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# **Scaling Circular Innovations: A Qualitative Study on Opportunities and Challenges**

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# Introduction

Over the last few decades, major changes have occurred in how societies and businesses think about economic growth, production, and consumption. For much of modern industrial history, the linear economic model has been dominant. This model, often described as “take–make–dispose,” fueled industrial expansion and mass consumption but has proven to be unsustainable. It has caused resource depletion, environmental damage, and a sharp rise in pollution and waste. Concerns about climate change, limited resources, and stricter environmental rules have pushed policymakers, businesses, and consumers to look for alternatives.

One promising alternative is given by circular economy, which has emerged both as a response to the limits of the linear model and as a proactive path toward sustainability. Instead of following a “take–make–dispose” logic, the circular economy relies on a “make–use–return” cycle. Products, materials, and resources are kept in circulation for as long as possible and waste is no longer treated as inevitable but is seen as a key resource. Therefore, this approach improves resource efficiency while reducing environmental impact. Many businesses are now recognizing the value and opportunities of circular principles. For established firms, this often means transforming existing operations to move from linear to circular systems, while for start-ups it can be directly built into their business model from the very beginning. These innovations can be radical, reshaping value chains, customer relationships, and even entire industries. However, the impact of circular innovations is greatest when they scale beyond small projects. Pilot initiatives can show what is possible, but real change requires widespread adoption across industries and markets. Scaling is difficult though, because circular innovations face not only the usual challenges of business growth, but also unique barriers tied to circularity. Balancing environmental goals, financial viability, and consumer acceptance makes scaling especially complex. This tension between opportunities and challenges makes it important to better understand how circular innovations scale. Businesses that succeed can reach new markets, strengthen their reputation, meet stricter regulations, and deliver real environmental benefits. At the same time, they must face operational challenges, financial challenges and cultural obstacles which might be difficult to overcome. Building on these considerations, this study aims to answer the following question:

*What are the primary challenges, effective strategies, and potential opportunities for scaling circular economy innovations?*

To answer this question, a qualitative research design was used. Seven semi-structured interviews were conducted with Italian companies representing different industries and sizes. This diversity provided a wide range of perspectives and insights that aim to go beyond industry-specific issues. Italy is a particularly interesting setting: its strong manufacturing tradition, design culture, and growing regulatory focus on sustainability create both opportunities and challenges for circular practices. Opportunities exist in areas like fashion, food, and industrial manufacturing. At the same time, fragmented regulations, diverse consumer behaviors, and resistance in traditional sectors create obstacles. The interviews identified four main dimensions that shape the scaling process: Operational Challenges, Cost Challenges, Market Opportunities, and Circularity Enablers. Together, these dimensions show how companies move from small initiatives to broader operations while staying aligned with circular principles.

In conclusion, while the transition from a linear to a circular model presents significant obstacles, it also opens the door to transformative opportunities. Businesses that successfully scale their circular innovations will not only contribute to global sustainability goals but also reshape their industries for a more resilient and sustainable future. This study, through its qualitative exploration of Italian companies, provides insights into the lived realities of firms navigating this transition. By learning from the challenges, strategies, and opportunities that companies face, both businesses and policymakers can better support the wider changes needed to unlock the full potential of the circular economy.

# Chapter 1: Context and Research Design

Scaling up refers to the process by which innovations, ideas, or business models grow in scope, influence, and operational capacity. In the entrepreneurial domain, scaling up can take many forms such as increasing the customer base, expanding market reach, growing revenue, replicating business models, or influencing industry norms. This concept, while often confused with growth, has distinct characteristics. Growth implies any form of increase, such as more employees or larger revenues. Scaling, on the other hand, involves the efficient and often exponential increase of output relative to input, this means doing more with proportionally less and thus increasing efficiency (Bohan et al., 2024). Especially in the domain of innovative business practices such as those found in the circular economy, understanding what scaling entails becomes crucial.

The need to investigate scaling in the context of circular economy companies arises from the complexity and novelty of the models these firms adopt. Unlike traditional businesses that are primarily driven by profit and efficiency, circular economy firms prioritize sustainability, resource efficiency, and environmental regeneration, while also keeping in mind economic sustainability, as “there cannot be environmental sustainability without economic and social sustainability” (Case 3). These goals often require the adoption of novel technologies, collaboration across sectors, and fundamental shifts in value creation mechanisms. Consequently, circular businesses face unique challenges that conventional firms do not. Regulatory complexities, technological uncertainty and lack of consumer awareness, all complicate the scaling process. This is why this study aims to analyse the following question:

*What are the primary challenges, effective strategies, and potential opportunities for scaling circular economy innovations?*

To answer this question, this study adopts a qualitative research methodology based on semi-structured interviews. This approach enables the collection of rich, detailed narratives from seven Italian companies operating across diverse sectors, each committed to circular business models. These interviews uncovered not only the individual paths each firm took to scale but also the recurring themes that emerge when circular innovations attempt to scale up. The rationale behind choosing qualitative methodology lies in the complexity of the subject studied. Circular economy innovations are not simply technical solutions but involve deep changes in organizational behaviour, market interactions, and societal norms. These elements are difficult to capture through

quantitative metrics alone. On the other hand, the semi-structured interview format allows respondents to express their perspectives freely (Kvale, 2011), while the systematic coding and analysis ensure that emerging themes can be traced back to concrete, empirical data (Gioia et al., 2012). The analysis is organized in terms of first-order concepts (derived directly from participants' language), second-order themes (interpreted by the researcher), and aggregate theoretical dimensions.

Findings from the existing literature review highlight several critical challenges. First, circular economy firms often operate in regulatory grey zones. Many environmental regulations are designed for linear production systems and do not accommodate circular processes like product reuse, remanufacturing, or sharing services. This creates bureaucratic barriers and increases the compliance burden. In some cases, companies reported having to go beyond existing norms to define new standards or push for institutional change (Fitch-Roy et al., 2021). Second, consumer behavior is a significant obstacle. Traditional consumer models are deeply embedded in the linear buy-use-dispose model. Convincing customers to rent instead of buy, repair instead of discard, or purchase reused goods requires not only marketing efforts but also a shift in societal values. This challenge is intensified by the perceived inferior quality of reused or recycled products (Linder & Williander, 2017). Several interviewees stressed the importance of educating consumers and building trust through transparency and quality assurance. Third, scaling circular models often demands complex coordination across the value chain. For example, remanufacturing depends on efficient reverse logistics, getting used products back from consumers in a usable condition. This requires coordination with transport providers, collection hubs, and sometimes customers themselves. In contrast to linear production, which is a one-way street, circular value chains are loops that must be carefully managed. Building such systems is both resource-intensive and time-consuming (Stahel, 2016; Tura et al., 2019). Technological challenges were also highlighted. While some circular innovations are enabled by cutting-edge technologies, such as digital tracking of product life cycles or blockchain for transparency, these same technologies can introduce high costs, steep learning curves, and integration difficulties. Especially for small and medium-sized enterprises (SMEs), accessing and effectively deploying these technologies can be a major barrier (Genus & Coles, 2008; Linder & Williander, 2017; Tura et al., 2019). On the other hand, the literature review uncovered several best practices and opportunities that facilitate scaling. One prominent strategy is intersectoral collaboration. Many circular firms grow by partnering with businesses in other industries to repurpose waste or by-products. These synergies not only reduce costs but also create new value streams (Rocca et al., 2023). For instance, one company used

leftover of marble production, marble powder, to create textiles out of it (Case 6). Another effective scaling strategy involves the formation of local or regional circular value chains. By focusing on local partners, companies can reduce logistical complexity, foster trust, and promote economic resilience. The so-called "km0" approach, or zero-kilometer model, enables firms to build closed-loop systems at a regional level, often in alignment with local policy goals (Rocca et al., 2023). The creation of spin-offs or new business units dedicated exclusively to circular practices is another promising route. When integrating circularity across an existing firm's operations proves to be too difficult, especially in the experimentation phase, setting up a new, specialized unit often allows for more agile experimentation and targeted scaling. These units can act as laboratories for circular innovation and may later influence the parent company or the broader industry (Rocca et al., 2023). The role of human capital also emerged as a key enabler of circular scaling, in the literature review. Green human resource management practices, such as environmentally focused training and recruitment, were linked to better circular outcomes. Companies that integrated environmental values into their organizational culture reported more efficient implementation of circular strategies and higher levels of employee engagement (Marrucci et al., 2021). Institutional support, or the lack thereof, was another recurrent theme. While some firms benefited from regional or EU-level initiatives promoting sustainability, others struggled with fragmented or outdated policies. There is a general consensus that coherent, integrated policy frameworks are necessary to allow the systemic change required for circular models to succeed. Particularly important are incentives for sustainable procurement, subsidies for circular innovation, and infrastructure investment for reverse logistics and recycling (Linder & Williander, 2017; Sairanen & Aarikka-Stenroos, 2024; Tura et al., 2019).

On the other hand, the findings of this study revealed four main aggregate dimensions that help structure the results and analysis. These dimensions are operational challenges, cost challenges, market opportunities, and circularity enablers. Each of these categories includes key opportunities and difficulties that practitioners in circular business models have faced while trying to scale their innovations. By identifying these main themes, the study provides a clear and organized view of what is happening in the real world of circular innovation. Within these four areas, the study outlines the shared and unique challenges that different businesses encountered. For instance, operational challenges might include difficulties in managing supply chains or dealing with waste logistics, while cost challenges relate to the extra financial burden of building circular systems. Market opportunities cover the ways in which businesses can attract new customers or create competitive advantages by being more sustainable. Finally, circularity enablers focus on factors that help businesses succeed, such as partnerships, supportive policies, or access to local materials.

These findings will be then compared to the existing literature. By doing so, it will be possible to see where this study aligns with previous research and where it brings new insights. This comparison also adds depth to the research and helps make it more complete. It is important to compare real-world experiences with academic knowledge in order to understand where gaps exist and what areas need further research.

One key contribution of this study is that it addresses a gap in the literature. Currently, there is limited research that focuses specifically on how circular innovations can be scaled across different industries. Most academic work either focuses on just one part of the process, such as technology or business models, or it looks at a single case study. This narrow focus limits how useful the findings can be for other industries or situations. As a result, there is little general knowledge about the challenges and success factors involved in scaling circular business models more broadly. There is a common idea that scaling is a one-size-fits-all process that works the same way across industries and business models. However, this is often not the case, especially when it comes to circular innovations. Circular business models come with their own unique set of challenges. In addition to the usual complexities of scaling up, such as production and distribution, these models also have to deal with the complexity of closing material loops. This might include collecting waste, sorting materials, dealing with local regulations, and adapting to the availability of waste streams. These are not small challenges and can create serious barriers to growth. For example, a company trying to reuse waste from a specific region may struggle to find a consistent supply of materials if the waste stream is not well developed or if regulations vary from one area to another. These added layers of complexity make it clear that circular innovations need different strategies compared to traditional business models. Unfortunately, many of these issues have not been deeply studied yet, which means there is a lack of guidance for businesses and policymakers.

To address this, a range of businesses operating in different industries and of various sizes were interviewed. This variety helps to provide a broader picture of the real challenges and opportunities involved in scaling circular innovations. By including diverse perspectives, the study aims to identify patterns and common issues that many businesses face, regardless of their specific field. At the same time, it also highlights unique advantages and opportunities that circular businesses may have compared to traditional competitors. These insights can be valuable not only for business practitioners but also for regulators, policymakers, and other stakeholders. Understanding what helps or hinders circular innovations can guide future policies and programs. For example, if governments know that access to local waste streams is a major challenge, they can create incentives or infrastructure to support that part of the process. In the same way, if certain business

models have shown competitive advantages, those can be promoted as examples for others to follow.

In conclusion, this study adds new and important knowledge to the field by offering a practical view of what businesses are experiencing while trying to scale their circular models. It gives a voice to real practitioners and shows that the path to scaling circular innovation is full of both challenges and opportunities. By sharing these findings, the study wants to support a more informed approach to scaling circular solutions in the future.

## Chapter 2: Literature Review

The literature review was conducted in three distinct steps. The first phase focused primarily on how *scaling* is defined in the existing literature and which related phenomena have been explored to date. In this context, various definitions and methods for measuring scaling were identified and analyzed. The second phase concentrated more broadly on the concept of the circular economy, with the aim of assessing the current state of knowledge and clarifying how the term is commonly defined. In the third step, we examined existing literature specifically addressing the scaling of circular economy innovations. The goal was to identify the most relevant academic contributions that explore how circular economy initiatives can be scaled. This analysis is crucial to understand how the present study differentiates itself from existing academic work. To achieve this objective, a search was conducted on the Scopus database using the keyword combination ["circular economy" AND ("scaling\*" OR "scalability" OR "diffusion")]. This search strategy was designed to capture the most pertinent discussions and insights related to the scaling and diffusion of circular economy practices. To ensure a high academic standard, the search was further refined by including only journals listed in the Association of Business Schools (ABS) journal ranking list, which is widely recognized as a reliable indicator of journal quality and academic impact. The initial search yielded 69 relevant articles. However, to ensure the relevance of the selected literature, a detailed screening of abstracts was carried out to determine whether each article directly addressed the phenomenon under investigation. This process narrowed the selection down to 9 articles that clearly aligned with the focus of this research.

### 2.1 Exploring Definitions of Scaling in Existing Literature

Although there is an increase of interest in literature for the analysis of the term scaling in the entrepreneurial field, there is still a lack of alignment between the different definitions which it is assigned to. In recent years, this phenomenon has increased its importance and presence, especially being boosted by digitalization (Bohan et al., 2024), which has led to the growing importance to define scaling clearly. Digitalization, in fact, has lowered entry barriers, enabled rapid market expansion, and facilitated the creation of scalable business models, especially through platforms, automation, and data-driven strategies. This has heightened the need to define scaling more

precisely. Scaling is not only relevant for businesses but also for policymakers, thanks to the positive impact that it has on productivity and furthermore on job and wealth creations.

Thanks to a literature review performed by Palmié et al., (2023) it becomes clear that scaling is defined on four different variables, which are financial, organizational, market and volume. Moreover, in most cases scaling is used as a synonym of “growth”, especially in the context of policymakers, due to OECD’s definition of High-Growth Firms (HGFs). HGFs are defined by the OECD as the businesses having an employment or otherwise a sales growth rate higher than 20% per year, for 3 years consecutively (Bohan et al., 2024). This growth-oriented perspective, however, only captures part of the picture. A more nuanced view sees scaling not merely as rapid expansion, but as a distinct phase in a firm’s development. In this context, scaling is seen as the businesses which have moved beyond the early stage of experimentation. These businesses, after having identified a viable product or service along with a target market, shift their focus toward a phase focused on expanding their market presence significantly (Duruflé et al., 2018). Scaling was also conceptualized as dynamic organizational capabilities needed for the strategic replication and expansion of internal resources and processes to achieve a rapid and sustained growth (Jansen et al., 2023). In many cases scaling is also intended as the replication of a validated business model (Taupin et al., 2024; Winter & Szulanski, 2001).

Moreover, the definitions of scaling may vary significantly depending on the specific business context. For example, the term “global scaling” defines scaling as the replication of a proven and valid business model across different geographic boundaries (Reuber et al., 2021).

While, if we go back to the actual mathematical definition of scaling, the real difference between growth and scaling becomes clear. In mathematical perspective the growth can be simply understood as any increase in size. On the other hand, scaling is more specifically defined in the mathematical perspective as a system increasing in size proportionally over a time frame, often using an exponential pattern. Differently from general growth, which can happen in any form, scaling involves consistent, repeated proportional increases in inputs and output (Bohan et al., 2024).

The relationship which arises from scaling can be described by the following equation:

$$y = ax^{\beta} + c$$

where the output is given by  $y$  and the input is given by  $x$ . The scaling relationships between output and input variables may be of three different types. The scaling is said to be “linear” when  $\beta =$

1, “sublinear” when  $\beta < 1$  and “superlinear” when  $\beta > 1$ . Those relationships explain how the input and output interact with each other and so how scaling impacts the efficiency. Efficiency in the economic context is described as the maximization of output with the minimization of input. In linear relationships the system remains constant, meaning that there is no change in efficiency. The sublinear relationship is characterized by decreasing efficiency, meaning that for each increase in input the output per unit decreases. On the other hand, the superlinear relation describes a system characterized by an increase in efficiency, meaning that every increase in input is followed by an increase of output per unit (Bohan et al., 2024). These relations are shown in Figure 1.

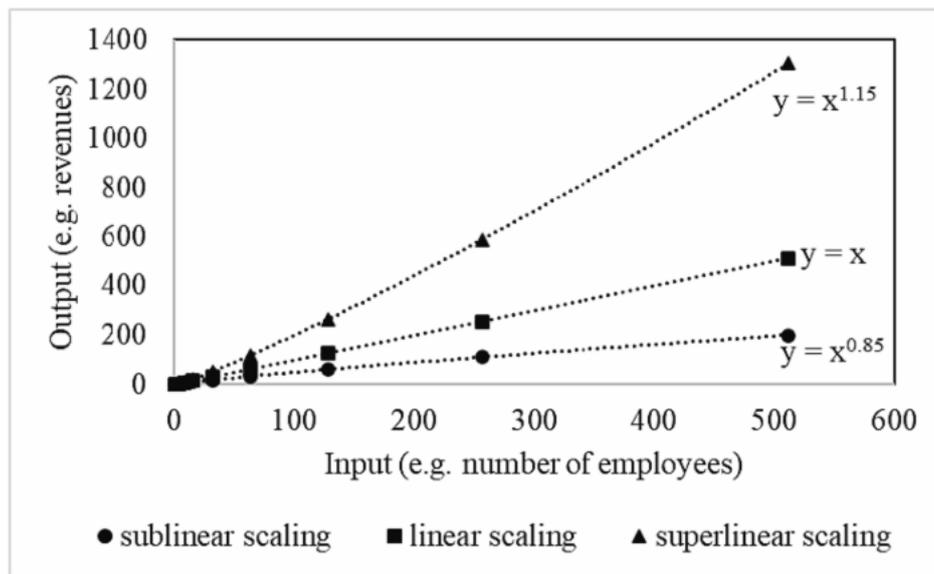


Figure 1 - Example of input/output-based sublinear, linear and superlinear scaling.

Source : Bohan et al., (2024, Figure 3)

The above-mentioned relations demonstrate the importance of scaling in the business context and reveal that good management in scaling activities is a key necessity to increase efficiency and competitive advantage through it. All these definitions explain that the description of scaling may vary across the literature and may vary its sense based on the context we analyze.

Consequently, what can be captured from the literature review is that in most cases, scaling is intended as a growth and expansion of a firm, which can happen in every moment of the firm path. This means that it is not limited to the early or startup phases but can also happen during later stages and most of the time it involves the replication of a validated business model.

Moreover, it is important to mention that the literature agrees with the fact that when scaling a business some special actions should be considered (Bohan et al., 2024). First of all, it is important to mention that scaling should happen once a sustainable and validated business model is identified

(Taupin et al., 2024). In fact, the scale-up phase can be closely related to the replication of a validated business model (Taupin et al., 2024). In order to overcome the challenges of the validation of a business model a methodology has been developed by Ries (2011), this is known as the lean start-up approach. In this approach two mechanisms are highlighted with the ultimate goal of reaching the scale-up phase (Taupin et al., 2024). The first mechanism consists in testing the hypothesis through the help of the “minimum-viable product”, which is a product having a minimal set of activities and ready to be adapted and pivoted based on the feedback gathered from the market. The second mechanism is defined by Eisenmann et al. (2012) as a revised business model that modifies certain components while preserving others. According to the literature review performed by Taupin et al. (2024), the business model validation should happen across six main dimensions. These include customers, organization of the company, value chain, stakeholders/networks, technical design and regulations. The validation of the business model is in fact one of the major challenges of the scaling phase and may be seen from two different perspectives, the start-up perspective and the established firm perspective. In the startup perspective the scaling up is describe by Duruflé et al. (2018), as a stage of development where start-ups have moved beyond the early exploratory period, identified their initial product or service and target market, and transition into a growth phase focused on achieving substantial market penetration. In this phase the business is expected to increase revenues and the numbers of employees and/or customers. While if we concentrate on the established firm perspective, the scale-up phase is intended as the replication of the validated business model, in order to enter new markets and expand the business.

However, scaling a business does not just consist in expanding the market presence or increasing revenues, it involves a deep internal transformation. In the research performed by Bohan et al. (2024), insights obtained from the Delphi analysis performed on entrepreneurial and management experts, reveal four essential attributes that define this transformation: *fundamental modification of inputs and input-output relationships, proactive transformation, well-paced transformation, and sustained innovation*. These interconnected processes influence how companies adapt internally to support, maintain, and drive growth.

At the core of scaling lies a fundamental transformation in how companies manage their inputs, such as labor, capital and technology, and how they convert these into output. This transformation does not just imply an increase of resources, but it rather addresses the need to rethink and redesign how different inputs interact with each other. This leads to the creation of greater value and efficiency. As organizations grow out their businesses, they often have to shift from simple

structures to more formalized and complex hierarchies. This shift is needed to maintain coordination and agility. Although this structural evolution may simplify and enhance the growth of the company, it may also lead to new challenges, such as recruiting capable leaders and aligning operational functions (Bohan et al., 2024). Although scaling is rather a linear process, successful scaling often has as aim a superlinear relationships through technological integration and process optimization.

A further important transformation during scaling is given by its proactive nature. Organizations which scale effectively anticipate the pressures and bottlenecks that come with growth and tend to take actions in advance. This is especially important for digital businesses, where system capacity and human resources must scale together. In this way they can support together the rapid customer adoption and market penetration. The adaptation to changes in the external market represents an essential feature for the company's survival. However, what really differentiates high-growth companies is their ability to proactively transform internally. This leads to reduced disruption and inefficiency. At the same time, it is highly important to avoid the mistake of making too many changes too rapidly or without coordination. This may lead to unnecessary complexity and hinder the company's ability to scale. This is why the third important element to consider for internal transformation is the pace at which it occurs. Uncontrolled or too rapid change can overwhelm management, causing confusion within the organization and ultimately hinder growth (Bohan et al., 2024). On the contrary, transformation that is paced appropriately allows the organization to build capacity and resilience incrementally. Successful scaling consists of aligning the pace of the internal changes with the company's growth rhythm. It starts with slow, steady progress to establish a solid foundation and then accelerate once systems and structures are consolidated. This approach prevents managerial burnout and operational breakdown, while ensuring that the company is ready to handle scale at each stage. Implementing the right time to pace transformation also helps to maintain stability and allows leaders and employees to adjust to new roles and processes set in place. This demonstrates that scaling is not just about fast growth, but about good timing and growing in step with the organizations' readiness and capacity.

Finally, sustained innovation is a crucial driver of long-term scaling success. Growth needs continuous update, not only to keep up with changing customers' needs but also to generate new growth opportunities and prevent the company from stagnation. However, innovation can become more difficult as firms become larger, often this is due to management practices which prioritize safety and efficiency over experimentation and risky actions. But to maintain exponential growth, organizations have to involve innovation into their operations, by fostering a company culture that

embraces change, experimentation and continuous improvement (Bohan et al., 2024). This may include developing new products and services, entering new markets, leveraging emerging technologies and reinventing the business model if necessary. Sustained innovation extends the life cycle of scaling and enables companies to repeatedly refresh their competitive advantage (Bohan et al., 2024).

In the literature it is shown that the replication of a validated business model needs exploration and requires large-scale knowledge transfers. Under this concept we can mention also the “McDonalds approach” which involves establishing and managing numerous standardized outlets that consistently provide specific products or services (Winter & Szulanski, 2001). Moreover, the scale-up phase involves the transition from a stage where the company has not clearly determined which elements are essential for driving growth, to a point where it has established a stable and sustainable growth path. By the end of this phase, the business should rely on a well-defined set of lasting characteristics to support this continued expansion (Taupin et al., 2024), in the case of knowledge transfer those characteristics can also be addressed as Arrow core (Winter & Szulanski, 2001).

This replication strategy can be found in over 60 industries and is becoming “one of the dominant organizational forms of our time” (Winter & Szulanski, 2001). These businesses can generate value by identifying and optimizing a business model. The identification and optimization of the valid business model happens through the selection of key elements required to reproduce it in different geographic areas, and the creation of capabilities needed to standardize the transfer of knowledge. Expanding through replication demands the ability to reproduce complex and partly tacit processes in new, strategically chosen locations, often with different personnel and potential resistance from independent local actors (Winter & Szulanski, 2001). In this respect, the literature identifies two different phases (Bradach, 1997; Schultz & Yang, 1997; Winter & Szulanski, 2001). The first phase consists of the exploration phase to develop and improve the business model. The second phase is given by the exploitation phase, where the model is stabilized and scaled through replication. The shift between these phases is crucial and requires the development of capabilities to support consistent and repeatable growth. The importance of finding a balance between these two phases should also be considered for the organization’s long-term survival. However, this balance is often difficult to maintain because of various factors that favor exploitation over exploration (Winter & Szulanski, 2001). According to Winter & Szulanski (2001), the replication strategy finds its base on two main components which are “the broad scope of knowledge transfer” and the focus on “dynamic capabilities of the center” (Winter & Szulanski, 2001). The broad scope of knowledge transfer defines a significant shape or transformation of the organizational environment. This is

important in the replication strategy as it assesses the creation of outlets that have the capability to produce their products or services locally. The creation of those outlets typically involves transferring a wide range of established and validated routines and practices. The dynamic capabilities of the center involve understanding the key business model elements that have to be replicated in each outlet, the steps needed to reproduce them successfully and deep understanding of the types of markets or environment where these elements will be most effective and valuable. Essentially, it means having the expertise to guarantee that every outlet consistently delivers value by applying validated methods by applying and adapting them to their specific environment.

It is important for the replication strategy to also mention the Arrow core, which represents the ideal set of information a replicator needs to successfully reproduce a specific business model. Named after economist Kenneth Arrow, this concept builds on his idea that knowledge is both a key resource and a challenging asset to transfer. It involves all the local knowledge, which is crucial for the value creation through replication, including the identification of replicable features, the processes to successfully replicate them and the optimal conditions needed. In essence, it provides a complete guide on what to replicate, how to replicate it and where replication will be most valuable. This knowledge is improved and enriched by intensive use, leading to the accumulation of valuable insights. The main goal is to replicate only the valuable and cost-effective aspects of the business model, in order to avoid the elements which, offer little benefit or are harmful. The strategy focuses on accurately reproducing the key traits and selecting the location with the right combination of inputs, resources, and output, market demand.

The successfulness of the replication strategy depends on the two main activities which are effective exploration to discover the Arrow core, and the exploitation through the replication. Replication is most profitable when the true Arrow core is accurately and precisely implemented as it only contains the information that contributes positively to the replication success and excludes all the harmful and/or irrelevant elements. However, the replicator initially lacks a precise understanding of what the true Arrow core consists of. That is why in the early stages, the primary focus should be experimenting with various templates to uncover and define the true Arrow core. Once the Arrow core is implemented by the replicator, the *replication dilemma* can be encountered. The replication dilemma is based on two main scenarios that may arise. In the first scenarios the Arrow core is precisely replicated through a rigid replication approach. In this case the main risk lies in replicating unnecessary or harmful features which may increase costs and hinder learning and innovation by slowing down improvement. These issues remain critical in time because a strict replication may prevent discovery of the true Arrow core. On the other hand, in the second scenario the new outlet is

given more flexibility in order to adapt the established model to fit local conditions. However, when the model is complex and unclear, this flexibility may increase costs and slow progress. Adapting the model can also introduce new challenges that require costly, local trial and error to resolve, which can in turn hinder rapid and profitable growth. Therefore, the replication dilemma consists of finding a balance between the benefits of precision and the opportunities learning adaptation. The core strength of replication strategy lies in the ability to scale quickly across broad markets, rather than generating high return per unit or ensuring long-term sustainability (Winter & Szulanski, 2001).

An important question about replication strategy is under what conditions it remains sustainable, meaning whether resources can be easily copied but still resist imitation enough to maintain a competitive advantage. Many assume that the Arrow core is visible and accessible to everyone. This is not the case as this core is complex and largely hidden. Often it involves tacit knowledge, which is hard to explain or document and can only be learned through practical experience. Despite these challenges, replication strategies can be profitable due to several knowledge-related advantages. The core strength of a replication strategy lies in its ability to scale quickly across broad markets, rather than generating high returns per unit (depth) or ensuring long-term sustainability (length). Even when imitation is possible but costly, setting prices low enough to discourage copying can lead to lower margins but higher overall profits due to scale and enhanced sustainability.

There are four main reasons that make replication strategies successful. The first reason is that the replicator benefits from privileged access to a working example of the successful business model, known as the template. This template includes routines and practices that are often tacit and can only be learned through practical training with specialized equipment. Because this knowledge is complex and partly hidden within local outlets, imitators who rely only on public information or manuals face significant barriers. This makes accurate replication costly and difficult and gives the replicator a clear advantage. Secondly, over time, the replicator gains experience and develops specialized capabilities that improve the efficiency and speed of replication. That is why it is not enough for competitors to copy a single outlet, whereas they should build the organizational ability to open new outlets as effectively as the replicator does. These higher-level capabilities, built from learning and investment, are less visible and harder for imitators to acquire. The third advantage that the replicator has over imitators is the first-mover advantage in obtaining prime locations. Since good sites are limited and differ significantly, early entry allows the replicator to acquire them at favorable prices, so that imitators are left with less attractive options. This positional advantage, combined with scale economies, could even discourage competitors from entering some markets

entirely. Finally, the last advantage relies on the fact that the replicator is a well-established organization focused on replication. Therefore, it benefits from extensive experience and strong knowledge-sharing capabilities. The organizational history and culture that the replicator has provide a much deeper understanding of critical knowledge compared to new entrants or imitators who need to build replication skills from scratch (Winter & Szulanski, 2001).

It is also important to mention that replication is not an on-time knowledge transfer but rather an ongoing progress. It involves the recreation of complex and often casually ambiguous routines across new locations and maintaining them over time. This continuous knowledge transfer happens both in a spatial dimension, which means across multiple outlets, and in a temporal dimension, as the organization adapts and sustains routines despite the challenges that they may encounter such as employee turnover. Moreover, tacit knowledge, such as specialized skills passed only through practical training or apprenticeship, plays a key role in replication. Its transfer presents unique challenges because it cannot be fully captured in manuals or codified instructions. For this reason, successful replicators must develop dynamic capabilities which enable them to identify optimal new locations, adapt routines as needed and sustain competitive advantage through continuous learning. Replicating organizations offer valuable models to understand knowledge management, as they illustrate how firms can effectively manage complex knowledge assets and overcome difficulties related to transfer and maintenance of such knowledge across space and time. Overall, it becomes clear that replication is not simply about copying but rather requires significant managerial expertise and dynamic capabilities. This is the reason why replication gives firms a powerful source of competitive advantage by enabling them to exploit their unique knowledge resources at scale (Winter & Szulanski, 2001).

In the study of DeSantola & Gulati (2017), scaling is presented as one of the most critical and complex challenges entrepreneurial ventures face. It refers not only to the replication of existing processes at a larger scale, but also to managing the new scope of activities that emerge as organizations grow (DeSantola & Gulati, 2017). Unlike mature firms, entrepreneurial ventures often lack the resources and experience to manage scaling smoothly. As they typically operate under conditions of uncertainty, such as rapid technological and market shift, this makes scaling especially difficult and thus failure to manage organizational growth often translates directly into failure to survive (DeSantola & Gulati, 2017). Two contrasting narratives that dominate scholarly perspectives on scaling can be identified. The *endurance narrative* emphasizes the persistence of founding conditions (DeSantola & Gulati, 2017). Early choices about how a company is set up, who's on the team, and what the culture is like can have a long-lasting effect. As the company

grows, these first decisions continue to influence how it operates, making scaling a matter of working with the patterns already in place. (DeSantola & Gulati, 2017; Eisenmann et al., 2012; Taupin et al., 2024; Winter & Szulanski, 2001). By contrast, the *change narrative* highlights the transformative effects of growth. Scaling requires ventures to dramatically adapt their internal organizations, moving from informal, founder-driven structures to more formalized systems (DeSantola & Gulati, 2017). This often entails the replacement of founders by professional managers, the creation of specialized roles, and shifts in organizational culture from flexible and personal to more formal and institutionalized (Bohan et al., 2024; DeSantola & Gulati, 2017). The dynamics of scaling are examined along three dimensions: organizational design, team composition, and organizational culture (DeSantola & Gulati, 2017). In terms of design, ventures evolve from fluid and informal role structures toward more formalized hierarchies to address complexity. In team composition, they often shift from founder-led management toward professionalized executive teams, sometimes under pressure from investors. In culture, early values and shared norms may endure, but scaling can also force changes toward broader, more institutionalized forms of organizational identity (DeSantola & Gulati, 2017). The study of DeSantola & Gulati (2017) argues that scaling is a balancing act between continuity and transformation. Ventures that retain too much of their founding structure risk rigidity and inefficiency, while those that change too much risk losing their identity and vision. This aligns with the overall literature and leads to the conclusion that successful scaling lies in managing the balance between preserving elements of the original entrepreneurial DNA while adapting the organization to handle new challenges.

A key insight which arises from the literature on business model scaling is between two distinct but complementary strategies, which are *breadth-scaling* and *depth-scaling* (Hermans et al., 2016; Hultberg, 2025). These approaches represent different pathways to achieve growth and impact, in particular in the context of sustainable and circular business models (CBMs). Breadth-scaling, often referred to also as scaling out, involves expanding the organization's operations, such as increasing turnover, entering new geographic markets and addressing a larger customer base. This approach is mostly addressed in traditional management literature, where the emphasis is set on efficiency, replication and standardization. The core idea behind this scaling strategy is that by expanding the presence of an organization and thus reaching more customers effectively, revenues may grow. When implemented properly, this strategy can lead to an increase in efficiency, by increasing output while decreasing the amount of input required per unit (Hultberg, 2025; Pal & Gander, 2018). This growth can be achieved through the replication strategy across different regions or to new target groups. On the other hand, depth-scaling focuses not merely on organizational expansion but rather

on fostering cultural, behavioral and institutional change. This form of scaling is mainly rooted in the social innovation and sustainability literature, where success is not just measured by growth metrics, but rather by the ability to foster systematic transformation. For this reason, depth-scaling strategies aim to shift societal values and norms, while influencing customer behavior and challenging existing institutional framework which hinder sustainable development. Together breadth- and depth-scaling provide a comprehensive and complementary framework to understand how circular business models can grow while remaining aligned with their core sustainability missions. Breadth-scaling ensures economic profitability, while depth-scaling addresses long-term cultural and institutional support for circular practices. Effective scaling, especially in the context of circular businesses, requires a balance of these two approaches, growing and scaling the business while simultaneously reshaping the ecosystem in which the company operates (Hultberg, 2025).

Important is also to mention the study of Goworek et al. (2018), which explores how sustainability challenges are deeply tied to the issue of scale. In the study it is shown that moving between the individual, organizational, and global levels is far from straightforward, especially for sustainable businesses. Rather than seeing scale as a simple ladder where local practices can be extended to larger arenas, the authors emphasize that each level, micro (individual and consumer decisions), meso (organizations and industries), and macro (global systems and regulations), has its own dynamics that interact in complex ways (Goworek et al., 2018). At the individual or local level, dominant business and marketing logics encourage consumption, growth, and novelty. These pressures lead to patterns of overproduction and waste, while consumers are expected to bear the moral responsibility for making sustainable choices. Nevertheless, consumers' decisions are constrained by systemic factors such as investment logics and managerial obligations to shareholders, which often prioritize financial returns over ecological concerns. Managers therefore face a dilemma: they have to balance sustainability goals with business demands, even when investors have not clearly asked for it (Goworek et al., 2018). At the global level, regulation becomes critical. Agencies such as Environmental Protection Agencies (EPAs) have not only to ensure firms comply with environmental laws but have also to stimulate innovations that reduce environmental harm. This dual role is demanding, particularly because small-scale innovations developed in one place may be difficult to adopt elsewhere. Voluntary environmental agreements and eco-innovation awards can help, but they also risk being seen as additional burdens by businesses. Moreover, initiatives that succeed locally often require global visibility to inspire adoption in other regions (Goworek et al., 2018). Moreover, the study questions the traditional business view of scaling, which assumes that practices can be replicated and enlarged without

significant changes. This mindset, borrowed from economies-of-scale thinking, can flatten important differences. For instance, when diverse energy technologies are evaluated only by their carbon output, social and political implications, such as the risks of nuclear power versus the decentralized nature of biomass, are obscured. While such simplification allows projects to be compared and expanded, it does so at the cost of ignoring diversity and local specificity (Goworek et al., 2018). A more robust approach, the authors argue, is to think of scaling as the creation of networks that connect local actions. Instead of enforcing one universal solution, scaling can be achieved through building alliances and associations that link different contexts. This perspective recognizes that every action is rooted in a local setting, and the challenge lies in connecting these actions in ways that allow them to align across multiple places without erasing their uniqueness (Goworek et al., 2018). The overall conclusion emerging from Goworek et al. (2018) is that scaling sustainability cannot be reduced to replication or uniform expansion. The effective responses to climate change depend on recognizing how local, organizational, and global dimensions are interdependent. Moreover, progress is most likely when sustainability is scaled through networks of connected actions and it is facilitated by intermediaries that build bridges across sites. Such an approach avoids the pitfalls of imposing a single global logic and instead values multiplicity, difference, and context-sensitive adaptation (Goworek et al., 2018).

## 2.2 Circular Economy and Circular Business Models: Key Insights from Literature

Circular Economy has gained increasing importance in recent years and has garnered significant attention from both scholars and practitioners, as it is seen as a practical approach for business to implement the widely discussed principles of sustainable development (Ghisellini et al., 2016; Kirchherr et al., 2017; Murray et al., 2017). Nowadays, the classical view of organizations is the linear economy consisting of the take-make-dispose pattern (Ellen MacArthur Foundation, 2014). In this view, businesses extract raw materials by then transforming those into products. After having sold them to consumers, they typically are thrown away once they are no longer useful (Ellen MacArthur Foundation, 2014). This linear model has brought an increase in waste generation and the uncontrolled exploitation of resources. Circular Economy represents a valuable alternative. In this approach waste is treated as a valuable input for new processes. This led to the so-called closed loop system, which decreases the waste, and the resources used within industries, as shown in Figure 2 (Stahel, 2016). This model is a significant shift from traditional production mainly centered only on economic profitability, to strategies who value long-term profitability of the

company. It does not consider only the economic dimension but rather focuses also on the environmental and social ones. This model emphasizes the use of strategies such as reuse, recycling, repair and remanufacturing to extend the lifecycle of the products. Research performed on seven European countries suggests that the transition to a circular economy could cut greenhouse gas emissions by up to 70% and increase employment by approximately 4% (Stahel, 2016).

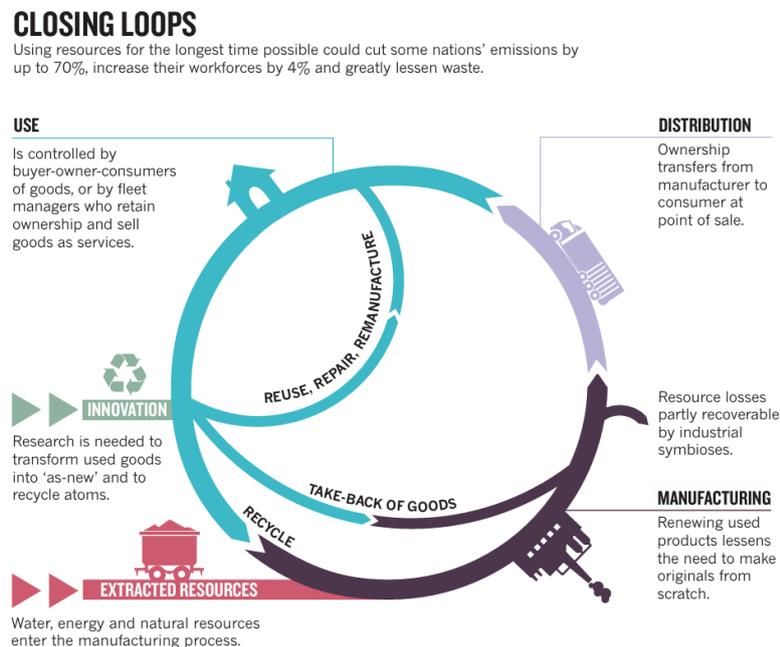


Figure 2 - Closing Loop.

Source: Stahel, (2016, p. 436)

The circular economy is an industrial model which has as primary objective the restoration and the regeneration of the environment through business activities (Ellen MacArthur Foundation, 2014). It focuses on three main principles. As the first principle, it tries to eliminate the concept of waste entirely. Products are intentionally designed and optimized to be disassembled and reused, in this way waste is not generated. Secondly, the circular economy clearly distinguishes between a product's consumable elements and its durable part and treats them according to its intended lifespan and function to assure the maximization of the lifecycle of each component. Thirdly, the energy which drives the production cycle should come from renewable sources, to reduce reliance on finite resources and enhance the system's ability to withstand disruptions, such as fluctuations in oil supply (Ellen MacArthur Foundation, 2014). Consequently, Circular Economy may be described as an economic model that replaces the traditional "end-of-life" concept with strategies focused on reducing, reusing, recycling and recovering material through the value chain. It functions across three different levels: micro, macro and meso (Kirchherr et al., 2017). The micro level focuses on individual products, companies and consumers. The macro level focuses on cities, regions, nations

and beyond. While the meso level is about eco-industrial parks and finding synergies among industries. The goal consists in supporting sustainable development by promoting environmental health, economic growth and social equity for both present and future generations. Moreover, this system is driven by innovative business models and conscious consumer behavior. It is important also to mention the 9R strategies which constitute a key element of Circular Economy. Those strategies represent the nine ways in which a product’s lifespan can be extended. As shown in Figure 3, the 9R strategies can be listed based on the impact that they have on circularity, moreover they can also be grouped based on the impact they have on the product itself.

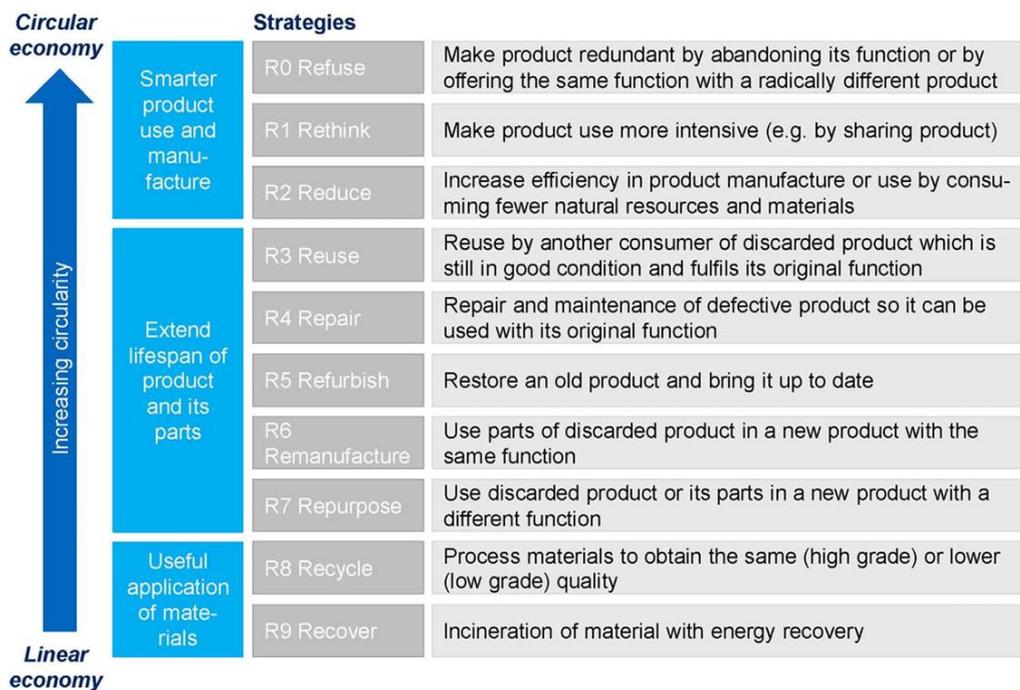


Figure 3 - The 9R Framework.  
Source: Kirchherr et al., (2017, Figure 1)

The first strategy is refuse, which involves rejecting harmful materials or unnecessary products by replacing them with safer or more sustainable alternatives. An example could be refusing the use of plastic, by opting for more sustainable products. Afterwards it can be founded the rethink strategy, which encourages a fundamental shift in how products are designed and used, such as moving from ownership to shared-use model. The reduce strategy on the other hand aims to lower resource consumption and waste by improving efficiency and minimizing the use of raw material and energy. An example can be given by the use of renewable self-produced energy or the machinery optimization, to use less resources. Reuse strategy extends a product’s life by using it again in its original form, this is usually done through second-hand shops, where products are sold and continue their life instead of being thrown away. The repair strategy restores back broken or damaged products to their original working condition although this does not always lead to their original

performance or quality. Refurbish consist in bringing products back to good condition by replacing key components and making aesthetic improvements without the full disassembly of the product. Remanufacture strategy involves a more intensive process of disassembling and rebuilding the product to restore its full functionality. On the other hand, the repurpose strategy gives a product or its parts a new use which differs from its original function. Moreover, recycle strategy is the process through which waste is transformed into raw material to create new products. An example can be recycled plastic, in this case the products often loose the original products' added value. Finally, recover consists in the extraction of energy remaining useful material from non-recyclable waste, this is most of the time done through methods like combustion or gasification.

There are four primary means by which companies can generate value by taking advantage of cost differences between new and reused materials. The power of inner circle efficiency, means reducing the degree to which a product must be changed in order to be reused, refurbished, or remanufactured (Ellen MacArthur Foundation, 2014). This lowers material, energy, and labor use, and it also reduces environmental pressures like greenhouse gas emission. The second strategy, power of circling longer, involves maintaining products for use over a longer time by renovating them by means of repair and reuse (Ellen MacArthur Foundation, 2014). This ensures that companies reduce the use of resources that would otherwise be necessary to produce new goods entirely, saving energy, materials, and labour. A third value stream comes from cascaded use, i.e., reuse within other segments in the value chain. Cotton clothes can, for instance, be first reused as second-hand wear, later reused in furniture form as fiber-fill, and finally reused even further in buildings for use as insulation. The succession of uses replaces new material at each step, producing substantial savings. Last and above all, pure inputs underscore how crucial it is to have uncontaminated material flows. Uncontaminated materials improve collection and redistribution processes, especially for technical materials. This, in turn, increases the longevity of products and overall material productivity.

An extensive analysis of the drivers and barriers to the adoption of circular economy is performed in the research of Tura et al. (2019). These factors can be grouped into seven categories and each of them encompasses various challenges and incentives. The first factor is the environmental one. Environmental drivers for Circular Economy rise from global pressure to minimize environmental impact. One if the key driver is given by the increasing of resources scarcity, especially regarding fossil fuels and other critical material. Moreover, companies are also driven by the desire to reduce emissions and waste to align with climate change mitigation goals and sustainability values.

The main economic incentive lies in the opportunities for cost savings, innovation, and new revenue streams offered by the Circular Economy. These arise from waste valorization, as companies can reduce costs and thus gain competitive advantages through it. This also creates potential for new business models and service development, especially in areas like digital platforms and waste management solutions. Despite these economic opportunities there are also several barriers. Transitioning to CE models often requires major upfront investment in technology and processes, which can be a major barrier for companies without sufficient resources. Financial risks also play a role. Economic uncertainty and the difficulty of accurately measuring long-term benefit can discourage businesses from investing in circular economy projects. Moreover, resource scarcity presents a further obstacle, as the limited availability of raw material or supporting assets can prevent the implementation of circular economy initiatives. The last economic barrier is given by the dominance of traditional economic indicators, which often prioritize short-term financial returns over long-term sustainability.

Social drivers represent a further key element. Customers and stakeholders are increasingly asking for more sustainable products and practices. This results in a strong incentive for companies to adapt their operations to meet these expectations. Moreover, CE initiatives are also recognized as a way to stimulate job creation and enhance overall economic vitality (Tura et al., 2019). Social factors also present challenges to the adoption of circular economy practices. One major obstacle is that in many markets, customers are either unaware of circular economy solutions or unwilling to pay a premium for them. Additionally, conservative approaches to business practices can be a significant barrier. Many industries remain heavily anchored in traditional, linear models and are thus reluctant to undertake transformative changes.

Institutional factors may drive the implementation of circular economy. For example, supportive policies and regulations such as EU landfill bans and global ISO standards for solid recovered fuels, create a strong institutional driver (Sairanen & Aarikka-Stenroos, 2024; Tura et al., 2019). The reaction is further amplified with the use of subsidies, recycling policies and tax incentives which can further reduce risks and stimulate innovation in circular practices. However, institutional factors may also pose significant challenges to the implementation of circular economy. Complex and conflicting regulations often create confusion and make compliance difficult. Moreover, a lack of governmental support may limit the effectiveness of circular economy implementation. This may result from the fact that many governments and municipia decision-makers lack the necessary knowledge and understanding (Linder & Williander, 2017; Sairanen & Aarikka-Stenroos, 2024; Tura et al., 2019).

The fifth category is given by technological and informational factors. Technological advancements, including cleaner production technologies and digital platforms, are crucial to enhance CE. A key role is played especially by information sharing on the digital platforms which simplifies collaboration and transparency across supply chains (Genus & Coles, 2008; Tura et al., 2019). Yet, technological dimension also provides some barriers. The first obstacle is given by technological immaturity as many emerging circular economy solutions are still underdeveloped, costly or difficult to integrate into existing systems. Moreover, rapid technological innovation can make current investments quickly outdated, adding risk and uncertainty. A further obstacle is given by information management. Many firms lack the systems and processes needed to collect and effectively utilize data related to circular practices (Linder & Williander, 2017; Tura et al., 2019).

The sixth category is given by supply chain factors, as transparency and collaboration are critical for CE success. A strong relationship with partners facilitates the integration of circular practices, while standardization of processes and data sharing supports new value creation. Barriers to circular economy adoption also arise within supply chains. Conflicting interests and values among stakeholders often lead to resistance or a lack of cooperation. Moreover, many circular economy projects also encounter some difficulties in dealing with unclear ownership and responsibility. This arises from leadership and governance structures which are often not well-defined within supply chains. On top of that, many businesses are reluctant to share data due to concerns about confidentiality and potential competitive disadvantages. This limits the potential for data-driven collaborations that are essential to circular initiatives.

The last category that impacts the implementation of circular economy is given by organizational factors. Internally, organizations can use CE as a branding opportunity to improve their sustainability image. Multidisciplinary thinking, flexibility, and incorporation of CE into core strategies can help enable its adoption. The development of internal skills and CE-related capabilities is another compelling motivator. However, there are several organizational challenges that impede the adoption of circular economy practices as well. Siloed operations and rigid structures can limit the cross-functional collaboration that is critical for implementing circular initiatives. Many firms also remain risk-averse by focusing only on short-term economic returns while overlooking broader sustainability objectives. Shifting from linear to circular approaches also requires significant changes in both operations and organizational culture, which may not be aligned with existing business models. Finally, if circular economy goals are not clearly integrated into the overall strategy, efforts may remain fragmented and underfinanced. This in turn makes it difficult to achieve lasting impact (Tura et al., 2019).

Circular Economy Business Models (CEBMs) can be categorized into two main types. The first one promotes prolonged product use by enabling repair, refurbishment, upgrades and remanufacturing of the product. While the other focuses on recovering material from used products to create new resources and valorize waste through recycling (Stahel, 2016). In literature there are six major circular economy business model patterns identified as shown in Figure 4 (Lüdeke-Freund et al., 2019). The first pattern focuses on extending the product life cycle through services such as repair and maintenance. This service can be offered by Original Equipment manufacturers or external service providers. Some examples may include lifetime warranties or dedicated repair shops. The second model focuses on collecting used products from customers and redistributing them to new customers. In this case businesses may operate through buy-back programs, second-hand shops or online marketplaces. This model increases the life cycle of existing products by finding new customers for existing products and thus keeping them longer in circulation.

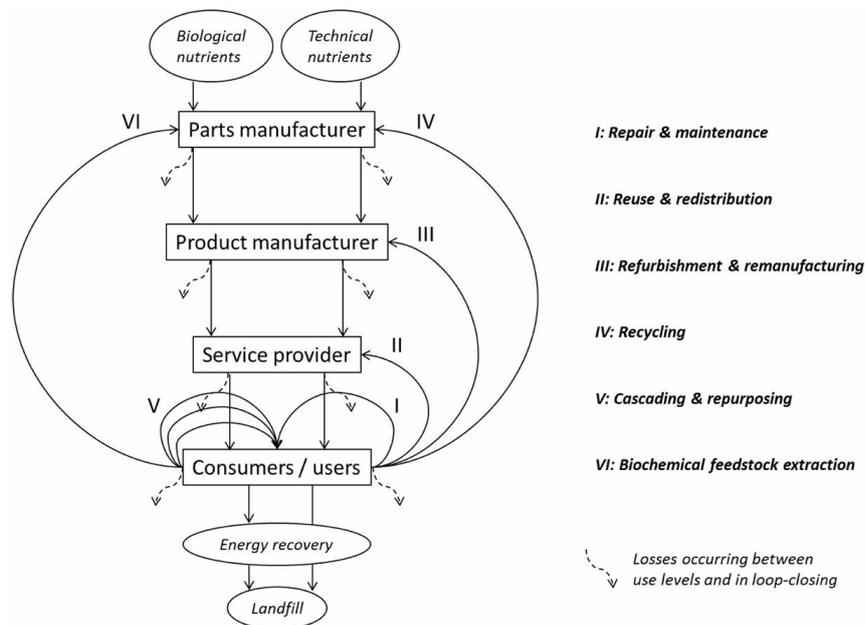


Figure 4 - Major reverse cycles for the circular economy.  
Source : Lüdeke-Freund et al., (2019, Figure 2)

The third model focuses on restoring products to like-new condition, by using strategies as refurbishment and remanufacturing. The strategy of refurbishing typically includes minor repairs and aesthetic improvements, while remanufacturing focuses on deeper work on the product to meet original performance standards. These renewed products are then introduced in specific markets, offering high-quality options with lower environmental impacts.

The fourth model is recycling. This process focuses on reclaiming materials from used products in order to create new ones. It involves collecting, storing and processing waste to recover valuable

resources. These resources can be then reintegrated into production cycle. Through this approach the need for virgin materials is minimized.

The fifth model maximizes the utility of materials by repurposing their use. In this way the use of the materials is enhanced by transitioning them from one product or process to another. This helps to extract maximum value, minimize waste and retain them as long as possible in the cycle. Finally, the organic feedstock model focuses on the use of biological waste and organic materials as inputs for new production processes. Organic waste is converted into compost, bio-based material or bioenergy, this approach supports the use of renewable energy and reduce environmental impacts. It is important that the successful implementation of Circular Economy Business Model goes hand in hand with Closed-Loop Supply Chains (CLSCs). These are the logistical and operational core, which facilitates the collection and reintegration of used products and material in the production process (Lüdeke-Freund et al., 2019). CLSCs manage the physical flows, which involves returning product to manufacturer and reintegrating material into new production cycles. On the other hand, CEBMs go beyond the logistics. They focus on the entire business logic, such as offer and customer relationships. In essence, CLSCs enable the practical flow of material, whereas CEBMs define the overall strategies and business practices that integrate circular thinking in the operations. Consequently, moving to a circular economy requires companies to change the way they manage their supply chain by introducing various forms of reverse cycle. This shift also requires a new point of view on how value is generated and delivered to customers. In this context, the business model plays a crucial role. Improving supply chain to make the business model more efficient and achieve the closed loop is a crucial step, however it is not sufficient. The creation of a right business model to support these changes is essential to stand out (Lüdeke-Freund et al., 2019).

Literature has also analysed the uncertainties and difficulties for CBMs implementation. Firstly, customer type restrictions highlight that only certain customers are likely to accept remanufactured products, such as those focused on cost savings or environmental impact (Linder & Williander, 2017). Secondly, technological expertise is often needed to restore products to their original or better condition, which requires significant knowledge (Berchicci & Bodewes, 2005; Linder & Williander, 2017). Third, return flow challenges refer to the unpredictable timing and volume of returned products. This complicates the planning for reuse or remanufacturing (Linder & Williander, 2017; Östlin et al., 2008; Ravi & Shankar, 2005; Seitz, 2007). Fourth, product category restrictions show that only some types of products are suitable for remanufacturing, particularly those that are factory-made, stable in technology, and have a high value in returned components (Linder & Williander, 2017). There is also the risk of cannibalization, where remanufactured

products reduce the demand for new products (Guiltinan, 2009). Another issue consists in fashion vulnerability, since customer prefer new model, this can undermine demand for reused products (Linder & Williander, 2017). Additionally, capital tied up in products leased rather than sold increases financial risk for producers (Linder & Williander, 2017). Operational risk is also problematic, as manufacturers take on more responsibilities traditionally handled by customers. Finally, lack of supportive regulation can create barriers, since current policies often favour linear production models (Linder & Williander, 2017; Tura et al., 2019). Partner restrictions further complicate implementation, as retailers or service partners must be aligned with the CBM to ensure its success.

## 2.3 Exploring the Literature on Scaling Circular Economy Innovations

The concept of CE has emerged as a transformative alternative to the traditional linear economy, which has now become clear to not be sustainable anymore. It focuses on minimizing waste and keeping resources in use for as long as possible (Kirchherr et al., 2017). The idea of moving towards a regenerative system has evolved to address various aspect of production, consumption and resource management across different sectors. Lin et al. (2025) argue that blockchain technology plays a key role in supporting circular innovation, as it offers a valuable instrument to increase transparency, traceability and accountability in supply chains. It is highlighted how blockchain can reliably help track material and product life cycles, however they warn about challenges like technical complexity and regulatory uncertainty. These challenges need to be overcome through cross-sector collaboration and further research (Lin et al., 2025). Digitalization plays a key role in simplifying the election and inspection of end-of-life products for remanufacturing (Franzè et al., 2023). By digitalizing data, companies may better identify which items are worth remanufacturing. This reduces uncertainty and inefficiency, by leading to faster and more cost-effective remanufacturing decisions. It results in a better product quality and enhances the overall upstream efficiency. On the other hand, digitalisations cannot directly ensure the scalability of downstream activities like repairs, testing and resale (Franzè et al., 2023). In fact, digitalisation creates new organisational dependencies and complexities which makes knowledge transfer and decision-making harder. The solution could be given by moving from a linear supply chain model to a platform-based model in order to promote collaboration and data sharing across all the stakeholders (Franzè et al., 2023).

A further challenge is proven in the research of De Pascale et al. (2021), which provides a detailed analysis of over 61 different metrics across micro, meso and macro scales. In this analysis it is stated that while diversity of indicators reflects complexity and flexibility of CE practices, it also creates challenges in standardizing evaluation and communicating results to stakeholders (De Pascale et al., 2021). Rocca et al. (2023) support this view by identifying that, despite increased interest in CE practices, most initiatives remain pilot projects or early-adopter experiments. This is mainly due to organizational and technical barriers that make it hard to integrate CE practices throughout entire production processes (Rocca et al., 2023). The scaling of CE practices is crucial for transitioning from isolated innovations to system-wide change. In the study performed by Rocca et al. (2023), three main ways through which circular practices scale have emerged, each contributing uniquely to the diffusion and adoption of CE principles. One of the most impactful approaches to scaling circular practices is intersectoral collaboration. In this approach companies, often from different industries, come together to find synergies.

This idea is captured in industrial symbiosis. Here, one company's waste or leftover materials become valuable resources for another. These partnerships usually happen at a mid-scale, beyond just one company, and involve building networks of businesses that work together towards a circular economy. These partnerships help businesses address resources, expertise, and the costs of putting circular practices into action. They also show the power of working together. Sharing the knowledge and sharing their resources enables them to move from a "take-make-waste" approach to a circular one. This way of scaling up is especially helpful in industries that have similar types of waste, like plastics, rubber, and other materials. A second strategy for scaling CE practices involves building local or regional circular value chains, often referred to as "km0" approaches (Rocca et al., 2023). Here, companies focus on local supply chains, local resources, and local employment, which not only reduce transportation impacts and costs but also foster trust and shared responsibility within local ecosystems. When companies put circular practices into action locally, it is easier to find partners and collaborators nearby. This not only supports the local economy but also makes it easier to manage how resources flow. In addition, this proximity often aligns with consumers' preferences, products that are locally sourced and environmentally friendly. All of this can help more businesses adopt circular models and keep things growing. The third pathway to scaling circular practices is through the creation of new business entities dedicated to circularity. These are typically new companies or spin-offs that fully integrate circular principles into their core business model. This approach is particularly relevant when it is too complex or costly to apply circularity across an existing firm's entire operations. By creating a new, specialized enterprise, companies can

more easily test, refine, and scale circular solutions. These circular enterprises often rely on “parent” companies to supply them with waste materials that become raw inputs for their production processes. It is important to mention that this strategy allows for gradual scaling: once these specialized circular businesses demonstrate success, their practices and learnings can inspire broader changes within the parent company or even across their sector (Rocca et al., 2023). In order for these scaling pathways to be successful several key factors must be present. Firstly, there must be clear economic and environmental advantages, such as cost savings, resource efficiency, and emissions reductions (Rocca et al., 2023). These tangible benefits make circular practices more attractive to companies and help justify the investment in new business models. Secondly, compatibility with existing business models or sector-specific needs is crucial (Rocca et al., 2023). Circular initiatives that align with the core activities and values of a business or industry are more likely to be adopted and scaled effectively. Thirdly, trialability plays a significant role in scaling (Rocca et al., 2023). Companies must have the ability to test circular practices on a smaller scale before committing to full implementation. This helps reduce uncertainty and allows firms to assess the benefits and feasibility of circular approaches. Equally important is the visibility and communication of these circular practices (Rocca et al., 2023). When the results and benefits of circular initiatives are clearly shared, they can inspire others to replicate or adapt similar practices, creating a ripple effect throughout the market. Finally, while most circular practices are currently driven by private initiatives, supportive policies and incentives are essential for wider diffusion (Rocca et al., 2023). These policies, although currently limited, can help overcome financial and regulatory barriers, especially for smaller enterprises that may lack the resources to invest in circular innovations independently.

Hofmann & Zu Knyphausen-Aufseß (2022) highlight that experimentation capabilities are central to the successful scaling of circular business models. These practices allow firms to learn quickly, adapt to new challenges, and integrate circular practices more deeply into their organizational culture. The first capability that needs to be established is contextualizing. This means that the organizations need to pay attention to what is happening around them by spotting external trends and implementing these insights into their strategy. For instance, they might integrate circular economy (CE) trends with advances in digital tools and sustainability efforts. Second, they have to rethink how they work internally. Dynamic co-structuring means building and managing a circular innovation system (CIS) that fits within their current structures. This helps them stay flexible and overcome the weight of old habits. Third, they must pay close attention to the often-overlooked

intangible assets, like knowledge, relationships, and trust. Managing these well is critical for taking circular business models from pilot stages to full scale.

Scaling these new models is not easy. It requires breaking free from the old, linear ways of doing business and creating space within the organization for CBMs to grow (Hofmann & Zu Knyphausen-Aufseß, 2022). Sometimes, this means setting up in-house start-ups or autonomous teams that can experiment more freely. Balancing the old and the new, also known as organizational ambidexterity, is a key element (Hofmann & Zu Knyphausen-Aufseß, 2022). Companies need to keep their traditional operations strong for short-term stability while also investing in “lifeworld laboratories” (Hofmann & Zu Knyphausen-Aufseß, 2022) to test and grow circular models for long-term success. Scaling also involves building new strategic partnerships across industries. This may include the collaboration on access control technologies or digital infrastructure (Hofmann & Zu Knyphausen-Aufseß, 2022). These cross-sector alliances create new market opportunities and accelerate growth. Throughout this process, management of intangible assets, like trust, brand reputation, and legitimacy, becomes crucial. It is important to notice that companies should shift from just chasing profits to focusing on learning. This is especially relevant in the early phases of CBM experiments. Challenges should be seen as opportunities to learn and adjust, which create the way for a more circular and resilient future (Hofmann & Zu Knyphausen-Aufseß, 2022).

This emphasis on experimentation and dynamic adaptation connects with the work of Coppola et al. (2023) in the Italian textile industry, which is recognized as one of the country’s most polluting and resource-intensive sectors. Despite the CE’s potential for sustainability, the industry still faces significant challenges in closing the loop of production and addressing pollution and resource inefficiencies (Coppola et al., 2023). The study points out that transitioning to a circular economy does not just involve new technologies or materials, but it also requires fostering internal practices and enhancing collaborations throughout the supply chain (Coppola et al., 2023). Moreover, the significance of both internal and external initiatives is highlighted. Internal initiatives may address employee engagement and organizational restructuring while external ones may include co-creating solutions with partners and customers in realizing circular goals. Coppola et al. (2023) also argue that dynamic capabilities, like the ability to identify opportunities, capitalize them and reconfigure value chains, are crucial enablers for adopting circular business models. Additionally, the importance of working closely with downstream partners and addressing technical challenges is highlighted.

Meanwhile, Marrucci et al. (2021) focus on the human side of scaling circular practices and show that green human resource management (GHRM) practices, such as green training, green recruitment, and employee involvement in environmental initiatives, are crucial to internalize circular values in firms. It is revealed that GHRM practices significantly enhance the circular economy performance, environmental performance, economic performance, and environmental reputation of EMAS-registered organizations. EMAS-registered organizations include companies, public institutions, and various other organizations that participate in the Eco-Management and Audit Scheme (EMAS), a voluntary environmental management initiative established by the European Union. Specifically, green recruiting and the involvement of employees emerge as the most influential practices in improving circular economy performance, while green training also contributes to environmental performance and reputation but does not significantly impact circular performance (Marrucci et al., 2021). On the other hand, green appraisals and reward systems have less impact on sustainability performance but do help improve the financial bottom line (Marrucci et al., 2021). Interesting to notice is also that the “circular environment” outside the organization, like customers demand or competitors’ actions, does not really influence impact of GHRM practices on circular economy performance. This highlights the key role of internal organizational commitment in driving sustainability transitions (Marrucci et al., 2021).

In the broader policy landscape, Fitch-Roy et al. (2021) analyze national circular economy regulatory policy packages (CERPPs) in 60 countries. CERPPs are defined as coordinated sets of regulations and policy instruments explicitly designed to implement circular economy principles across sectors. It was found that out of these 60 countries only 10 met the criteria for a full CERPP. Whereas most countries rely on incremental measures, layering CE elements onto existing waste management systems rather than developing entirely new and integrated policy frameworks (Fitch-Roy et al., 2021). This limits the effectiveness of CE policies and weakens their potential to drive transformative change. Optimal CE policy design requires two core attributes: coherence with broader economic and environmental strategies, and the use of genuinely new instruments (Fitch-Roy et al., 2021). However, in their study it becomes clear that many national policies lack external coherence and often rely on repurposed tools rather than innovation. Overall, most current CE policies are incremental rather than transformational. Without bold, coherent, and innovative approaches, CE policies risk becoming superficial and fail their goal to disrupt linear economic models.

The concept of circular innovation scaling emerges therefore as a multi-step process shaped by dynamic capabilities, organizational experimentation, robust policy frameworks, stakeholder

engagement, and digital enablers. While notable progresses have been made in identifying key drivers, such as firms' experimentation capabilities (Hofmann & Zu Knyphausen-Aufseß, 2022), dynamic capabilities within the textile sector (Coppola et al., 2023), green human resource management practices (Marrucci et al., 2021), and the transparency potential of blockchain technologies (Lin et al., 2025), significant barriers remain. These include fragmented indicators (De Pascale et al., 2021), policy incoherence (Fitch-Roy et al., 2021), and technological hurdles. Looking ahead, the successful scaling of circular innovations will depend on integrated, cross-sectoral approaches that align firm-level capabilities with supportive regulatory and technological ecosystems.

Despite the extended existing literature on the topic, there is still a lack of clear guidance on how to scale CE innovations, especially regarding the opportunities and challenges involved in the process. Most of the articles that address this matter, rely on single case studies. This limits the applicability of their insights to different contexts. While it might be assumed that scaling CE innovations is similar to scaling conventional innovations, this is actually not the case. CE innovations differ from conventional innovations in several fundamental ways, particularly in their objectives, scope, and implementation challenges. They must meet specific environmental and systemic standards, which introduce unique complexities that are not typically encountered in traditional innovation scaling. While traditional innovations are generally driven by goals such as profit maximization, efficiency improvement, or product enhancement, CE innovations are driven by the principles of sustainability. They aim to minimize environmental impact, reduce resource consumption, and promote the reuse, repair, remanufacturing, and recycling of materials within closed-loop systems. Another key difference lies in the systemic nature of CE innovations. Whereas conventional innovations often focus on improving a specific product, process, or service in isolation, CE innovations require a broader, system-level perspective. They involve rethinking entire value chains and lifecycle processes to enable circularity. This systemic approach requires a deeper integration across different actors, including suppliers, manufacturers, consumers, and waste management entities. In terms of value creation, conventional innovations tend to generate value through increased sales, market share, or reduced production costs. In contrast, CE innovations derive value from resource efficiency, longer product lifespans, and service-based business models such as product-as-a-service. These models challenge traditional ownership structures and shift the emphasis from selling products to delivering outcomes.

The scaling of CE innovations also presents unique challenges. While conventional innovations can often be scaled by simply expanding production or market reach, CE innovations require supportive

infrastructure (e.g., reverse logistics systems), changes in consumer behavior, and alignment with environmental regulations. Additionally, CE innovations must meet specific standards related to sustainability, lifecycle performance, and circular metrics, requirements that are typically absent in conventional innovation processes. This is why this research makes a relevant contribution to the existing body of literature.

# Chapter 3: Methodology

## 3.1 The Qualitative Methodology

Qualitative research is a powerful approach for exploring complex human experiences by emphasizing meaning, context, and depth over numerical data or broad generalizations. Rather than testing hypotheses or seeking measurable outcomes, it aims to understand how individuals perceive and live their lives. Unlike quantitative research, which focuses on measurement, qualitative research prioritizes the participants' perspective. It values personal narratives, interpretation, and the collaborative creation of meaning between researcher and participant.

Qualitative methodology is a research approach focused on understanding human experiences, behaviours, and social phenomena through non-numerical data. Unlike quantitative research, which relies on statistics and large datasets, qualitative research explores meanings, perceptions, and interpretations. The most common data collection methods include interviews, focus groups, observations, and content analyses. These allow researchers to gather detailed, in-depth insights into participants' perspectives. Rather than testing hypotheses, qualitative research often begins with open-ended questions, using an inductive process to identify patterns and themes that emerge from the data. The subsequent data analysis involves coding and interpreting the emerged themes to build a meaningful narrative.

At the core of Kvale's (2011) approach to qualitative research, is the idea of the interview as a space where knowledge is created. He intends the qualitative interview as a “construction site of knowledge”, where meaning is formed through the interaction between interviewer and interviewee. This co-creation of understanding fits within the phenomenological tradition, which focuses on how people experience the world as they live it, rather than treating experiences as abstract variables (Kvale, 2011). Kvale's method emphasizes the semi-structured life-world interview, designed to gather in-depth accounts of participants' lived experiences. Unlike fixed questionnaires or fully structured interviews, this format allows for flexibility, spontaneity, and deeper exploration. The interviewer starts with a set of guiding themes but can change the order and style of questions based on the flow of the conversation. This adaptability is not a weakness, but a sign of methodological care, as it lets the interview unfold in a way that respects the richness and individuality of human experience. It is emphasized that qualitative interviewing is a craft, not just a technique. The interviewer must learn the art of asking follow-up questions, exploring deeper layers of emotionally

or conceptually rich responses. Other important aspects to consider are recognizing the value of silence and the natural flow of dialogue.

Good interviews balance two key dimensions: the thematic, which relates to the content and aims of the research, and the dynamic, which concerns the quality of interaction and the participant's comfort and engagement (Kvale, 2011). The craft also involves careful preparation, starting with the opening briefing, where the researcher explains the study and builds a relation. The same importance lies in the ending with the debriefing, where participants are encouraged to reflect on the experience and address any remaining questions or concerns (Kvale, 2011). This approach is based on the idea that understanding comes through dialogue. The interviewer is not just an outsider observing, but an active participant in a shared exchange. As it is shown in the research, even short conversations can offer deep insights into identity, memory, and emotion when handled with care and skill (Kvale, 2011). In this perspective, participants are not simply sources of information, but rather active partners in creating knowledge, and their voices and interpretations should be respected and emphasized.

Once data collection is complete, it must be carefully analyzed to ensure meaningful and accurate results. This process is often more complex and sensitive in qualitative research compared to quantitative methods, as it involves interpreting rich, detailed, and often subjective information. A strong example of effective analysis in qualitative research is the Gioia method (Gioia et al., 2012). The work of Gioia et al. (2012) provides a clear and structured approach to qualitative research focused on building theory from data. Their method responds to concerns about qualitative studies that lack depth or clear links between data and conclusions. The Gioia method aims to improve rigor in concept development by blending open-ended inquiry with systematic coding and the creation of abstract concepts. It builds on the grounded theory approach, especially the work of Glaser & Strauss (1967), but adapts it to meet the needs of modern organizational research. The research starts with the idea that participants are "knowledgeable agents" (Gioia et al., 2012) who can explain their own lived experiences. This means researchers must first listen closely and prioritize participants' perspectives, rather than applying existing theories too soon. In the early stages of collecting and analyzing data, the focus is on gathering first-order terms, which consist of participants' own words and labels. These terms are then compared, grouped, and slowly developed into second-order concepts, which are researcher-generated theoretical ideas. These second-order concepts lay the foundation for creating new constructs and, ultimately, grounded theory.

The Gioia method involves various overlapping stages. Researchers begin by conducting in-depth, semi-structured interviews to gather detailed stories about the topic being studied. This closely matches Kvale's approach to interviewing, where the goal is not just to collect answers but to invite participants to share rich, layered experiences. Interviews are recorded, transcribed, and then carefully coded. In the first-order analysis, the focus is on keeping the participants' voices intact and capturing their meanings as clearly and accurately as possible. As more interviews are collected, researchers start to notice patterns and differences in how participants describe things, which leads into the second-order analysis.

The second-order analysis moves the focus from describing what participants said to explaining what it means. At this stage, the researcher takes on a more interpretive role, grouping first-order codes into broader themes and exploring how they relate to one another. This process is repetitive and often complex, involving several rounds of coding, comparison, and refining of the model. The aim is to create a data structure, often a visual and conceptual map of the developing theory, that shows how raw data leads to more abstract ideas. This structure usually has three layers: first-order terms which reflect participants' words, second-order themes which addresses the researcher's interpretation, and aggregate dimensions which refers to broader theoretical concepts (Gioia et al., 2012). This framework not only clarifies how the data were analyzed but also connects real-world observations to deeper theoretical understanding. A key feature of the Gioia methodology is its focus on creating new concepts, rather than just building on existing theories. The method is especially useful for studying complex and evolving issues, like organizational change, identity development, or strategic decisions, that happen over time and do not easily belong to fixed categories. In these situations, Gioia et al. recommend an abductive approach that moves back and forth between data and theory, allowing fresh ideas to emerge while still connecting to existing research. This mix of open-ended exploration and theoretical grounding makes the Gioia method a valuable tool for qualitative researchers aiming to make meaningful contributions to academic discussions.

The strength of this method comes not from numbers or statistical proof, but from the clarity, consistency, and depth of its analysis. Gioia et al. (2012) highlight the importance of showing clearly how findings are grounded in the data. This means not only creating a solid data structure but also sharing results through detailed narratives that include direct quotes, clear explanations of themes, and a grounded model that illustrates how concepts are connected. As it is stated in the research the credibility in qualitative research depends on showing how theory grows from the data, how interpretations take shape, and how emerging ideas link to what was actually observed.

Both Kvale's and Gioia's approaches show a strong commitment to qualitative rigor, even though they focus on different parts of the research process. Kvale highlights the interpersonal and philosophical sides of interviewing, emphasizing empathy, openness, and the ethical duties of the researcher. He views the qualitative interview as a dialogue that demands sensitivity, self-awareness, and moral care. In contrast, Gioia et al. stress analytical precision, clear concepts, and transparent methods. They provide a structured approach for generating credible, meaningful, and theory-driven insights. Together, these two works offer a well-rounded view of qualitative research, one that values both the human side of understanding and the structured process of examination. Furthermore, the combination of both perspectives shows how qualitative research can be both deeply human-centered and carefully analytical. A well-executed interview produces not only personal stories but also theoretical understanding. When these stories are systematically coded, compared, and abstracted, as exemplified by the Gioia method, they can support the creation of strong and useful theories. This dual ability makes qualitative research especially well-suited to capturing the richness and complexity of human experience.

In addition, the ethical and relational aspects of qualitative research are critically important. As Kvale (2011) points out, the interview is a space of vulnerability, where participants reveal personal parts of their lives to someone they do not know well. The researcher's task is not just to gather data but to respect the trust given, listen with care, and think critically about their own role and assumptions. Likewise, Gioia et al. (2012) highlight the need to protect anonymity, safeguard participants' interests, and involve them in the research when appropriate. These ethical concerns are not side issues but are central to the quality and credibility of qualitative research.

This results in the fact that value of qualitative research goes beyond academic settings. By creating detailed, grounded, and context-aware knowledge, qualitative studies can influence policy, guide practice, and shape public understanding. They provide insight into the real-life experiences of people and organizations, revealing aspects that often do not appear in quantitative data.

It was decided to use the qualitative method in this research as it allows to explore complex, context-dependent processes in depth. By conducting semi-structured interviews with CE company founders, rich and detailed insights were gathered about their personal experiences and strategic decisions throughout their scaling journeys. This approach enabled an overall understanding of both opportunities and challenges they encountered. Rather than reducing these experiences to numbers, the qualitative method captured the meaning, emotions, and reflections behind key turning points, offering valuable knowledge on how CE innovations evolve and grow in real-world settings.

## 3.2 Case Description: An Overview of the Various Cases Analysed

To analyze the phenomenon of the opportunities and challenges that circular innovations face when scaling up, seven in-depth interviews were conducted with companies operating in various sectors. The organizations selected for this study differ significantly in terms of industry, size, and maturity. Some are newly established startups still in the early stages of development, while others are well-established firms with a strong market presence and experience in expanding into new geographic regions. This diversity was intentionally selected to provide a broad and representative overview of how different types of companies approach circular innovation and to uncover whether common challenges persist across distinct business models and contexts. Despite their differences, all the companies share two defining characteristics: they are Italian companies, and they are built around circular business models which aim to reduce waste, extend product lifecycles, and optimize the use of resources. The aim of the research is to explore the obstacles and opportunities that circular innovations encounter as they attempt to scale beyond initial pilot phases or local markets. By analyzing a varied set of case studies, the study aims to identify the fundamental themes, success factors, and barriers that frequently emerge in the scaling-up process. This approach not only helps to capture the complexity of the circular economy landscape but also provides insights that may inform both practitioners and policymakers interested in fostering sustainable growth through innovation.

The following subsections offer a detailed discussion of the cases that have been analyzed.

### 3.2.1 Case 1

Founded in 2017, the first company also addressed as Case 1, was established with the aim of revolutionizing the construction industry through a green and circular approach. The company's mission is rooted in the principles of the circular economy, seeking to transform the traditional building sector by introducing an innovative and sustainable production model. This model is designed to recover and repurpose materials that typically present challenges for reuse or disposal, such as glass, ceramic waste, steel and metallurgical by-products, cast iron scraps, and residues from extraction activities like quarrying. Through a proprietary process, these materials are transformed into a wide range of functional products for sustainable construction, thereby reducing reliance on virgin resources and minimizing environmental impact.

Innovation is central to Case 1's identity. The company continuously explores new environmentally friendly solutions aimed at enhancing quality of life while addressing ecological concerns. This

drive for innovation is matched by a strong commitment to sustainability, expressed through the use of advanced technologies and green processes that significantly lower the environmental footprint of construction materials. Responsibility is another foundational value, reflected in the company's dedication to social responsibility and its active role in supporting surrounding communities.

Case 1 operates with an acute awareness of its environmental impact, aligning every stage of its production process with the United Nations Sustainable Development Goals (SDGs). Using a Life Cycle Assessment (LCA) approach, the company ensures that each phase is optimized to achieve the lowest possible environmental impact, placing environmental protection at the core of sustainable innovation. Its green policy enables it to act as a key player in the transition from a linear to a circular economy, producing materials that are not only eco-friendly but also certified as sustainable through rigorous chemical and physical analysis. In doing so, Case 1 directly contributes to SDG 11 on sustainable cities and communities, SDG 12 on responsible consumption and production, and SDG 13 on climate action.

### 3.2.2 Case 2

Case 2 is an Italian company specializing in tailored fruit-based solutions for the Food & Beverage and Flavour & Fragrance industries. Founded in 1985, the company has evolved through a strategic process of diversification and vertical integration, transforming from a provider of complementary products, such as packaging for citrus exporters, into a global producer of natural ingredients. Its operations are centred around high-quality citrus transformation, managing an advanced supply chain that ensures full control over the use of premium juices and other natural components. With more than three decades of expertise, Case 2 is now recognized as a benchmark in the sector, offering not just raw materials but complete, innovative solutions developed in close collaboration with partners to meet market demands. The company's identity is deeply tied to its origins in one of Europe's most significant citrus-growing regions. Over the years, it expanded its product offering from simple citrus pressing to juice concentration, essential oils extraction, and, more recently, the development of aromatic compounds and tailor-made ingredients for both industrial and consumer markets. This expansion was supported by significant investments in production capacity, research and development, and internationalization. With a production facility of 20,000 square meters and a flexible processing capacity that can scale up by 200%, Case 2 can handle 37,500 tons of product annually, operating across multiple high-efficiency production lines. Although its production plant is currently located exclusively in Italy, the company is planning to open a new facility in Egypt to further support its international growth and supply chain flexibility.

The entry of the third generation into the business has marked a new phase of growth, strengthening the family-company bond while accelerating global expansion and innovation. Today, Case 2 distributes its products worldwide, leveraging its strategic location in the Mediterranean basin and direct access to major export hubs. Its mission is to create products that nourish, refresh, surprise, and bring moments of joy, while its long-term vision is guided by a commitment to customers, people, and the planet. The company strives to be a leading partner for businesses aiming to produce successful consumer goods, a workplace where people can thrive, and an active player in building a sustainable future through responsible resource use. Central to its strategy are three pillars: continuous investment in research and development, a strong focus on high-quality Italian citrus and select global fruit sources, and a customer-centric approach that delivers exceptional experience and value. Quality is embedded in every aspect of the business. Through a comprehensive quality management system and numerous international certifications, ranging from FSSC 22000 to Organic, HALAL, Kosher, and Global G.A.P., Case 2 ensures its products meet the highest standards of safety, sustainability, and traceability. Its commitment to organic production is reinforced by the naturally favourable agricultural conditions in southern Italy, which allow for lower pesticide use and greater prevalence of zero-residue ingredients. With its integrated model, global vision, and strong family values, Case 2 continues to anticipate market trends and deliver tailor-made, high-quality solutions to clients across the globe.

### 3.2.3 Case 3

Case 3 was established in 1994 with the goal of commercializing high-quality, Italian-made promotional design objects, also commonly known as “gadget promozionali”. Promotional products are not mere giveaways, they are strategic communication tools used by companies to represent their identity at events, trade fairs, and within broader marketing campaigns. As such, they need to be well-designed, professionally made, and visually compelling. The value of “Made in Italy” remains central in this context: Italian craftsmanship is still widely associated with quality, creativity, attention to detail, and reliability.

However, the founding of Case 3 coincided with the rise of low-cost, mass-produced Chinese products entering the European market. Many of these items imitated Italian designs but were manufactured at significantly lower cost, often with lower quality. As these products flooded the market, the pressure to lower prices became intense. For companies like Case 3, which relied on authentic design and quality production, this surge of low-cost imitation goods posed an existential threat. The business faced the real risk of closure unless it found a bold, innovative way to

differentiate itself. In response, Case 3 made a strategic and transformative decision: it stopped operating solely as a commercial intermediary and began designing and manufacturing its own products independently.

But this shift was not only about production; it was about reimagining the very purpose of the objects. Case 3 no longer focused on creating generic promotional items, but rather on designing *communicating objects*, products that expressed the values, identity, and stories of the companies they were made for. Each object would carry meaning, narrative, and purpose, transcending its function to become a form of visual storytelling.

A key innovation in this transformation was the use of discarded materials, industrial scraps and leftovers that were often provided directly by the very clients who commissioned the products. Instead of treating these materials as waste, Case 3 recognized them as untapped resources rich with narrative potential. By integrating this waste into the design process, the company was able to significantly reduce raw material costs while giving new life to materials that would otherwise have been discarded. This not only aligned with emerging principles of sustainability but also added unique emotional and communicative value to each product.

Depending on the product requested by clients, Case 3 collaborated with existing, well-established manufacturers that had the required machinery and expertise. Although these manufacturers produced exclusively for Case 3 using recycled materials supplied by the company, often derived from the client's own production scraps, they still enjoyed a significant advantage: the increased production volumes allowed them to enhance overall output, improve operational efficiency, and benefit from economies of scale. This made the collaboration economically advantageous for both parties. Case 3, meanwhile, did not have to build new supply chains from scratch, instead, it embedded itself within existing ones, functioning as a strategic link between sustainability, material innovation, and design excellence.

Another strength of this model lays in how the materials were sourced and processed. Case 3 often intercepted scraps and byproducts before they were mixed with other waste streams, making recovery and reprocessing significantly easier. The materials could be cleaned, sorted, and regenerated with precision, in many cases achieving a quality nearly identical to that of virgin raw materials. These regenerated inputs were then used in the production of high-quality, design-driven objects that fulfilled both aesthetic and communicative goals. This circular and collaborative model resulted in a win-win scenario for all involved. Manufacturers increased their output and optimized their resources, clients received unique, meaningful objects that embodied their values, and Case 3

positioned itself as a pioneer in ethical and sustainable design. Although these products cost more than their mass-produced Chinese counterparts, they offered far greater value in terms of brand image, environmental responsibility, and storytelling power, factors increasingly valued by modern consumers and businesses alike.

It is important to note that Case 3 did not start as a company with a sustainability agenda. At the time of its founding, there were no strong regulations or widespread concern about waste management. Instead, the company emerged from a practical observation: that many businesses were throwing away valuable materials simply because they did not know how to reuse them. Case 3 saw an opportunity in this oversight. It realized that discarded materials could be transformed into something new, meaningful, and even superior to conventional products. Over time, this pragmatic intuition evolved into a deeply rooted philosophy. Sustainability, once incidental, became a guiding principle. In 2019, Case 3 formalized this commitment by becoming a Benefit Corporation, embedding its mission to create positive environmental and social impact directly into its legal structure. What began as a response to competitive pressure became a visionary model of circular innovation, where nothing is wasted, and everything is reimaged. At its heart, Case 3 operates according to the Heraclitean principle that “nothing is created, nothing is destroyed, everything is transformed”, embracing this philosophy as a guiding vision for its circular innovation model. Through this lens, every object is not just a product, but a story, one that honors the past of the material and shapes a more conscious, creative future.

#### 3.2.4 Case 4

Case 4 is a sustainable fashion company that was founded in 2017 as a conscious response to one of the most pressing issues facing the modern clothing industry: overproduction. In a sector where fast fashion dominates, driven by mass manufacturing and relentless consumption cycles, the result has been a staggering accumulation of unsold garments, many of which are ultimately destined for incineration. These mountains of wasted clothing are the byproduct of an economic model that prioritizes volume over value, speed over sustainability, and short-term profit over long-term responsibility. The company’s story begins when its founder, then participating in a United Nations development program in Vietnam, witnessed firsthand the environmental and social consequences of this flawed system. Confronted with the vast scale of textile waste and the human cost of mass production, they made the decision to return to their hometown in Italy, an area with deep-rooted traditions in textile craftsmanship and fabric regeneration. In this historic district, once known for turning old materials into new garments out of necessity and wisdom, the vision for Case 4 took

shape. Starting with a successful crowdfunding campaign, Case 4 quickly transformed from an idea into a functioning sustainable fashion startup. The company established its production in the heart of Italy's textile district, not only to benefit from the artisanal expertise of local producers but also to ensure transparency, traceability, and ethical labor practices. Every garment is made with care, using regenerated fibers and sustainable processes designed to reduce environmental impact at every stage, from sourcing to final product. The company rejects the throwaway culture of fast fashion, choosing instead to embrace circular principles that give new life to existing materials and restore value to what would otherwise be discarded. As the brand matured, it attracted growing interest from consumers, investors, and partners who shared its values. Over the years, Case 4 closed two rounds of investment, allowing it to expand its operations and strengthen its position in the market. The team grew to include around 25 people, all aligned with the company's mission to reimagine fashion as a force for good. In 2020, Case 4 became a certified B Corporation, joining a global community of companies committed to meeting the highest standards of social and environmental performance, transparency, and accountability. Today, Case 4 is a thriving example of how fashion can be both beautiful and responsible. Its collections are available not only through its own digital channels but also in over 400 retail stores across the globe. By merging traditional craftsmanship with modern sustainability practices, the company has built a brand that resonates with conscious consumers who demand more from the clothes they wear. Case 4 continues to challenge industry norms, proving that it is possible to scale a fashion business without compromising on ethics, quality, or the health of the planet.

### 3.2.5 Case 5

Case 5 represents a paradigm shift in how materials are sourced, produced, consumed, and reimaged for future use. It is not merely a company, it is a community, a platform, and a philosophy rooted in environmental consciousness and circular innovation. At its essence, Case 5 brings together individuals and brands who believe that the things we own should be durable, meaningful, and ethically made. It stands in direct opposition to a culture of overconsumption, offering an alternative path that values quality over quantity and long-term stewardship over disposable convenience. Through science, transparency, and shared responsibility, Case 5 is reshaping the relationship between industry, consumer, and environment. The origin of Case 5's mission dates back to the late 2000s, when the underlying company began to take measurable steps toward sustainable innovation. In 2007, it published its first sustainability report, establishing a commitment to environmental accountability and corporate responsibility. But it was in 2011 that a

groundbreaking technological advancement propelled the company into the global spotlight. A new regeneration system was introduced that enabled the chemical recycling of nylon waste into a material indistinguishable in quality and performance from virgin nylon. Unlike traditional mechanical recycling methods, which degrade the quality of materials over time, this chemical process restored the nylon to its original molecular structure. This innovation meant that nylon, traditionally derived from fossil fuels, could now be made entirely from waste, and even more radically, be recycled an infinite number of times without loss of quality. It was a moment that redefined the potential of circularity in the materials industry.

The feedstock for this regenerated nylon is as diverse as it is global. Case 5 sources waste from multiple post- and pre-consumer channels. One major source is discarded fishing nets, including ghost nets recovered from oceans and aquaculture waste. These nets, which are among the most harmful pollutants in marine ecosystems, are carefully retrieved and cleaned to extract the nylon content. Another source includes used carpets, up to 72 million pounds annually, which are broken down into their base components: polypropylene, calcium carbonate, and nylon. Textile scraps from manufacturing facilities, unsold inventory, and take-back garments from recycling initiatives also form a critical input stream. These materials, which would otherwise end up in landfills or incinerators, are instead given a second life through the regeneration system. This process is not only environmentally beneficial but also offers a scalable solution to global waste management challenges. Once processed, the regenerated nylon is as versatile as it is sustainable. It can be spun into textile fibers for fashion and apparel, molded into durable components for automotive interiors, or used in carpets and furniture for residential and commercial spaces. From swimwear and jackets to sneakers, rugs, and luxury handbags, the reach of this material spans industries and continents. The regenerated nylon has become a preferred choice for nearly 2,000 brands worldwide, including pioneers in high-performance sportswear, interior design, and automotive innovation. These partnerships are built not only on material quality but also on shared values, transparency, ethics, and a vision for a cleaner planet.

Case 5 does not stop at production. In 2020, it supported the launch of the first fully circular fashion collection designed with end-of-life in mind. This collection marked a significant milestone in sustainable design, showing that fashion could be both high-performing and regenerative. The following year, in 2021, Case 5 reached a major turning point with the launch of a direct-to-consumer digital platform. This online hub brought together responsibly crafted products, educational content, and real-time sustainability insights. It provided consumers with the tools they needed to make informed, ethical purchases, helping demystify sustainability through plain

language and data-backed storytelling. This e-commerce platform was more than a shop, it was a community hub. It became a place where like-minded individuals could learn about the environmental impact of materials, read certifications, and explore case studies from partner brands. The platform positioned Case 5 not just as a supplier, but as a thought leader and advocate for change. It helped close the gap between industrial innovation and consumer awareness by bringing sustainability out of the supply chain and into the hands of everyday people.

In 2023, the reach and reputation of Case 5 took another significant step forward. A prominent luxury fashion house, known for its commitment to ethical and sustainable design, launched its first circular product made entirely from regenerated nylon. This marked the first time a luxury brand had fully embraced circular principles in product creation at a commercial scale. It proved that high fashion and sustainability need not be at odds, that quality and environmental responsibility could not only coexist but enhance one another. By 2025, Case 5 had established itself as a powerful community-driven movement. It adopted a mantra that reflects its ethos: “Individually, we are a drop. Together, we are an ocean”. This expression captures the essence of its model, each individual decision, each responsible purchase, each reused item contributes to a collective impact. This is not a company that sells materials; it offers a way of life, where consumers are invited to think not just about what they buy, but what those products are made of, how they are made, and what happens to them at the end of their life. The regenerative process lies at the center of everything Case 5 stands for. The system begins with the rescue of waste, which is then regenerated through a highly advanced chemical process and ultimately remade into new applications. Unlike virgin nylon production, which is energy-intensive and environmentally damaging, this method avoids the need for crude oil and significantly lowers greenhouse gas emissions. It is not merely recycling, it is the reinvention of material sourcing.

Case 5 also works actively to educate its audiences. It publishes annual sustainability reports, issues detailed brochures on circular design and offers access to certifications and life cycle assessments. It collaborates with design schools, hosts workshops, and supports take-back programs that extend the life of garments. Its efforts are guided by the belief that education is the key to transformation, that people will make better choices when they are given the knowledge and tools to do so. In the broader landscape of sustainability, Case 5 represents a new model, one that is regenerative, transparent, community-focused, and driven by both science and values. It does not seek to be perfect but strives to be accountable. Through collaboration, innovation, and advocacy, it continues to lead by example, showing how circular systems can redefine entire industries. It proves that progress does not have to come at the planet’s expense and that with the right vision, waste can

become the foundation of something better. Case 5 is not just building a brand. It is nurturing a culture where the things we wear, sit on, drive in, and walk across are not the result of exploitation, but of regeneration, intention, and care. It reminds us that sustainability is not a trend, it is a responsibility. And in taking that responsibility seriously, it gives every consumer, every designer, and every partner a chance to be part of the solution.

### 3.2.6 Case 6

Case 6 is a forward-thinking textile start-up that combines scientific innovation, environmental responsibility, and deep appreciation for Italian heritage. Founded by two passionate individuals during their university years at the Politecnico di Milano, the company officially came into being in February 2020. Its name, an anagram of the founders' nicknames, symbolizes the thread, both literal and metaphorical, that connects people, materials, and ideas. With a mission to redefine the relationship between humanity and the environment, Case 6 positions itself at the intersection of technology, design, and sustainability, offering a new vision for the textile and fashion industries. At the heart of Case 6's philosophy lies the belief that innovation must be responsible. The company has distinguished itself by developing textile products using unexpected raw materials, specifically, the powder derived from marble and minerals. These byproducts, typically considered waste within the stone industry, are given a second life as functional, high-performance textiles. The resulting fabrics are not only waterproof, wind-resistant, and durable, but also carry a unique and naturally elegant aesthetic due to the characteristics of the minerals themselves. The colors achieved are entirely natural, without the need for synthetic dyes, and reflect the inherent beauty of the raw material.

Every phase of production takes place within a limited geographic area in Italy, ensuring careful control over quality and significantly reducing emissions related to transportation. This local approach contributes to a broader strategy rooted in the principles of the circular economy. Rather than extracting new resources, Case 6 focuses on reusing what already exists, transforming surplus and discarded materials into something valuable and enduring. The company collaborates closely with expert Italian artisans and manufacturers who share its values and ethics, ensuring that every product reflects both technical excellence and cultural authenticity. In addition to their core textile innovations, Case 6 has developed a natural dyeing process that utilizes mineral-based pigments. This alternative to conventional chemical dyeing minimizes environmental impact by reducing water usage and eliminating harmful substances, all while enhancing the richness and uniqueness of

the fabric's appearance. This process exemplifies how the company uses research and development to address long-standing environmental challenges in the textile sector.

Case 6's innovations have reached beyond the realm of fashion, demonstrating their versatility in sectors such as automotive design. In collaboration with a historic Italian car brand, the company has contributed to the interior design of a new vehicle model, using its sustainable fabric solutions for elements like dashboard covers and door panels. This partnership highlights the elegance, durability, and ethical value of Case 6's textiles, showing how their innovations can elevate not only clothing but also environments and experiences. The company operates with a holistic approach to sustainability. Every decision, from the sourcing of raw materials to the end-of-life of a product, is made with the goal of minimizing harm and maximizing positive impact. Case 6 avoids overproduction, a major issue in the fashion industry, by producing intentionally and efficiently. It optimizes processes to minimize waste and views each resource as precious, striving to extend the life cycle of every material. By converting stone industry byproducts into useful textiles, the company ensures that nothing is wasted and everything is respected. In 2021, Case 6 formally became a Benefit Corporation, underlining its commitment not only to commercial success but also to generating social and environmental value. As part of this commitment, the company publishes regular sustainability reports, providing transparency and accountability while outlining the goals and values that guide its operations. This legal and cultural shift reflects a broader purpose: to contribute to a future in which fashion, design, and industry are aligned with the well-being of people and the planet. The team behind Case 6 is composed of young, driven individuals with a shared passion for science, design, and sustainability. Their curiosity and respect for the natural world fuel their research, while their creativity allows them to imagine new uses for materials that have long been overlooked. The team works with a scientific yet artistic mindset, continuously innovating while remaining grounded in a deep understanding of materials, processes, and environmental impact.

Case 6's approach represents a significant departure from traditional industrial models. Rather than prioritizing speed and volume, the company champions intention, quality, and purpose. It believes that fashion can be a force for good, and that responsible design has the power to shape culture and influence broader societal change. Its fabrics are not just products, they are statements of possibility, born from the fusion of nature and technology. With each innovation, Case 6 challenges the status quo and invites others to reimagine the role of textiles in our daily lives. It demonstrates that sustainability does not require compromise in beauty or function, and that responsible production can coexist with bold creativity. Through its continued efforts, the company not only honors its

Italian roots but also contributes to a global movement for a more ethical and sustainable future in design and manufacturing.

### 3.2.7 Case 7

Case 7, a leading entity in the recycled cartonboard sector, represents a sophisticated blend of tradition, innovation, and sustainability in the packaging industry. With roots tracing back to the 17th century through mills that later became part of its corporate structure, the company has evolved into one of the most prominent players in its field. Its strategic headquarters are located in Milan, Italy, yet its footprint extends internationally through a network of 10 production mills and 4 sheeting centers spread across Italy, France, Germany, Spain, the Netherlands, Sweden, and the United States. This international presence enables Case 7 to serve a broad range of global markets while maintaining operational resilience and logistical efficiency. The company specializes in the production of cartonboard used predominantly for packaging consumer goods, such as food, pharmaceuticals, electronics, cosmetics, and personal care items. It also provides materials for commercial displays, luxury packaging, specialty products, and toys. Its coated board is mainly distributed across Europe, while its solid board segment has significant reach into the U.S. and Asia, demonstrating its strong global orientation. This diversity in market penetration not only secures stable demand but also allows Case 7 to tailor its product offerings to varying regulatory and consumer expectations across regions. Since its official formation in 2016 through the merger of several major players, Case 7 has pursued an aggressive expansion strategy. This has included various acquisitions. Each of them brought new capabilities, geographic access, and synergies to the group. These moves have not only strengthened its market share but also enhanced its ability to deliver on a cohesive sustainability agenda across borders. In 2021, a significant corporate event marked a new phase in Case 7's trajectory when its shares were acquired by Apollo Global Management, opening new avenues for strategic growth and capital investment.

The company's strategic vision is underpinned by three overarching goals: delivering high-quality products and services, optimizing costs through operational efficiency, and maximizing stakeholder satisfaction across all business dimensions. These objectives are actively reinforced by a deeply ingrained set of corporate values, including a shared group-wide vision, a sense of unity and belonging, responsible decision-making with awareness of broader impacts, and empathetic leadership. Together, these values form the foundation of Case 7's approach to both internal collaboration and external engagement. Sustainability forms a central pillar of the company's business model. Far from being a secondary consideration, it is embedded into operational decision-

making, governance structures, and financial planning. The company's alignment with the circular economy is not merely conceptual; it is tangible across all levels of its operations. Approximately 95% of the fiber used in production is sourced from recycled paper and cartonboard, supplemented only minimally by certified virgin fibers for products requiring specific mechanical attributes. This commitment underscores Case 7's role in closing material loops and fostering resource regeneration within its industry. To give structure and measurable outcomes to its sustainability ambitions, Case 7 has developed a long-term Sustainability Plan covering the decade from 2020 to 2030. This roadmap outlines ambitious yet achievable goals across environmental and social dimensions. Core to the plan is the reduction of carbon emissions, improved water management, waste minimization, supplier ESG compliance, and enhanced employee engagement. In 2021, these commitments were further reinforced through the issuance of a Sustainability-Linked Bond (SLB), which ties financial returns to the achievement of key environmental targets, thereby holding the company accountable to investors and the public alike. This bond is linked specifically to three key performance indicators: reduction of Scope 1 and Scope 2 CO<sub>2</sub> emissions, reduction in wastewater discharge, and reduction of total waste generation per unit of production. Scope 1 CO<sub>2</sub> emissions are direct emissions from sources that a company owns or controls, such as fuel combustion in company vehicles, boilers, or manufacturing equipment. Whereas Scope 2 CO<sub>2</sub> emissions are indirect emissions from the generation of purchased electricity, steam, heating, or cooling that a company consumes. While the company doesn't produce these emissions directly, they result from the energy it buys and uses.

The company also views sustainability in systemic terms, integrating upstream and downstream impacts into its planning. For instance, the company not only sources recycled material but also ensures its products are recyclable, contributing to a closed-loop system. Moreover, multiple production sites have implemented advanced water reuse systems, and continual investment is made in energy efficiency and process innovation. Case 7 serves as a compelling example of how an industrial manufacturing group can embrace a sustainability-oriented transformation without compromising on growth, profitability, or product quality. By aligning financial instruments with environmental outcomes, embedding sustainability into operational KPIs, and fostering a culture of collective accountability, Case 7 is redefining what it means to be a responsible leader in the packaging sector. As it advances toward its 2030 goals, the company continues to demonstrate that economic resilience and ecological responsibility are not mutually exclusive, but rather deeply interconnected pillars of long-term success.

### 3.2.8 Summary Table

Case #	Type of Business	Business	Industry	Size	Market	Role of Interviewer	Duration Interview
Case 1	B2B	Sustainable Construction Materials	Construction	Small (start-up)	Italy	Founder	00:35:24
Case 2	B2B	Fruit-based Ingredients for F&B and Fragrances	Food & Beverage, Fragrance	Medium to Large	Global	Sustainability Specialist	00:47:46
Case 3	B2B	Promotional Design Objects Using Recycled Materials	Promotional Products/ Design	Small	Italy	Founder	01:50:39
Case 4	B2C	Sustainable Fashion Using Regenerated Fibers	Fashion	Small	Global	Founder	00:10:47
Case 5	B2B	Regenerated Nylon Across Industries	Textile/Materials	Large	Global	Sustainability Communication Practitioner	Email
Case 6	B2B	Textile from Marble and Minerals Waste	Textile	Small (start-up)	Italy	Founder	00:30:07
Case 7	B2B	Recycled Cardboard for Packaging	Packaging	Large	Global	Chief Sustainability & Innovation Officer	00:38:07

## Chapter 4: Findings

In the following sections, the key findings from the interviews will be presented and discussed. The analysis led to the identification of four Aggregate Dimensions that together capture the main challenges and opportunities associated with scaling CE innovations. These dimensions are: Operational Challenges, Cost Challenges, Market Opportunities, and Circularity Enablers and provide a structured framework for understanding how CE firms address the transition from small-scale initiatives to larger, more established operations. This section will explore in deep how these dimensions influence strategic decisions, impact growth trajectories, and shape the dynamics of circular business models. By examining these themes, the aim is to offer valuable insights into what scaling circular innovations really involves and to highlight how this process differs in important ways from scaling more conventional, linear innovations.

### 4.1 Operational Challenges

One of the first and most important concepts that emerged from the interviews is that especially small-sized companies and startups face significant challenges when they attempt to find suitable third-party producers to manufacture their products. This difficulty is mainly due to the fact that most established producers and manufacturing partners are accustomed to working with standard, linear production processes that have been optimized over decades to produce large volumes of conventional products in a predictable way. As a result, they are often reluctant or even unwilling to adapt their operations to accommodate a circular model of production, which requires different approaches to materials, processes, and quality control. The few producers who are willing to make adjustments and differentiate themselves by producing new and innovative products frequently lack the necessary knowledge and technical experience to handle special materials, manage small batch sizes, or deal with the unique challenges of innovation in this area. For example, one of the interviewees stated, “it is difficult to find a supply chain that wants to produce for small quantities” (Case 6). This statement highlights a widespread issue in the circular economy space. Producing small quantities often requires a manufacturer to adapt machinery, change production processes, train staff, and set up specialized workflows, all of which consume time and resources. These changes ultimately make the process costlier and less profitable for producers, which is why many

are hesitant to participate. Moreover, recycled materials themselves require particular handling and treatment procedures to ensure that the final products meet acceptable standards of safety, consistency, and performance. Many third-party producers simply lack the technical know-how to process recycled inputs properly or to adjust their machinery and production lines to work with them. Often, making such changes requires not only time but significant investment in research and development. This is needed to adapt both the production process and the product itself to fit within the limitations and capabilities of the equipment that is already in place. This issue becomes even more problematic and acute when companies are attempting to produce a completely new product that has previously only been tested in the laboratory at a small scale and must now be scaled up to industrial production volumes for the first time. As was described in Case 1, scaling up from lab-scale prototypes to full-scale production is a massive leap. It introduces a series of technical, operational, and logistical challenges that many producers are either unprepared or unwilling to address. Some industries are also inherently conservative and skeptical toward innovative products, particularly those made from waste materials or recycled inputs. This skepticism often leads to what was described as a “mistrust toward innovative products” (Case 1). These attitudes are not purely based on prejudice; they stem partly from concerns about product consistency, durability, and safety. Still, the end result is that many suppliers prefer to avoid such risks altogether by sticking to traditional production with virgin raw materials. One reason why circular startups and small firms rely on third-party producers in the first place is because owning and operating their own production facilities is prohibitively expensive, especially during the early phases of development when cash flow and capital are extremely limited. Building a plant from scratch requires not only money but also regulatory approvals, specialized staff, and the capacity to operate at scale, resources that most young companies simply do not have. Therefore, outsourcing production to existing facilities operated by third parties becomes the only feasible way to produce their products at any meaningful scale without having to build an entire factory. Third-party producers also bring years or even decades of expertise in manufacturing, which smaller companies often lack themselves. However, even when a third-party producer agrees to collaborate, the costs of adapting both products and processes to the external facilities can be very high. As one interviewee explained, “investing in research and development to adapt both the product and the production process to the different machinery used by producers is a huge cost that small circular companies have to face” (Case 6). Each time the company works with a new producer, it must repeat a similar adaptation process, since every factory has different equipment, operating procedures, and production constraints. As described in Case 1, “adapting the product to the facility takes time, as each facility is different”. Circular materials also often behave differently compared to traditional,

virgin materials. For example, recycled plastics may melt at slightly different temperatures, have more variability in color or density, or contain trace contaminants. These differences require additional engineering work, extensive testing, and sometimes new tooling or production adjustments in order to achieve a consistent output. All of these adaptations are time-consuming and costly, which further increases the complexity of scaling circular innovations.

Another important concept that emerged from the interviews is the need to educate producers on how to work with these new processes and materials. Producers are, for the most part, deeply accustomed to handling traditional, virgin materials that are highly consistent and predictable. Circular processes, on the other hand, demand a different mindset and technical approach. For example, recycled materials often require special preparation, more rigorous inspection, and new quality assurance protocols to ensure they meet specifications. Many suppliers have never dealt with these requirements before and lack the experience or understanding to implement them effectively. For this reason, as was mentioned in Case 3, there is a strong need for “training producers(...) to help them see that they too can progress by switching materials”. This training can help overcome resistance and skepticism while also building new capabilities within the supply chain. Education is a critical enabler for circular production because it helps to close the knowledge gap that currently exists between innovative firms and traditional manufacturers. Yet, even if producers are willing and trained, there remains another major barrier in the form of skepticism from downstream supply chain partners and customers. Many of these stakeholders have reservations about the consistency, safety, and overall quality of recycled materials compared to virgin materials. As was described in Case 7, virgin fiber usually has higher quality and is therefore perceived as “cleaner, safer, and longer lasting”. As a result, if the price difference between virgin and recycled materials is not substantial enough to justify the perceived risk, downstream partners will typically prefer the virgin option. This tendency limits market acceptance and makes it harder for circular firms to build demand for their products.

All of these issues, be grouped together under the second-order theme of supply chain barriers. These barriers represent a powerful set of obstacles that stand in the way of circular companies trying to scale their impact.

In addition to these supply chain issues, circular firms face challenges related to scaling their operations due to the very nature of circularity itself. One of the core principles of the circular economy is the idea of closing materials loops by collecting, reusing, and recycling waste materials. However, the availability and collection of waste materials are often local in nature, which limits

access to uniform and predictable inputs. As one interviewee pointed out, “there is not enough collection of used or waste materials, which may cause a problem for circular innovations” (Case 7). Because waste streams are unevenly distributed across regions, circular companies must develop complex relationships with local suppliers, collectors, and processors in order to secure the materials they need. These relationships are harder to standardize and replicate when expanding production across different geographies. For example, a process that works in one country might not be feasible in another due to differences in waste collection practices, contamination rates, or local regulations. Case 7 provided a concrete example of this challenge. In Sweden, the collected waste paper often contains much higher contamination levels than in other markets. This means that before the paper can be reused, it requires specific cleaning and treatment processes to remove impurities and bring it up to quality standards. These processes may be technically demanding and do not always scale easily to new locations. As a result, circular companies often have to adapt their workflows repeatedly to local conditions, adding time, complexity, and cost to their operations.

Another core aspect of circularity is the idea of producing only the quantities needed in order to minimize waste and avoid overproduction. While this principle is valuable from an environmental perspective, it creates difficulties in achieving economies of scale. Traditional manufacturing relies on high-volume production to drive down unit costs. By contrast, producing smaller batches or customizing products to local waste streams inherently limits the ability to spread fixed costs over larger quantities. A further issue that emerged is the preference for local production in order to minimize CO<sub>2</sub> emissions associated with transportation. Transporting either the waste materials themselves or the finished products over long distances increases the overall carbon footprint of the operation, which partly undermines the sustainability benefits of using recycled materials in the first place. As was mentioned in Case 7, “for recycled products and circular products, it will be rather a local supply and value chain”. This preference for local sourcing and production has clear environmental benefits, but it can also restrict growth opportunities, as companies may be unable or unwilling to expand production beyond their immediate region. Local production also has the advantage of making it easier to control collection, sorting, and treatment processes. When companies work with nearby partners, they can monitor compliance more effectively, share knowledge, and collaborate more closely to improve quality. However, as was highlighted in Case 6, expanding abroad introduces a host of challenges: “expanding abroad would not allow the same level of control”, which is why many companies prefer to work with local partners and think carefully before making any international moves. In addition, working closely with the supply and value chain gives companies a bigger impact on improving practices, educating partners, and

aligning everyone toward shared sustainability goals. This close relationship also supports efforts to measure emissions and ensure transparency in sourcing and production. Transparency is critical, as it prevents greenwashing and builds trust with stakeholders, from customers to regulators to investors. As pointed out in Case 2 and Case 7, sustainability claims must be supported by verifiable data and processes. Diverse suppliers or distant partners can create inconsistencies, introduce contamination risks, or deviate from established circular practices. Furthermore, regulations and reporting obligations in many countries require companies to demonstrate traceability throughout their supply chain if they want to obtain certifications or participate in specific programs and awards.

All of these factors together contribute to what can be called operational scope limits. This term captures the fact that circular firms face built-in constraints on where and how much they can scale because of their reliance on local waste streams, the need for specialized processes, and the importance of maintaining high levels of oversight and transparency. Taken together, operational scope limits and supply chain barriers can be grouped under the broader, aggregate dimension of operational challenges. This dimension represents one of the most significant differences between circular firms and traditional firms. While conventional companies can scale relatively straightforwardly by replicating standardized processes in new markets, circular firms must navigate a much more complex landscape of technical, logistical, and relational hurdles.

In conclusion, circular companies face a unique combination of challenges that stem from the very nature of their mission to close materials loops and produce more sustainable products. They must overcome the reluctance of established producers to adapt, educate supply chain partners on new materials and processes, and build trust with skeptical downstream customers. At the same time, they must find ways to secure consistent supplies of recycled inputs, manage the complexities of local production, and maintain transparency and control across all their operations. These operational challenges are not easy to solve, but they are fundamental to the success and growth of circular business models. Recognizing and addressing them is a necessary step in advancing the circular economy and making it possible for these innovative companies to scale their impact in meaningful ways.

## 4.2 Cost Challenges

One of the most important insights that emerged from the interviews was the significant cost challenges that circular innovations face, especially when companies attempt to scale them up. Unlike more traditional business models, circular businesses often encounter a unique set of financial and operational barriers that require careful planning and substantial resources. These challenges do not only relate to the initial setup of the business but also to maintaining and expanding operations over time. A major issue is the need for high upfront investments in specialized technology and infrastructure. As explained by the representative of Case 5, “the main difficulties include sourcing waste materials and optimizing industrial processes”. This statement reflects the reality that circular innovations, in contrast to traditional innovations, frequently require technologies designed specifically to collect, sort, clean, regenerate, and reprocess waste materials. For example, in the context of producing textiles or consumer goods from recycled inputs, companies must develop or purchase machines that can handle non-standardized materials with unpredictable qualities. Additionally, large investments in R&D are necessary to understand how to transform different waste streams into consistent, usable raw materials. These investments are not one-off expenses. Rather, they are continuous because waste streams themselves are dynamic as new materials are constantly entering the market, and regulations around waste management frequently evolve. Circular businesses must stay ahead of these developments to maintain their competitive advantage and meet compliance requirements. This contrasts sharply with traditional companies that typically purchase standardized, virgin raw materials from suppliers. These inputs are ready for immediate use, need little processing, and have consistent qualities that integrate smoothly into existing production workflows. By comparison, circular businesses must either adapt their production processes to accommodate secondary materials or invest in developing new ones altogether. As the representative of Case 3 explained, this adds complexity and extra costs to their operations. Moreover, circular business models often require additional infrastructure to ensure traceability, measurement, and compliance with sustainability standards. For example, many companies must build or access treatment plants that can purify recycled inputs or install internal water recycling systems to meet environmental regulations. These investments are not just about meeting legal requirements, they are also essential to maintaining credibility in the eyes of customers, investors, and other stakeholders (Case 2). Case 2 highlighted that failing to comply with sustainability standards could damage the company’s reputation and undermine its entire value proposition. When it comes to scaling, each new site or production facility frequently requires tailored adaptations to handle local waste streams and comply with regional regulations. As Case 7 explained, “when replicating a business model, you always have to take into account culture and

regulations”, because the waste you can collect or the way you operate can differ from place to place. For example, in one region, the available waste might mainly be textile scraps, while in another, it could be post-consumer packaging. Each situation demands specific strategies, technologies, and partnerships, which increases costs and slows down replication.

Another critical cost barrier is that circularity often leads to higher production costs compared to conventional alternatives. This is particularly apparent in the clothing industry. As Case 4 shared, today’s consumers are accustomed to very cheap garments that are mass-produced through economies of scale in low-cost countries. In this environment, trying to produce clothing from recycled materials means that margins are often very low because consumers expect to pay almost nothing for new garments. This pressure is compounded by the fact that circular products typically involve additional labor and processing steps. The same applies in other industries. For example, as Case 3 noted, most products are manufactured abroad at much lower production costs than locally produced goods. In Italy, where many of these companies operate, the cost of labor, compliance, and operations is significantly higher, making it even more difficult to compete on price. As a result, both B2B customers and private consumers are often unwilling to pay the premium needed to cover these extra costs, even if they support the idea of sustainability in principle. Indeed, price sensitivity remains a major factor driving purchasing decisions in most markets. Case 6 emphasized that for many customers, both in B2B procurement and retail, price is still the primary driver. While niche or prestige markets sometimes value innovation and quality over cost, like in the case of architecture firms highlighted by Case 1, but these are the exceptions rather than the rule. For most companies trying to operate at scale, competing on price is unavoidable, and this creates significant economic constraints that limit their ability to grow and invest further in circular solutions. Another aspect that contributes to higher costs is that circular businesses, particularly smaller firms and startups, typically operate with smaller production batches. Unlike large companies that achieve economies of scale by producing massive quantities, these businesses must deal with higher unit costs. Smaller batches mean less bargaining power with suppliers, higher logistics costs, and lower process efficiency. When they rely on third-party suppliers, they also incur the additional expenses of training and adapting these partners to handle secondary materials and meet sustainability standards. Moreover, the process of obtaining sustainability and circularity certifications, as well as maintaining traceability and reporting systems, introduces additional overhead. These certifications are critical to demonstrate credibility and differentiate genuinely sustainable products from greenwashing claims. But they require time, specialized expertise, and continuous investment. Companies need to set up tracking systems to document the origin, processing, and environmental

impact of materials. Each production site often requires specialized equipment or process changes to meet certification criteria. All these factors can be grouped under the broader theme of economic constraints. Essentially, the circular economy demands a different kind of business model, one that is inherently more complex and cost-intensive than traditional linear production systems. This is one of the main reasons why circular businesses face so many barriers to scaling.

Closely linked to these economic constraints is the second critical theme that emerged: consumer awareness and education. While cost issues are fundamental, they are compounded by the fact that most consumers are not fully aware of what makes a product truly sustainable. Many purchasing decisions are unconscious or driven almost entirely by price. As Case 4 pointed out, “breaking out of the niche is difficult (...) it requires educating the customers”. In the mainstream market, price sensitivity is still extremely high. Customers are accustomed to low prices for most categories of products, and responsible production is often perceived as an optional premium feature rather than the new normal. Even when people express interest in sustainability, this interest frequently does not translate into actual purchasing behavior if prices are higher. For companies, this means they have to operate with very low margins while also carrying higher costs of production, a difficult combination that limits profitability and reinvestment potential. The interviews also showed that even in B2B markets, where companies might be expected to care more about environmental impact, price is still a major decision driver. Except in very specific niches, such as luxury or high-profile projects, most corporate buyers are primarily focused on minimizing procurement costs. For example, Case 1 shared that “for large clients, like architecture firms, the innovation and quality of the product is the main driver”, but this is not the norm across the broader B2B landscape.

This reality highlights the urgent need to educate consumers and professional buyers about the true value of circular and sustainable products. Many companies explained that customers often do not fully understand what sustainability claims really mean. There is widespread confusion due to greenwashing practices, where companies make vague or misleading claims about the environmental benefits of their products without providing evidence. Case 6 emphasized the importance of “helping consumers learn how to make more conscious and responsible purchasing decisions”. This education is essential not only to drive demand but also to build trust. If customers cannot distinguish between genuinely sustainable products and those that only claim to be, they are more likely to base decisions solely on price. In turn, this undermines the efforts of companies that are truly committed to circularity and responsibility. Case 3 pointed out that “the messaging around circular products is more prominent and can serve as a purchasing driver”, but if this message is diluted by greenwashing, the whole system suffers. Customers may become skeptical or simply

give up trying to understand the difference. That is why it is critical for circular companies to invest in clear communication, robust traceability systems, and third-party certifications to back up their claims. These efforts can help protect their reputation, differentiate them from less committed competitors, and build long-term relationships with customers who value authenticity. Moreover, educating consumers and business partners can gradually shift perceptions and expectations around pricing. When customers understand the real costs involved in producing sustainable products, like the investments in technology, labor, and compliance, they are more likely to appreciate why these products may be more expensive. Over time, this awareness can build a willingness to pay a premium for products that genuinely reduce environmental impact.

In summary, the aggregate dimension of cost challenges in circular innovations can be broken down into two interrelated themes: economic constraints and customer awareness. On the one hand, companies face high costs related to sourcing, processing, compliance, and scaling. On the other, they must address widespread consumer price sensitivity and confusion about sustainability claims. Addressing these issues requires a holistic approach that combines investments in technology and infrastructure with sustained efforts to educate customers and build trust. Only by tackling both of these themes can circular businesses hope to scale successfully and make a meaningful impact on reducing waste and promoting more responsible production and consumption practices.

### 4.3 Market Opportunities

After discussing the many challenges that circular innovations face when scaling up, it is essential to also examine the significant opportunities and advantages that these business models bring. Although adopting circular practices requires overcoming economic constraints and operational barriers, CE innovations also benefit from powerful market trends, regulatory support, and growing consumer awareness. These positive factors can make scaling circular solutions not only possible but, in some cases, strategically advantageous.

One of the main aggregate dimensions that emerged from the interviews with practitioners and experts is market opportunities. In today's business environment, multiple factors are converging to create favorable conditions for companies that adopt sustainable and circular models. These factors include regulatory momentum, shifts in market demand, and the growing importance of brand reputation. In this section, these aspects will be explored in detail, explaining how they create pathways for circular businesses to expand and gain a competitive edge.

In recent years, there has been a very strong legislative push toward more sustainable products and practices. Governments and institutions around the world are increasingly recognizing that the old “make-use-dispose” approach, also known as the linear model, is not sustainable in the long term. This model leads to resource depletion, environmental pollution, and waste accumulation. In response, regulators are introducing new policies, agreements, and laws to promote more circular practices across industries. Case 6 explained that legislation has become a major driver for B2B clients. Business customers are being pushed and incentivized to buy sustainable and circular products because they must comply with an expanding array of standards for traceability, certification, and transparency. For these companies, partnering with suppliers who are already aligned with these requirements is easier, safer, and more efficient than trying to adapt less-compliant supply chains. This creates a clear advantage for circular innovators who can prove that their processes are in line with these regulatory expectations. Case 7 emphasized this point clearly, stating, “EU regulations are a great driver to increase circularity and sustainability”. This comment demonstrates that regulations are no longer optional guidelines. Instead, they are becoming mandatory frameworks that define the basic rules of market participation. If a company wants to win contracts, especially with larger B2B clients or public institutions, it must be able to prove compliance. This is transforming sustainability into a market access condition rather than just a marketing argument. Case 2 shared similar insights, highlighting that regulations are trying to raise procurement standards. The goal is to ensure that buyers, whether businesses or customers, can make more responsible purchasing decisions. Additionally, this regulatory shift is intended to create a fairer competitive environment. Instead of rewarding companies that produce cheaply by exploiting workers or destroying ecosystems, new regulations encourage fair competition based on transparency and responsibility. For companies working on circular innovations, this regulatory pressure creates a valuable window of opportunity. Since regulations increasingly incentivize recycled and low-impact materials, demand for these solutions is growing faster. In some cases, there are also mandatory targets for recycled content in products, as well as penalties for using high-impact materials. This combination of incentives and obligations helps companies justify investments in innovation while reducing the risk of being undercut by less responsible competitors. Another first-order concept that emerged from the interviews is the growing demand for transparency and disclosure. Today, consumers and B2B clients expect much more information about products’ environmental and social impacts. Case 2 explained that “consumers and B2B clients are demanding more transparency, making it essential to measure emissions and track carbon footprint”. This demand is partly driven by legislation, such as the EU Corporate Sustainability Reporting Directive, which requires companies to disclose their sustainability performance in detail.

Case 2 also noted that “companies will start requiring certain information, data, and reporting so they can perform their own reporting”. This means that suppliers who cannot provide verified data and transparent information will be excluded from procurement processes. Circular innovators who already have robust measurement and reporting systems in place have a clear advantage because they can provide the necessary evidence of compliance. This is not just a bureaucratic requirement, but rather a key trust-building element with customers and partners. Credibility is extremely important in this environment. If a business buys from an untrustworthy supplier and later faces accusations of greenwashing or irresponsible sourcing, the resulting scandal can damage its reputation and even threaten its existence. This is why Case 2 emphasized, “it is important to create clear reporting to build trust with all stakeholders and ensure the necessary transparency”. Similarly, Case 6 described traceability and control as essential for maintaining credibility over time. This demand for transparency is reinforced by consumer skepticism toward greenwashing. Many buyers have become cautious about unverified claims and marketing slogans. Instead, they expect clear documentation of environmental impact, credible certifications, and transparent communication. Companies that can provide these elements not only reduce their regulatory risks but also strengthen their brand and customer relationships. Finally, the need for measurement and traceability creates internal benefits as well. When a company develops systems to track emissions, waste, and resource use, it gains valuable insights into its own processes. This information allows managers to identify areas for improvement, optimize resource use, and become more efficient. As a result, regulatory momentum does not just create external pressure, but it also provides internal incentives to innovate and continuously improve. Overall, the first-order concepts related to regulations, incentives, and transparency can be clustered in the second-order theme of regulatory momentum. This momentum makes it easier for circular innovations to scale by increasing demand, reducing market risks, and creating a supportive ecosystem of incentives and requirements.

A second critical dimension that creates opportunities for scaling circular innovations is the ongoing shift in market demand. Consumers are becoming more conscious of their purchasing decisions, and sustainability is increasingly valued. This shift goes beyond superficial trends and reflects a deeper cultural change. People are starting to understand the power they have as consumers and how their buying choices can influence environmental and social outcomes. Case 4 shared that they identified a need from a “very attentive and radical clientele” who were seeking products that combine quality, design, and responsibility. This realization was the starting point for their business. Although Case 4 acknowledged that “the market is still small”, they also explained that it is expanding steadily as more people become interested in making informed and responsible choices.

Case 7 provided further evidence of this trend, stating that “even in the face of inflation and geopolitical uncertainty, consumers continue to value sustainability”. This insight is important because it shows that sustainability is not just a luxury feature that people prioritize when the economy is strong. Instead, it has become a fundamental value that influences purchasing decisions, even during difficult times. Case 2 echoed these ideas, explaining that circularity represents “a competitive advantage because environmental issues are becoming even more important and are being taken into greater consideration”. This change affects both retail consumers and B2B clients. In the business world, although price remains a significant factor in procurement decisions, there is a growing willingness to consider sustainability and transparency as equally important criteria. Case 1 shared that for certain clients, such as architecture firms or other high-profile buyers, “innovative products are the main purchasing drivers, and price plays a relatively minor role”. In other words, when products are highly visible or part of flagship projects, companies are more willing to invest in circular solutions because they know these choices will also enhance their own brand and reputation. Market shifts are also visible in procurement practices. Companies are increasingly steering toward green procurement, not only because of regulations and consumer expectations but also because they understand that adopting sustainable practices is critical to stay competitive. Case 3 emphasized that B2B clients are motivated to change because they do not want to be left behind. In this environment, companies are willing to pay a premium if they have confidence that the products they buy are transparent, compliant, and truly sustainable. This demand for traceability and transparency also provides reassurance. By working with suppliers who can prove their sustainability credentials, companies protect themselves from reputational risks. If a supplier fails to meet standards or is caught making false claims, the buyer’s brand can suffer collateral damage. By prioritizing credible partners, businesses create a safety net that protects their own credibility. In addition to mainstream markets gradually shifting toward sustainability, niche markets are emerging specifically for circular products. Case 4 noted, “it is a small but rapidly growing market (...) with a focus on this niche segment that continues to gain traction”. This observation highlights the importance of moving quickly to identify and serve these markets before they become crowded. Case 5 supported this point, explaining that there is “growing demand for regenerated materials”. Whether in fashion, packaging, construction, or consumer goods, there are dedicated communities of buyers willing to pay more for products that align with their values. Serving these early adopters can create a solid foundation for scaling up as the broader market catches up over time.

The third dimension that creates opportunities for scaling circular innovations is the impact on brand reputation. Circularity does not only provide functional benefits or regulatory compliance, but

it also builds a powerful narrative that companies can use to differentiate themselves in crowded markets. Case 2 emphasized that circularity strengthens brand reputation not just for the company itself but also for its B2B clients. When a business can demonstrate authentic environmental commitment, it gains a competitive advantage over companies that focus solely on price or superficial marketing. Sustainability is becoming a top priority for many stakeholders, from investors to employees to customers. Case 3 explained that “the communication of a circular product is more powerful and can be a driver of purchase”. This is because circular products tell a story of innovation, responsibility, and care for future generations. These qualities connect emotionally with consumers and create deeper connections than purely functional benefits. To maximize this advantage, circular companies need to “take a radical approach and keep differentiating more strongly”, as Case 4 recommended. By doing so, they position themselves as pioneers rather than followers. Case 1 also emphasized that “the image and characteristics of sustainability are the winning choice” because they signal an authentic commitment instead of mere compliance. In a digitalized economy where new brands emerge and disappear rapidly, sustainability provides a lasting differentiator. Case 1 shared, “Innovative products serve as key drivers, and pairing a strong brand image with sustainability is the formula for success”. This is especially important in saturated markets, where it is increasingly difficult to stand out. Circularity also creates emotional appeal. Many consumers want to feel that they are part of a positive change and that their purchases have a purpose beyond personal satisfaction. This emotional dimension is not only a marketing tactic, but it is rather a genuine reflection of shifting cultural values. For companies, it is also a justification for premium pricing, as consumers are often willing to pay more for products that align with their values. Competitors often struggle to match credible sustainability claims. This makes circularity a defensible differentiator. Companies that can prove their practices are genuinely circular and responsible create barriers that are hard for less committed competitors to cross. Finally, circularity provides visibility through awards, certifications, and media coverage. Many interview participants noted that their sustainability innovations had won prizes and certifications that brought them recognition and opened doors to new partnerships. Case 1 explained that “many of the awards won are tied to the sustainability of the idea”. This recognition creates powerful momentum. As Case 1 further explained, “for visibility, recognition, and relevance, presenting a sustainable idea or innovation makes a big difference”. For example, they did not have to pay to participate in some trade fairs because their project was sustainable. Case 3 also highlighted that “circular products have the advantage of a much wider and more powerful narrative around them”. On the same path, Case 6 noted that sustainability helped them build relationships with B2B clients and attract media attention. Moreover, awards and certifications provide third-

party validation of a company's claims and enhance credibility. They also reduce marketing costs by creating free publicity and supporting customer trust. In turn, this visibility makes it easier to enter new markets and form strategic partnerships.

The three second-order themes, regulatory momentum, market demand shift, and brand reputation, are the foundation of the aggregate dimension of market opportunities. They show that circular economy innovations are not only challenged by higher costs and complex processes but also supported by powerful trends and incentives that can help them scale successfully. These opportunities demonstrate that circular business models offer significant advantages over traditional ones. In a market increasingly shaped by regulations, informed consumers, and demand for authenticity, companies that can combine innovation with sustainability are well positioned to thrive.

#### 4.4 Circularity Enablers

The aggregate dimension of circularity enablers deals with a range of opportunities and suggestions for scaling CE innovations more broadly across industries and supply chains.

One of the most critical themes that emerged from the interviews with companies already active in circular practices is the essential role that collaboration and communication with the entire value chain play in driving meaningful change. From the interviews, it became clear that open collaboration and transparent communication among all actors in the ecosystem are not optional but are fundamental to any serious attempt to build a more sustainable and circular industry. As highlighted by Case 2, “the only way to build a more sustainable industry is through collaboration with all the actors in the ecosystem to pursue common objectives”. This insight emphasizes that no single company, regardless of its size or resources, can achieve circularity in isolation. Instead, it requires a collective effort where everyone, suppliers, distributors, producers, customers, and even regulatory bodies, aligns toward shared goals. Case 3 similarly highlighted this point by pointing out “the importance of training the value chain, as well as suppliers and producers, to drive change and build awareness, ensuring no one is left behind”. This statement reveals an often-overlooked reality: while some companies are already on advanced sustainability journeys, others may still be in the early stages of understanding what circularity even means. To move the entire system forward, it is essential to actively engage all partners, invest in their capabilities, and make sure that every link in the chain has the knowledge and tools to contribute effectively. Case 4 added to this

idea by stressing that “in order to drive change, it is important to engage the supply chain, involve it actively, and treat it as an integral part of the team”. This perspective reinforces that the supply chain should not be regarded simply as an external service provider. Instead, suppliers and partners must be included as collaborators who share responsibility for reaching sustainability objectives. In Case 6, the importance of the supply chain was again emphasized, noting that “the transition to circularity cannot be achieved in isolation”. This is because every part of the supply chain impacts the credibility and traceability of sustainability claims, as well as the costs and feasibility of production and logistics. When companies and their suppliers collaborate closely, they can align goals, engage in joint problem-solving, and make shared investments in infrastructure and education. This type of collaboration enables the ecosystem to progress together, reducing the risk that some parts will lag and undermine broader efforts. Another important first-order concept is the need to assist supply chain partners in making their own transitions. Training suppliers and producers helps them understand how they can grow alongside the company by adopting new materials and production methods. Case 2 described how providing education and support to less mature companies can help everyone advance together, explaining that “not all companies across the supply chain are on the same journey, and this creates a challenge for scaling circular innovation. That is why education, active collaboration, and offering practical tools to support less mature companies are all necessary”. This insight highlights that while leading companies may have deep experience in circular economy practices, many of their suppliers do not. These suppliers often lack experience working with recycled materials and typically do not have the infrastructure to meet sustainability requirements. Moreover, many suppliers can be hesitant to invest or adapt without clear support, fearing financial risks or operational disruptions. To overcome this reluctance, companies need to share knowledge and resources generously, provide training, and sometimes even offer financial incentives. Co-developing processes that work in suppliers’ facilities is also critical because it ensures that sustainable methods can be practically implemented in real-world production environments.

A further crucial first-order concept is the importance of open innovation and sharing know-how. Many companies see this not just as a moral or environmental obligation but as a significant economic opportunity. By developing expertise in circularity, a company can position itself as a leader and build a reputation that attracts both customers and partners. Case 3 explained that “earnings no longer come only from projects but also from sharing and transferring know-how”. This reflects a growing trend in which companies monetize their expertise by offering consulting services to help others adopt circular practices. Case 5 reinforced this idea, noting that

“opportunities include forging strategic partnerships and achieving strong competitive differentiation”. Case 2 explained that “collaboration and open communication, combined with education and active engagement, are essential to equip less mature companies with the tools they need to progress”. This demonstrates how open innovation accelerates the adoption of circular practices across industries. By sharing best practices and solutions, companies lower the barriers for smaller suppliers and less experienced partners. This broader adoption fosters fair competition and helps ensure that the transition toward circularity is consistent and credible across the industry. In addition, sharing know-how can open new revenue streams for companies, such as selling training services or offering consulting on sustainable transformation. Open innovation also builds trust and loyalty among partners. When companies share what they have learned, they show their commitment to mutual success rather than focusing only on their own advantage. Over time, this transparency can help standardize processes, reduce costs, and improve efficiency across the ecosystem. For the company leading this sharing, it also solidifies their reputation as a reference point for sustainability expertise, strengthening their brand and making them the first choice for customers who value environmental responsibility.

These ideas, fall under the broader second-order theme of ecosystem collaboration. This theme illustrates that companies must think beyond their internal operations and consider the entire value chain. The performance of suppliers, distributors, and partners is not an afterthought but is rather a critical factor that influences whether circular innovations can scale successfully.

A second second-order theme that emerged from the interviews is strategic integration. This theme describes the opportunities and pathways that companies must follow when scaling circular economy innovations. One key element is that circularity and sustainability must be seen as strategic drivers rather than simply compliance obligations. As Case 2 explained, “sustainability is an opportunity for growth. It helps reconcile environmental efficiency with economic value and operational effectiveness”. This insight is particularly powerful because it reframes sustainability from a cost or burden into a tool for creating value. When companies treat circularity as an opportunity to improve efficiency, reduce costs, and strengthen their brand, they become more motivated to invest in long-term transformation and understand the enormous competitive advantage to which circularity can lead to. Case 3 shared an example of companies that initially recognized the innovation in a certain product but failed to achieve economic sustainability and ultimately abandoned their efforts. However, by starting from waste materials instead of virgin inputs, these same innovations became economically viable and were brought to market successfully. This demonstrates that when used effectively, circular practices can be an important

lever for differentiation and long-term growth. Another important dimension of strategic integration is the cost advantage of circular sourcing over virgin materials. According to Case 7, “recycled materials are more cost-effective”. Using recycled inputs not only supports sustainability goals but also helps meet other key performance indicators, such as cost efficiency and responsible sourcing. Case 3 offered a compelling example of this advantage: by using production waste from the firms they collaborated with, they were able to lower raw materials costs and simultaneously strengthen the product’s narrative. As Case 3 put it, “using production waste from other companies is a smart way to eliminate raw materials costs and lower production expenses”. In addition, Case 5 noted that while circular economy models often require higher investments in research and development, they lead to long-term cost efficiency through closed-loop production systems. This approach shields companies from commodity price volatility, reduces dependence on scarce resources, and improves supply security over time. Beyond raw material costs, circularity also improves efficiency throughout operations. Case 2 explained that adopting circularity and sustainability led to improvements in production efficiency that created additional economic value. For example, the company reused water in production processes, which reduced consumption, and turned by-products into natural fertilizers, decreasing costs while creating higher-quality outputs. Measurement and tracking play a crucial role here. By gathering and examining data on resource use and waste production, companies can identify inefficiencies and focus on the most critical areas for improvement. Case 3 emphasized that in many instances, the solution to sustainability challenges came directly from circular economy practices, noting that “there cannot be environmental sustainability without also having social and economic sustainability”. Case 7 reiterated that recycled materials can often be more cost-effective, further strengthening the business case for circularity. These examples illustrate how circularity leads to efficiency improvements, such as lower resource consumption and waste disposal costs, while also creating new revenue streams, like turning waste into energy, compost, or fertilizers. Ultimately, these advantages contribute to stronger competitive positioning. Flexibility through design is another strategic advantage. Case 6 explained that “starting out as a small company allows for greater agility and makes it easier to implement changes. It is essential to embed circularity and sustainability right from the design phase”. This proactive approach avoids costly adjustments of processes later on and helps products remain relevant as regulations and market expectations evolve. Case 3 stressed that thinking circular from the beginning enables more agile adaptation, while Case 2 stated that “embedding circularity right from the design phase is essential to prevent the high cost of later adjustments and redesign”. When companies integrate circularity early, they can design processes to be sustainable and effective, which provides a significant advantage over

competitors who may be forced to retrofit their processes in response to external pressures. Closely related to flexibility is the outsourcing of production to support growth. Although outsourcing can bring challenges, many companies emphasized its advantages, especially in early growth phases. As noted in the interviews, “having production outsourced to third parties enables simultaneous manufacturing across different sites”, which can drastically reduce the costs and complexity of scaling. Case 1 described how outsourcing was necessary to meet growing demand, explaining that while there were some initial challenges with third-party producers, most problems were resolved within a few months through targeted R&D. Outsourcing reduces the need for large capital investments in building production facilities, allows companies to scale across regions more quickly, and provides access to specialized equipment and expertise. Taken together, these insights reveal that scaling circular economy innovations requires a combination of ecosystem collaboration and strategic integration. Collaboration ensures that every actor in the value chain progresses together, reducing the risk that lagging suppliers or partners will undermine progress. Strategic integration embeds circularity into core operations, from sourcing and production to process design and growth strategies.

By treating sustainability as a strategic driver rather than a compliance obligation, companies can unlock significant value by lowering costs, improving efficiency, reducing risk, and opening new revenue streams. At the same time, by collaborating openly with partners, sharing know-how, and supporting less mature companies, they help create the systemic change needed to make circularity the norm rather than the exception. Ultimately, the interviews illustrate that circularity is not simply an environmental imperative but a transformative business opportunity. It is a pathway to more resilient, efficient, and innovative operations that can deliver both economic and social value over the long term.

## 4.5 Gioia Table

1st Order Concepts	2nd Order Themes	Aggregate Dimensions
<ul style="list-style-type: none"> <li>• “It is difficult to find producers who wants to produce for small quantities” (Case 6)</li> <li>• “(...) scaling up from labo-scale to full-scale production, implies unforeseen challenges in the production process” (Case 1)</li> <li>• “(...) mistrust towards innovative products” (Case 1)</li> <li>• “(...) investing in research and development to adapt both the product and the production process to the different machinery used by producers is a huge cost that small circular companies have to face” (Case 6)</li> <li>• “(...) adapting the product to the facility takes time, as each facility is different” (Case 1)</li> <li>• “Producers often do not know how to handle recycled materials, so there is often the need to train them” (Case 3)</li> </ul>	Supply Chain Barriers	Operational Challenges
<ul style="list-style-type: none"> <li>• “There is not enough collection of used or waste materials, which may cause a problem for circular innovations” (Case 7)</li> <li>• “(...) different quality and regulations in the different nations for the recycling and collection of waste” (Case 7)</li> <li>• “(...) for recycled products and circular products, it is rather a local supply and value chain” (Case 7)</li> <li>• “Expanding abroad would not allow the same level of control” (Case 6)</li> <li>• “Sustainability claims must be supported by verifiable data” (Case 7)</li> <li>• “Need for certifications and data in order to be transparent” (Case 2)</li> </ul>	Operational Scope Limits	
<ul style="list-style-type: none"> <li>• “The main difficulties include sourcing waste materials and optimizing industrial processes” (Case 5)</li> <li>• “(...) in order to meet reuse waste production processes need to be adopted (...)” (Case 3)</li> <li>• “(...) important to remain credible and to comply with sustainability through reports in order not to lose brand reputation and scandals” (Case 2)</li> <li>• “(...) when replicating a business model, you always have to take into account culture and regulations” (Case 7)</li> <li>• “Customers are used to very cheap garments (...) mass-produced (...)” (Case 4)</li> <li>• “Gadgets were produced in low-cost countries at very low prices (...) we were not able to compete” (Case 3)</li> <li>• “For many private customers price is still important” (Case 6)</li> <li>• “For private customers the price is still very important, for large clients like architecture firms, price isn’t a significant factor, they value more the product quality and the innovation” (Case 1)</li> </ul>	Economic Constraints	Cost Challenges
<ul style="list-style-type: none"> <li>• “(...) breaking out of the niche is difficult (...) it requires educating the customers” (Case 4)</li> <li>• “(...) for large clients, like architecture firms, the innovation and quality of the product is the main driver” (Case 1)</li> <li>• “(...) Important to help consumers learn how to make more conscious and responsible purchasing decisions” (Case 6)</li> <li>• “(...) the messaging around circular products is more prominent and can serve as a purchasing driver” (Case 3)</li> </ul>	Consumer Awareness	

1st Order Concepts	2nd Order Themes	Aggregate Dimensions
<ul style="list-style-type: none"> <li>•“Legislation is a major driver for B2B; business clients are pushed and incentivized to buy sustainable and circular products” (Case 6)</li> <li>•“The EU regulations are a great driver to increase circularity and sustainability” (Case 7)</li> <li>•“Because of regulations, there is growing interest in sustainable practices, and it is also becoming a legislative obligation” (Case 2)</li> <li>•“(…) companies will start requiring certain information, data, and reporting so they can perform their own reporting” (Case 2)</li> <li>•“(…) it is important to create clear reporting to build trust with all stakeholders and ensure the necessary transparency” (Case 2)</li> <li>•“(…) important to have traceability and control in order to remain credible” (Case 6)</li> </ul>	Regulatory Momentum	Market Opportunities
<ul style="list-style-type: none"> <li>•“The market is still small but expanding, as more people are becoming interested in making informed, responsible choices.” (Case 4)</li> <li>•“Even in the face of inflation and geopolitical uncertainty, consumers continue to value sustainability” (Case 7)</li> <li>•“(…) competitive advantage: because environmental issues are becoming ever more important and are being taken into greater consideration” (Case 2)</li> <li>•“(…) innovative products are the main purchasing drivers, and price plays a relatively minor role” (Case 1)</li> <li>•“The solution emerged through the circular economy. Initially, they recognized the innovation in a certain product, but it lacked economic sustainability, which led them to abandon it. By starting from waste materials, they were ultimately able to reach economic viability” (Case 3)</li> <li>•“(…) it is a small but rapidly growing market (…) with a focus on this niche segment that continues to gain traction” (Case 4)</li> <li>•“(…) growing demand for regenerated materials” (Case 5)</li> <li>•“(…) the communication of a circular product is more powerful and can be a driver of purchase” (Case 3)</li> </ul>	Market Demand Shift	
<ul style="list-style-type: none"> <li>•“(…) competitive advantage: because environmental issues are becoming ever more important and are being taken into greater consideration” (Case 2)</li> <li>•“(…) the communication of a circular product is more powerful and can be a driver of purchase” (Case 3)</li> <li>•“(…) take a radical approach and keep differentiating more strongly” (Case 4)</li> <li>•“(…) the image and characteristics of sustainability are the winning choice” (Case 1)</li> <li>•“Innovative products serve as key drivers, and pairing a strong brand image with sustainability is the formula for success” (Case 1)</li> <li>•“(…) many of the awards won are tied to the sustainability of the idea. (…) for visibility, recognition, and relevance, presenting a sustainable idea or innovation makes a big difference” (Case 1)</li> <li>•“(…) circular products have the advantage of a much wider and more powerful narrative around them” (Case 3)</li> <li>•“(…) many collaborations with big brands took place thanks to the sustainability of the idea (…)” (Case 6)</li> </ul>	Brand Differentiation	

1st Order Concepts	2nd Order Themes	Aggregate Dimensions
<ul style="list-style-type: none"> <li>•“(…) the only way to build a more sustainable industry is through collaboration with all the actors in the ecosystem to pursue common objectives” (Case 2)</li> <li>•“(…) the importance of training the value chain, as well as suppliers and producers, to drive change and build awareness, ensuring no one is left behind” (Case 3)</li> <li>•“(…) in order to drive change, it is important to engage the supply chain, involve it actively, and treat it as an integral part of the team” (Case 4)</li> <li>•“(…) the transition to circularity cannot be achieved in isolation” (Case 6)</li> <li>•“(…) not all companies across the supply chain are on the same journey, and this creates a challenge for scaling circular innovation. That is why education, active collaboration, and offering practical tools to support less mature companies are all necessary” (Case 2)</li> <li>•“(…) earnings no longer come only from projects but also from sharing and transferring know-how” (Case 3)</li> <li>•“(…) opportunities include forging strategic partnerships and achieving strong competitive differentiation” (Case 5)</li> <li>•“(…) collaboration and open communication, combined with education and active engagement, are essential to equip less mature companies with the tools they need to progress” (Case 2)</li> </ul>	Ecosystem Collaboration	Circularity Enablers
<ul style="list-style-type: none"> <li>•“(…) sustainability is an opportunity for growth. It helps reconcile environmental efficiency with economic value and operational effectiveness” (Case 2)</li> <li>•“The solution emerged through the circular economy. Initially, they recognized the innovation in a certain product, but it lacked economic sustainability, which led them to abandon it. By starting from waste materials, they were ultimately able to reach economic viability” (Case 3)</li> <li>•“(…) recycled materials are more cost-effective” (Case 7)</li> <li>•“(…) using production waste from other companies is a smart way to eliminate raw materials costs and lower production expenses” (Case 3)</li> <li>•“(…) the high upfront investments lead to long-term cost efficiency (…)” (Case 5)</li> <li>•“Becoming more efficient always creates opportunities and generates additional economic value, and circularity leads to efficiency” (Case 2)</li> <li>•“(…) there cannot be environmental sustainability without also having social and economic sustainability” (Case 3)</li> <li>•“(…) recycled materials can be more cost effective” (Case 7)</li> <li>•“(…) starting out as a small company allows for greater agility and makes it easier to implement changes. It is essential to embed circularity and sustainability right from the design phase” (Case 6)</li> <li>•“Adopting circularity from the beginning enables more agile adaptation” (Case 3)</li> <li>•“Embedding circularity right from the design phase is essential to prevent the high cost of later adjustments (…)” (Case 2)</li> <li>•“Having production outsourced to third parties enables simultaneous manufacturing across different sites” (Case 6)</li> <li>•“Despite challenges with third-party producers, outsourcing was necessary to scale production” (Case 1)</li> </ul>	Strategic Integration	

## Chapter 5: Discussion

This section integrates insights from the literature review with the empirical findings of the study to develop a more comprehensive understanding of what scaling CE innovations involves. By comparing theoretical perspectives with real-world experiences, this analysis highlights both similarities and differences and contributes to the broader understanding of the field. While existing literature provides a robust conceptual framework for understanding CE innovations, practical efforts to scale these models often face more specific and complex challenges, such as operational, financial, and relational barriers that are not always fully recognized in literature.

Circular Economy innovations are often presented as fundamentally different from traditional business models. They aim to do more than just make processes efficient or save money. The goal is to completely rethink how resources are used and how waste is managed. Rather than producing a product, selling it, and disposing of it, circular strategies focus on keeping materials in use for as long as possible. This may involve repair, reuse, recycling, or redesigning systems that eliminate waste entirely. These concepts are widely accepted in literature, which often discuss the big-picture changes needed in society, government, and the economy to make circular practices widely adopted. When speaking with people working directly on circular solutions, the same values come through, though often in more practical terms. Many companies are trying to scale their innovations by expanding into new markets or increasing production. At the same time, they focus on changing customer behavior, shifting partner expectations, and dealing with systems that were not built with circularity in mind. Success, in this context, is not just about growing revenue. It also means contributing to a broader cultural and environmental shift. Exactly here can be addressed the first alignment between theory and practice, which is the importance of breadth- and depth- scaling. Breadth-scaling means bringing circular solutions to more people or entering more markets (Hermans et al., 2016). Depth-scaling means making a stronger impact by changing how people think about waste, influencing regulations, or transforming supply chains. Although interview participants did not explicitly use these terms, their responses reflected the concepts described by Hermans et al. (2016). Interviewees consistently emphasized how important education, awareness-raising, and cultural change are. These are not just supportive activities but are essential to scale CE innovations, as they try to reshape societal values, influence consumer behavior, and challenge existing institutional structures that hinder sustainable development. Thus, this study confirms that

CE scaling is both a technical and a cultural transformation, as already expressed in existing literature (Hermans et al., 2016).

This alignment extends to the drivers and barriers of CE adoption as categorized by Tura et al. (2019). Many of the seven categories identified in their research were supported in the interviews conducted for this study. For instance, environmental considerations remain a strong driver. Companies reported an increase in global pressure to minimize environmental impacts. A particular emphasis was placed on the demand for transparency, often directly coming from business clients (Case 1, Case 2, Case 6). This is especially relevant considering recent European Union regulations that require higher levels of accountability in production and supply chains. Practitioners noted that stakeholders, from regulators to investors and customers, expect greater transparency not only in sustainability metrics but also in product lifecycles and material sourcing. Transparency can be therefore seen as both, a regulatory requirement and a strategic advantage.

Another important motivation comes from the alignment between circular innovation and broader climate goals (Tura et al., 2019). Companies want to be part of the global effort to reduce greenhouse gas emissions and protect natural resources. In several cases, businesses reported that their circular practices helped them reduce waste, conserve water, and repurpose materials (Case 2, Case Case3). One company described how it reused wastewater in its production process and turned leftover materials into fertilizer (Case 2). These strategies did not just help the environment, but they also lowered costs and made the businesses more efficient. Moreover, this strategic approach helps to build reputational advantages while aligning with shifting consumer and stakeholder values.

Economic incentives also played a key role in encouraging circular practices (Tura et al., 2019). Several companies found that working with waste materials or optimizing resources gave them a financial advantage (Case 2, Case 3). One example involved a company that drastically reduced costs by designing its operations around the reuse of production byproducts (Case 3). Another business found that reusing water and production byproducts helped them decrease overall production costs (Case 2). These kinds of efficiencies show that circularity does not only lead to positive impacts on environmental aspects but also to economic advantages.

Despite these benefits, many companies still face significant challenges. In earlier research, most attention focused on the difficulties that traditional businesses experience when trying to shift and adopt circular practices. The high cost of changing systems, training staff, and upgrading technology often hinders progress (Tura et al., 2019). But in this study, the challenges were

somewhat different. The focus was mostly on companies that started with circularity at their core. For them, the problem was not switching to a new model but figuring out how to scale their existing model. One of the biggest issues faced by these businesses was working with third-party manufacturers. Since many small and medium-sized circular companies do not have their own production facilities, they depend on third-party manufacturers to produce their products. Unfortunately, these partners often lack the tools, knowledge, or motivation to handle circular materials or processes. Several companies reported having to invest heavily in research and development just to get their partners fully prepared (Case 1, Case 3, Case 6). This kind of investment can be risky, especially for younger companies that do not have large financial reserves.

Rules and regulations play a mixed role in this context. On one hand, they encourage companies to adopt more sustainable practices by creating stricter environmental standards (Sairanen & Aarikka-Stenroos, 2024; Tura et al., 2019). Several participants emphasized that evolving regulatory standards are pushing companies to integrate sustainability and circularity into their operations. These frameworks not only encourage CE innovation but also stimulate market demand, especially in business-to-business contexts, by setting new benchmarks for product design, production, and post-use management. On the other hand, the complexity of regulations, especially when trying to scale internationally, can create delays and confusion (Case 2). Different countries have different rules about recycling, waste, and transparency, which means companies must change and adapt their strategies depending on where they want to expand (Case7). In many cases, this leads to slower scaling or the need to redesign business processes for each new location.

In addition to regulatory complexity, supply chain challenges often slow down growth. Successful circular strategies depend on tight coordination across suppliers, manufacturers, and distributors. Trust, transparency, and long-term relationships are critical (Case 1, Case 2, Case 3). For instance, a company that wants to reuse waste from one process as raw material for another depends heavily on the cooperation of partners throughout the supply chain. If those partners are unwilling or unable to adapt, the entire model can fall apart. For startups, the reliance on third-party manufacturers who lack circular expertise can significantly hinder their ability to scale. This is especially problematic when upstream partners are not aligned with CE principles, leading to delays, inefficiencies, or even the failure of scaling initiatives. While literature often focuses on downstream challenges, such as product take-back or customer acceptance, this study points out the equally important need for upstream transformation and alignment. Many of the companies interviewed stressed the importance of training and educating their partners. This was not just about teaching them new techniques but about building trust and aligning goals (Case 2, Case 3). Companies found that when

everyone involved understood why circularity matters, and how it works, things moved much more easily. But getting to that point often requires time, money, and repeated effort.

Another important takeaway is that companies that treat circularity as a long-term strategy tend to perform better (Tura et al., 2019). Instead of seeing circular practices as a way to meet compliance or marketing goals, they make them part of their overall business approach. When integrated into the core of a company's business model, circular practices can differentiate the firm in the marketplace by enhancing brand credibility and generate long-term cost efficiencies. Several companies described how this approach helped them reduce risks, cut costs, and improve customer loyalty (Case 2, Case 3, Case 5).

The customer side of CE innovations also presents both opportunities and limitations. As Linder & Williander (2017) have noted, circular products tend to appeal to specific customer segments, especially those interested in environmental concerns. This study confirms that the market for circular products is still a relatively niche market, but it is growing rapidly. Several participants observed that this trend creates an opportunity for early movers to establish market leadership and shape consumer expectations (Case 3, Case 4).

Another shared challenge which emerged from both literature and this study, is managing the variability in return flows, which are materials that are reused, refurbished, or recycled within CE systems. The literature describes these flows as difficult to predict in terms of timing and quality (Linder & Williander, 2017; Östlin et al., 2008; Ravi & Shankar, 2005; Seitz, 2007), and this was reinforced by findings from Case 7. Waste streams often differ depending on geographic region, and their quality can vary widely, which requires companies to conduct localized assessments and adapt strategies accordingly. This further reinforces the idea that circularity is mostly tied to local contexts. While some literature presents local production as a strategic choice (Rocca et al., 2023), the companies in this study often viewed it as a structural necessity. For example, Case 1 pointed out that transporting reused materials over long distances can be costly and harmful to the environment, which goes against the idea of circularity. That is why localized production and sourcing are often a necessity rather than a choice for scaling CE models.

A related issue between literature and this study is given by the ability to test circular practices on a small scale before rolling them out widely (Tura et al., 2019). Many interviewees emphasized that before full-scale implementation, innovations must undergo pilot testing to evaluate feasibility and identify potential challenges. However, companies frequently encounter unforeseen technical obstacles when transitioning from pilot to full-scale operations. Case 1, for instance, described how

scaling revealed previously unnoticed technological constraints that required significant investment in R&D to be resolved. This process, although resource-intensive, appears to be essential for the effective scaling of CE innovations.

The study also reinforces the importance of communication and capacity building across the supply chain (Goworek et al., 2018; Tura et al., 2019). Several companies noted the necessity of educating partners and manufacturers about circular practices to ensure easier collaboration. By investing in training and knowledge exchange, businesses can reduce friction, enhance efficiency, and create a more stable network of stakeholders. This is not only beneficial for environmental performance but also crucial from a strategic and operational standpoint.

An additional finding that aligns with literature is the value of cross-industry collaboration. As Hofmann and Zu Knyphausen-Aufseß (2022), Coppola et al. (2023) and Goworek et al. (2018) argue, CE cannot succeed in isolation, it requires partnerships across sectors to build closed-loop systems. This was evident in Case 2, as the company collaborated with a local biogas producer to turn waste into energy. Such collaborations generate systemic benefits, both environmental and economic, while strengthening circularity as a model that can deliver shared value across industries.

While many of these findings match up with the existing literature, there were also some differences. One surprising discovery was that interviewees did not talk much about digital tools such as blockchain or advanced traceability systems. These topics often appear in academic discussions about how to scale circular innovations. However, in practice, businesses seemed more focused on hands-on challenges, like finding reliable partners, managing unpredictable material flows, and navigating local infrastructure limitations. The fact that these technologies were not mentioned by interviewees suggests a disconnect between academic focus and real-world priorities.

On the other hand, one of the most critical challenges reported by practitioners, which is the difficulty of finding capable third-party producers, is rarely emphasized in literature. This could depend on the fact that most academic studies focus on established companies transitioning toward circularity or on single innovations, rather than on the broader scaling process. As such, this study contributes new insights by drawing attention to the practical challenges of external collaboration, manufacturing compatibility, and knowledge gaps within supply chains.

In conclusion, this study affirms that many of the core challenges and enablers identified in the literature also apply to the scaling of CE innovations. At the same time, it adds depth to the understanding of scaling by highlighting specific issues faced by companies that are inherently circular and aiming for growth. The findings contribute new insights regarding partner capabilities,

localized constraints, and the gradual nature of scaling. At the same time, it calls attention to underexplored dimensions such as the need for greater upstream alignment and the absence of digital technology integration in practitioner discourse.

In the end, scaling circular innovations is not just about technical solutions or financial investment. It is about building ecosystems of trust, collaboration, and shared purpose. The road is not easy, and it comes with many challenges. But those who manage to scale successfully are creating more than just profitable businesses, they are contributing to a wider transition toward sustainability. This study helps show how theory and practice come together, and where they diverge. It confirms many known ideas while adding fresh perspectives from those working directly in the field. It highlights that circular economy scaling is as much about people, relationships, and adaptability as it is about systems and technologies. And most importantly, it shows that with the right mindset and support, circular innovations can grow in ways that benefit not just businesses, but the planet as well.

## Conclusions

This study has examined the opportunities and challenges that companies face when attempting to scale up circular economy innovations. By focusing on Italian companies across different sectors, the research revealed how firms translate circular principles into practice and what factors either enable or hinder these efforts. The findings highlight that scaling up is both essential and difficult: there are clear opportunities for innovation and competitiveness, but major barriers still prevent many initiatives from moving beyond small trials to wider adoption.

Among the most important challenges are the operational ones. These include supply chain barriers, such as finding suitable third-party producers willing or able to manufacture circular products. This requires managing reverse logistics, product recovery, and substituting recycled materials for virgin ones. Such systems are harder to manage because they demand careful coordination, additional resources, and new expertise. Another difficulty is the cost of adapting both products and production processes to external facilities, which is closely tied to the expense of training producers in these new methods. Operational barriers also arise from the scope limits of the circular economy itself. By definition, circularity and sustainability stand in contrast to mass and overproduction. Instead, they emphasize efficient resource use and the principle of producing and consuming only what is necessary. Moreover, circularity is often local in nature, since it is linked to reducing CO<sub>2</sub> emissions and requires strict oversight. Cost challenges are another major obstacle. Circular initiatives typically require higher upfront investments, while financial benefits may take time to materialize. This tension between immediate costs and long-term gains discourages some firms from scaling further. Closely related is the issue of consumer awareness. Many consumers are either unaware of circular products or reluctant to adopt them. Price sensitivity remains a dominant factor in purchasing decisions and many people underestimate the power they hold through their choices, or the significant impact those choices have on the broader system. At the same time, the research showed that scaling circular innovations also offers clear opportunities. For example, market opportunities which are given by the regulatory momentum, which arises from the strong legislative push towards sustainable products and the regulations that incentivize the use of recycled and low-impact materials. Another dimension of market opportunities comes from the shift in market demand. Consumers increasingly value sustainability, while B2B clients emphasize transparency and sustainable product choices. At the same time, niche markets for circular products are emerging, representing a significant opportunity for scaling. A further element is brand

differentiation as strong sustainability performance enhances brand reputation and serves as a key differentiator in crowded markets. Moreover, it increases visibility through awards, certifications, and media coverage. Another key aspect that emerged is the role of circularity enablers. The first is ecosystem collaboration. As highlighted in the literature, collaboration and communication across the entire value chain are essential to driving change. Supporting supply chain partners in their transition toward more sustainable and circular processes is crucial. In this context, open innovation and knowledge sharing play a central role in enabling circular innovations. A second enabler is strategic integration. The findings show that when circular innovations are scaled effectively, they can deliver cost advantages over virgin materials and improve efficiency, ultimately generating economic benefits. However, to achieve this, circularity and sustainability must be regarded as strategic drivers rather than merely compliance requirements.

A careful analysis of the literature review and this study emphasized that opportunities and challenges are deeply interconnected. The very features that make circular models valuable, such as closing loops and reusing materials, also make them complex especially nowadays where most value chains, especially supply chains, are still linear. The promise of competitiveness, resilience and innovation is often balanced by the reality of higher upfront costs, operational barriers and strong need to educate the whole value chain. For this reason, scaling circular innovations requires more than technical solutions. It depends on cultural transformation, supportive policy frameworks and active collaboration across value chains. It is important to highlight that the firms that succeeded were those that treated circularity not as an isolated project but as an integrated part of their identity and strategy. This thesis also underlined the uneven nature of the transition. Some sectors and firms are more advanced, while others remain cautious. Progress depends strongly on organizational culture, leadership, and the surrounding institutional environment. This variability suggests that scaling is not a uniform process but one shaped by specific contexts and conditions. It also highlights the need for more coherent and supportive frameworks that can create the right environment for circular innovations to grow.

Nevertheless, this study presents some limitations that must be acknowledged. The focus on Italian companies means that the findings reflect a specific national context, characterized by the prevalence of small and medium enterprises and particular regulatory and cultural conditions. The analysis was based on a limited number of case studies and while these were diverse, they cannot represent all industries. The qualitative approach provided depth but not statistical generalization, and the research reflects a specific moment in time, while many initiatives are still developing. These limitations suggest directions for future research. For example, comparative studies across

countries would clarify how national contexts influence the scaling of circular economy practices. Moreover sector-specific investigations would deepen understanding of how opportunities and challenges differ between industries such as fashion, food, or manufacturing. Further research on larger-scale or longitudinal studies could provide insights into how circular initiatives evolve over time, while consumer-focused research would shed light on the demand side of scaling. Finally, evaluating the effects of policy incentives would also be important to understand how governments can support firms more effectively.

In conclusion, this study shows that scaling up circular economy innovations in Italy is both possible and necessary but also highly challenging. The opportunities are real: firms can achieve competitiveness and environmental benefits by embedding circularity into their strategies. However, the barriers are equally strong, including high upfront costs, operational complexities and cultural resistance. The evidence suggests that success requires long-term commitment, collaboration, and supportive frameworks that allow innovation to grow into systemic transformations. The Italian experience demonstrates both the potential and the fragility of the circular transition. Achieving scale will depend not only on the vision and action of individual companies but also on collective efforts across industries, institutions, and society. By highlighting both the opportunities and the challenges, this research contributes to a clearer understanding of the key issues involved in scaling circular innovations and how this process can shape a more sustainable future.

# Appendix 1

## Questions Interview

1. Could you provide a brief overview of your company's history?
2. How has the company managed to grow?
3. What are the main challenges and opportunities you have faced in integrating sustainability with business growth?
4. How were you able to overcome these challenges?
5. What advice would you give to other circular businesses looking to grow while keeping sustainability at the core of their business model?
6. What are your next goals in terms of growth?

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