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Organizational drivers and barriers in Circular business model innovation: a study on Italian Startups' circular design strategies

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Introduction

The adoption of a circular economy (CE) has become essential for enterprises aiming to tackle the environmental and resource issues caused by the current linear economic and production system, which takes resources from the surrounding environment, and transforms them into product, which are disposed of at last. The objective of the CE is to transition from this "take-make-dispose" paradigm to a regenerative one that intentionally preserves resources at their maximum usefulness for as long as feasible by recycling, reusing, and regenerating them.

The transition towards a more circular economy is crucial, as firms are increasingly being asked to minimize waste and be able to use resources more efficiently. There are many ways toward the Circular Economy, and firms represent an increasingly important agent in promoting the transition process since their innovative capabilities are key in shaping what constitutes a new economic and manufacturing paradigm.

Precisely, Circular business model innovation has been considered as one way to achieve sustainable development and production, and is gaining popularity as a leading phenomenon in the field. CBMI, however, is a complex organizational challenge facing multi-dimensional barriers. The aforementioned concept of circular business model innovation (CBMI) has been widely studied and analyzed, however there is a need for more empirical studies further diving into the notion of drivers and barriers which respectively enable and hinder circular business model innovation.

The study will precisely focus on organizational drivers and barriers and their impact on Circular strategy decisions, taking into account startups' cases, exploring a different path than the literature, which is focused more on the experience of MNCs (Multinational Corporations). The literature has been so far interested and keen in studying the role of MNCs and their circular economy initiatives. However, it is interesting to study the role of startups in this scenario as the CE notion is highly volatile and flexible organizations are more incline to innovate in this kind of environment.

This study aims to determine which are the organizational factors driving or hindering innovation in Circular business model strategies by looking at the relationship between organizational factors and circular strategies. An online survey was conducted using Qualtrics to respond to the question, obtaining insights from 88 employees of startups in Italy involved in circular initiatives.

Literature review

In this section we will delve deeper into the main theme of the study: the circular economy. We will discuss further the definition of CE, the types of Circular Business Model Innovation (CBMI) and the CBMI framework. Drawing the boundaries of the CE is essential for our analysis in order to assess and understand which Business models are circular.

1. Conceptualizing Circular Economy

In recent years, the concept of CE has been recognized as a strong alternative to a more traditional, linear, economic model. The economy we are used to live in is currently shaped by a "cradle-to-grave" design in which resources are taken from the environment, transformed into products, these products are used and ultimately discarded as "waste". The fundamental principle of "circularity" is closing this loop, maintaining resources within the production system, ensuring a greener, more efficient economy.

The circular economy (CE) is based on production and consumption systems that are restorative and regenerative by default. These systems strive to maintain products, components, and materials at their peak utility and value for as long as possible, operating within both technical and biological cycles. The concept of CE goes beyond the 3Rs (reduce, reuse, recycle). Instead, CE model embraces innovative concepts such as designing out waste and pursuing eco-effectiveness instead of eco-efficiency (Braungart et al., 2007). From this starting point, entrepreneurs can create new business models by slowing and closing resource loops (Bocken et al., 2016).

However, in order to have a systemic change, new approaches to CE are needed, depending on the sector, industry, business model, etc. Several approaches to CE have emerged in the literature to respond to current challenges in different sectors of the economy. These approaches are summarized in seven schools of thought, which will be briefly described below.

- **Performance Economy**

Walter Stahel's concept of the performance economy stands as a groundbreaking departure from traditional linear economic paradigms, bringing the discussion towards a greener and more resilient global economic system. The core of Stahel's theory was the transformation from a "production economy" in which the main activity performed was the actual production of the product followed and the main purpose was the ownership of the one, to rather producing products in order to deliver services and outcomes (Stahel, 2010). In this new approach, the emphasis lies not on ownership but on the availability of the functionalities and benefits of products through various service-based models such as leasing, renting, or sharing. This shift is key to reaching the maximization of the utilization of the capacity of products, decoupling economic growth from resource consumption. The performance economy seeks to extend the lifetime of products, minimize waste creation, and maximize resource utilization. At the heart of Stahel's vision is a fundamental reimagination of the relationship between businesses and consumers. Rather than viewing products as disposable commodities, the performance economy encourages manufacturers to design products in order to achieve durability, reparability, and upgradability.

- **Biomimicry**

Biomimicry is the approach that draws inspiration from the ingenious solutions found in the natural world to address human challenges. It is based on the imitation of nature's best practices, designs and processes (Benyus, 1997). By harnessing nature's principles, biomimicry not only leads to innovative and eco-friendly designs but also fosters a deeper appreciation and respect for the natural world. As we confront pressing environmental and technological challenges, biomimicry stands as a powerful tool for unlocking sustainable solutions that benefit both humanity and the planet.

- **Industrial ecology**

Industrial Ecology (IE) can be defined as a broad, holistic framework for guiding the transformation of the industrial system to a sustainable basis (Lowe & Evans, 1995). It is built on the idea of managing material and energy flows through industrial eco-systems. This model is closely related to biomimicry, as the model to imitate is now the ecosystem as a whole. IE suggests to use the design of ecosystems to plan and reshape industrial systems. This approach needs, however, a web of interaction among companies such that the residuals of one facility become feedstock for another.

- **Natural Capitalism**

Natural Capitalism is instead a model that values and efficiently utilizes natural resources, improving business profitability and environmental sustainability through innovative practices and technologies. Specifically, Natural capital can be defined as the earth's natural resources and the ecological systems that provide vital life support and this method lies on the assumption that the current economic system is deteriorating the Natural Capital. This approach includes increasing resource efficiency, adopting Nature-alike production models, shifting to service-based business models, and reinvesting in Natural Capital to ensure sustainability and profitability.

- **Blue economy**

The "Blue Economy" concept, as introduced by Gunter Pauli in his 2010 book, advocates for sustainability in resource use, based on the principles observed in natural ecosystems. This approach emphasizes the use of innovative solutions based on open-source innovation to extract value from underutilized resources locally, using the resources available within cascading systems, so that the waste of one product becomes the input to create a new production and economic flow, bringing closed-loop systems into light.

- **Regenerative design**

According to this approach, all systems, from agriculture to industries, should be orchestrated in order to have a regeneration plan. Production processes themselves renew or regenerate the sources of energy and material that they consume. The ultimate goal is to integrate human activities within natural processes to design landscapes, buildings, and infrastructure to imitate natural ecosystems. This process would lead to the creation of environments that are not only self-sustaining but also beneficial to the natural world, enhancing rather than depleting ecological health.

- **Cradle to Cradle (The Eco-effectiveness Paradigm)**

Cradle-to-Cradle design represents one leading concept within Circular Economy. It provides practitioners with a framework to move beyond the concept of zero emission approach, minimization and efficiency, towards a fundamental redesign of material flows, able to maintain the inner value of resources.

According to Braungart et al. (2007), cradle-to-cradle design, which is part of the broader concept of eco-effectiveness, offers an alternative to the present philosophy of eco-efficiency. Eco-efficiency seeks to reduce the environmental footprint by reducing consumption of resources during production, by engaging in different strategies such as volume minimization, reduced consumption, design solutions for recycling, repair and durability (Braungart et al., 2007). Eco-efficiency is not a new concept; its inception dates back to 1989 when the *World Business Council for Sustainable Development* originally defined eco-efficiency as "*being achieved by the delivery of competitively priced goods and services that satisfy human needs and bring quality of life, while progressively reducing ecological impacts and resource intensity throughout the life cycle to a level at least in line with the earth's carrying capacity*" (World Business Council for Sustainable Development, nd). The matter of "eco-efficiency" has greatly evolved since then, with more material-based and socially oriented approaches but the core can, to this day, be summarized as *to get more from less:* more products, more variety, with less waste and less resource usage. Eco-efficiency is embedded in various business strategies nowadays that are intended to reinvent obsolete inefficient production processes, taking numerous strategies and ways such as:

- Dematerialization
- Increased resource productivity
- Reduced toxicity
- Increased recyclability
- Extended product lifetime

Each of these strategies was *not* meant to disrupt present production processes and still rely on a Cradle-to-Grave approach; in fact, their core logic is to achieve a similar production level with reduced material input. Eco-efficiency and related strategies are not adequate solutions as "*less bad is no good*". The ultimate goal to reduce waste and emissions still presumes the idea of the Earth as "landfill" and recyclability often constitutes in "downcycling" as resources tend to lose value and quality during the process, ultimately leading to landfills. Moreover, the sole concept of Eco-efficiency could exacerbate the overproduction process as explained by the Rebound, or "Jevons" effect (Alcott, 2005). The mode of action of ecoefficiency strategies, mainly making production cheaper, leads to an increase in production and consumption which could lead to more waste to be managed.

Eco-efficiency is a reactionary approach that does not address the need for fundamental re-design of industrial material flows as it does not address the issue of remapping the current linear industrial system, making eco-efficiency ineffective towards long-term economic growth and innovation.

In contrast to eco-efficiency, eco-effectiveness is a concept which encompasses a cradle-to-cradle set of strategies, based on successful symbiosis and regenerative design of natural systems' solutions. Waste is eliminated from the equation and the focus is not on efficiency anymore, as long as the resources stay within the industrial process (Braungart et al., 2007).

The practical expression of the eco-effective approach is the design of industrial processes turning raw materials and resources into nutrients, letting them circle within the material flow, precisely within two distinct and separated flows: the biological metabolism and the technical metabolism.

The processes of resource extraction, manufacture, and consumer use are all included in the biological metabolism. Eventually, these materials return to natural systems so that they might be used by humans as resources once more. On the other hand, the technical metabolism concerns the products, frequently synthetic, that have the potential to remain within the production loop through reuse, recovery, remanufacture design strategies, while at the same time maintaining the highest value, with no risk of downcycling.

The shift from eco-efficiency to eco-effectiveness poses great challenges to entrepreneurs and businesses since C2C (Cradle-to-Cradle) design offers a broad theoretical framework for the transition but businesses are in desperate need for actual strategies and solutions to implement eco-effectiveness.

Braungart et al., (2007) proposed a five-step process to realize the transition from eco-efficiency to eco-effectiveness:

1. Free of…
2. Personal preferences
3. The passive positive list
4. The active positive list
5. Reinvention

The process starts when the product is designed with the elimination of toxic and hazardous substances, starting with acknowledging the presence of numerous toxic substances in the product and the effect they could have on the natural environment. Getting rid of these substances and materials is indeed a first step towards eco-effectiveness but the replacement shall be made with caution to ensure the quality and durability of the product are not compromised. The second step of the process comes to "personal preferences" which is the step in which the product is free of toxicity and the decisions of the product design focus on improvements, resulting in a better and less polluting version. These stages of the process still mainly rely on a eco-efficiency approach since the intermediate result is a "less bad" version.

The third step, the passive positive list, encompasses a deep assessment of the capacity of the nutrients, hence the raw materials, to flow within the biological and technical flows. After careful considerations regarding the toxicity, efficiency, replaceability of the materials, a passive positive list can be generated, composed by materials classified according to the degree of additional optimization needed to reach the true definition of positive consumption (Braungart et al., 2007). Step 4 (active positive list) and step 5 (reinvention) is where eco-effectiveness is reached. The active positive list is an optimized version of the passive one, in which the materials from the passive list have been optimized for the material or technical cycle. Step 5, instead, is the step where the relationship between the product and the customer is reshaped, reimagining the product role and design in numerous ways. These two steps involve practices like the product designs and business models solution defined by Bocken et al. (2016), and the types of Product service systems by Tukker (2004). These last two steps represent the actual shift from eco-efficiency to eco-effectiveness and will be discussed deeper below.

2. Product design and Business Models strategies for Circular Economy

Braungart et al. (2007) acknowledged the importance of closing resource loops, differentiating the "technical" side from the "biological" one in a Cradle-to-Cradle, hence circular, system. Moreover, according to Stahel (2010), a distinction was needed within the technical cycle between recycling and reuse of materials, with the latter being the most "circular" option.

Circular business models thus can enable economically viable ways to continually reuse products and materials, using renewable resources where possible. In their innovative research, Bocken et al. (2016) developed different product designs and strategies for Business Model innovation resembling the Cradle-To-Cradle approach proposed by Braungart et al. (2007) and discussed earlier.

Bocken et al. (2016) divided these strategies into categories according to the mechanisms by which resources flow through a system. From the concept of "closed loop systems" brought by Stahel (2010), and the re-use of goods with different techniques such as reconditioning, restructuring, upgrading and remanufacturing, the *slow replacement system* was defined. Differently, the recycling of materials, distinguished by Stahel from reuse, defined the *closing* of the resource loop, not affecting the velocity of the process.

Building on these assumptions, three main strategies, illustrated in Figure 1, can be defined (Bocken et al., 2016):

1. Slowing resource loops
2. Closing resource loops
3. Narrowing resource loops

Slowing resource loops is about building long-lasting products and processes, designing products for prolonged use and ensuring product life extension. Closing resource loops, on the other hand, refers to the reuse of materials and resources to avoid landfills and waste. Narrowing resource loops, however, is about reducing the materials used in production (Bocken et al., 2016). It becomes clear by now that reducing is a different approach, inclined towards eco-efficiency, and business model strategies resembling the "narrowing" approach can be successfully applied in a linear system and alongside strategies closer to "slowing" and "closing". Narrowing, however, is not a circular design strategy by itself as the time dimension is not addressed, leading to further increases in production (Bocken et al., 2016), recalling the Rebound effect.

Starting from the above assumptions and strategies categories, Bocken et al. (2016) grouped a series of design strategies, from which innovative business models come from.

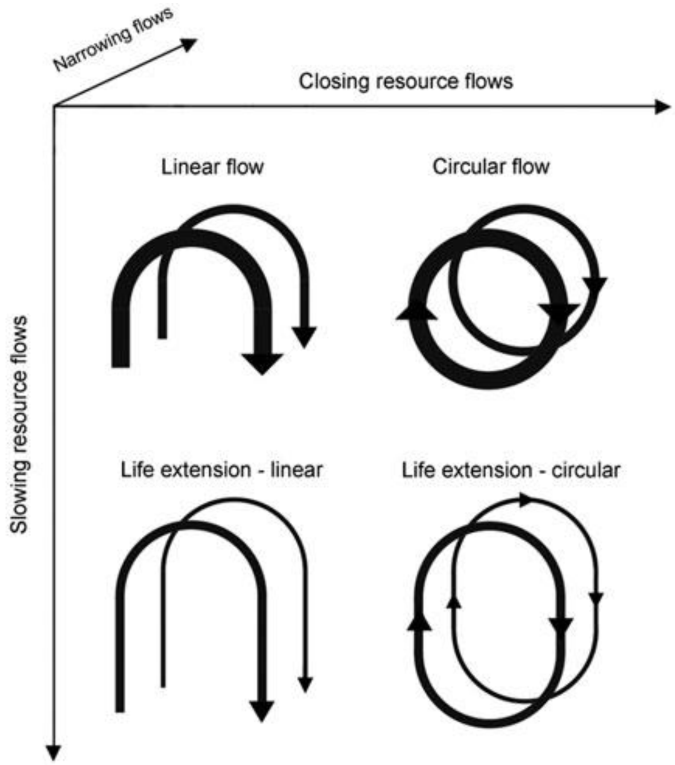


Figure 1: Categorization of linear and circular approaches for reducing resource use (Bocken et al., 2016)

Design strategies for slowing resource loops

The starting point for a CE model is to slow the resource and product flow to landfills, in order to maintain the nutrients as valuable as possible for the longest time possible. In order to obtain this, it is important to build long-life products and extend the product's lifetime, so that their value will be maintained for a longer period of time.

To build long-life products, businesses and entrepreneurs must work on the durability and reliability of their products (physical durability) and explore new ways to build attachment and trust for their products among consumers (emotional durability). The "design for attachment and trust" can be defined as the creation of products that will last longer because consumers love them and will not be replaced since a long-lasting emotional attachment has been created between the user and the product. However, if the product needs to be replaced because it lacks in performance or degrades very easily, the consumer will be forced to buy a new one and replace it; design solutions for durability and reliability make sure the beloved products will last as long as consumers need. Specifically, durability refers to the development of physically durable products that will not break down after falls and hits. In this case, the material selection is crucial in the design process. Conversely, design for reliability relates to the designing of systems and processes carried out to make sure the product will operate efficiently and as programmed for a specific (long) period of time (Bocken et al., 2016).

Product life extension, instead, is another design strategy to slow resource loops, and it relates to the extension, post-production, of the product use using additional services and mechanisms. Bocken et al. (2016) identified four different methods to extend product lifetime and slow resource loops:

1. Design for ease of maintenance and repair
2. Design for upgradability and adaptability
3. Design for standardization and compatibility
4. Design for dis- and reassembly

Maintenance and repair can be very effective strategies for firms to acquire a competitive advantage over their competitors as it enables the users and consumers to maintain their products at the top of performance for a prolonged period of time. Precisely, according to Bocken et al. (2016), repair involves the restoration of a product to ensure its full operational functionality, while maintenance involves the execution of inspection and/or servicing duties (technical, administrative, and managerial).

The second strategy refers to designing products that support future modification and upgrades, so consumers won’t need to buy a new product. Businesses and entrepreneurs can extract added value from existing products and projects by adding additional services to upgrade the product, improving the quality value, as well as the performances (Linton & Jayaraman, 2005). On the other hand, the third strategy type is about creating products with similar structures and designs in order to share components and be assembled easily, cutting down costs and waste. The standardization of products is essential for the fourth strategy type, “Design for dis- and reassembly” which is about making sure that the products and parts can be dismantled and reassembled easily. An overview of the design strategies is displayed in Table 1.

Table 1. Overview of design strategies to slow resource loops.

Design strategies to slow loops
Designing long-life products
• Design for attachment and trust
• Design for reliability and durability
Design for product-life extension
• Design for ease of maintenance and repair
• Design for upgradability and adaptability
• Design for standardization and compatibility
• Design for dis- and reassembly

Source: Bocken et al., (2016)

Design strategies for closing resource loops

In the long term, waste is generated within a system and it can face two possible scenarios: either reuse/recycling or dissipative loss (Ayres, 1989). According to Braungart et al. (2007) these two different fates pose great challenges for businesses in a Circular Economy environment and they came up with two distinct strategy types as well: dissipative losses need to be compatible with the natural environment, while other resources should be completely recycled or reused in a "technological cycle". Precisely, to effectively close resource loops, two main designs are to be followed: design for a technological cycle and for a biological cycle.

Businesses designed for the technological cycle are focused on services and "products of service", i.e., products comprising services as deliverables. The ultimate aim for this kind of design solution is to make it possible for materials to stay within the loop, being continuously recycled into new products. However, to achieve this, the products and materials recycled must maintain the same properties and value of the original, which is possible only in case of primary and tertiary recycling (Bocken et al., 2016). According to Bocken et al. (2016), in fact, there are four different levels of recycling. Primary recycling, also referred to as closed-loop recycling, is defined as: "*Mechanical reprocessing into a product with equivalent properties"* (Hopewell et al., 2009). Primary recycling is the benchmark as the concept of *upcycling* is achieved since the properties of the materials are retained (Braungart et al., 2007). Secondary recycling is, instead, the mechanical reprocessing of materials resulting in a downgraded version of the original, resulting in *downcycling* (Hopewell et al., 2009).

Tertiary recycling, on the other hand, is based on the recovery of resources through chemical processes such as depolymerization and consecutive buildup of the other material showcasing the same properties of the original (Kumar et al., 2011). Quaternary recycling, also described as thermal recycling, is the collection of energy and heat from waste materials, and it does not fit a circular economy approach as only a small portion of the original is reused and saved.

Lastly, in order for organic materials to be back in the environment safely, businesses design products of consumption (food, clothes etc.) with safe and sane materials to make them suitable for dissipating in the environment. In a biological cycle, these materials are biodegraded to be safely introduced back into the environment (Bocken et al., 2016). Examples of processes that enable this mechanism are anaerobic digestion and chemical feedstock, falling in the category of tertiary recycling. A snapshot of the described design strategies to close resource loops is presented in Table 2.

Table 2. Overview of design strategies to close resource loops.

Design strategies to close loops
• Design for a technological cycle • Design for a biological cycle • Design for dis- and reassembly

Source: Bocken et al., (2016)

Circular Business model strategies

This paragraph extends the discussion regarding circular design strategies further, diving into the concept of Circular Economy Business model strategies.

Business models are defined as *"the way firms do business"* (Magretta, 2002). According to Teece (2010), an innovative product or a disruptive technology does not guarantee business success as the product/technology shall be paired with a unique, tailor-made "go-to-market" strategy, hence, the business model. This is particularly true in challenging business environments such as the Circular Economy, which is posing numerous radical changes in the way entrepreneurs do business.

In the table below, the design strategies identified by Bocken et al. (2016), built on the works by Braungart et al. (2007) and Stahel (2010), are interpolated with the studies from Tukker (2004) and Bakker et al., (2010).

As in the *design for slowing resource loops* (Bocken et al., 2016), business model strategies to slow resource loops encourage product-life extension and the production of long-life products. A non-exhaustive list is shown in the table, starting with the "*access and performance model*", which is the strategy based on providing access to the benefits of a product without needing to own it. Tukker (2004) defined the business models falling into this category as "*Product service systems*" since they are characterized by a mix of products and services. Tukker (2004) identified three separate PSS categories, according to the amount of value added by the product and by the service, which are: 1) product-oriented services, 2) use-oriented services, and 3) result-oriented services. Category 1 comprises business models mainly focused on the product part and their value extraction still relies a lot on the product sales, hence, there's ownership transfer. the first category does not coincide with the definition of access and performance model, which is why they are separated in the table. Category 2, instead, comprises business models that are not geared towards selling products. The product is owned by the provider who makes it available in a different form, allowing sometimes the use of the product by multiple consumers (Tukker, 2004). The final category comprises business models in which the client and the provider reach a mutual agreement with no pre-determined product involvement.

Tukker (2004) distinguished eight subcategories of PSS falling within the three just mentioned and they are displayed in the example column in table 3. *Advice and consultancy*, example of a product-oriented service, falls within the strategy for long-life products, as, in relation to the product sold, the provider gives advices on the most efficient use (Tukker, 2004). *Product-related* services is the second subcategory of *product-oriented* services and the relation between the provider and the consumer does not stop with the sale, instead, the provider offers services needed during the use phase of the product like a maintenance program or take-back system. This is a case of a business model strategy designed to *extend the product's life-time*, in order *to slow resource loops* (Bocken et al., 2016).

Other three subcategories from Tukker (2004) are product sharing, product leasing and product pooling, falling into the use-oriented PSS definition. These are, again, examples of business model strategies to *extend the product life-time*, in order *to slow resource loops* (Bocken et al., 2016). The last three subcategories identified by Tukker (2004) are: outsourcing, pay per service unit and functional result.

Another business model strategy to slow resource flow is producing *Classic long-life products*, designing long-life products built for attachment and trust (Bocken et al., 2016; Haines-Gadd, 2018). These products typically reach high quality levels and numerous additional services are present, levitating the starting price which is usually premium, capturing value from customers' loyalty and the product's long lifetime (Bocken et al., 2016). A similar strategy is the basis for *sufficiency-based* business models, characterized by solutions actively seeking to reduce consumerism, building products made to last longer, designed for *durability* and *reliability* (Bocken et al., 2014). Examples are Rolex high-end watches as well as high-end garments.

Moreover, in order to slow down the resource loops, extending the life of products is another viable, and popular, option. A number of Circular business models rely on the strategy to *extend the product value* over time, which is the case for the aforementioned use-oriented business models defined by Tukker (2004) but other take-back systems developed by fashion retailers, or second-hand eCommerce platforms fall into this strategy type (Bocken et al., 2016).

To close resource loops, instead, businesses should increase the lifetime of materials rather than merely products. An example of this is the collection of what is considered waste, turning it into a product (Bocken et al., 2016). The value proposition is centered on making use of resources' residual value, which might increase the product's appeal to some customers (such as those who have an interest in being "green") while lowering the cost of materials and the final product price. The company will eventually capture value by turning otherwise "wasted" resources into new forms of value (Bocken et al., 2016).

Comparably, industrial symbiosis is a process-oriented approach that focuses on converting waste products from one company into raw materials for another process or product line within another company. Value is created as a reduction of risks and costs for all businesses and companies involved in the symbiosis. An example of this is the Kalundborg Eco-Industrial Park (Jacobsen, 2006).

So far, we have investigated the general concept underlying the Circular Economy, starting from the seven schools of thought such as Regenerative Design, Performance Economy, Cradle to Cradle, Industrial Ecology, Biomimicry, Blue Economy, Permaculture, Natural Capitalism, Industrial Metabolism and Industrial Symbiosis. We then delved deeper into the conceptual models by providing a high-level view of the current design and business model strategies, which all originate from the seven schools of thought.

Finally, we can conclude by providing a comprehensive definition of the Circular Economy. According to Kirchherr et al., (2023), CE can be defined as: *"a regenerative economic system which necessitates a paradigm shift to replace the end-of-life concept with reducing, alternatively reusing, recycling and recovering materials throughout the supply chain with the aim to promote value maintenance and sustainable development, creating environmental quality, economic development, and social equity, to the benefit of the current and future generations. It is enabled by an alliance of stakeholders (industry, consumers, policymakers, academia) and their technological innovations and capabilities."*

Table 3: Business model strategies to slow and close resource loops. Developed from by Bocken et al., (2016), Tukker (2004) and Bakker et al., (2010).

Design strategy type	**Design strategy**	**Example**	**Business model strategy**	**Example**
Design strategies for slowing resource loops	Designing long-life products	- Design for attachment and trust - Design for reliability and durability	- *Access and performance model (use and result oriented)* - *Product-oriented services* - *Classic long-life products* - *Encourage sufficiency*	- *Advice and consultancy* - *Premium long-life products with additional services* - *Sufficiency-based Business models* - *Product-related (maintenance service)* - *Building durable products*
	Designing for product-life extension	- Design for ease of maintenance and repair - Design for upgradability and adaptability - Design for standardization - Design for dis- and reassembly	- *Access and performance model (use and result oriented)* - *Product-oriented services* - *Extending product value*	- *Product sharing Product lease* - *Product pooling* - *Retails return schemes* - *Second-hand platforms* - *Refurbished electronics* - *Remanufacturing* - *Product-related (take-back system)*
Design strategies for closing resource loops	Design for a technological cycle	- Primary recycling - Tertiary recycling	- *Extending resource value* - *Industrial symbiosis*	- *Collecting waste for repurpose (e.g. plastic waste turned into clothes)* - *Waste collection and transformation into feedstock for partners*
	Design for a biological cycle	- Design for biodegradability - Anaerobic digestion	- *Extending resource value* - *Industrial symbiosis*	- *Selling biodegradable materials*

3. Defining Circular Business Models and CBMI

Recently, Circular economy has gained popularity as a strategy to reduce resource usage, waste and emissions. In order for the transition to be successful, the implementation of business models aligned with the basic principles of CE which have been widely discussed in the section above, is crucial.

The importance of CE is profoundly significant in addressing contemporary environmental challenges. Circular economy represents a paradigm shift towards regeneration and resource efficiency, aimed at closing the loop of product lifecycles through increased recycling, reuse, and reduced resource consumption. This model drives environmental sustainability while offering a chance for businesses to gain a competitive advantage by multipling economic growth from reduced resource consumption. This is why businesses are increasingly integrating CE principles in their business strategy by developing new innovative circular business models.

In order to have a clear view of the focus of the study, it is key to separate and discuss the differences between Sustainable Business Models (SBMs) and Circular Business Models (CBMs).

According to Abdelkafi & Tauscher (2016), SBMs are defined as: "*Sustainable business models that incorporate sustainability as an integral part of the company's value proposition and value creation logic, providing value to the customer and the natural environment and/or society."* Moreover, for Geissdoerfer et al., (2016), SBMs are: *"a simplified representation of the elements, the interrelation between these elements, and the interactions with its stakeholders that an organizational unit uses to create, deliver, capture, and exchange sustainable value for, and in collaboration with, a broad range of stakeholders".* Lastly, for Geissdoerfer et al., (2018), SBMs ultimately are: *"business models that incorporate pro-active multi-stakeholder management, the creation of monetary and non-monetary value for a broad range of stakeholders, and hold a long-term perspective".* The literature describes different archetypes and generic strategies for SBMs, with CBMs being one of them (Geissdoerfer et al., 2018).

Circular business models (CBMs) first emerged as a concept in an article by Schwager & Moser (2006) but became widely known after the CE notion by the Ellen MacArthur Foundation and the World Economic Forum (EMF, 2012).

According to Roos (2014), CBMs are "*circular value chain business models in which all intermediary outputs that have no further user in the value creating-activities of the firms are monetized in the form of either cost reductions or revenue streams".* This definition incorporates elements from two Schools of thought, Biomimicry and Industrial Ecology, but it remains unclear how the waste collected from non-value creation activities can reduce costs (Geissdoerfer et al., 2020). Moreover, Linder & Williander (2017) defined CBMs as: *"a business model in which the conceptual logic for value creation is based on utilizing economic value retained in products after use in the production of new offerings. Thus, a circular business model implies a return flow to the producer from users, though there can be intermediaries between the two parties. The term circular business model, therefore, overlaps with the concept of closed-loop supply chains, and always involves recycling, remanufacturing, reuse or one of their sibling activities".* This second definition, however, seems to be focused solely on the "closing resource loops" design strategies explained by Bocken et al., (2016), and assumes re- strategies (i.e. reuse, remanufacture, recycle and so on) are always embedded within CBMs (Geissdoerfer et al., 2020).

On the other hand, Nußholz (2017) defined CBMs as *"how a company creates, captures, and delivers value with the value creation logic designed to improve resource efficiency through contributing to extending the useful life of products and parts (e.g., through long-life design, repair and remanufacturing) and closing material loops".* This definition is built on Bocken et al., (2016) design strategies and mixes closing and slowing resource loops (Geissdoerfer et al., 2020). According to Henry et al. (2020), CBMs are more precise in addressing environmental concerns, establishing specific actions to address the negative effects of firms' operations leading to excessive waste generation and resource depletion.

Definitions of CBM from the literature are based on the intersection between the value creation logic by Richardson (2008), which is based on the three dimensions of value proposition, delivery and capture, and the CE principles. According to this view, CBMs are "*business models that are cycling, extending, intensifying, and/or dematerializing material and energy loops to reduce the resource inputs into and the waste and emission leakage out of an organizational system. This comprises recycling measures (cycling), use phase extensions (extending), a more intense use phase (intensifying), and the substitution of products by service and software solutions (dematerializing)*" (Geissdoerfer et al., 2020). The four core strategies identified by Geissdoerfer et al. (2020) can be merged and combined creating a multitude of different combinations and innovative solutions.

Cycling refers to re- strategies, in order for materials and resources to be recycled within a system. Extending resource loops implies that the use phase of the product is extended, through repair activities and additional services, or design and marketing solutions. The last two core strategies refer to the intensification of usage, with solutions like the sharing economy, and the dematerialization of products, through the offer of services rather than hardware solutions, which is the case for a lot of Product-service systems and the digital economy.

According to Geissdoerfer et al., (2018), Circular Business Models (CBMs), in light of the literature's definitions displayed above, is a subcategory of Sustainable business models (SBMs), and not only foster sustainable value from a proactive, long-term multi-stakeholder perspective, but also enhance resource efficiency by closing, slowing, intensifying, and dematerializing resource loops, as shown in figure 2.

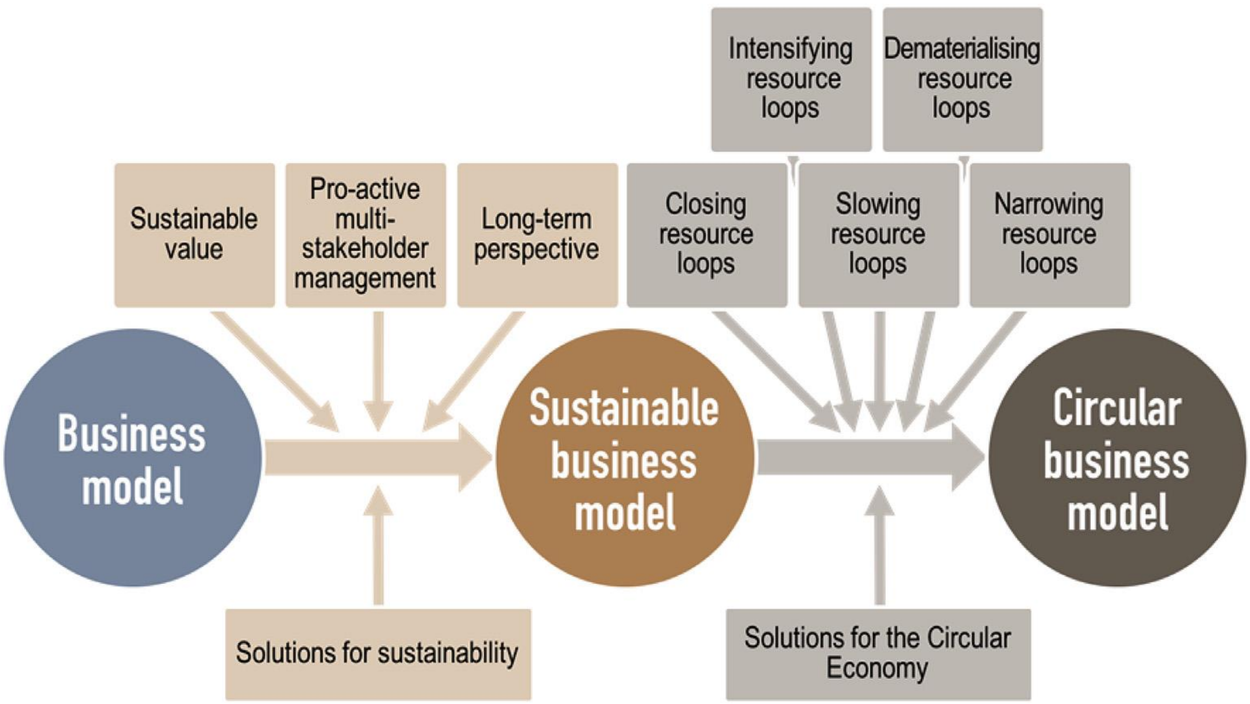


Figure 2: Path from Business models to CBMs (Geissdoerfer et al., 2018)

Circular Business Model Innovation (CBMI)

Business models are the results of a multitude of factors and are influenced by the external environment and the organizational one. Business Model innovation is referred to as a change in the configuration of either the business model as a whole or a certain aspect of it, as a reaction to new business opportunities or challenges.

Geissdoerfer et al. (2016) provided a more comprehensive definition of Business model innovation, stating that: "*Business model innovation describes either a process of transformation from one business model to another within incumbent companies or after mergers and acquisitions, or the creation of entirely new business models in start-ups". * Business model innovation is, therefore, the conceptualization and implementation of new business models (Geissdoerfer et al., 2018). The researchers have identified four specific types of Business model innovation: the development of entirely new business models (start–ups), the diversification of the traditional business model (BM diversification), the transformation of the current business model into a new one (BM transformation), and the acquisition of a new business model (BM acquisition).

Circular Business Model Innovation (CBMI) builds on the same concept as the business model innovation briefly described above, as circular business model innovation is related to the business model innovation concept in the same way as circular business models are related to business models (Geissdoerfer et al., 2020).

In light of this, CBMI incorporates principles from Circular Economy as guidelines for the design of business models, in order to boost resource effectiveness, ultimately closing energy and resource flows by changing the way economic value and the interpretation of products are approached (Pieroni, 2019).

Figure 3: Matrix showing the four types of CBMI (Geissdoerfer et al., 2020)

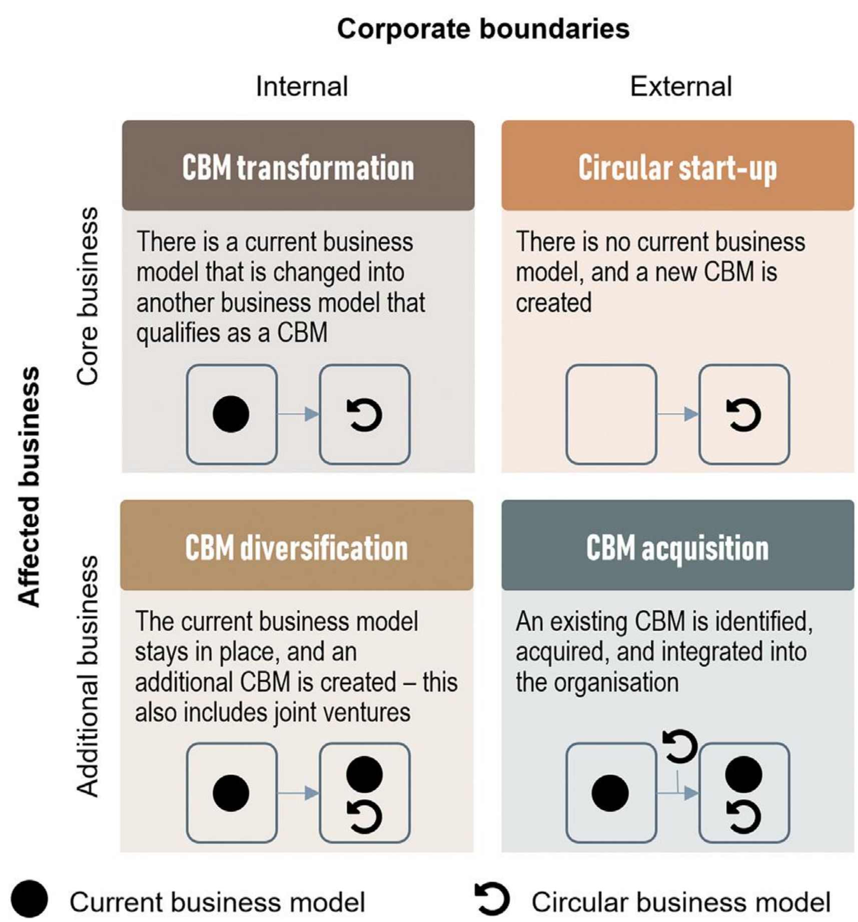


Figure 3 represents the four different types of circular business model innovation, developed by Geissdoerfer et al. (2020) integrating the four types of business model innovation with the principle of CE. Starting from this, CBMI can be defined as: *"the conceptualization and implementation of circular business models, which comprises the creation of circular start-ups, the diversification into circular business models, the acquisition of circular business models, or the transformation of a business model into a circular one. This can affect the entire business model or one or more of its elements, the interrelations between them, and the value network".*

Circular Start-ups

Research on circular business models (CBMs) has been mainly focused on circular initiatives adopted by incumbent firms, while the contributions of new companies, circular startups, have been largely overlooked. However, the role of Circular start-ups as innovators in the circular economy is crucial, as circular innovations and strategies is often seen first in new entrants, such as startups. As noted by Christensen (2015), incumbents present a stronger path dependency than start-ups, as an established and already profitable business model is hard to replace, and the resources are usually directed towards the existent BM. Moreover, Circular startups are not exposed to certain limitations such as Silo thinking and fears of cannibalization, with the top management ultimately prioritizing the linear business model over the new circular one. Evidences form present research indicate that large companies tend to focus on lower CBM strategies, like recycling, and make marginal, incremental, changes rather than shifting their core business models (Bocken et al., 2016). This is coherent with the study carried out by Geissdoerfer et al. 2020, as CBM Transformation and CBM diversification, two types of CBM innovation with the existent of a previous, linear, business model, showed high levels of Organizational ambidexterity, defined as: *"Challenge of managing the current business model while developing a new business model".*

Henry et al (2020) identified four archetypes of circular startups, classifying CSUs (Circular Start-ups) based on the various innovation categories pursued and on the dominant re-strategies per venture. They identified 6 CBM innovation categories:

1. Product service systems (PSS) → increase in servitisation with progressive decrease of ownership transfer (Tukker, 2004)
2. Active consumer involvement → consumers increasingly included in after-use product/resource lifecycle

3. Core technology → innovation in the product design phase, in the resource procurement and in key processes.
4. Enabling technology → innovation in the utilization and after use phases, such as sharing and trading (web) platforms
5. Industrial symbiosis → Structured inter-organizational collaboration to create value from residual resource streams
6. Circularity standards/accreditation → Establishing of process/material standards with suppliers through knowledge sharing and backward integration of activities along the supply chain

They then cross-referenced the aforementioned CBM innovation categories with four re-strategies, namely:

1. Regenerate → Keep, or increase, the inner value of resources
2. Reduce → Enhance the efficiency of product design by preventing and/or minimizing the use of hazardous substances or any raw materials, or by facilitating more intensive usage of the product
3. Reuse → Maintain products within the economic cycle, increasing their life cycle as well as that of their parts
4. Recycle → Reprocess the product after their life cycle through chemical and mechanical processes to obtain virgin-like quality raw materials
5. Recover → Incinerate residual flows for energy recovery

Their research aimed to theorize a typology for CSUs and, based on the data gathered through semi-structured interviews with a subset of the sample. They found four major clusters:

- **Design-based Circular Startups**, which include startups with a business model characterized by a dominant "reduce" strategy combined with innovation in the core technology. This type resulted to be the most common, with BMs mostly focused on resources minimization, product design or manufacturing processes efficiency.
- **Waste-based Circular Startups,** pursuing the less impactful of the re-strategies, "reycle" and "recover", innovating through Industrial symbiosis.
- **Platform-based Circular Startups,** which include CSUs with markeplaces for second-hand product and sharing platforms. The dominant re strategies are "reduce" and "reuse", with "enabling technology" as main innovation category.
- S**ervice-based Circular Startups,** with CSUs focused on PSSs as main innovation category, combined with the active involvement of consumers, with their dominant re-strategies being "reduce".

4. Drivers and barriers for Circular Business Model Innovation

Given the definition of CBMI and the identification of its four types, an examination of the factors that promote and hinder the development of circular business model innovation (CBMI) offers crucial information on how companies may make the shift to more environmentally friendly and circular operations.

CBMI is an essential tool to radically transform an organization's current linear business model (LBM). Nevertheless, this shift also results in a number of barriers that may prevent CBMI from happening, as well as different types of factors actively driving CBMI within businesses and industries. Researchers have examined a range of drivers and barriers and classified them into many groups, in different ways.

Hina et al. (2022) provided a first macro classification of drivers and barriers into two main categories: internal and external.

Internal barriers are obstacles that arise when a company attempts to implement a business plan into practice. Organisational, financial, and product qualities, together with expertise, have been acknowledged in the literature to date as internal barriers (Hina et al., 2022). The researchers further develop their categorization, identifying seven sub-categories: companies' policies and strategies (Van Keulen & Kirchherr, 2021), financial barriers (Kazancoglu et al., 2020), technological barriers (Donner & de Vries, 2021), lack of resources (Guldmann & Huulgaard, 2020), collaborations (Zucchella & Previtali, 2019), product design (Urbinati et al., 2021) and internal stakeholders (Jabbour et al., 2020).

External barriers refer to obstacles coming from outside the firm hindering CBMI. Hina et al. (2022) provide five types of external barriers to CBMI, drawing from existing literature: consumer barriers (Hobson, 2020), legislative and economic barriers (Paletta et al., 2019), supply chain barriers (Vermunt et al., 2019) and social, cultural and environmental barriers (Donner & de Vries, 2021).

Internal drivers, on the other hand, are factors enhancing the integration of CE principle inside a firm's operations from inside the firm itself. Hina et al. (2022) identified four types of internal drivers: organizational, resource availability and optimization drivers, financial drivers and product design and process development drivers.

Finally, external drivers are factors driving the integration of CE principle inside a firm's operations from outside the firm itself. Hina et al. (2022) organized the external drivers into the following categories: policy and regulation (Urbinati et al., 2021), supply chain (Vermunt et al., 2019), society and environment (D'Agostin et al., 2020), stakeholder pressure and infrastructure.

Based on the review of existing literature, Tura et al. (2019) explored the different drivers and barriers for CBMI and, as done by Hina et al. (2022), categorized them into seven main types: environmental, economic, social, institutional, technological, supply chain, organizational. A similar categorization was brought about by Geissdoerfer et al. (2023), whose study identified five categories of drivers and six of barriers. According to their explorative study, the drivers for CBMI can be: financial, legal, market, technical and organizational, with the barriers displaying the value chain category as an additional one.

Financial drivers were the most present category with 23 identifications, with drivers such as business growth (access to new markets), business resilience (reduction in risk exposure from external events), cost reduction and resource scarcity (plan for future and current value chain disruption events caused by raw materials' scarcity). Legal drivers were also relevant, especially considering the European focus of the study, with regulatory push and legal compliance. Market drivers, on the other hand, were tied to customer preferences, with drivers like long-term customer satisfaction and changing customer demands by offering, for example, sustainable products. Technical drivers, such as new technological opportunities, and organizational ones like corporate sustainability were also identified as key in driving CBMI (Geissdoerfer et al., 2023).

Geissdoerfer et al. (2023) focused their study on cases that exemplified a combination of the CBM strategies defined by Bocken et al. (2016) and undergone all four CBM innovation types, contacting a total of 21 firms that included circular start-ups, CBM acquisition, transformation, and diversification (Geissdoerfer et al., 2020).

The results from Geissdoerfer et al. (2023) are coherent with the analysis carried out by Guldmann & Huulgaard, (2020), showing that most barriers to circular business model innovation are encountered at the organizational level, followed by the value chain level, the employee level, and the market and institutional level.

Geissdoerfer et al. (2023), however, went even further in identifying a pattern between these drivers and barriers and the firms' CBMI types.

For CBM transformation, the most relevant drivers were market and organizational ones, while start-ups and CBM diversification saw their main drivers in financial and market factors. According to Geissdoerfer et al. (2023), three of CBMI types were motivated by the necessity of adapting to a higher demand for more sustainable products (market). Moreover, in terms of technological drivers, the development of new technologies was a relevant driver for circular start-ups.

Organizational drivers and barriers for CBMI

The transition to Circular business models (CBMs) presents several organizational challenges and opportunities, marked by a blend of barriers and drivers, alongside other dimensions that were discussed earlier.

A key organizational driver for CBMI was, according to Geissdoerfer et al. (2023), corporate sustainability, which indicates the integration of sustainability and circularity into the corporate strategy, goals and culture. The analysis carried out by Hina et al. (2022), has shown more organizational factors driving CBMI, including leadership, design strategies, innovation, research and development and organizational design. Leadership was recognized as the primary and most effective element for the successful implementation of circular business models. This is coherent with the study from Geissdoerfer et al. (2023), as leadership is a component of a company's culture. Employees' mindset, know-how and commitment can also facilitate and drive an organization's transition to the CBMs.

Moreover, according to Tura et al. (2019), organizational structure changes, strategy and culture are drivers for CBMI. The development of skills and CE-oriented capabilities is another strong driver and a success factor for Circular business models, since technical know-how is key in implementing these kinds of BMs, especially during the design phase. Lastly, a flexible decision-making process will reinforce the creation and implementation of CBMs.

Bocken & Geradts (2020) highlighted organizational factors at the institutional, strategic and operational level. Examples of Institutional factors are well-established rules, norms, and beliefs that define the reality of organizations and influence organizational behavior. They identified three institutional drivers: the importance of harmonizing the value of shareholders and stakeholders, the prevention of uncertainty, and valuing business sustainability. The significance of a proportionate focus on shareholder and stakeholder value as an institutional driver was emphasized by the researchers. Leadership and generally a wider interest for the society surrounding the business are key in creating this balance. This result is coherent with the ones displayed above. Moreover, according to the study, management needs to start embracing ambiguity and accept uncertainty over the outcome of sustainable solutions, hence, a risk-taker management is an institutional driver for sustainable and circular business models innovation.

Strategic drivers, on the other hand, focus mainly on collaborative innovation and long-term thinking and investments. Circular and sustainable business models pose great technical challenges, which can be solved only by considering the business in a systemic way, collaborating with different stakeholders, including other companies. According to Bocken & Geradts (2020), institutional drivers foster long-term thinking, resulting in investments designed for long-term growth. A long-term vision by top management is then considered to be a major driver for CBMI.

Lastly, operational drivers include people capability development, an enabling innovation structure, ring-fenced resources for SBMI, an incentive scheme for sustainability, and performance metrics for sustainability.

Hina et al. (2022) also identified the lack of inter-organizational collaborations and internal stakeholders as two major types of factors hindering CBMI.

Collaborations are a crucial factor for CBMI as Circular business models are to be developed in a holistic systemic environment, as some cases brought out by several Schools of Thought (Industrial symbiosis) rely on collaborations between different companies to reach closed-loop supply chains, including SME integration and buyer-supplier relationship. Inter-organizational collaborations can act as a barrier for CBMI in case the business models of the different companies are not compatible, with one being circular and the other one being linear. Sousa-Zomer et al. (2018) highlighted several solutions to avoid this barrier, such as supplier certification programs and integrated management systems, which were proven to avoid conflicts of interests making partners' BMs compatible between each other. Another barrier arising from difficulties in collaborations' management is inter-firm knowledge sharing. According to Hina et al. (2022), firms are hesitant to share information due to competition arising from the length of the value chain (Kazancoglu et al., 2020).

Lastly, "internal stakeholders" was another barrier category highlighted by Hina et al. (2022). Among internal stakeholders, shareholders and employees are the most prominent and represented category, which puts pressure on CBMI. A lack of communication between departments and unclear responsibilities between them may hinder Circular innovation in the company.

Kazancoglu et al. (2020), though their focus group study, identified several barriers to CBMI, with their results relatively aligned with the ones discussed earlier. They clustered the results into several groups. "Management and decision-making" was the first one, based upon the general administration of CE practices in the company. The group comprised of barriers such as the lack of performance evaluation system as well as lack of acceptance of new business models. According to the study, firms should evaluate their circular practices. However, there is a lack of common standards and recognized KPIs in performance evaluation system for CE practices.

Another cluster for potential organizational barriers was "labour", specifically, the need for intensive workforce and lack of intermediate trained staff. Last one is especially strategic in a closed-loop system and the lack of eco-literacy in staff occupied in key activities. The last organizational cluster developed by Kazancoglu et al. (2020) was "knowledge and awareness". Lack of CE awareness, theoretical information, and technical know-how pose great challenges for businesses to develop, implement and innovate new and existing Circular business models.

Liu & Bai (2014) categorized organizational factors hindering or driving CBMI as "*structural factors"*. Their study results showed that inefficient bureaucracy, long procedures and hierarchical systems inhibit flexibility and innovation. Moreover, organizations show few learning programs and mechanisms, resulting in the lack of CE knowledge referenced earlier. More barriers involve management's activities, with top and middle management showing short term limit, hindering CE activities, notoriously long-term oriented.

Geissdoerfer et al. (2023) identified several key barriers to CBMI, including numerous organizational and technical challenges, starting from a lack of in-house resources, knowledge, or competencies essential for implementing CBMI. This gap spans a lack of clear definitions, strategic alignment with circular principles, technical know-how, and understanding of sustainability impacts, which are all essential for successful CBMs.

Additionally, a significant barrier is the absence of strong, CE-committed leadership, causing intraorganizational challenges fueled by ambidexterity. Organizational ambidexterity is the challenge of managing a circular business model alongside a linear, probably more profitable, one, creating intraorganizational tensions and fear of cannibalization, where new circular strategies might undercut or devalue existing products or revenue streams. Another obstacle is organizational transformation, which involves controlling, planning, and enforcing the required changes inside the organization. Moreover, a lack of experience with circular business models complicates understanding their broader organizational and operational implications, further impeding effective adaptation and integration.

These results are coherent with the analysis developed Hina et al. (2022), showing that inadequate staff availability and insufficient training create unfavorable circumstances for a company to maximize its value through the application of CBMs. Tura et al. (2019) confirm these results, as their study shows that a high dependence on conventional (linear) processes, risk aversion, and a lack of relationship between CE and strategy were the most relevant factors hindering CBMI.

Guldmann & Huulgaard (2020), through their qualitative study, identified other relevant barriers preventing CBMI. According to their study, companies, start-ups as well, experienced difficulties in achieving management buy-in to changes towards more circular solutions, especially if ROI and similar KPIs are considered, which do not fully capture the long-term value of circular initiatives. This result is coherent with the analysis carried out by Tura et al. (2019), showing that a *Silo thinking* resulted in a challenge to get resources due to conflicts of interest within the organization and even within a single department. This is because projects frequently require a variety of resources from several departments, and if one department withholds its resources, the project will be shut down. A lack of of resources, knowledge or competencies in-house, added to a lack of general knowledge about CE principles proved again to be a major barrier for CBMI. Moreover, difficulty in establishing cross-organizational collaborations, in line with the studies by Hina et al. (2022), was identified as a factor hindering circular innovation, together with the difficulty to find concrete evidence of financial and environmental benefit (Guldmann & Huulgaard, 2020).

Lastly, some case companies showed a *narrow focus on existing sustainability strategies*, blocking the development of new circular business models, as, especially big corporations, were more hesitant towards new system's solutions, locked into sustainability paradigms.

Table 4 shows a comprehensive overview of the organizational drivers and barriers discussed above, with relative references.

Table 4: Organizational drivers and barriers for CBMI

Source	Drivers	Barriers
Geissdoerfer et al. (2023)	Corporate sustainability	Lack of CE-committed leadership Organizational ambidexterity Transformation challenges Lack of experience
Hina et al. (2022)	CE-committed Leadership Design strategies Employees' mindset and know-how Organizational design	Lack of cross-organizational collaboration Lack of interfirm knowledge-sharing Lack of communication among employees Inadequate staff Unclear responsibilities
Tura et al. (2019)	Skills development Technical know-how Flexible decision making	Risk aversion Silo thinking
Bocken et al. (2020)	Wider interest for society Risk-taker management Long-term thinking Collaborative innovation	
Sousa-Zomer et al. (2018)	Integrated management system	
Kazancoglu et al. (2020)		Lack of performance valuation Lack of common standards Lack of CE awareness Lack of CE theoretical knowledge Lack of technical know-how
Liu & Bai (2014)		Inefficient bureaucracy Long procedure hierarchy Few learning programs Short-term thinking
Guldmann & Huulgaard (2020)	Stakeholders' engagement	Difficulties achieving management buy-in Narrow focus on sustainability initiatives Lack of resources No immediate financial and/or environmental benefits
Cantú et al. (2021)	Clear internal/external communication on CE	Limited information access over partners Perception of Sustainable initiatives as "costs"

Methods

1. Data collection

The present study is structured to investigate which are the organizational factors that drive (drivers) or hinder (barriers) Circular business model innovation, and to look for which of these factors are more likely to lead to a *closing approach* to Circular economy rather than a *slowing* one, building on the experience of circular start-ups in Italy. The study has been carried out through a quantitative method based on the administration of an online questionnaire.

The quantitative method (data analysis will be discussed below) has been identified as the most appropriate one in order to evaluate and validate the findings from the existing literature, which have been widely discussed above. This methodological method assures that the study's conclusions are not only anecdotal or subjective, but also supported by quantitative evidence that complies to the criteria of scientific rigour (Stockemer et al., 2019). The reasoning method is then the deductive one, a method of reasoning in which a specific conclusion is drawn from a set of general premises or principles (Soiferman, 2010).

The results of this study will then contribute to the ongoing, and growing, discussion regarding Circular business model Innovation (CBMI), building a new perspective as the study will focus on a specific geography, Italy, and a specific company type, startups.

An online survey was created using Qualtrics software, in order to collect the data required and distribute it to respondents working in Italian startups engaged in circular initiatives.

The online survey has been administrated to attendants, making it possible to gather enough numerical data to practice statistical techniques. While qualitative methods, such as focus groups, interviews and case studies, can provide valuable insights for explorative and inductive studies, the quantitative method is considered to be more appropriate to deduct generic rules, as explorative studies are characterized by a narrow data sample. Quantitative research, due to a larger sample size compared to qualitative research, can provide a broader and more comprehensive depiction of the phenomenon.

The survey was sent to a diverse set of startups working in different sectors and contexts, in order to have a high-level view. However, every startup identified has a business model design that is built on the design strategies framework developed by Bocken et al. (2016).

The respondents were contacted through the professional networking platform called *Linkedin*, which has been recognized as a reliable platform for the fast collection of research data. The research also followed a privacy policy for ethical purposes, to ensure the confidentiality and reliability of the data collected. A total of 88 fully completed responses were collected.

The questionnaire consisted of 36 questions, taking approximately 6 minutes to be completed. It is divided into three sections with the first one dedicated to the demographics of the respondents and the firm, hence personal questions and company-related ones. The second section comprises of questions designed to investigate the organizational factors that drive innovation within circular business models, while the third and last section is dedicated to the organizational barriers hindering CBMI (Circular business Model Innovation).

The survey has been administered in Italian since the companies interviewed are all located in Italy. After the collection phase, data has been analyzed using SPSS, a software useful to handle data for effective management and to analyze complex statistical tests. The survey is available in the Appendix below.

2. Measurement scales

Within the first section of the survey, relying on the notion of closing and slowing resource loops (Bocken et al., 2016), respondents were asked to highlight the design strategy closer to the business model of their startup. In section two and three, on the other hand, questions were designed to investigate the factors discussed in the existing literature. However, from the initial 40 items present in Table 4, 6 are the ones investigated in the survey. Some of the items were considered to be redundant and repetitive, as the item "risk-taker management" (Bocken et al., 2020) is similar to "risk aversion" (Tura et al., 2019). The items regarding the technical and theoretical preparation of employees were numerous and heavily mentioned as barriers in the literature, hence "inadeguate staff" (Hina et al., 2022), "lack of theoretical knowledge" (Kazancoglu et al., 2020) and "lack of CE awareness" together with "lack of technical know-how" (Kazancoglu et al., 2020) have been considered redundant compared to "Skills development and Technical know-how" (Tura et al., 2019) and "CE awareness" (Hina et al., 2022).

Finally, it was determined that the concepts of 'organizational ambidexterity' and 'silo thinking' did not align well with the characteristics of the selected companies, as all of them were startups. In their research, Guldmann & Huulgaard (2020) mentioned "fear of cannibalization" as a major organizational barrier, in line with the results from Geissdoerfer et al. (2023), whose study explored organizational ambidexterity as the *"challenge of managing the current business model while developing a new business model, ultimately producing intra-organizational tensions and fear of cannibalization"* (Geissdoerfer et al. 2023). However, none of these studies found evidence of these barriers for startups, which can reflect that circular start-ups are 'born' with a circular mindset, and more importantly rarely have two business models.

Moreover, the different organizational factors identified in the literature have been clustered in six main ones: Corporate social responsibility (CSR), Collaborative Innovation (CI), People Capability Development (PCD), lack of internal communication, lack of external communication and hierarchy.

It is key to highlight why these six factors have been chosen as the object for the investigation. Firstly, CSR, alongside with CE commitment from leadership, has been one of the first arguments in the literature numerous times. McWilliams & Siegel (2001) defined CSR as *"actions that appear to further some social good, beyond the interests of the firm and that which is required by law".* Following the aforementioned definition, some elements of Corporate social responsibility have been identified in the literature. Guldmann & Huulgaard (2020) mentioned "stakeholders' engagement" as a major organizational driver, while Geissdoerfer et al. (2023) proposed "corporate sustainability" as the organizational driver nurturing CBMI. According to their study, "corporate sustainability" occurs when Sustainability and circularity are integrated into the corporate strategy, with top management actively pursuing initiatives to "*to do something for the environment"*. This approach is in line with the definition of CSR brought up by McWilliams & Siegel (2001).

The factor CSR was measured, using a five-item scale. The items were scaled on a 5-point Likert scale and retrieved from Kucharska & Kowalczyk (2019) and Staniškienė & Stankevičiūtė (2018).

Collaborative Innovation (CI) was selected as another driver since this organizational factor was found to be a key one in the literature review. Guldmann & Huulgaard (2020) identified "stakeholders' engagement" as a driver, while, according to Sousa-Zomer et al., (2018), "Integrated management system" was another key driver. "Lack of cross-organizational collaboration" and "Lack of interfirm knowledge-sharing" were two of the barriers identified by Hina et al. (2022), marking the importance of inter-firm collaboration in this environment.

The factor "collaborative Innovation" was measured using six items, scaled on a 5-point Likert scale, and were retrieved from Thomson et al. (2009) and Sundram et al. (2016).

People capability development (PCD) was found to be another group of key drivers. "Lack of experience" was highlighted by Geissdoerfer et al. (2023) as an organizational barrier to CBMI, while Tura et al. (2019) considered technical know-how and skills development to foster circular innovation. This driver was measured in the analysis using four items, scaled on a 5-points Likert scale and taken from Abd Rahman et al. (2013) and from Hong et al. (2012).

Furthermore, “lack of internal communication” and “lack of external communication” have been recognized as two of the main organizational factors hindering CBMI. “Clear internal/external communication on CE” was identified to be a key driver for CBMI by Cantú et al. (2021). “Lack of communication among employees”, “Unclear responsibilities” are among other barriers identified by Hina et al. (2022) and, finally, “Lack of common standards”, according to Kazancoglu et al. (2020) hinders CBMI.

These two factors have been tracked using 5 items, scaled the same way as the others. The items used to measure “lack of external communication” were taken from Sundram et al. (2016). Holt et al. (2007), on the other hand, was the reference for “lack of internal communication”.

Lastly, Hierarchy is the final organizational factor included in the model, as, according to Liu & Bai (2014), inhibit innovation. The four items used to scale this variable were retrieved from Kucharska et al. (2019).

The rest of the organizational factors, such as Leadership or risk aversion, have not been considered further in the analysis as the focus of the study is the organization’s side, rather than the individual.

Table 5 shows an overview of the measurement scales used for the data collection needed to carry out the statistical analysis. Indeed, this study seeks to investigate the relationship between the six organizational factors discussed above and the company's choice of circular strategy, which is critical for CBMI in Circular startups. To that purpose, a conceptual model is provided (Figure 4) that defines the direct links between these organizational characteristics and the cyclical strategy of slowing or closing resource cycles. The model incorporates internal and external communication dynamics, hierarchical structures, and strategic organizational drivers such as Corporate Social Responsibility (CSR), Collaborative Innovation, and People Capability Development. The objective of the model is to understands how these factors affects the likelihood of choosing “closing resource loops” strategies. The conceptual model is displayed below.

Figure 4: Conceptual Model of the relationship between organizational factors and choice of circular strategy

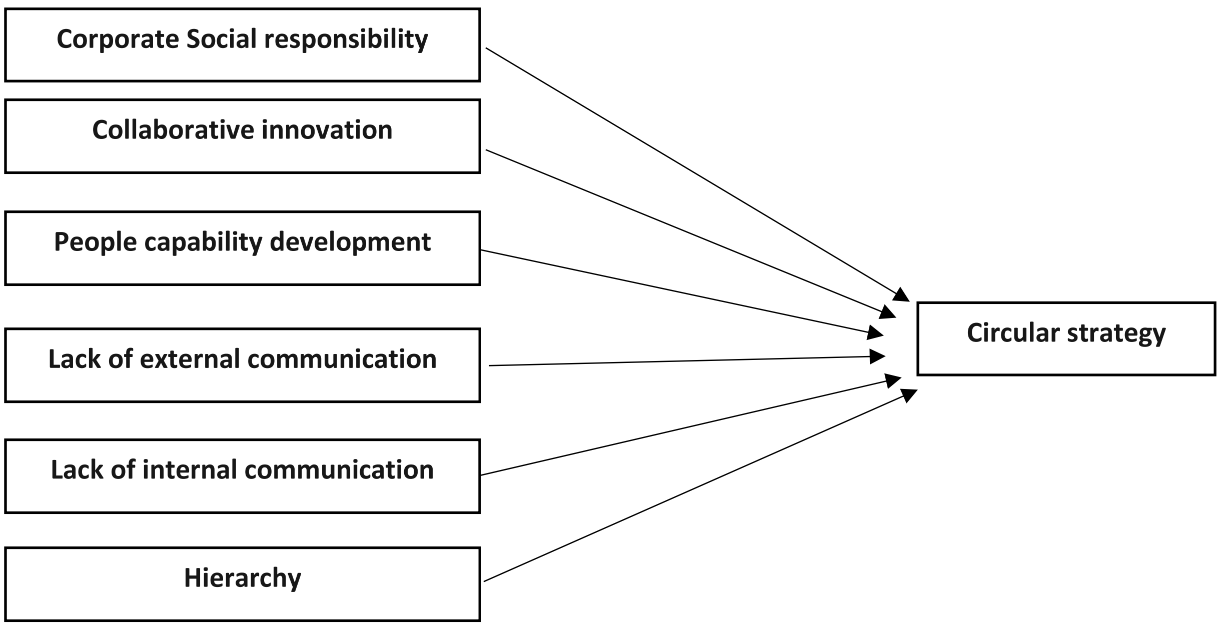


Table 5: Overview of the constructs with factor's name, description, number of items and measurement scales

Factor	Number of items	Measurement scale	Scale sources
Corporate Social responsibility	Five	5-point Likert scale	Kucharska & Kowalczyk (2019) Staniškienė & Stankevičiūtė (2018)
Collaborative innovation	Six	5-point Likert scale	Thomson et al. (2009) Sundram et al. (2016).
People capability development	Four	5-point Likert scale	Abd Rahman et al. (2013) Hong, et al. (2012)
Lack of external communication	Five	5-point Likert scale	Sundram et al. (2016)
Lack of internal communication	Five	5-point Likert scale	Holt et al., (2007)
Hierarchy	Four	5-point Likert scale	Kucharska & Kowalczyk (2019)

3. Data analysis

The statistical analysis for this study begins with one-way ANOVA tests on both demographic and organizational control variables to determine whether the means of the numerical dependent variables (the six organizational factors) differ significantly across the categories of the control variables. These first tests aid in determining the impact of control variables on the variable of interest of the analysis. Following that, stringent multicollinearity and linearity tests are run to confirm that the model is robust and suitable for binary logistic regression.

The main study involves a binary logistic regression with two steps. As the focus of the study is on the organizational dimension (specifically circular start-ups), the first model includes only organizational control variables, excluding sociodemographic components. The second model combines these control variables with the six organizational factors, namely, Corporate Social Responsibility, Collaborative Innovation, People Capability Development, Lack of Internal Communication, Lack of External Communication, and Hierarchy, forming the group of our covariates.

This stepwise technique helps in examining the impact of organizational drivers and barriers on circular startups strategy. The fundamental purpose of this multidimensional statistical research is to extensively investigate the relationship between organizational factors and how they influence the ultimate decision of CSUs to pursue a "*closing resource loops*" strategy rather than a "*slowing resource loops*" one.

Results

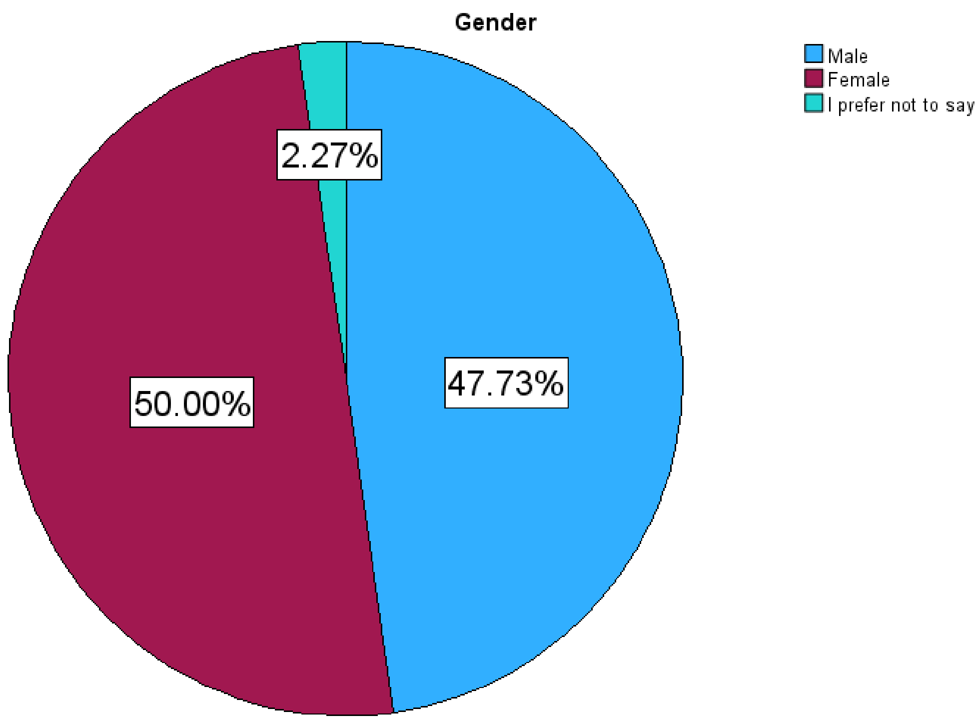
In this section we are going to analyze the results, in numeric terms, obtained by running the analysis.

1. Socio-demographics variables

The first step is to characterize the sample using the socio-demographic variables of the survey participants. Participant characteristics can influence the relationship between independent and dependent variables in a study. Analyzing these variables helps us better understand the factors that may have impacted the results. The demographic variables accounted for in the study are: gender, age, education, and job position.

Starting with gender, the sample, consisting of 88 respondents, has a virtually uniform gender distribution, with around equal proportions of male and female individuals. Specifically, as shown in *Figure 5*, female respondents were slightly more, representing 50% of the total sample, followed by males accounting for 47.73% of the total respondents. A minute portion of the sample preferred not to state their gender (2.27%). This discovery ensures the study's results are not influenced by a biased sample based on gender. A uniform gender distribution can improve the study's generalizability and make the results more reflective of the whole population. The study's conclusions are more credible due to the sample's homogenous gender distribution.

Figure 5: Gender distribution (SPSS author elaboration)



The next step is to test if the control variable "gender" has any statistically significant effect on the variables of the study, namely: Corporate social responsibility, Collaborative innovation, People capability development, lack of internal communication, lack of external communication and hierarchy. To do so, a one-way ANOVA test is performed, as it is designed to test whether the means of the numerical variables differ significantly across the categories of the control variables. The result is displayed in *Figure 6*.

Figure 6: One-way ANOVA result comparing Gender and organizational factors (SPSS table elaboration of the author)

ANOVA

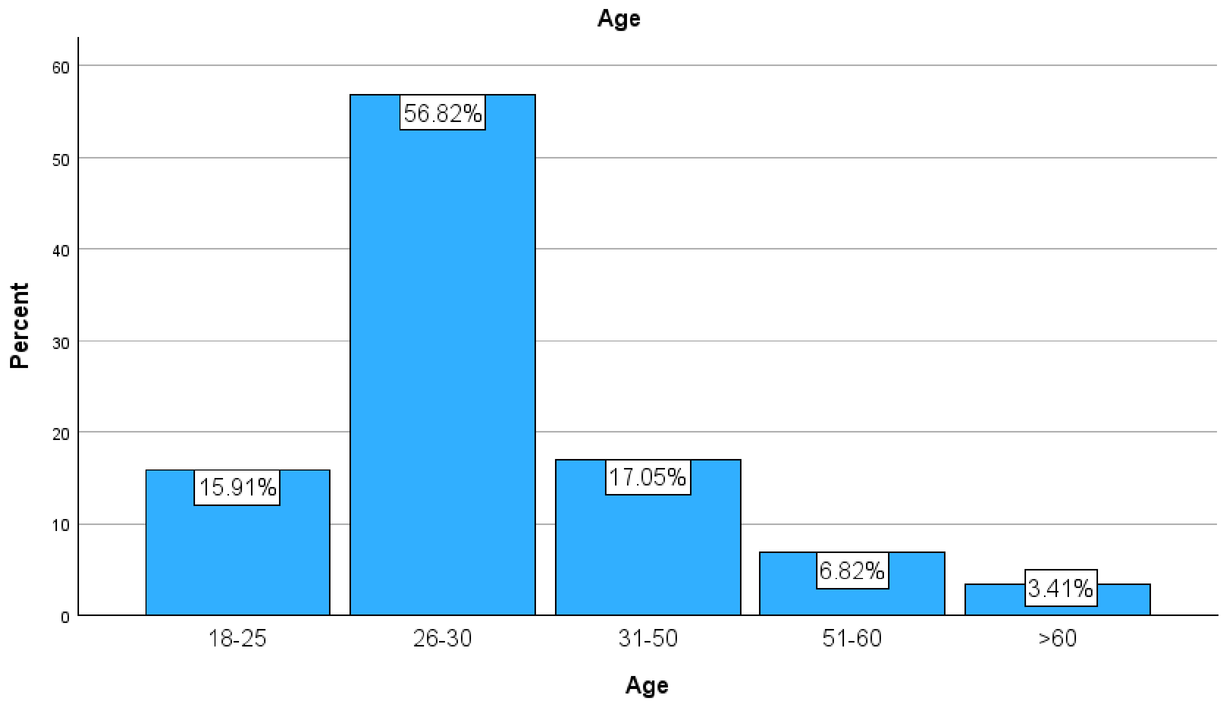
		Sum of Squares	df	Mean Square	F	Sig.
Corporate social responsibility	Between Groups	.151	2	.075	.466	.629
	Within Groups	13.740	85	.162		
	Total	13.891	87			
Collaborative Innovation	Between Groups	2.779	2	1.390	1.813	.169
	Within Groups	65.160	85	.767		
	Total	67.939	87			
People capability development	Between Groups	1.447	2	.724	.855	.429
	Within Groups	71.914	85	.846		
	Total	73.361	87			
Lack of external communication	Between Groups	1.393	2	.697	1.373	.259
	Within Groups	43.115	85	.507		
	Total	44.509	87			
Lack of internal communication	Between Groups	.621	2	.310	1.937	.150
	Within Groups	13.618	85	.160		
	Total	14.238	87			
Hierarchy	Between Groups	.270	2	.135	.411	.664
	Within Groups	27.860	85	.328		
	Total	28.130	87			

The ANOVA analysis performed shows that none of the dependent variables tested are affected by the factor "Gender", as all the p-values are above the .05 threshold. Across all dependent variables, the within-group variance exceeds the between-group variance. This suggests that the majority of the variability in the data stems from variances within gender groups rather than differences between gender groups. This finding is consistent with the non-significant ANOVA results, which show that gender does not explain much of the variability in these dependent variables and is consistent with the generally low F values.

The control variable "age", on the other hand, was tracked and divided in the survey in clusters, each one representing an age range. This method improved data clarity and allowed for extensive analysis across age groups. The introduction of clusters simplified understanding of the age variable and improved communication of research findings.

A total of six age ranges were identified, but the first one (<18) was not present in the sample. This was predictable as the questionnaire was sent to respondents working in circular startups and minors are more focused on education. As *figure 7* shows, the most common answer was the range "26-30" (56.8%). Clusters "31-50" and "18-25" are respectively the second and third most represented groups, accounting for 17% and 15.9% of the sample. This result reflects the young presence and leadership within the startup environment. The survey findings may therefore be more representative of people under 30 years old. This is crucial to note when evaluating the results, since they may not be applicable to the entire population.

Figure 7: Age distribution (SPSS Author elaboration)



Again, the ANOVA test was chosen to assess the impact of the factor "age" on the same dependent variable as before. The result shows that none of the dependent variables are affected by the age of the respondents. The p-values for every of the organizational factors are > .05 (as shown in *Figure 8*), suggesting that the age of the respondents does not explain the variability of the organizational factors studied. This is consistent with the low F (Fisher) values, which is the ratio between the two estimated variances, "between groups" and "within groups". The higher the Fisher value is, the more the variance between the means are assumed to be produced by the "between group" variance, hence, explained by the various organizational factors.

Figure 8: One-way ANOVA result comparing Age and organizational factors (SPSS table elaboration of the author)

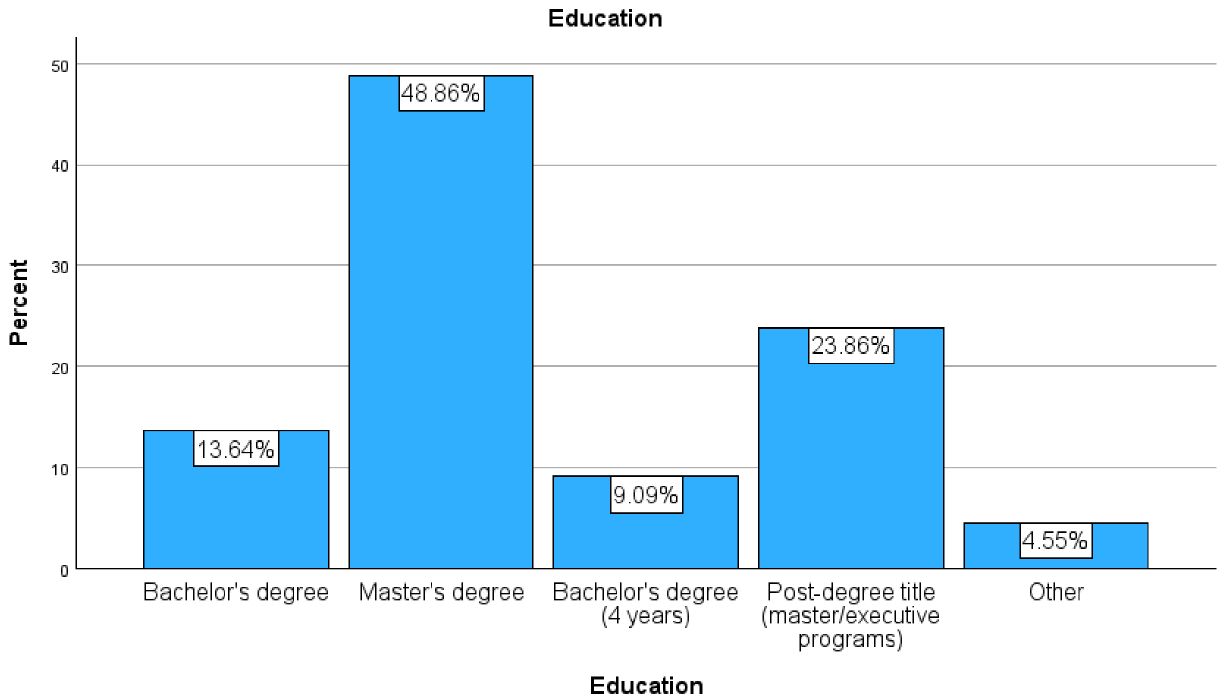
ANOVA

		Sum of Squares	df	Mean Square	F	Sig.
Corporate social responsibility	Between Groups	1.239	4	.310	2.032	.097
	Within Groups	12.652	83	.152		
	Total	13.891	87			
Collaborative Innovation	Between Groups	5.961	4	1.490	1.996	.103
	Within Groups	61.979	83	.747		
	Total	67.939	87			
People capability development	Between Groups	2.433	4	.608	.712	.586
	Within Groups	70.927	83	.855		
	Total	73.361	87			
Lack of external communication	Between Groups	1.984	4	.496	.968	.430
	Within Groups	42.525	83	.512		
	Total	44.509	87			
Lack of internal communication	Between Groups	.075	4	.019	.111	.979
	Within Groups	14.163	83	.171		
	Total	14.238	87			
Hierarchy	Between Groups	2.161	4	.540	1.727	.152
	Within Groups	25.969	83	.313		
	Total	28.130	87			

Moreover, "education" was another control variable in the questionnaire, showing that respondents generally show high education levels. Importantly, as *figure 9* highlights, the modal cluster is "Master's degree" as almost half of the respondents obtained a master's degree (48.86%). The second most common answer was a post degree title (as an additional master or an executive program), with 23.8% of respondents saying they hold such title. Bachelor's degree (13.6%) and bachelor's degree (4 years)[1], accounting for 9% of the total sample, precede the least common option, the cluster "other" (4.5%). The survey findings indicate that most participants are well-educated and have a solid academic background, which is important for understanding the issue and the questions, providing relevant responses.

[1] The original item in the survey was "Laurea Vecchio ordinamento".

Figure 9: Education distribution (SPSS Author elaboration)



By conducting the one-way ANOVA test with "education" as a factor, some interesting results were discovered (shown in *Figure 10*). It was found that "education" has a significant (p-value = .012) effect on the perception of CSR of the respondents. The education level has an impact on the perception of hierarchy as well (p-value = .030).

Figure 10: One-way ANOVA result comparing Education and organizational factors (SPSS table elaboration of the author)

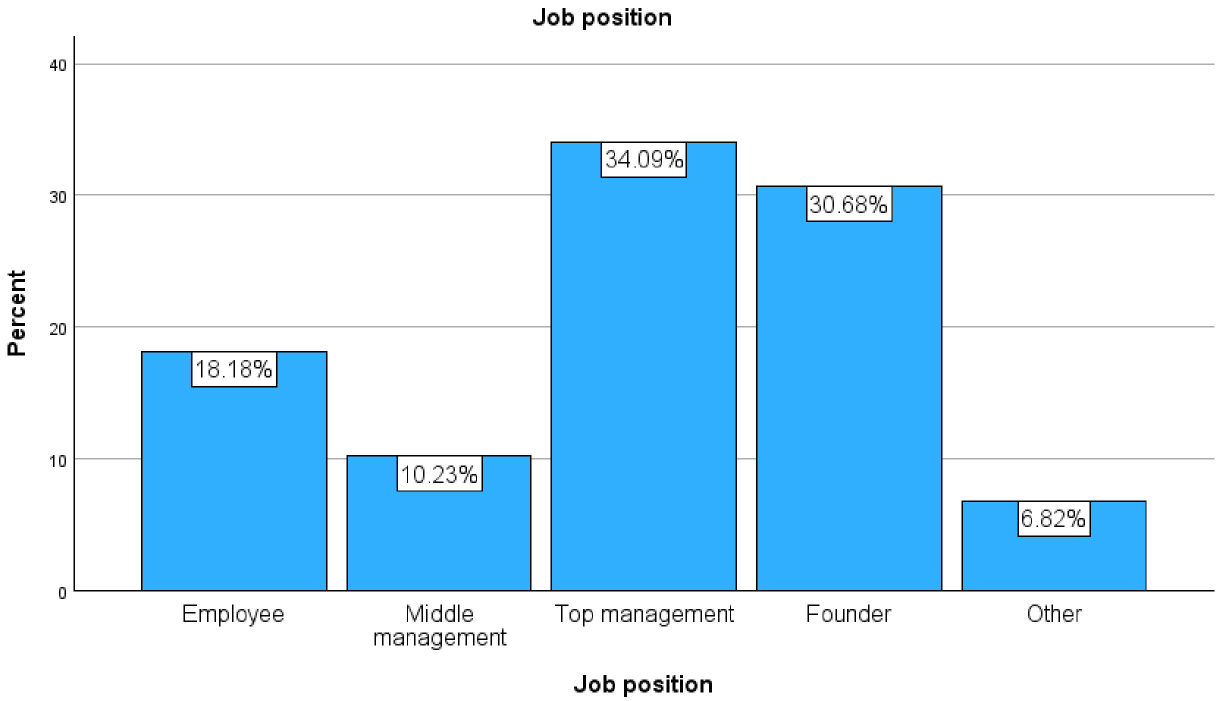
ANOVA

		Sum of Squares	df	Mean Square	F	Sig.
Corporate social responsibility	Between Groups	1.981	4	.495	3.451	.012
	Within Groups	11.910	83	.143		
	Total	13.891	87			
Collaborative Innovation	Between Groups	2.046	4	.512	.644	.632
	Within Groups	65.893	83	.794		
	Total	67.939	87			
People capability development	Between Groups	4.785	4	1.196	1.448	.226
	Within Groups	68.576	83	.826		
	Total	73.361	87			
Lack of external communication	Between Groups	2.233	4	.558	1.096	.364
	Within Groups	42.275	83	.509		
	Total	44.509	87			
Lack of internal communication	Between Groups	1.313	4	.328	2.108	.087
	Within Groups	12.925	83	.156		
	Total	14.238	87			
Hierarchy	Between Groups	3.368	4	.842	2.823	.030
	Within Groups	24.762	83	.298		
	Total	28.130	87			

"Job position" was considered as another control variable. *Figure 11* shows that 34% of all the respondents are within the top management of the startups they work in. The second biggest cluster was the "founder" one, counting for 30.6% of the responses. "Employee" and "middle management" are the following most present clusters of job position, accounting, respectively, for 18% and 10% of total respondents. Lastly, the category "other" follows, with 6.8% of respondents not belonging to any of the others.

These results shows that the perspectives of decision-makers and key influencers within the organizations are prominently captured by the analysis.

Figure 11: Job position distribution (SPSS author elaboration)



Another one-way ANOVA test was performed (results in *Figure 12*) with the factor being the control variable “job position”. The variable “Corporate social responsibility” and “hierarchy” are affected by the job position of the respondents, as the p-value for both is <.001. The high F-value implies that the variation across job positions is much greater than the variance within each job position group. This implies that CSR ratings vary dramatically among people with different employment types. The p-value ($p < 0.001$) indicates that employment status has a significant impact on CSR and perception of hierarchy.

The factor “job position”, as well as the factor “education” will not, however, be present in the regression analysis as the focus of the study in this case is not the individual but rather the organization they work in. For this reason, the next cluster of control variables, the organization-related one, will be analyzed.

Figure 12: One-way ANOVA result comparing Job position and organizational factors (SPSS table elaboration of the author)

ANOVA

		Sum of Squares	df	Mean Square	F	Sig.
Corporate social responsibility	Between Groups	2.857	4	.714	5.372	<.001
	Within Groups	11.034	83	.133		
	Total	13.891	87			
Collaborative Innovation	Between Groups	1.254	4	.313	.390	.815
	Within Groups	66.686	83	.803		
	Total	67.939	87			
People capability development	Between Groups	.953	4	.238	.273	.895
	Within Groups	72.408	83	.872		
	Total	73.361	87			
Lack of external communication	Between Groups	.232	4	.058	.109	.979
	Within Groups	44.277	83	.533		
	Total	44.509	87			
Lack of internal communication	Between Groups	.672	4	.168	1.028	.398
	Within Groups	13.566	83	.163		
	Total	14.238	87			
Hierarchy	Between Groups	5.799	4	1.450	5.388	<.001
	Within Groups	22.331	83	.269		
	Total	28.130	87			

2. Organization-related variables

As the focus of the study is the organization in which respondents work, the circular startups (CSUs), other control variables have been considered in the analysis, namely the industry in which the different firms operate, their relative size, location and year of establishment.

The bar chart shown in *Figure 13* depicts the distribution of firms among different industries[2], with the Y-axis showing the proportion of firms in each industry. The statistics show that the "Retail Trade" industry is the most represented, accounting for 40.91% of the enterprises, followed by "Other Activities" (17.05%) and "Manufacturing" (15.91%). Other industries, including "Agriculture, Forestry, and Fisheries", "Machine Repair, Maintenance, and Installation", and "Financial, Real Estate, Professional Services, and Business Support", account for 4.55% of the respondents. "Utilities", "Transport, Warehousing, and Postal and Courier Activities", and "Information and Communication Services" are among the least represented industries, accounting for around 1.14% of enterprises who participated in the survey.

[2] Industries were selected from ISTAT.

Figure 13: Firms' industry distribution (SPSS author elaboration)

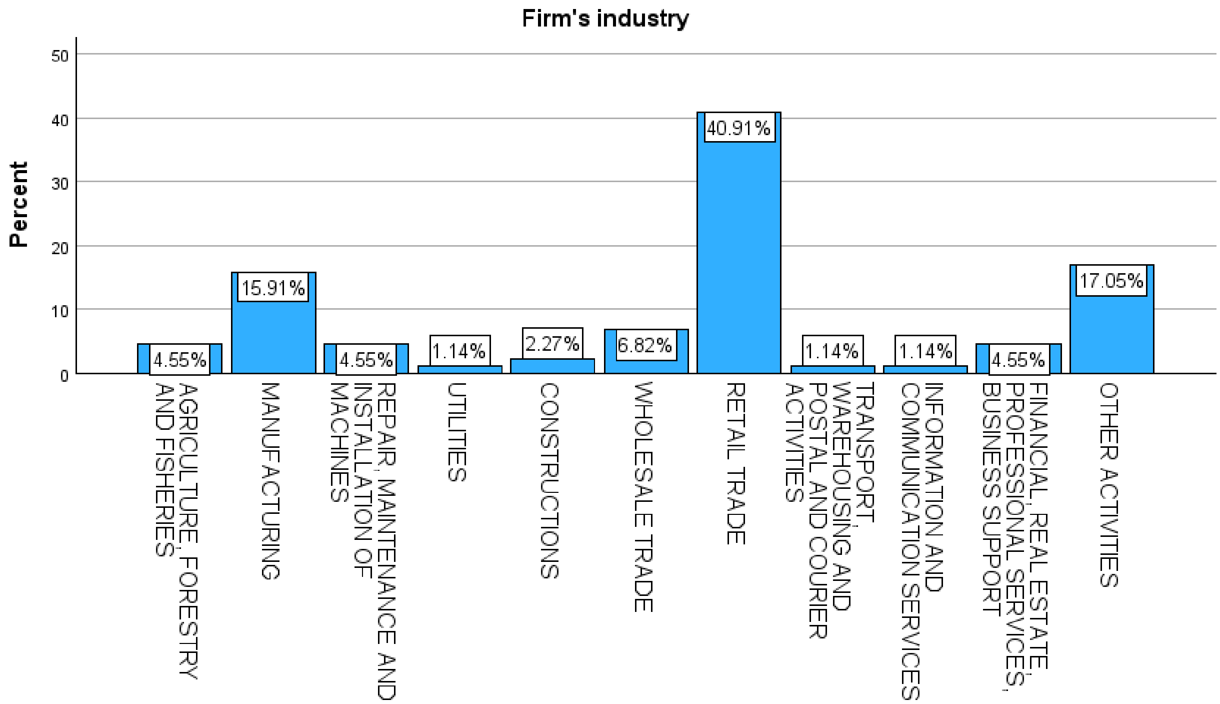


Figure 14: One-way ANOVA result comparing Firms' industry and organizational factors (SPSS table elaboration of the author)

ANOVA

		Sum of Squares	df	Mean Square	F	Sig.
Corporate social responsibility	Between Groups	3.285	10	.329	2.385	.016
	Within Groups	10.606	77	.138		
	Total	13.891	87			
Collaborative Innovation	Between Groups	13.108	10	1.311	1.841	.067
	Within Groups	54.831	77	.712		
	Total	67.939	87			
People capability development	Between Groups	19.330	10	1.933	2.755	.006
	Within Groups	54.031	77	.702		
	Total	73.361	87			
Lack of external communication	Between Groups	6.494	10	.649	1.315	.237
	Within Groups	38.014	77	.494		
	Total	44.509	87			
Lack of internal communication	Between Groups	2.616	10	.262	1.733	.088
	Within Groups	11.622	77	.151		
	Total	14.238	87			
Hierarchy	Between Groups	4.760	10	.476	1.568	.132
	Within Groups	23.370	77	.304		
	Total	28.130	87			

Figure 14, on the other hand, shows the results from the one-way ANOVA test to assess the impact of the factor "firm's industry" on the organizational factors. The test shows statistically significant results for the variable "Corporate social responsibility" ($p = .016$) and for "People capability development" ($p = .006$). Moreover, *Figure 15* shows the results of another control variable, namely "firm's size". The size was divided into four clusters, resembling the ones taken from the EC Recommendation 2003/361/CE, according to which the SMEs are firms counting less than 250 employees. Specifically, small firms have less than 50 employees and, for the purpose of this study, this was the highest scale chosen.

Firms with 10-25 workers comprise 45.45% of the dataset, while those with fewer than 10 employees account for 28.41%. Medium-sized enterprises (26-50 people) account for 25.00%, whereas larger firms (more than 50 employees) are infrequent, accounting for only 1.14% of the sample. This result was predictable as the focus of the study are circular startups, notoriously micro or small companies.

Figure 15: Firms' size distribution (SPSS Author elaboration)

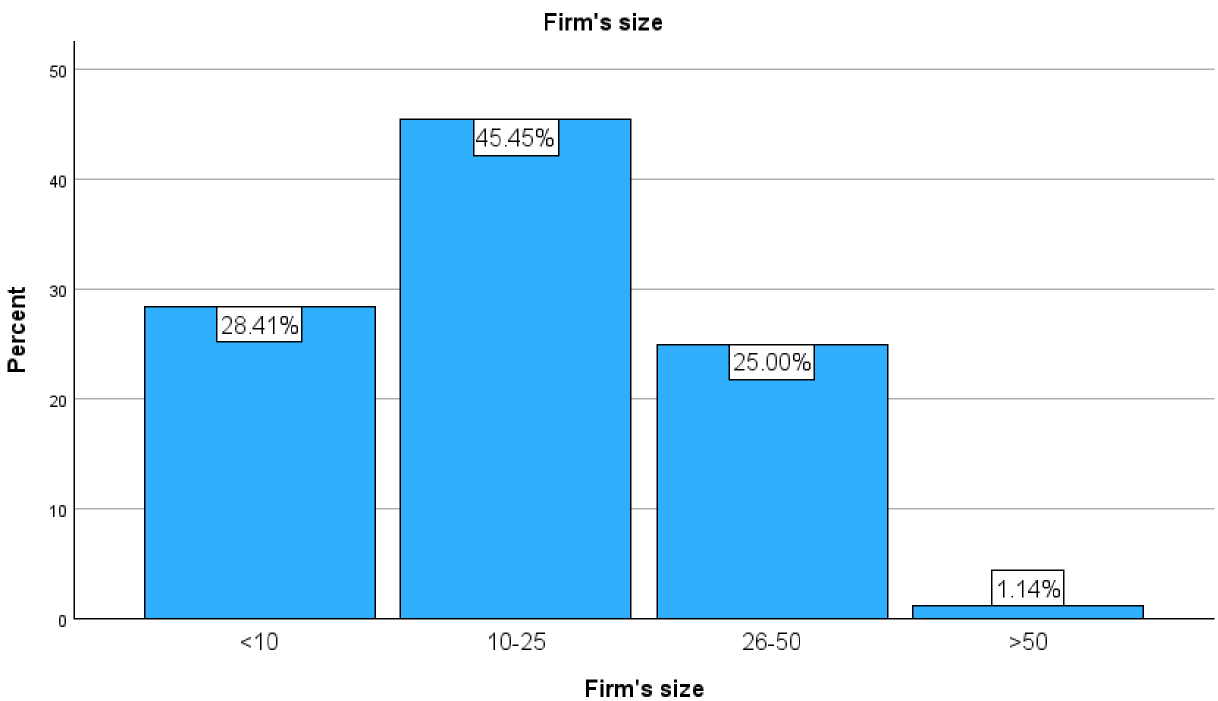


Figure 16: One-way ANOVA result comparing Firms' size and organizational factors (SPSS table elaboration of the author)

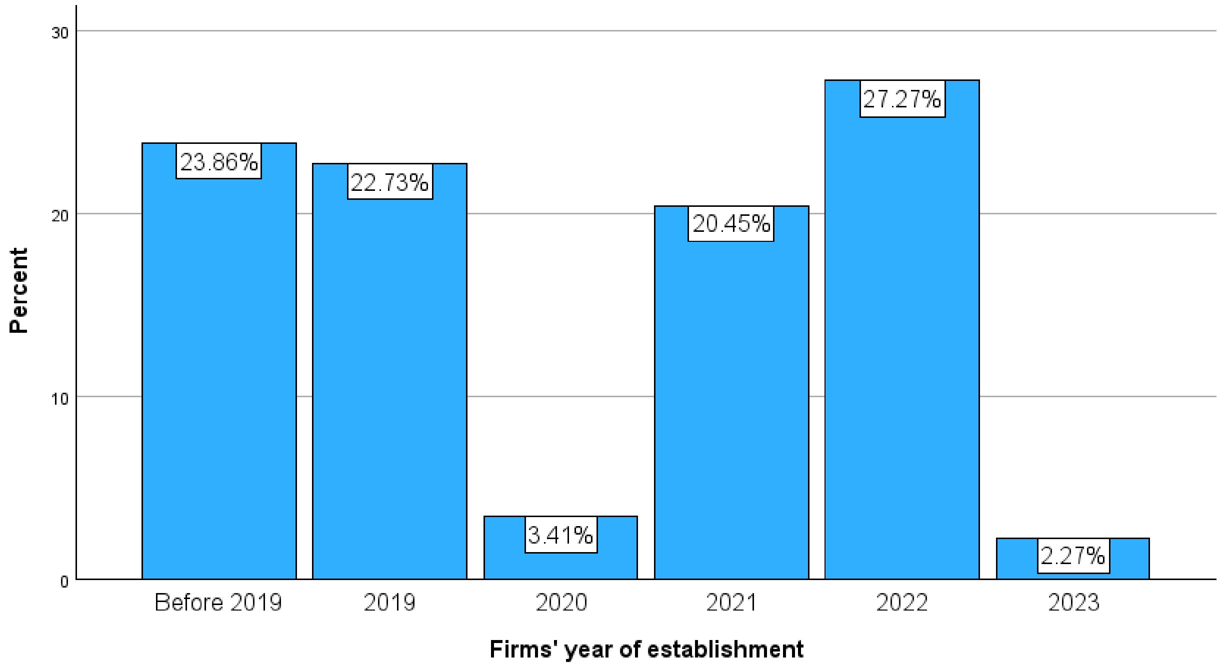
ANOVA

		Sum of Squares	df	Mean Square	F	Sig.
Corporate social responsibility	Between Groups	.905	3	.302	1.951	.128
	Within Groups	12.986	84	.155		
	Total	13.891	87			
Collaborative Innovation	Between Groups	1.445	3	.482	.608	.611
	Within Groups	66.495	84	.792		
	Total	67.939	87			
People capability development	Between Groups	.555	3	.185	.213	.887
	Within Groups	72.806	84	.867		
	Total	73.361	87			
Lack of external communication	Between Groups	.734	3	.245	.470	.704
	Within Groups	43.774	84	.521		
	Total	44.509	87			
Lack of internal communication	Between Groups	.381	3	.127	.926	.432
	Within Groups	11.504	84	.137		
	Total	11.884	87			
Hierarchy	Between Groups	1.025	3	.342	1.132	.341
	Within Groups	25.372	84	.302		
	Total	26.398	87			

Figure 16 shows the results of the one-way ANOVA test performed. In this case, it was found that firm's size does not affect the organizational factors as the p-values are above the 0.05 threshold.

Moving on with the organization control variables, the bar chart in *Figure 17* depicts the distribution of enterprises by year of establishment, emphasizing a wide age range. The bulk of businesses were started in 2022 (27.27%), followed by those founded before 2019 (23.86%) and in 2019 (22.73%). The number of enterprises founded in 2021 and 2020 has decreased significantly, accounting for 20.45% and 3.41% of the total, respectively. The smallest number of enterprises, 2.27%, were founded in 2023. This distribution may represent economic trends and external factors influencing firm launch activity, with the huge decline in 2020 most likely owing to the global effects of the COVID-19 pandemic.

Figure 17: Firms' year of establishment (SPSS Author elaboration)



Furthermore, in *Figure 18*, the corresponding ANOVA test results are shown. Again, no statistically significant result was found, leading to the conclusion that the year of establishment does not explain much of the variability in these dependent variables (the organizational factors) and is consistent with the generally low F values displayed.

Figure 18: One-way ANOVA result comparing firms' year of establishment and organizational factors (SPSS table elaboration of the author)

		Sum of Squares	df	Mean Square	F	Sig.
Corporate social responsibility	Between Groups	.253	5	.051	.305	.909
	Within Groups	13.638	82	.166		
	Total	13.891	87			
Collaborative Innovation	Between Groups	4.573	5	.915	1.184	.324
	Within Groups	63.366	82	.773		
	Total	67.939	87			
People capability development	Between Groups	4.962	5	.992	1.190	.321
	Within Groups	68.399	82	.834		
	Total	73.361	87			
Lack of external communication	Between Groups	1.862	5	.372	.716	.613
	Within Groups	42.647	82	.520		
	Total	44.509	87			
Lack of internal communication	Between Groups	.585	5	.117	.849	.519
	Within Groups	11.300	82	.138		
	Total	11.884	87			
Hierarchy	Between Groups	.994	5	.199	.642	.669
	Within Groups	25.404	82	.310		
	Total	26.398	87			

3. Binary logistic Regression analysis

A logistic regression model was used for this analysis because the primary goal is to investigate the relationship between a categorical dependent variable, the "circular strategy" (which has two possible outcomes, closing or slowing resource loops), and six continuous independent variables, which include CSR, Collaborative Innovation, People Capability Development, Lack of Internal Communication, Lack of External Communication, and Hierarchy, which have been found during the literature review to be the primary organizational factors influencing Circular Business Model Innovation. The binary Logistic regression is especially useful when the dependent variable is binary, as it allows to estimate the likelihood of a certain result based on the values of the independent variables.

Before delving into the regression analysis, however, it is needed to check for multicollinearity and linearity.

Multicollinearity test

Multicollinearity refers to a situation in which two or more independent variables are significantly connected with one another. This implies that one independent variable may be linearly predicted from the others with a high degree of accuracy (Farrar & Glauber, 1967). The variance inflation factor (VIF) is used to detect multicollinearity in variables. A VIF score of less than 10 suggests that there is no major multicollinearity concern (Hair, 2009). In the analysis the VIF scores related to every independent variable (and organizational control variables) are <10 and range between 1.088 to 3.007. *Figure 19* shows the VIF analysis. This is proof that there is no multicollinearity in the model, strengthening the model, since high correlation between predictors can distort the impact of individual variables, leading to misleading interpretations.

Figure 19: Variance Inflation factor results from the collinearity diagnostics with "circular strategy" as dependent variable (SPSS table elaboration of the author)

Model		Collinearity Statistics	
		Tolerance	VIF
1	Firm's industry	.919	1.088
	Corporate social responsibility	.840	1.190
	Collaborative Innovation	.333	3.007
	People capability development	.407	2.456
	Lack of external communication	.361	2.766
	Lack of internal communication	.839	1.192
	Hierarchy	.887	1.128
	Firm's size	.853	1.172
	Firms' year of establishment	.917	1.091

Linearity test

Linearity implies that the independent variables have a constant influence on the dependent variable, which means that a one-unit change in the independent variable always results in the same change in the dependent variable, regardless of the independent variable's value. Specifically, the linearity assumption in logistic regressions states that the continuous independent variables must have a linear connection with their logit (logarithm of the chances) transformation.

In order to check this, the first step is to create new log variables for the independent variables in the model, namely: CSR, CI, PCD, Lack of internal communication, lack of external communication and hierarchy. The second step is to perform a binary logistic regression analysis with "Circular strategy" as the dependent variable, with the interaction between the log transformation of the independent variables and the independent variables, the independent variables themselves and the organizational control variables as covariates.

Figure 20 shows the output of the test. The p-value of each of the different interaction variables coded is >.05, which indicates the existence of a linear relationship between the continuous variables and the log-odds. We can then proceed with the logistic regression analysis.

Figure 20: Results of the binary logistic regression test with "circular strategy" as dependent variable to check linearity of the model (SPSS table elaboration of the author)

		B	S.E.	Wald	df	Sig.	Exp(B)
Step 1[a]	Firm's industry	-.125	.093	1.816	1	.178	.882
	Firm's size	.076	.634	.014	1	.904	1.079
	Firms' year of establishment	-.157	.356	.194	1	.660	.855
	Corporate social responsibility	39.356	59.109	.443	1	.506	1.236E+17
	Collaborative Innovation	-13.603	15.740	.747	1	.387	.000
	People capability development	17.814	10.605	2.822	1	.093	54528515.756
	Lack of external communication	23.098	21.576	1.146	1	.284	10751671371
	Lack of internal communication	-8.234	16.139	.260	1	.610	.000
	Hierarchy	-.440	8.525	.003	1	.959	.644
	Corporate social responsibility by ln_CSR	-16.746	24.027	.486	1	.486	.000
	Collaborative Innovation by ln_CI	7.106	7.388	.925	1	.336	1219.773
	People capability development by ln_PCD	-8.997	4.992	3.248	1	.072	.000
	Lack of external communication by ln_excomm	-10.312	9.798	1.108	1	.293	.000
	Lack of internal communication by ln_intcomm	3.289	7.203	.209	1	.648	26.829
	Hierarchy by ln_hierarchy	.562	4.493	.016	1	.900	1.754
	Constant	-89.188	104.156	.733	1	.392	.000

Performing the logistic regression analysis

Logistic regression models are defined as "statistical models which describe the relationship between a qualitative dependent variable (that is, one which can take only certain discrete values, such as the presence or absence of a disease) and an independent variable" (Gullion & Berman, 2006).

Logistic regression models examine how predictor factors affect categorical outcomes. When the result is binary, such as presence or absence of illness (in this case it's two scenarios, slowing or closing resource loops), the model is known as a binary logistic model. A simple logistic regression model includes only one predictor variable. A multiple or multivariable logistic regression model involves several predictors, such as risk factors and treatments, and includes both categorical and continuous variables.

In our case, the statistical analysis persecuted is a multiple binary logistic regression, with the purpose to assess which organizational factors influence the decision regarding the circular strategy adopted by CSUs.

The control variables that will be included in the analysis are: firm's industry, firm's size and firm's year of establishment.
The binary logistic regression was performed building two models, the first one with the control variables as predictors, and the second one adding the organizational factors as predictors alongside the control variables. The results are shown below. The binary logistic regression significance relies on the Omnibus Tests of Model Coefficients, which tests the overall significance of the model (the first one in our case). If we take into account only the control variables as predictors with the dependent variable, circular strategy, the model is marginally non-significant as $p > .05$. The omnibus tests of model coefficients shows that the improvement in fit provided by model 1 with the control variables as the set of predictors is marginal and not statistically significant ($p = 0.092$).

Figure 21: Results of the Omnibus Tests of Model coefficients with organizational control variables as covariates (SPSS table elaboration of the author)

		Chi-square	df	Sig.
Step 1	Step	6.438	3	.092
	Block	6.438	3	.092
	Model	6.438	3	.092

Moving on with the Model 1 of the analysis, the "model summary" is displayed in *Figure 22*, showing two values of importance, the "Cox & Snell R Square" and the "Nagelkerke R Square". These measures represent the variance of the dependent variable explained by the model. Specifically, between 7.1% and 9.5% of the variance in the dependent variable (circular strategy) is explained by the model with the control variables as predictors.

Figure 22: Model 1 summary (SPSS table elaboration of the author)

Step	-2 Log likelihood	Cox & Snell R Square	Nagelkerke R Square
1	113.915[a]	.071	.095

The last value of importance is the "Hosmer and Lemeshow Test". Here, in order to support the model, an insignificant value is needed. The p-value here is equal to .033, which is significant as $p < .05$. This test is useful to assess the data fit to the model and a non-significant result reflects a good fit of the model.

Figure 23: Model 1 Hosmer and Lemeshow Test (SPSS table elaboration of the author)

Step	Chi-square	df	Sig.
1	16.721	8	.033

The next step was to assess the predictive capability of Model 1. The classification table shows the results of predicting the categorical dependent variable (circular strategy) using Model 1. According to the result, Model 1 (the model with the control variables as independent variables), when all categories are taken into account, accurately predicts the circular approach 69.3 % of the time. This indicates a moderate level of accuracy, but there is room for improvement.

Figure 24: Model 1 classification table (SPSS table elaboration of the author)

			Predicted		
			Circular strategy		
Observed			Slowing resource loops	Closing resource loops	Percentage Correct
Step 1	Circular strategy	Slowing resource loops	43	7	86.0
		Closing resource loops	20	18	47.4
	Overall Percentage				69.3

a. The cut value is .500

Finally, model 1 shows the impact of firms' industry, size and year of establishment on the choice of circular tactics ("slowing" vs "closing" resource loops). The findings show that a firm's industry has a considerable impact on strategy choice, with industries varied in their tendency to choose "closing" methods (odds ratio = 0.883, p = 0.018). Meanwhile, job position and education had no significant impact on the decision, indicating that industry features have a stronger influence on strategic decisions than educational background or work position inside the organization.

Figure 25: Model 1 equation coefficients and odd ratio (SPSS table elaboration of the author)

		B	S.E.	Wald	df	Sig.	Exp(B)
Step 1[a]	Firm's industry	-.124	.053	5.578	1	.018	.883
	Firm's size	-.036	.300	.015	1	.904	.964
	Firms' year of establishment	.042	.138	.091	1	.763	1.043
	Constant	.669	.926	.523	1	.470	1.953

a. Variable(s) entered on step 1: Firm's industry , Firm's size, Firms' year of establishment.

The six organizational factors were added to the regression analysis, composing model 2. In this case, the "Omnibus tests of Model coefficients" proved the significance of the model with a p-value < .001, showing a decisive improvement from Model 1 (p = .092). *Figure 26* depicts the details of the test.

Figure 26: Results of the Omnibus Tests of Model coefficients with organizational control variables and organizational factors as covariates (SPSS table elaboration of the author)

		Chi-square	df	Sig.
Step 1	Step	62.702	6	<.001
	Block	62.702	6	<.001
	Model	69.140	9	<.001

Moving on, the model summary shows that between 54.4% (Cox & Snell R Square) and 73.0% (Nagelkerke R Square) of the variance in the dependent variable (circular strategy) is explained by the model 2. This is another significant improvement from model 1.

Figure 27: Model 2 summary (SPSS table elaboration of the author)

Step	-2 Log likelihood	Cox & Snell R Square	Nagelkerke R Square
1	51.213[a]	.544	.730

Figure 28: Model 2 Hosmer and Lemeshow Test (SPSS table elaboration of the author)

Step	Chi-square	df	Sig.
1	9.920	8	.271

The fit of Model 2 is proven again, as the significance of the "Hosmer and Lemeshow Test" is > .05. Moreover, the classification table from Model 2 shows another improvement from Model 1. In this case the model, after taking into account all the categories, can predict the circular approach 87.5% of the times.

Figure 29: Model 2 classification table (SPSS table elaboration of the author)

			Predicted		
			Circular strategy		
Observed			Slowing resource loops	Closing resource loops	Percentage Correct
Step 1	Circular strategy	Slowing resource loops	45	5	90.0
		Closing resource loops	6	32	84.2
	Overall Percentage				87.5

Lasty, we need to study the variables in the equation. When investigating the drivers of circular strategy selection inside businesses, the model 2 identifies major impacts from two variables. Collaborative innovation appears as a major positive driver, statistically significant ($p = 0.016$), boosting the chance of choosing “closing resource loops” by an odds ratio of 5.142. People capability development ($p = 0.013$), on the other hand, has a significant negative influence, decreasing the possibility of pursuing strategies to close resource loops (the odds ratio is, however, lower, with Exp (B) = 0.264). The logistic regression shows that a one-unit increase in Collaborative Innovation raises the log odds of the dependent variable, which is choosing the circular strategy, by 1.638 units. This impact increases the probability of choosing the closing approach over the slowing strategy by approximately 5.142 times, as demonstrated by the Exp(B) value.

Figure 30: Model 2 equation coefficients and odd ratio (SPSS table elaboration of the author)

		B	S.E.	Wald	df	Sig.	Exp(B)
Step 1[a]	Firm's industry	-.091	.079	1.325	1	.250	.913
	Firm's size	.300	.517	.336	1	.562	1.350
	Firms' year of establishment	.092	.238	.149	1	.699	1.096
	Corporate social responsibility	-.455	1.035	.193	1	.660	.634
	Collaborative Innovation	1.638	.682	5.767	1	.016	5.142
	People capability development	-1.334	.539	6.127	1	.013	.264
	Lack of external communication	.449	.731	.377	1	.539	1.566
	Lack of internal communication	-1.031	1.264	.665	1	.415	.357
	Hierarchy	.290	.797	.133	1	.716	1.337
	Constant	2.048	7.116	.083	1	.774	7.752

a. Variable(s) entered on step 1: Firm's industry , Firm's size, Firms' year of establishment, Corporate social responsibility, Collaborative Innovation , People capability development, Lack of external communication , Lack of internal communication , Hierarchy.

By looking at the output of the analysis we can then proceed to build the equation model, in order to model the probability of the event “closing resource loops”. The model equation is as follows:

$$\text{logit}(P) = 2.048 + 1.638X_{\text{CollaborativeInnovation}} - 1.334X_{\text{PeopleCapabilityDevelopment}}$$

where p represents the probability of the firm to choose a circular strategy to *close resource loops*. Logit (P) is then the log odds of choosing the *closing resource loops* strategy over the *slowing resource loops* ones.

Discussion

The results retrieved from the analysis are displayed in Figure 30 which shows different insights and conclusions. To comment the data properly, the discussion will be developed following the order of the independent variables in Model 2, commenting the Collaborative Innovation role, the People capability development one, and the rest of the organizational factors, providing a rationale behind the model.

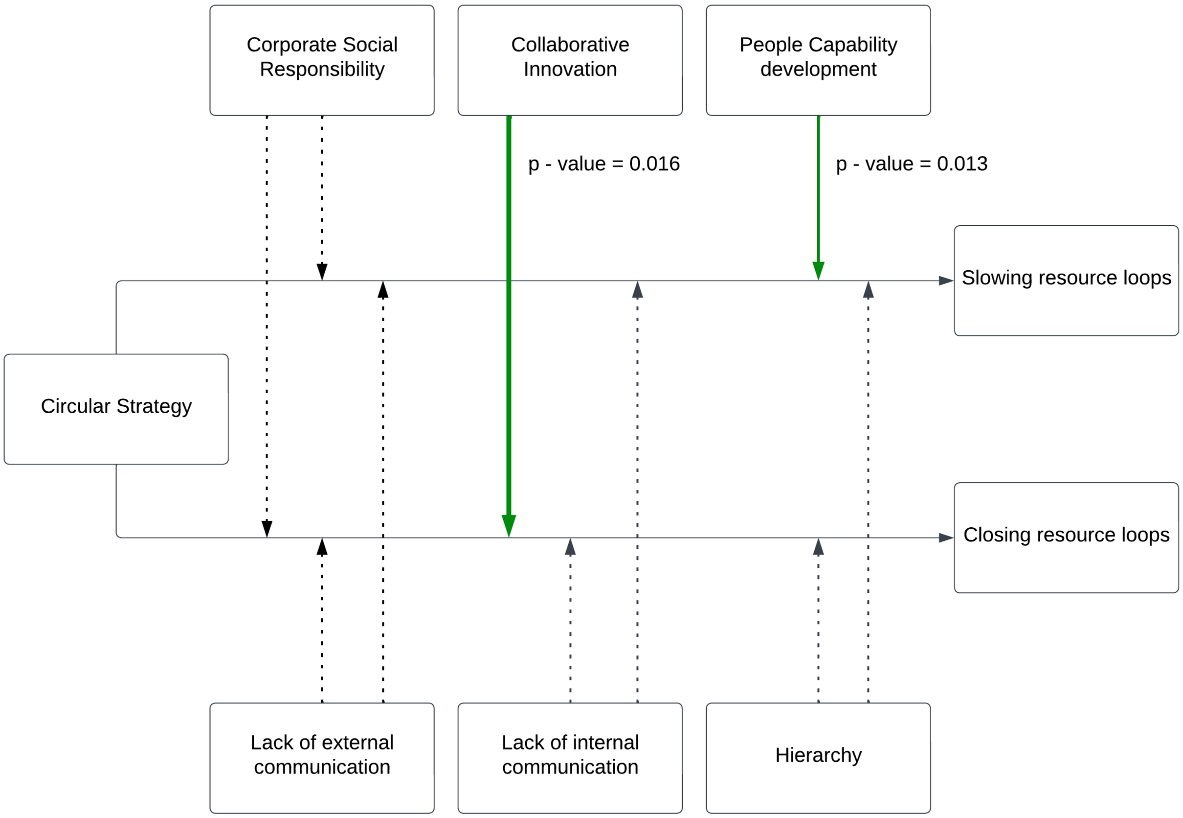
Firstly, the factor having the strongest effect on the odds of choosing a "*closing resource loops*" type of circular strategy is definitely "collaborative innovation". This particular organizational factor appears to be a major driver for closing strategies, having a positive and statistically significant effect on the likelihood of a firm choosing to "*close resource loops*". An increase in collaborative innovation multiplies the odds of choosing a *closing* strategy by 5.142, as the Exp(b) value shows, when all the other variables are held constant.

This is in line with the need for collaborations by firms engaging in business models with a closing strategy. Precisely, according to Köhler (2022), the transition from linear to circular economy needs cross-sectoral collaboration. Such collaboration enables the integration of different firms from various industries and other stakeholders, driving knowledge sharing and innovation which are crucial for the successful implementation of CE principles.

This is especially true for firms engaging in business models with the ultimate aim to *close resource loops.* As seen in the literature review, design strategies *for closing resource loops* involve solutions to extend resources' value within biological and technological cycles, respectively by producing biodegradable products and by recycling, as well as engaging in industrial symbiosis activities. In order to successfully pursue these business models, the interaction with partners and other stakeholders is crucial. In our case, firms pursuing closing strategies show business models focused mainly on producing biodegradable products and waste repurpose activities.

In both cases collaboration with partners is key for the success of the business as one core activity is to collect the waste of other companies (not necessarily engaged in any circular activity) in order to transform the waste into new resources or products (depending on which of the two cycles is the circular firm focused on). *Figure 31* presents a graphical representation of the different relations between the investigated organizational factors and the two different strategy types, highlighting the significant ones.

Figure 31: Graphic representation of the results from the binary logistic regression analysis (Author elaboration)



Moreover, the other significant result from the analysis performed is the role of people capability development in influencing the likelihood of *closing resource loops* strategies adoption. The relation shows a negative coefficient for people capability development (-1.334), indicating an inverse relationship between this organizational factor and the probability for choosing a *closing* strategy, hence, opting for the *slowing* ones. This fact is reinforced by the exp(b) value, 0.264, indicating that for one unit increase in people capability development, the odds of choosing closing resource loops strategies are multiplied by 0.264, effectively reducing the likelihood of closing strategies to be pursued, in favour of slowing ones.

Slowing resource loops strategies involve solutions like repair, maintenance, reuse, and refurbishment to extend a product's life, and these activities requires specific technical skills. For example, in industries like fashion and electronics, technical expertise in repairing and refurbishment helps slow resource loops by maintaining the value of products and reducing waste. For example, sewing skills in fashion can significantly reduce textile waste (Bocken et al., 2018).

Technical skills are crucial in remanufacturing, refurbishment as well as in component reuse, especially for complex products like vehicles. Employees need to be skilled in assessing product conditions and determining appropriate reuse strategies to prolong product (and resources) life, thus reducing the need for new raw materials.

Higher scores in people capability developments characterize *slowing resource loops* strategy as the CBMs developed to pursue this kind of strategy are usually based on providing services, whereas, *closing resource loops* strategies show higher levels of collaborative innovation (with a much more intensity) as the focus is the transformation of resources from previous productions into new products, therefore the presence of established partnerships, stakeholders' engagement and knowledge and assets sharing are key factors in determining the success of the business.

Corporate Social Responsibility (CSR) was another major driver discovered in the literature review. However, in the context of Circular startups (CSUs), this driver was non-significant in defining the circular strategy of CSUs. The p-value for CSR was, in fact, 0.660, highly above the threshold of .05 for significance.

This is due to the fact that CSR practices are embedded in every business aspect in the case of CSUs, as, unlike bigger and more traditional corporations, CSR is not a separate initiative but rather an integral part of the firm's identity and business model.

Moving on, lack of external, as well as internal, communication, showed no significant result in the binary logistic regression performed. This is, again, connected to the nature of the firms involved in the investigation, as all of them were Circular startups and therefore inherently agile and organizationally flexible.

Lastly, Hierarchy was another factor hindering CBMI according to the literature, however no evidence was found that higher levels of hierarchy led to one of the two circular strategies. This is due to the size of the firms involved in the research, as all of them were startups and, precisely, more than 73% of the startups surveyed had less than 25 employees. Even if CSUs showed different circular strategies, the relative non difference in size made this factor (hierarchy) non-significant for the purpose of the analysis.

Conclusion

The goal of the study was to explore and evaluate the relationship between the Circular Strategy adopted by Italian circular startups (CSUs) and the organizational factors identified and considered influential in the development of Circular Business Model Innovation (CBMI) during the literature review. The study began with defining Circular Economy, taking a closer look to Circular design strategies (namely closing and slowing resource loops) and circular business models. The research then proceeded to develop a definition for Circular Business model Innovation, finalizing the literature review stage and concluding with exploring the organizational factors affecting CBMI. The dependent and independent variables composing the research model were retrieved from the present literature review, namely the two types of Circular strategy (closing and slowing resource loops) and the six organizational factors, which are aggregate dimensions of the various factors found in the literature.

The lack of research and consideration towards startups motivated the research. The role of Circular start-ups as innovators in the circular economy is crucial, as circular innovations and strategies are often seen first in new entrants, such as startups. As noted by Christensen (2015), incumbents present a stronger path dependency than start-ups, as an established and already profitable business model is hard to replace, and the resources are usually directed towards the existent BM.

The methodology employed was found on a quantitative approach, involving the distribution of a questionnaire to employees of various Italian startups that were involved in circular initiatives. The questionnaire was powered by Qualtrics, and was designed to monitor the six organizational factors and establish a connection between them and the circular strategy of the startup. Data analysis was conducted using the SPSS software, performing a multivariate binary logistic regression to assess the impact of six specific organizational factors (Corporate Social Responsibility, Collaborative Innovation, People Capability development, Lack of Internal Communication, Lack of External Communication, and Hierarchy) on the likelihood of the presence of a *closing resource loops strategy*.

The results of the regression analysis showed a strong relationship between Collaborative Innovation and strategies to *close resource loops*, suggesting to practitioners to invest more in collaboration in order for their startups to innovate more while pursuing *closing resource loops* strategies. Conversely, People capability development has been identified as a strong driver for startups looking to *slow resource loops* strategies.

1. Managerial implications

More in details, the experimental study and analysis served to highlight the need, from Circular startups whose strategy is to *close resource loops*, of more collaboration among partners. Establishing partnerships with other innovative firms is crucial to overcome the linear model of economy.

Open innovation, for example, is the process where firms benefit strategically and financially by accessing and exploiting external knowledge while also offering internal competencies and knowledge for others' use (Köhler, 2022). The concept of open innovation is key for the success of partnership, hence, the success of business models with the ultimate aim to close resource loops. Cross-sectoral collaboration, is another key aspect for the success of strategies to close resource loops. This is because cross-sectoral collaborations enable and facilitate knowledge sharing (also crucial for open innovation as these two concepts are very much related), resource sharing and therefore resource upcycling. Various examples for this are the startups engaged in developing bio-materials from waste generated in other industries and sectors.

Ultimately, in the context of Circular economy, and more specifically for companies whose ultimate goal is *to close resource loop,* not generating any kind of waste, open innovation is key for developing systems (ecosystems) of firms where waste is minimized and resources are continually reused (and upcycled). It also helps firms adapt to market changes by reconfiguring resources to align with circular principles (Köhler, 2022). Startups should invest more in open innovation projects, sharing resources assets and knowledge among them, as well as developing more integrated management systems, as CSUs in Italy still struggle in this sense.

However, effective collaborations and open innovation projects, require governance structures that ensure knowledge is shared appropriately.

Moreover, another highlight of the study, was the importance of building knowledge and competencies within the firm so that the business models employed by the firms would be successful, with the ultimate aim to *slow resource loops*. CSUs looking to slow resource loops should invest more than other CSUs in developing operational capabilities and technical know-how, as their business models are generally more dependent on operational skills than startups looking to *close resource loops*. Additionally, CSUs seeking to slow resource loops should invest more in creating a robust learning and skills development capability, with targeted training programs that equip employees with essential skills.

2. Limits and future research

While providing significant results about how Collaborative Innovation and People Capability Development affect the implementation of specific types of circular strategies, the study acknowledges several limitations that pave the way for future research opportunities.

Notably, the sample size and diversity could be expanded in the future, to enhance the generalizability of the results across different stages of the startups' maturity. The findings' overall generalizability is limited by the relatively small sample size (88 respondents). Furthermore, new research paths can fill this gap, by expanding and including more respondents thus increasing the sample size, in order to include startups from a more diverse range of sectors and with different grades of maturity.

Additionally, the study primarily employed a quantitative approach, which, while robust (as the collinearity and linearity tests have proven), restricts the depth of understanding that can be accomplished through qualitative insights, particularly in the interpretation of the motivations behind the adoption of the selected circular strategy. In fact, the survey was composed of questions that were limited to rather generic constructs and items, making it difficult to grasp the numerous challenges CE poses on organizations, as well as the different responses to these challenges. The consideration of qualitative methods of data collection, like interviews or case studies, can provide the research with more and different points of view, enriching the understanding of organizational factors and their impact on circular strategy decisions.

Furthermore, the focus of the empirical study was the choice between *closing resource loops* and *slowing resource loops* strategies, but this focus did not extend to the evaluation of the long-term success of these strategies in terms of sustainability outcomes. An empirical study developed on the relationship between specific organizational factors, such as Collaborative innovation and their ultimate effectiveness in achieving circular economy goals could be a new research path in the field.

These acknowledgements show different limitations of the present study but also push the boundaries of research in circular economy innovation, offering a more comprehensive understanding of the dynamics at play.

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Appendix

"Organizational drivers and barriers for Circular business model innovation: Focus on Italian Startups"

In questo sondaggio vi verranno poste alcune domande per capire quali sono i fattori a livello organizzativo che stimolano (driver) o inibiscono (barriere) la nascita e l'implementazione di nuovi business models circolari. Le informazioni raccolte non saranno diffuse e il loro utilizzo sarà esclusivamente finalizzato a scopi di ricerca accademica. Per assicurare il totale rispetto della privacy dei partecipanti alla ricerca, le risposte al questionario saranno mantenute completamente anonime. In anticipo, vi ringrazio per il tempo e l'attenzione che dedicherete alla compilazione.

Tempo stimato per la compilazione: **6 minuti**

Obbligo di riservatezza

Le informazioni raccolte per mezzo di tale questionario sono soggette all'obbligo di riservatezza.

I risultati della ricerca potranno essere pubblicati in forma aggregata ed ogni eventuale riferimento esplicito al nome delle singole aziende intervistate potrà avvenire solo se esplicitamente autorizzato dall'azienda medesima ai sensi del d.lgs. 19/03.

In nessun caso (MAI) saranno resi noti i risultati relativi alle singole persone che hanno compilato il questionario.

PARTE 1: DATI PERSONALI E AZIENDALI

Q1: Genere:

1. Maschio
2. Femmina
3. Genere non-binario / Terzo genere
4. Preferisco non rispondere

Q2: Quanti anni ha?

1. <18
2. 18-25
3. 26-30
4. 31-50
5. 51-60
6. >60

Q3: Qual è il suo attuale livello d’istruzione?

1. Diploma di scuola superiore
2. Laurea Triennale
3. Laurea magistrale
4. Laura Vecchio ordinamento
5. Titolo post laurea (es. Master, Scuola di Specializzazione)
6. Dottorato di Ricerca
7. Altro

Q4: Qual è la sua posizione attuale in azienda?

1. Dipendente senza responsabilità di collaboratori
2. Middle management (dipendente con responsabilità di collaboratori)
3. Top management/vertice aziendale
4. Imprenditore/fondatore
5. Altro

Q5: In quale settore opera l'azienda per cui lavora?

1. Agricoltura, silvicoltura e pesca
2. Attività estrattive e servizi di supporto
3. Attività manifatturiere
4. Riparazione, manutenzione e installazione di macchine e apparecchiature
5. Utilities (energia elettrica, gas, acqua e rifiuti)
6. Costruzioni
7. Commercio all'ingrosso
8. Commercio al dettaglio
9. Trasporto, magazzinaggio e attività postali e di corriere
10. Servizi di alloggio e ristorazione
11. Servizi di informazione e di comunicazione
12. Servizi finanziari, immobiliari, professionali, supporto imprese
13. Amministrazione pubblica e difesa
14. Sanita', assistenza, istruzione
15. Intrattenimento e servizi alla persona
16. Servizi di intermediazione (ad esclusione dell'intermediazione in ambito finanziario, assicurativo e immobiliare)
17. Altre attivita

Q5: Quanti dipendenti ha l’azienda?

1. <10
2. 10-25
3. 26-50
4. >50

Q6: In quale anno è stata costituita la sua azienda?

1. Prima del 2018
2. 2019
3. 2020
4. 2021
5. 2022
6. 2023
7. 2024

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Le strategies per rallentare il ciclo di vita dei prodotti sono incentrate sul mantenimento del massimo valore delle risorse primarie per il maggior tempo possibile. Le strategie per chiudere il ciclo di vita dei prodotti e delle risorse, invece, hanno l’obiettivo ultimo di mantenere le risorse in un ciclo continuo chiudendolo e impedendo la produzione di rifiuti. Nella prima categoria risiedono business models incentrati sull’allungamento di vita del prodotto e sulla produzione di prodotti il cui ciclo di vita è di per sè lungo (come prodotti di extralusso come orologi). Nella seconda categoria risiedono, per esempio, business models per il ciclo di vita biologico e tecnologico, dove imprese disegnano prodotti da poter smaltire facilmente e senza ripercussioni negative per l’ambiente (usando materiali biologici e biodegradabili, per esempio).

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Q7: In base alle sue conoscenze, quale strategia sta perseguendo la tua azienda?

1. Strategia per rallentare il ciclo di vita dei prodotti e delle risorse
2. Strategia per chiudere il ciclo di vita dei prodotti e delle risorse

PARTE 2: DRIVERS

Relativamente alle seguenti domande, Le chiediamo di esprimere la Sua valutazione su una scala da 1 a 5, in cui 1= "Fortemente in disaccordo" e 5 = "Fortemente d'accordo".

	Fortemente in disaccordo — *Fortemente d'accordo*
Q8) L'azienda è socialmente responsabile[3] (Item originale: The organization is socially responsible.)	(1) ------ (2) ------ (3) ------ (4) ------ (5)
Q9) L'azienda tiene alla comunità locale di cui fa parte[3] (Item originale: My company cares about the local community)	(1) ------ (2) ------ (3) ------ (4) ------ (5)
Q10) E' importante comportarsi eticamente[3] (item originale: It is important to act ethically)	(1) ------ (2) ------ (3) ------ (4) ------ (5)
Q11) L'azienda ci tiene ai propri dipendenti [3] (Item originale: The company cares about employees)	(1) ------ (2) ------ (3) ------ (4) ------ (5)
Q12) Il sistema di compensazione è giusto [4] (Item originale: The compensation system is fair)	(1) ------ (2) ------ (3) ------ (4) ------ (5)

[3] Kucharska, W., & Kowalczyk, R. (2019). How to achieve sustainability?—Employee's point of view on company's culture and CSR practice. Corporate Social Responsibility and Environmental Management, 26(2), 453-467.
[4] Staniškienė, E., & Stankevičiūtė, Ž. (2018). Social sustainability measurement framework: The case of employee perspective in a CSR-committed organisation. Journal of cleaner production, 188, 708-719.

Relativamente alle seguenti domande, Le chiediamo di esprimere la Sua valutazione su una scala da 1 a 5, in cui 1= “Fortemente in disaccordo” e 5 = “Fortemente d’accordo”.

	Fortemente in disaccordo — *Fortemente d’accordo*
Q13) L’azienda presenta accordi formali che stabiliscono partnership con alter organizzazioni[5] (Item originale: Your organization relies on a formal agreement that spells out relationships between partner organizations)	(1) ------ (2) ------ (3) ------ (4) ------ (5)
Q14) L’azienda presenta procedure standard create da aziende partner per coordinare le attività della partnership[5] (Item originale: Your organization relies on standard operating procedures (like rules, policies, forms) created by partner organizations to coordinate each other’s activities in the collaboration)	(1) ------ (2) ------ (3) ------ (4) ------ (5)
Q15) L’azienda si affida a relazioni personali informali con le organizzazioni partner quando prende decisioni sulla collaborazione[5] (item originale: Your organization relies on informal personal relationships with partner organizations when making decisions about the collaboration)	(1) ------ (2) ------ (3) ------ (4) ------ (5)
Q16) L’azienda, per raggiungere gli obiettivi, necessita delle risorse, servizi o supporto da parte di aziende partner[5] (Item originale: Your organization, to accomplish its goals, needs the resources, services, or support of partner organizations)	(1) ------ (2) ------ (3) ------ (4) ------ (5)
Q17) L’azienda risolve i problemi collaborando con i propri partner[6] (Item originale: Organization regularly solve problems jointly with its suppliers)	(1) ------ (2) ------ (3) ------ (4) ------ (5)
Q18) I membri della catena di fornitura condividono le spese di ricerca e sviluppo e i risultati tra loro[6] (Item originale: Supply chain members share research and development costs and results with each other)	(1) ------ (2) ------ (3) ------ (4) ------ (5)

[5] Thomson, A. M., Perry, J. L., & Miller, T. K. (2009). Conceptualizing and measuring collaboration. Journal of public administration research and theory, 19(1), 23-56.
[6] V. P. K. Sundram, V. Chandran, and M. A. Bhatti, “Supply chain practices and performance: the indirect effects of supply chain integration,” Benchmarking An Int. J., vol. 23, no. 6, pp. 1445–1471, 2016

Relativamente alle seguenti domande, Le chiediamo di esprimere la Sua valutazione su una scala da 1 a 5, in cui 1= "Fortemente in disaccordo" e 5 = "Fortemente d'accordo".

	Fortemente in disaccordo ... *Fortemente d'accordo*
Q19) L'azienda presenta processi per generare nuove conoscenze da conoscenze esistenti [7] (item originale: My organization has processes for generating new knowledge from existing knowledge)	(1) ------ (2) ------ (3) ------ (4) ------ (5)
Q20) Ho ricevuto sufficiente training in azienda per fare il mio lavoro [8] (item originale: I have received sufficient training at firm to do my job effectively)	(1) ------ (2) ------ (3) ------ (4) ------ (5)
Q21) Ricevo training regolarmente[8] (item originale: I am given training at a regular basis)	(1) ------ (2) ------ (3) ------ (4) ------ (5)
Q22) Ho una figura mentor che mi affianca nel mio percorso di carriera[8] (item originale: I am arranged with a mentor to facilitate career planning)	(1) ------ (2) ------ (3) ------ (4) ------ (5)

[7] Abd Rahman, A., Imm Ng, S., Sambasivan, M., & Wong, F. (2013). Training and organizational effectiveness: moderating role of knowledge management process. European Journal of Training and Development, 37(5), 472-488.

[8] Hong, E. N. C., Hao, L. Z., Kumar, R., Ramendran, C., & Kadiresan, V. (2012). An effectiveness of human resource management practices on employee retention in institute of higher learning: A regression analysis. International journal of business research and management, 3(2), 60-79.

PARTE 3: BARRIERS

Relativamente alle seguenti domande, Le chiediamo di esprimere la Sua valutazione su una scala da 1 a 5, in cui 1= "Fortemente in disaccordo" e 5 = "Fortemente d'accordo".

	Fortemente in disaccordo ... *Fortemente d'accordo*
Q23) L'azienda informa I propri partner in anticipo circa cambiamenti delle necessità [9] (item originale: Organization informs its trading partners in advance of changing needs)	(1) ------ (2) ------ (3) ------ (4) ------ (5)
Q24) I partner dell'azienda condividono informazioni di loro proprietà con la nostra organizzazione[12] (item originale: Organization's trading partners share proprietary information with your organization)	(1) ------ (2) ------ (3) ------ (4) ------ (5)
Q25) La condivisione di informazioni tra l'azienda e i partner è tempestiva[12] (item originale: Information exchange between organization and its trading partners is timely)	(1) ------ (2) ------ (3) ------ (4) ------ (5)
Q26) Le aziende nella nostra creano un sistema di comunicazione e di informazione compatibile[12] (Item originale: Firms in our supply chain create a compatible communication and information system)	(1) ------ (2) ------ (3) ------ (4) ------ (5)
Q27) I partner commerciali dell'organizzazione condividono conoscenze aziendali dei processi di business principali con la vostra organizzazione[12] (Item originale: Organization's trading partners share business knowledge of core business processes with your organization)	(1) ------ (2) ------ (3) ------ (4) ------ (5)

[9] V. P. K. Sundram, V. Chandran, and M. A. Bhatti, "Supply chain practices and performance: the indirect effects of supply chain integration," Benchmarking An Int. J., vol. 23, no. 6, pp. 1445–1471, 2016

Relativamente alle seguenti domande, Le chiediamo di esprimere la Sua valutazione su una scala da 1 a 5, in cui 1= "Fortemente in disaccordo" e 5 = "Fortemente d'accordo".

	Fortemente in disaccordo *Fortemente d'accordo*
Q28) Il Top management effettua la maggioranza delle decisioni senza consultare il resto dell'organico[10] (Item originale: Higher level staff make the majority of decisions without consulting lower level staff)	(1) ------ (2) ------ (3) ------ (4) ------ (5)
Q29) Il top management raramente chiede feedback da parte del resto dell'organico[13] (Item originale: Higher level staff rarely ask for feedback from lower level staff)	(1) ------ (2) ------ (3) ------ (4) ------ (5)
Q30) Il top management si isola dal resto dell'organico[13] (Item originale: Higher level staff isolate themselves from lower level staff)	(1) ------ (2) ------ (3) ------ (4) ------ (5)
Q31) I compiti più importanti non sono assegnati a dipendenti di livello inferiore[13] (Item originale: Important tasks are not assigned to lower level staff.)	(1) ------ (2) ------ (3) ------ (4) ------ (5)

[10] Kucharska, W., & Kowalczyk, R. (2019). How to achieve sustainability?—Employee's point of view on company's culture and CSR practice. Corporate Social Responsibility and Environmental Management, 26(2), 453-467

Relativamente alle seguenti domande, Le chiediamo di esprimere la Sua valutazione su una scala da 1 a 5, in cui 1= "Fortemente in disaccordo" e 5 = "Fortemente d'accordo".

	Fortemente in disaccordo ... *Fortemente d'accordo*
Q32) Ho l'impressione che nessuno mi dica niente di ciò che accade in azienda [11] (Item originale: I feel like no one ever tells me anything about what's going on around here)	(1) ------ (2) ------ (3) ------ (4) ------ (5)
Q33) Le mie performance migliorerebbero se ricevessi più informazioni su cosa accade in azienda [14] (Item originale: My performance would improve if I received more information about what's going on here)	(1) ------ (2) ------ (3) ------ (4) ------ (5)
Q34) Ricevo le informazioni necessarie per fare il mio lavoro[14] (Item originale: I receive the information needed to do my job)	(1) ------ (2) ------ (3) ------ (4) ------ (5)
Q35) Il top management conosce quali sono i problemi che affrontano gli altri dipendenti [12] (Item originale: The management team knows what issues the work floor is dealing with)	(1) ------ (2) ------ (3) ------ (4) ------ (5)
Q36) Sono soddisfatto circa le informazioni che ricevo su questioni pratiche all'interno dell'azienda (meeting, eventi etc.)[15] (Item originale: I am satisfied with the information I receive about practical matters within this organization)	(1) ------ (2) ------ (3) ------ (4) ------ (5)

[11] Holt, D. T., Bartczak, S. E., Clark, S. W., & Trent, M. R. (2007). The development of an instrument to measure readiness for knowledge management. *Knowledge Management Research & Practice*, *5*(2), 75-92.
[12] Zwijze-Koning, K., & de Jong, M. (2007). Evaluating the communication satisfaction questionnaire as a communication audit tool. Management communication quarterly, 20(3), 261-282.