers, and the broader society is crucial. Clear and persuasive communication strategies are needed to articulate how circular economy practices benefit all stakeholders, facilitating a deeper engagement and commitment to the circular model. This includes translating complex sustainability practices into relatable benefits that resonate with consumers' values and societal expectations, thereby fostering a supportive community and consumer base.

Additionally, the importance of negotiation cannot be understated. Practitioners must possess the skill to negotiate and communicate the mutual benefits of sustainable practices effectively. This involves finding common ground among stakeholders with varying priorities and expectations, ensuring that value can be co-captured, as this value is indivisible.

6. Conclusion

This thesis has explored the integration of futuring techniques in managing circular economy ecosystems, with a focus on the interplay between formal and informal foresight practices. Through a detailed case study of Circular Plastic, an emerging circular economy ecosystem, the research has provided insights into how these practices contribute to the orchestration of circular economy ecosystems.

Key findings indicate that informal futuring practices, such as vision articulation and open discussions, play a crucial role in orchestration, especially in the early stages of ecosystem development. These activities help to align stakeholders, foster collaboration, and build a shared understanding of the ecosystem's direction. Informal futuring is less resource-intensive and more adaptable, making it an effective strategy for engaging diverse participants and establishing a foundation of trust and cooperation.

The research also highlights the critical role of alignment in ecosystem orchestration. Achieving and maintaining alignment among stakeholders is essential for effective collaboration, resource sharing, and collective action. The articulation of a clear vision is vital in this process, as it helps to harmonize the goals and activities of individual actors with the broader objectives of the ecosystem. This multi-level alignment is crucial for addressing the complex and interconnected challenges inherent in circular economy ecosystems. Moreover, the concept of the joint value proposition is identified as a fundamental aspect of value creation and capture within circular economy ecosystems. By integrating the perspectives and resources of various actors, the joint value proposition facilitates collaborative innovation and sustainable practices. This approach emphasizes mutual dependency and shared benefits, shifting the focus from individual gains to collective outcomes.

While the findings underscore the importance of informal futuring practices, previous literature suggests that formal futuring methods, such as scenario planning and roadmapping, can also provide structured frameworks for long-term planning and resilience. Practitioners should therefore consider these formal approaches to complement the informal practices as the ecosystem matures, ensuring a comprehensive strategy that adapts to evolving challenges and opportunities.

In conclusion, this thesis offers a comprehensive framework for understanding and implementing futuring practices in circular economy ecosystems. By emphasizing the role of informal futuring activities and considering the integration of formal methods, stakeholders can enhance the resilience and sustainability of their ecosystems. Future research could further explore the scalability of successful futuring practices, the role of digital tools in futuring as well as in enhancing alignment and collaboration practices and explore the specific mechanisms that facilitate value co-creation and co-capture within circular economy ecosystems.

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8. Appendix

8.1 Interview guide

Introduction
Is it ok if we record this?

Introduction and Circular Economy

Could you please provide a brief background about yourself and describe your activities and interests within the circular economy?

What is your future vision of the circular economy?

- What is the circular economy to you?
- What do you see as the primary drivers or motivations for adopting circular economy principles?

What is the biggest challenge you see today to achieving your circular economy vision?

The Project

Why and in what way are you involved in the project?

What is attractive about the project?

- How is it tied to your organization's vision?

How does the project fit into the greater circular economy? Into your vision of the circular economy?

What are your goals for your involvement with the project?

What is your vision of the project?

- How does it tie to your vision of your organization?

Do you think all actors in the project share a similar vision or goals for what the project should achieve? Why or why not?

How do you perceive the idea of working with other project actors to create value?

From your perspective, what benefits or advantages does the project provide you and/or your organization?

Are there any specific opportunities and/or challenges for promoting circular economy principles within the project?

Under which circumstances would you consider leaving the project or stop collaborating with the other actors?

Orchestration and Planning

Could you briefly describe how you and other actors plan and coordinate your activities within the project?

- What happens during your meetings?

Which actors in the project do you have the closest collaborations with, and how? Information, resources, knowledge sharing, etc.

- What are your views on sharing all these?

Are there any specific changes or developments in your environment, e.g., customers, technology, markets, etc, that you would like to see addressed in the project moving forward?

Have you encountered any challenges or problems while working on the project? If so, how were they addressed?

The Future of the Circular Economy Ecosystem

How do you, within the project/circular economy, discuss the future?

- How often?
- Who do you speak with?
- What do you talk about?
- How many years in the future are your discussions?
- How are the potential results interpreted?

How do you think the project will evolve in the future, and what role do you envision for yourself and for other actors when the project ends?

How do you see the future collaboration among the actors internationally, both current and potentially new actors in other countries?

Other

Is there anything else that you would like to discuss or that you think we should consider?

Thank you very much for your time!

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