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Strategic value creation through circular business model innovation: The case of Kymia

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Biographical Note

Federico Capriati was born in Catania, Italy in 1997. He completed his undergraduate degree in Business administration at University of Catania in 2020.

Following his undergraduate studies, he pursued a Master's degree in Economics of Business and Strategy at the Faculty of Economics of the University of Porto (FEP), which he concluded with the present dissertation.

During the master's degree, he studied one semester, under the Erasmus program, at EM Normandie Business School, where he focused on Sustainable Business Strategy.

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Abstract

The transition towards more sustainable economic models has increased academic and managerial interest in circular economy and circular business model innovation (CBMI). In this context, circular business models and business model innovation are increasingly recognised as potential sources of value creation and competitive advantage for firms (Bocken et al., 2016; Ferasso et al., 2020; Teece, 2010). However, despite the growing body of literature, the relationship between business model innovation for sustainability and circularity remains only partially understood, as the field remains conceptually fragmented and requires further empirical investigation (Araujo et al., 2026; Ferasso et al., 2020), particularly in the context of circular startups, a category whose circular business model configurations remain poorly understood in the existing literature (Finner et al., 2026).

This dissertation investigates how CBMI embedded within a firm's business model contributes to strategic value creation and influences competitive positioning — intended to refer to the relative position that a firm occupies with respect to its competitors as an outcome of its value creation processes. The study adopts a qualitative case study approach focusing on Kymia, an Italian born-circular startup operating in B2B markets that transforms agricultural by-products into high-value natural bioactive ingredients. The research explores how circular innovation shapes the firm’s value creation and value capture mechanisms.

The findings reveal that CBMI contributes to strategic value creation through three interrelated mechanisms: valorisation of agricultural waste as a primary productive input, the development of a research partnership network, and the construction of a multi-dimensional value proposition. The study also identifies market awareness as a relevant condition for translating a distinctive resource configuration into actual competitive advantage.

Keywords: Circular economy, circular business models, business model innovation, strategic value creation, dynamic capabilities.

Resumo

A transição para modelos económicos mais sustentáveis tem aumentado o interesse académico e empresarial na economia circular e na inovação do modelo de negócio circular (CBMI). Neste contexto, os modelos de negócio circulares são cada vez mais reconhecidos como potenciais fontes de criação de valor e vantagem competitiva para as empresas (Bocken et al., 2016; Ferasso et al., 2020; Teece, 2010). No entanto, apesar do crescente corpo de literatura, a relação entre a inovação do modelo de negócio para a sustentabilidade e a circularidade permanece apenas parcialmente compreendida, uma vez que o campo continua fragmentado e requer maior investigação empírica (Araujo et al., 2026; Ferasso et al., 2020), particularmente no contexto das startups circulares, uma categoria cujas configurações de modelos de negócio circulares permanecem pouco compreendidas na literatura existente (Finner et al., 2026).

Esta dissertação investiga de que forma a CBMI incorporada no modelo de negócio de uma empresa contribui para a criação de valor estratégico e influencia o posicionamento competitivo — entendido como a posição relativa que uma empresa ocupa face aos seus concorrentes como resultado dos seus processos de criação de valor. O estudo adota uma abordagem qualitativa de estudo de caso centrada na Kymia, uma startup born-circular italiana que opera em mercados B2B e transforma subprodutos agrícolas em ingredientes bioativos naturais de alto valor. A investigação explora de que forma a inovação circular molda os mecanismos de criação e captação de valor da empresa.

Os resultados revelam que a CBMI contribui para a criação de valor estratégico através de três mecanismos interligados: valorização de resíduos agrícolas como input produtivo primário, o desenvolvimento de uma rede de parcerias de investigação, e a construção de uma proposta de valor multidimensional. O estudo identifica ainda a consciencialização do mercado como uma condição relevante para traduzir uma configuração distintiva de recursos em vantagem competitiva real.

Palavras-chave: Economia circular, modelos de negócio circulares, inovação do modelo de negócio, criação de valor estratégico, capacidades dinâmicas.

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1. Introduction

1.1 Context

In recent years, the transition towards more sustainable economic systems has attracted increasing attention from both academia and practitioners. The concept of circular economy (CE) has emerged as an alternative to traditional linear models of production and consumption, which are typically based on a "make–use–dispose" logic (Geissdoerfer et al., 2017). By contrast, the CE promotes a more efficient use of resources through strategies aimed at reducing waste and maintaining the value of materials over time. Beyond its environmental implications, the transition towards the circular economy requires changes in how firms organise their activities and manage resources. In particular, business models play a central role, as they define how firms create and capture value from their activities (Teece, 2010). Moreover, business models have been identified as key mechanisms through which firms can implement CE principles (Bocken et al., 2016). However, despite the growing body of literature on CE and sustainable business models, recent studies highlight that the field remains conceptually fragmented and still requires further empirical investigation (Araujo et al., 2026; Islam et al., 2025; Finner et al., 2026).

1.2 Research Objectives and Questions

Building on the existing literature, this dissertation aims to investigate how circular business model innovation (CBMI) contributes to strategic value creation within firms. While prior studies have explored CE principles and business model innovation, there is still limited empirical evidence on how firms operationalise circular innovation and translate it into value creation mechanisms (Araujo et al., 2026; Islam et al., 2025). This gap is particularly pronounced in the context of small and medium-sized enterprises (SMEs), as SMEs represent the backbone of the European business economy: according to the most recent data from the Joint Research Centre of the European Commission, they account for 99.8% of all enterprises in the EU non-financial business sector, generating the majority of employment and value added across all Member States (Schulze Brock et al., 2025). Despite this structural relevance, SMEs remain comparatively understudied in the circular business model literature (Ferasso et al., 2020; Islam et al., 2025). As noted

by Vermeulen et al. (2023), existing research on circular business models does not adequately tailor the conditions that characterise SMEs — limited access to capital, greater dependence on local supply chains, higher exposure to demand volatility, and constrained bargaining power with suppliers and clients. These conditions make the operationalisation of circular strategies particularly challenging and theoretically distinctive (Vermeulen et al., 2023).

In addition, circular startups — firms that design circularity as a foundational business logic from inception rather than as an adaptation of an existing linear model — remain largely overlooked in the existing CBM literature, which tends to focus on incumbent firms (Henry et al., 2020; Finner et al., 2026). This represents a significant theoretical gap, as circular startups differ from both conventional startups and established firms in their strategic orientation, resource configuration, and innovation logic, and are increasingly recognised as key agents of innovation in the transition towards a circular economy (Finner et al., 2026). Understanding how startups operationalise circular business model innovation and translate it into strategic value creation is therefore relevant both for advancing theoretical understanding and for informing managerial practice in a category of firms that has received insufficient empirical attention (Finner et al., 2026).

In this context, the study pursues the following sub-research questions:

- RQ1: How is circular innovation integrated into firms' business models?
- RQ2: How does circular business model innovation contribute to firms' strategic value creation?
- RQ3: How may circular business model innovation shape firms' competitive positioning as an outcome of value creation processes?

1.3 Research Methodology

This dissertation adopts a qualitative case study approach, focusing on Kymia, an Italian innovative startup operating in B2B markets and specialised in the transformation of agricultural by-products into high-value natural ingredients. The company develops

extraction processes aimed at recovering and valorising pistachio processing residues, which are typically discarded during agricultural activities. Through these processes, such by-products are transformed into functional ingredients used in the cosmetic sector. The selection of Kymia as a case study is motivated by its engagement in activities that are consistent with CE principles, particularly in relation to resource recovery and waste valorisation. Primary data were collected through two semi-structured interviews with Anna Cacopardo, co-founder of Kymia, complemented by secondary data from corporate documents, market reports, and publicly available institutional sources.

1.4 Dissertation Structure

This dissertation is organised into five chapters. Chapter 2 develops the theoretical and conceptual framework, reviewing the literature on circular economy, circular business models, dynamic capabilities, and the resource-based view, and presenting the conceptual model that guides the empirical analysis. Chapter 3 details the methodological approach adopted in the study, including the research design, case selection criteria, data collection procedures, and quality assessment. Chapter 4 presents the empirical findings organised around the three research objectives. Chapter 5 discusses the findings in light of the theoretical framework, presents the theoretical and managerial contributions of the study, and concludes with the limitations and directions for future research.

2. Literature Review and Theoretical Framework

2.1 Circular Economy: Conceptual Foundations and Contemporary Developments

The concept of circular economy (CE) has emerged as a response to the limitations of traditional linear economic systems, which are based on a "make–use–dispose" logic of resource use (Geissdoerfer et al., 2017). The traditional linear economic model has been increasingly criticised for its intensive use of natural resources and its contribution to environmental pressures, highlighting the need for more sustainable economic systems (Korhonen et al., 2018). In contrast, the CE proposes a systemic shift towards a model in which the use of resources is optimised and waste generation is minimised. Rather than treating waste as an inevitable outcome of production processes, CE promotes the continuous use of materials through strategies such as reuse, recycling, and recovery, with the aim of maintaining the value of products and resources over time (Kirchherr et al., 2017).

Despite its growing relevance, the concept of CE does not have a single universally accepted definition. As highlighted by Kirchherr et al. (2017), the CE has been conceptualised in multiple ways across different disciplines, resulting in a fragmented and evolving body of literature. This diversity reflects the fact that the concept has been developed not only by academic research, but also by practitioners and policymakers (Ellen MacArthur Foundation, 2013). From a theoretical perspective, CE is often described as a regenerative system aimed at decoupling economic growth from resource consumption and environmental impact (Geissdoerfer et al., 2017). In this view, CE is not limited to waste management practices, but involves a broader transformation of production and consumption systems, requiring changes in how resources are used, managed, and valued over time (Korhonen et al., 2018). At the core of the CE are a set of guiding principles aimed at improving resource efficiency and reducing environmental impact. One of the most widely recognised frameworks is based on the "3Rs" — reduce, reuse, and recycle — which emphasise the importance of minimising resource inputs and extending the lifecycle of materials (Kirchherr et al., 2017; Hachaichi & Bourdin, 2023). Over time, these principles have been expanded to include additional strategies such as recovery and regeneration, reflecting the increasing complexity of circular systems. From

a systems perspective, the CE can be understood as a regenerative system in which resources, production processes, and actors are interconnected through circular flows that eliminate waste and maintain material value over time (Geissdoerfer et al., 2017). Rather than operating as isolated units, firms engaging with circular principles are embedded in broader value networks — encompassing suppliers, research partners, and clients — through which resources and knowledge circulate continuously (Araujo et al., 2026).

However, the implementation of CE principles presents significant challenges, particularly at the organisational level. Integrating circularity into business activities requires firms to simultaneously consider environmental, economic, and social dimensions, which can be difficult to reconcile within existing business models (Geissdoerfer et al., 2020). Moreover, the lack of standardised definitions and measurement frameworks complicates the operationalisation and evaluation of circular strategies (Araujo et al., 2026). Despite these challenges, the CE has gained increasing attention in both academic research and business practice, as it offers the potential to generate multiple forms of value. In particular, CE has been associated with improvements in resource efficiency, the reduction of environmental impact, and the creation of new business opportunities (Araujo et al., 2026).

Overall, the CE represents a shift from linear to more regenerative and resource-efficient economic systems. However, translating its principles into concrete organisational practices requires further investigation, particularly in relation to how firms implement circular strategies and how these contribute to value creation (Araujo et al., 2026; Islam et al., 2025). While business models have been identified as a promising mechanism through which CE principles may be operationalised at the firm level (Bocken et al., 2016; Geissdoerfer et al., 2020), the extent to which they effectively support this process remains an open question in the literature, requiring further empirical investigation (Araujo et al., 2026; Islam et al., 2025). These developments also help explain why recent research has increasingly focused on circular business models as mechanisms for translating CE principles into firm-level practices (Islam et al., 2025).

2.2 Circular Business Models and Business Model Innovation

The relationship between the CE and firm-level business models is not uniform across all organisational contexts. For firms operating with linear resource flows, the adoption of CE principles may require significant changes in the way organisations design and operate their business models (Bocken et al., 2016; Lewandowski, 2016). However, for firms that are designed with circularity embedded from the outset — such as those that utilise waste or by-products generated by other organisations as primary productive inputs — circular practices represent the foundational logic of the business rather than the outcome of a transformation process (Urbinati et al., 2017; Lüdeke-Freund et al., 2019). Empirical evidence of this second pathway is documented in the literature: Donner et al. (2020) analysed 39 cases of firms that translate agricultural waste and by-products into high-value products through a CE approach, identifying six distinct types of circular business models — including upcycling entrepreneurship and environmental biorefinery — in which circularity constitutes the core operational logic of the firm rather than a strategic add-on. Similarly, Schlüter et al. (2022) examine four potato processors in Germany that valorise by-product streams — including peels, scraps, and pulp — through circular business models designed around waste valorisation from inception, without undergoing any transition from a prior linear configuration. At the level of SMEs, Reim et al. (2025) document the case of a firm that utilises fish waste and transforms it into animal food for international markets, operating entirely within a circular value logic from inception, without having undergone any business model redesign. In all these cases, business models serve as the organisational mechanism through which CE principles are embedded in firms' value creation processes. From a conceptual perspective, business models have been widely studied as systems of interdependent activities that determine how value is created and captured (Amit & Zott, 2001). In this sense, they provide a useful analytical lens for understanding how firms organise resources, processes, and relationships in order to generate value. Building on this view, Zott et al. (2011) highlight that business models play a central role in connecting strategy, innovation, and firm performance.

A widely adopted tool for mapping and analysing business models is the Business Model Canvas (BMC) developed by Osterwalder and Pigneur (2010). The BMC provides

a structured visual representation of the nine building blocks through which a firm creates, delivers, and captures value: value propositions, customer segments, channels, customer relationships, revenue streams, key resources, key activities, key partners, and cost structure. While originally developed as a managerial tool, the BMC has been widely adopted in academic research as a descriptive framework for mapping how firms organise their activities (Zott et al., 2011). In the context of circular economy research, the BMC provides a useful analytical lens for identifying which components of a business model embed circular principles and how they interconnect.

In the context of the CE, traditional business models based on linear resource flows are increasingly challenged by the need to improve resource efficiency and reduce waste. As a result, circular business models (CBMs) have emerged as approaches aimed at maintaining the value of products, materials, and resources over time (Geissdoerfer et al., 2017). CBMs are commonly associated with strategies such as product life extension, reuse, remanufacturing, and recycling, which aim to reduce resource inputs and minimise waste generation (Bocken et al., 2016). These models shift the focus from volume-based production towards value retention and resource optimisation. To clarify this distinction, Table 1 contrasts the key characteristics of traditional linear business models with circular business models across four dimensions. It should be noted that the dimensions represent idealised configurations: in practice, firms may adopt hybrid models that combine elements of both. In particular, revenue models such as subscriptions or leasing may appear in both traditional and circular contexts. In the circular economy literature, such models qualify as circular only when specifically designed to retain product ownership and enable resource recovery at end of life, as in product-as-a-service configurations (Bocken et al., 2016).

Table 1. Comparison Between Traditional and Circular Business Models

Dimension	Traditional Business Model	Circular Business Model
Resource logic	Linear: extract, produce, dispose	Circular: recover, reuse, regenerate
Value proposition	Based on product sales and volume	Based on resource efficiency and extended value retention

Revenue model	Primarily transactional, one-time sales. However, may include other models in which product ownership is not retained by the producer and resources are not designed to be recovered at end of life	Service-oriented, long-term relationships, new revenue streams from recovered materials
Stakeholder network	Supplier, producer, consumer	Integrated network of co-producers, recyclers, partners

Note. Sources: Bocken et al. (2014; 2016); Geissdoerfer et al. (2017); Linder & Williander (2017)

A widely recognised contribution in this field is provided by Bocken et al. (2016), who identify three circular resource loop strategies through which firms can redesign their business models to support circularity:

- Slowing loops — strategies to design long-life products and extend the useful life of products, for example through reuse and repair and new service-driven business models.
- Closing resource loops — recovering materials at end of life through recycling, recovery, or composting to keep resources within the economic system.
- Narrowing loops — improving resource efficiency by using fewer resources per unit of product.

Together, these strategies illustrate how firms can embed circularity at different points of the value chain. Similarly, Lewandowski (2016) highlights that circular business models require the integration of circular principles into all components of the business model, including value proposition, value creation processes, and revenue mechanisms. This perspective emphasises that circularity is not limited to specific activities, but involves a systemic redesign of how firms operate.

Building on these foundations, Urbinati et al. (2017) propose a taxonomy of CBMs organised along two analytical dimensions: (1) the degree of circularity embedded in the value proposition — that is, the extent to which the firm's core offer is built around circular principles such as waste valorisation, resource recovery, or product life extension; and (2) the extent of integration across the value network — that is, the degree to which the firm coordinates with suppliers, partners, and customers to enable circular flows of materials and knowledge. By combining these two dimensions, Urbinati et al.

(2017) identify four types of CBMs: (a) linear-oriented models, where circularity is absent or marginal in both value proposition and network integration; (b) partially circular — product-oriented models, where circularity is embedded in the value proposition but the value network remains largely linear; (c) partially circular — network-oriented models, where circular integration across the value network is high but the value proposition retains linear elements; and (d) fully circular models, where both the value proposition and the value network are deeply organised around circular principles. This taxonomy is particularly useful for empirical research as it enables researchers to classify and compare CBMs across firms, and to assess the depth and breadth of circular integration beyond simple binary classifications (Urbinati et al., 2017).

Similarly, Lüdeke-Freund et al. (2019) propose a typology of six circular economy business model patterns, highlighting that there is no single path to circularity at the business model level:

1. Repair and maintenance — business models centred on extending product life through servicing;
2. Reuse and redistribution — enabling products to be used again by new users;
3. Refurbishment and remanufacturing — restoring products or components to original quality standards;
4. Recycling — recovering materials at end of life to close resource loops;
5. Cascading and repurposing — finding new uses for materials or products across different sectors;
6. Organic feedstock — using biological materials that can safely re-enter natural cycles.

The diversity of these patterns underscores that circularity can be operationalised through a wide range of strategic configurations, and that firms may selectively adopt patterns aligned with their specific resource base, market context, and organisational capabilities (Lüdeke-Freund et al., 2019). The systematic review conducted by Ferasso et al. (2020) maps the state of research on CE business models, confirming that the field has grown substantially but remains fragmented, with limited empirical attention to the micro-level mechanisms through which circular strategies generate value (Ferasso et al.,

2020) — a gap that is particularly pronounced in the context of SMEs and circular startups (Vermeulen et al., 2023; Finner et al., 2026).

The transition towards circular business models is closely linked to business model innovation (BMI), which refers to changes in the way firms create and capture value (Foss & Saebi, 2017). BMI can involve incremental adjustments or more radical transformations of existing business models, depending on the extent of change required. As highlighted by Pieroni et al. (2019a; 2019b), circular business model innovation involves not only technological changes, but also broader organisational changes and adjustments in stakeholder relationships aimed at supporting circular value creation. Furthermore, Linder and Williander (2017) emphasise that circular business model innovation can lead to new value propositions based on resource efficiency and waste reduction, thereby opening new opportunities for value creation.

Despite the growing interest in circular business models, recent literature highlights that their implementation remains challenging. Geissdoerfer et al. (2020) point out that integrating circularity into business models requires balancing multiple dimensions, including economic viability, environmental sustainability, and operational feasibility. In addition, Araujo et al. (2026) underline that the field of circular and sustainable business model innovation is still evolving and requires further empirical investigation. While circular business models provide the structural foundation for implementing circular strategies, it is essential to understand how these innovations contribute to value creation and competitive positioning.

2.3 Circular Business Model Innovation and Strategic Value Creation

The literature on business models highlights that value creation is not limited to internal firm activities but also emerges from the configuration of transactions and relationships with external stakeholders (Amit & Zott, 2001). In this sense, business models can be understood as systems of interdependent activities that enable firms to generate value through the combination of resources, capabilities, and interactions. Understanding how firms develop and renew the capabilities to implement circular business model innovation (CBMI) requires the adoption of appropriate theoretical lens.

The dynamic capabilities framework, as the primary theoretical lens, originally developed by Teece et al. (1997) and further elaborated by Teece (2007), conceptualises dynamic capabilities as the firm's ability to sense new opportunities in the environment, seize those opportunities through reconfiguration of resources and activities, and transform existing organisational structures and processes accordingly. This framework is particularly appropriate for studying CBMI for two interrelated reasons. First, business model innovation is inherently a dynamic process — it requires firms to continuously adapt their value creation logic in response to changing market conditions, stakeholder expectations, and resource availability (Foss & Saebi, 2017; Teece, 2010). Second, the integration of circular economy principles into business models demands precisely the kind of organisational reconfiguration that dynamic capabilities theory addresses: identifying new opportunities embedded in waste and by-product flows, developing new value propositions around circular inputs, and redesigning stakeholder relationships and operational processes (Teece, 2007). CBMI can therefore be understood as both an expression of a firm's existing dynamic capabilities and as a process through which new capabilities are accumulated over time, enabling the firm to sustain its value creation and competitive positioning in the long run. Eisenhardt and Martin (2000) further clarify that dynamic capabilities are not idiosyncratic but exhibit commonalities across firms, suggesting that the mechanisms through which firms develop and exercise such capabilities can be identified and studied empirically (Eisenhardt & Martin, 2000).

As highlighted by Foss and Saebi (2017), business model innovation involves changes in the content, structure, or governance of a firm’s activities, leading to new ways of creating and capturing value. CBMI can therefore be understood as a process through which firms integrate CE principles into their business models, enabling new forms of value creation. In particular, circular strategies such as resource recovery, product life extension, and recycling can contribute to value creation by reducing input costs, improving efficiency, and enabling the development of new value propositions (Bocken et al., 2016). Moreover, CBMI may influence how firms capture value by creating new revenue streams and enhancing the long-term sustainability of business activities. In this regard, Teece (2010) emphasises that value capture mechanisms are essential for ensuring that firms can appropriate the benefits generated through innovation. According to Pieroni et al. (2019a; 2019b), CBMI involves changes across three core dimensions of

the business model: the value proposition — reconfiguring the firm's offer around circular principles; the value creation and delivery processes — redesigning operations and supply chain relationships to enable circular resource flows; and the value capture mechanisms — developing revenue models that monetise resource efficiency or recovery.

Alongside the dynamic capabilities framework, the Resource Based View (RBV) provides a useful complementary lens for assessing the competitive implications of CBMI. The RBV, originally developed by Barney (1991; 2001) and subsequently developed by Barney et al. (2011; 2021), holds that sustained competitive advantage derives from a firm's internal resources and capabilities when these are heterogeneously distributed across firms and imperfectly mobile. In this view, not all resources are equally valuable: competitive advantage emerges from those that are strategically significant and difficult for competitors to obtain or replicate. To operationalise this assessment, the VRIO framework is used to evaluate whether a resource or capability is valuable, rare, difficult to imitate, and supported by the firm's organisational structure (Barney, 2001).

Dynamic capabilities and the RBV are not mutually exclusive but operate at different levels of analysis. Dynamic capabilities address how firms develop, integrate, and reconfigure resources and competences in changing environments (Teece, 2007; Eisenhardt & Martin, 2000), while the RBV focuses on the resources and capabilities a firm possesses and on how they are deployed and combined to generate competitive advantage (Barney, 1991; 2001). In the context of CBMI, this perspective is relevant insofar as the circular configuration of a firm's activities may generate capabilities that are inherently difficult for competitors to replicate (Lüdeke-Freund et al., 2019; Barney, 2001). The RBV therefore complements the dynamic capabilities perspective by providing a framework for evaluating whether the resources and capabilities accumulated through CBMI are likely to generate durable competitive advantage beyond the immediate value creation effects. The RBV has undergone significant development since its original formulation. Barney et al. (2011) identified the link between resource-based theory and entrepreneurship as one of the most promising avenues for revitalising the framework. Building on this, Barney et al. (2021) identified new opportunities for expanding the RBV research agenda, including its application to entrepreneurial contexts where resource configurations differ substantially from those of established firms.

Finally, despite the increasing attention to CBMI, the relationship between circular innovation and strategic value creation remains an evolving area of research. Araujo et al. (2026) highlight that the field of circular and sustainable business model innovation is still conceptually fragmented and requires further empirical investigation, particularly with regard to how firms operationalise these models and how they contribute to different forms of value.

2.4 Conceptual Framework

Building on the literature reviewed in the previous sections, this dissertation adopts a conceptual framework that maps the three research objectives onto the theoretical constructs developed in this chapter. The framework identifies the key variables under investigation and the theoretical lenses through which each research objective is addressed.

As discussed in Section 2.1, the CE represents a shift from linear to more resource-efficient and regenerative systems, requiring firms to rethink how resources are used and managed (Geissdoerfer et al., 2017). At the organisational level, this transition is operationalised through business models, which define how value is created and captured (Teece, 2010). Section 2.2 highlighted that circular business models enable firms to implement CE principles through strategies such as resource recovery, reuse, and product life extension (Bocken et al., 2016; Urbinati et al., 2017; Lüdeke-Freund et al., 2019). These models require firms to redesign their activities and processes in order to maintain the value of resources over time. In this context, business model innovation plays a central role. As noted by Foss and Saebi (2017), business model innovation involves changes in how firms create and capture value. When applied to CE, such innovation enables firms to integrate sustainability-oriented practices into their core activities. The central role of innovation within this framework is also supported by recent review evidence, which identifies innovation as one of the main enabling factors in the adoption and implementation of circular business models (Islam et al., 2025).

Building on these theoretical foundations, this study conceptualises circular business model innovation as a key mechanism through which firms can influence strategic value

creation. In particular, circular innovation is expected to affect value creation through several interrelated mechanisms, including:

- Improved resource efficiency through circular use of resources, including the recovery and valorisation of materials and by-products (Bocken et al., 2016; Donner et al., 2020).
- Reduction of waste and more efficient use of resources through circular resource flows (Bocken et al., 2014), with potential cost savings associated with circular business models (Linder & Williander, 2017).
- Development of new value propositions, enabled by the reconfiguration of the firm's offer around circular principles (Urbinati et al., 2017; Lüdeke-Freund et al., 2019).
- Reconfiguration of value creation processes, involving organisational, technological, and stakeholder-related changes (Pieroni et al., 2019a; 2019b).

From a strategic perspective, value creation is closely linked to competitive positioning, which in this study is treated as a potential outcome of CBMI. As suggested by the resource-based view, firms may achieve sustained competitive advantage when they possess and effectively deploy resources and capabilities that are valuable, rare, difficult to imitate, and organisationally embedded (Barney, 1991; 2001; Barney et al., 2011; Barney et al., 2021). In the context of CBMI, such capabilities may emerge either through the deliberate reconfiguration of existing activities around circular principles (Urbinati et al., 2017; Lüdeke-Freund et al., 2019), or as an inherent feature of firms that are designed with circularity from inception — such as those that utilise waste or by-products as primary productive inputs (Donner et al., 2020; Finner et al., 2026). Competitive positioning is therefore conceptualised as an outcome that may materialise through sustained engagement with CBMI, as firms accumulate distinctive capabilities over time (Teece, 2007; 2010).

Overall, the conceptual framework of this study proposes that circular business model innovation influences strategic value creation by reshaping how firms organise resources, processes, and value propositions. This relationship is explored empirically in the following chapters. The conceptual framework presented in Figure 1 maps the three research objectives of this dissertation onto the theoretical constructs developed in this

chapter, identifying the key variables under investigation and the connections between them.

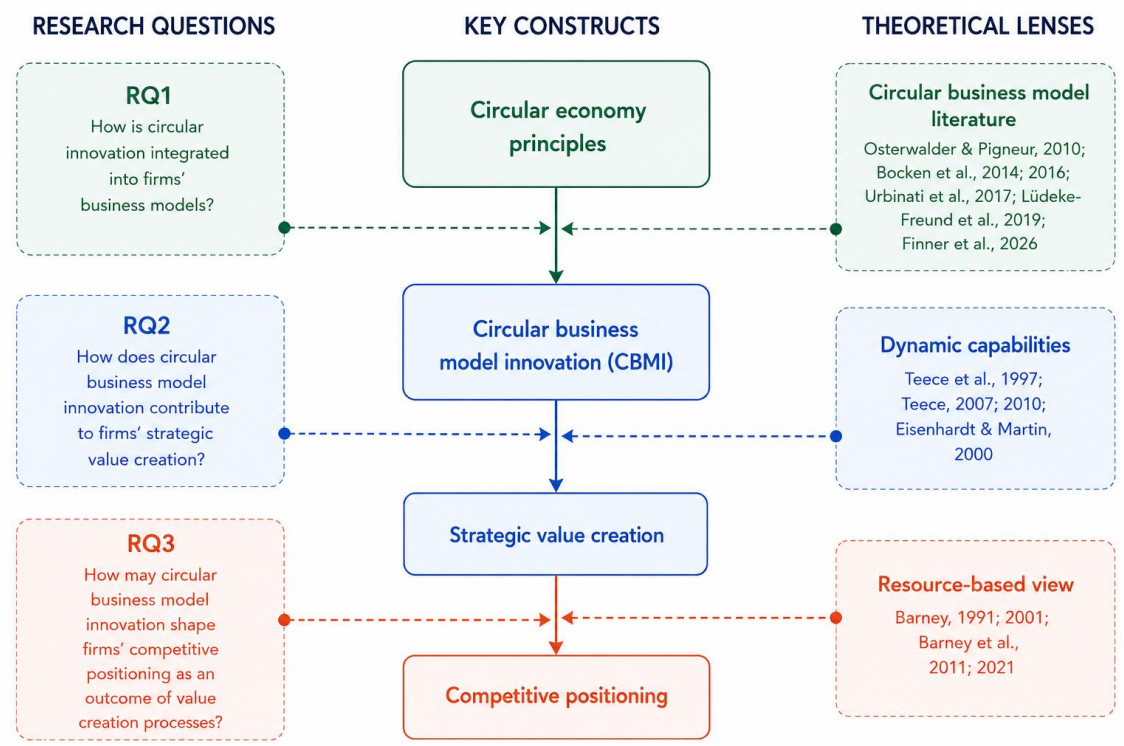


Figure 1. Conceptual Framework of the study
Note. Source: Author's elaboration

The first research objective — to analyse how circular innovation is integrated into firms' business models — is addressed through the Business Model Canvas as an analytical tool (Osterwalder & Pigneur, 2010) and circular business model typologies (Bocken et al., 2014; 2016; Urbinati et al., 2017; Lüdeke-Freund et al., 2019; Finner et al., 2026), which together provide the tools for identifying and classifying the circular dimensions of a firm's business model components. The second research objective — to examine how circular business model innovation contributes to firms' strategic value creation — is addressed through the dynamic capabilities framework (Teece et al., 1997; Teece, 2007; 2010; Eisenhardt & Martin, 2000), which explains the processes through which firms sense, seize, and reconfigure opportunities to generate new forms of value. The third research objective — to explore how circular business model innovation may shape firms' competitive positioning as an outcome of value creation processes — is addressed through the resource-based view (Barney, 1991; 2001; Barney et al., 2011;

2021), which evaluates whether the resources and capabilities accumulated and deployed through CBMI are sufficiently distinctive to sustain competitive advantage over time.

3. Methodology

This chapter describes and justifies the methodological choices adopted in this dissertation. It explains the research philosophy underpinning the study, the research design selected, the criteria guiding the choice of empirical case, the data collection procedures employed, the approach adopted for data analysis, and the measures taken to ensure the quality and trustworthiness of the research. The chapter concludes with an assessment of the quality and trustworthiness of the research.

3.1 Research Design

This dissertation investigates how circular business model innovation (CBMI) contributes to strategic value creation within firms, addressing three research objectives: (1) to analyse how circular innovation is embedded within firms' business models; (2) to examine how CBMI contributes to firms' strategic value creation; and (3) to explore how CBMI shapes firms' competitive positioning as an outcome of value creation processes. To do so, this dissertation adopts a qualitative case study research design. Case study research is defined by Yin (2018, p. 15) as "an empirical inquiry that investigates a contemporary phenomenon in depth and within its real-world context, especially when the boundaries between phenomenon and context may not be clearly evident." This approach is particularly appropriate when the research seeks to answer "how" and "why" questions about complex organisational processes that cannot be adequately addressed through survey-based or experimental designs (Yin, 2018).

The case study design was chosen for several reasons. First, the research questions of this dissertation — concerned with how CBMI is embedded in a firm's business model and how it contributes to strategic value creation — require an in-depth examination of a specific organisational context. In this study, the case is the circular business model of a born-circular startup and the context is the natural bioactive ingredients market, encompassing the agricultural supply chain from which the firm sources its primary input, the B2B cosmetic market in which it operates, and the academic and research ecosystem

through which it develops its scientific capabilities. Second, the circular economy business model literature remains a relatively young and fragmented field, and the relationship between CBMI and strategic value creation has not yet been empirically examined — a circumstance that calls for exploratory research (Ferasso et al., 2020; Islam et al., 2025). In particular, circular startups — firms that design circularity as a foundational business logic from inception — remain largely overlooked in the existing CBM literature, which tends to focus on incumbent firms (Henry et al., 2020; Finner et al., 2026).

The combination of primary and secondary data sources was motivated by the need to collect complementary and mutually enriching information. Specifically, primary data collected through interviews provided direct access to information on the company's circular business model, value creation processes, innovation trajectory, competitive strategy, and future vision. Secondary data — including the company's official website, press articles, market reports — provided contextual information about the company's background, the market environment in which it operates, and the scientific foundations of its core product. These sources were systematically reviewed and their contents compared with the primary interview data to identify points of convergence and, where relevant, areas requiring further clarification. Together, these two sources support the triangulation of evidence — a practice widely recommended in case study research to strengthen the credibility and internal consistency of the findings (Yin, 2018; Eisenhardt, 1989).

3.2 Case Selection

The selection of Kymia as the empirical case was guided by theoretical rather than statistical sampling logic, with the aim of generating insights that can contribute to theoretical understanding (Eisenhardt, 1989; Yin, 2018). Kymia was selected on the basis of three criteria. First, the case exemplifies a born-circular configuration — a firm designed with circularity as its foundational business logic rather than as an adaptation of a prior linear model — which is both theoretically significant and empirically underexplored in the CBMI literature (Henry et al., 2020; Finner et al., 2026). Second, the case operates in a B2B market where the tension between circular resource flows, technological innovation, and commercial scalability creates a rich context for examining

value creation. Third, access to the company's co-founder Anna Cacopardo — responsible for strategy, marketing, and external relations — was secured through direct contact, enabling the collection of primary data through semi-structured interviews.

Kymia Srl, an Italian innovative startup, was founded in 2017 and based in Bronte, Sicily. The company transforms pistachio agricultural by-products — specifically the hull (mallo) — into high-value natural bioactive ingredients for B2B cosmetic markets. Today, Kymia is in its seed stage — the go-to-market phase of development, having recently commenced its first commercial B2B sales (A. Cacopardo, personal communication, May 2026). Table 2 presents a chronological overview of Kymia's most relevant milestones from its founding to the present.

Table 2. Chronological Overview of Kymia's Key Milestones

Year	Milestone
2017	Kymia Srl founded in Bronte, Sicily
2021	- First extraction process developed; initial scientific testing conducted with University of Catania - Win at Start Cup Sicilia
2024-2025	Transition to patented aqueous extraction process; development and patenting of Pistactive-H®
2026	- EU cosmetic certifications obtained; first commercial B2B sales launched - Second place at Premio Cambiamenti CNA, ninth edition (1,000+ participating firms)

Note. Source: primary data (A. Cacopardo, personal communication, May 2026); secondary data (Agrigento Notizie, 2026; Italpress, 2026; CNA, 2026; Startup Italia, 2022)

3.3 Data Collection

Data collection for this dissertation relied on two complementary sources: semi-structured interviews and secondary data, such as the company's official website, press

materials, market research reports, and publicly available institutional documents. The following subsection describes specifically how primary data were collected.

Semi-structured interviews provide a predefined thematic structure through an interview guide, while simultaneously allowing the researcher to probe further, adapt the sequence of questions, and follow emerging lines of inquiry depending on the respondent's answers (Bryman, 2016; Kvale & Brinkmann, 2009). This combination of structure and flexibility makes semi-structured interviews especially appropriate for exploratory research aimed at understanding complex organisational phenomena, where the full range of relevant dimensions cannot be anticipated in advance (Bryman, 2016; Kvale & Brinkmann, 2009). Two semi-structured interviews were conducted with Anna Cacopardo, co-founder of Kymia and the representative responsible for marketing, strategy, and external relations, in May 2026. The decision to conduct both interviews with a single respondent reflects Anna Cacopardo's unique position within the firm: as co-founder with direct responsibility for the company's strategic orientation, commercial development, and external partnerships, she holds a cross-functional overview of the business model. The first interview focused on establishing an overview of the company's business model, circular strategy, and competitive positioning, while the second aimed at clarifying and expanding on specific themes that emerged from the initial session, including the firm's partnership network, its process innovation trajectory, and its strategic vision for future market expansion. Both interviews were conducted in Italian — the native language of the respondent — and each session lasted approximately 45 to 60 minutes and was recorded with the explicit consent of the participant. The recordings were subsequently used to produce detailed notes that formed the basis of the empirical analysis. Where information was indicated as commercially sensitive or confidential — such as the exact yield of the current extraction process — this preference was respected and the relevant details were not included in the dissertation beyond a general acknowledgement of their undisclosed nature.

The interview guide was structured around the three research objectives of this dissertation, ensuring correspondence between each thematic area and the conceptual model presented in Section 2.4. Table 3 presents this correspondence explicitly.

Table 3. Correspondence between Research Objectives, Theoretical Concepts, and Interview Questions

Research Questions	Theoretical Concept and References	Purpose	Block Interview Questions	Interview Questions
RQ1 — How is circular innovation embedded in firms' BMs?	Circular Economy Principles, BMC (Osterwalder & Pigneur, 2010), and CBM typologies (Bocken et al., 2014; 2016; Urbinati et al., 2017; Lewandowski, 2016; Lüdeke-Freund et al., 2019; Finner et al., 2026)	To understand the foundational logic of circularity in the firm and establish whether it qualifies as a born-circular configuration	A — Company profile and circular logic	Q1, Q2, Q3, Q4, Q5
		To map how circular principles are embedded across BM components using the BMC framework	B — Business model components and circularity	Q6, Q7, Q8, Q9, Q23, Q24, Q25
RQ2 — How does CBMI contribute to strategic value creation?	Dynamic Capabilities — (Teece et al., 1997; Teece, 2007; 2010; Eisenhardt & Martin, 2000)	To examine how CBMI contributes to value creation through sensing, seizing, and reconfiguring	C — Innovation and value creation	Q12, Q17, Q18, Q19, Q20, Q21, Q22, Q26, Q27
RQ3 — How does CBMI shape competitive positioning?	Resource-Based View — (Barney, 1991; 2001; Barney et al., 2011; 2021)	To explore how CBMI shapes competitive positioning	D — Competitive positioning	Q10, Q11, Q13, Q14, Q15, Q16, Q28
RQ1, RQ2, RQ3	(Geissdoerfer et al., 2017; Geissdoerfer et al., 2020; Finner et al., 2026)	To contextualise the case within broader CE trends, future trajectory, and to identify additional dimensions not covered by the theoretical framework	E — Circular strategy and future vision	Q29, Q30, Q31, Q32

Note. The full interview guide with all questions is provided in Appendix I.

3.4 Data Analysis

The analysis proceeded in three stages. In the first stage, the detailed notes produced from the two interview sessions were systematically reviewed and organised by thematic area, following the structure of the interview guide. Table 4 presents the coding structure adopted in this study, mapping the thematic categories used to organise the interview data onto the research objectives and theoretical concepts of the dissertation.

Table 4. Coding Structure

Thematic Category	Theoretical Concept	Interview Questions
Circular resource flows and waste valorisation	Closing/slowing loops (Bocken et al., 2014; Donner et al., 2020)	RQ1 — How is circular innovation embedded in firms' BMs?
Business model components	BMC (Osterwalder & Pigneur, 2010; Urbinati et al., 2017)	
Sensing opportunities, Seizing and reconfiguring	Dynamic Capabilities (Teece et al., 1997; Teece, 2007; 2010)	RQ2 — How does CBMI contribute to strategic value creation?
Resource uniqueness and rarity; Barriers to imitation	RBV (Barney, 1991; 2001; Barney et al., 2011; 2021)	RQ3 — How does CBMI shape competitive positioning?
Market awareness and commercial traction	CBMI drivers and barriers (Geissdoerfer et al., 2023; Islam et al., 2025)	

In the second stage, the themes identified in the primary data were compared and triangulated with the secondary data sources, with the aim of identifying convergences, inconsistencies, and areas where secondary sources could provide additional context or corroboration. In the third stage, the evidence was interpreted in light of the conceptual framework developed in Chapter 2 — specifically, the dynamic capabilities perspective (Teece et al., 1997; Teece, 2007; 2010), the resource-based view (Barney, 1991; 2001; Barney et al., 2011; Barney et al., 2021), and the circular business model literature (Urbinati et al., 2017; Lüdeke-Freund et al., 2019; Ferasso et al., 2020; Geissdoerfer et

al., 2023; Finner et al., 2026) — with the aim of generating theoretically grounded insights into how CBMI contributes to strategic value creation in the context of the case.

Throughout the analytical process, particular attention was paid to maintaining the distinction between what was directly stated by the interview respondent and what was inferred or interpreted by the researcher. Claims made by Kymia's representative that could not be independently verified — such as the comparative performance of Pistactive-H® relative to competing natural antioxidants — are presented in the findings as company declarations rather than established facts, in order to maintain analytical rigour and transparency.

3.5 Quality and Trustworthiness

Qualitative researchers have proposed alternative criteria that are more appropriate to the epistemological assumptions of interpretive inquiry (Bryman, 2016; Yin, 2018). In this study, quality was pursued along four dimensions: credibility, transferability, dependability, and confirmability.

Credibility refers to the degree to which the findings accurately represent the perspectives and experiences of the research participants (Bryman, 2016). In this study, credibility was pursued primarily by grounding all analytical claims in direct evidence from the interviews, including excerpts from the respondent's statements that support each finding presented in Chapter 4. As Bryman (2016) notes, credibility in qualitative research is strengthened when the researcher can demonstrate a close correspondence between the data collected and the interpretations made. Secondary data sources were used to contextualise the case and verify factual information about the company's background, market environment, and strategic trajectory.

Transferability refers to the degree to which the findings of the study can be applied to other contexts (Bryman, 2016). In qualitative research, transferability is not achieved through statistical generalisation but through what Yin (2018) calls analytic generalisation — the process of generalising from empirical findings to theoretical propositions rather than to populations. By grounding the analysis in well-established theoretical frameworks — dynamic capabilities, resource-based view, and circular

business model taxonomies — this study aims to generate insights that are applicable beyond the specific case of Kymia. The dynamic capabilities framework (Teece et al., 1997; Teece, 2007; 2010), the resource-based view (Barney, 1991; 2001; Barney et al., 2011; 2021), and the circular business model typologies (Urbinati et al., 2017; Lüdeke-Freund et al., 2019; Finner et al., 2026) are each explicitly connected to one of the three research objectives of the dissertation, as illustrated in the conceptual framework presented in Section 2.4, and operationalised in the findings through the coding structure presented in Section 3.4.

Dependability refers to the stability and consistency of the research process over time (Bryman, 2016). In this study, dependability was pursued by maintaining a structured interview guide that provided a common thematic framework across both sessions, while allowing the depth and focus of questioning to differ substantially between them — the first session aimed at obtaining a broad overview, the second at clarifying and deepening specific themes that emerged from the first. The data collection and analysis procedures were documented in sufficient detail to allow replication or audit.

Confirmability refers to the degree to which the findings are shaped by the data rather than by the researcher's personal biases (Bryman, 2016). In this study, confirmability was pursued by maintaining a clear distinction between empirical evidence and researcher interpretation, and by grounding all analytical claims in specific data points from the interviews or secondary sources.

4. Findings

The analytical approach adopted in this chapter seeks to move between empirical evidence and theoretical propositions, using the case of Kymia as a lens through which to examine how circular business model innovation (CBMI) operates as a mechanism for strategic value creation in the context of born-circular firms.

4.1 How Circular Innovation is Embedded Within Kymia's Business Model

This section addresses the first research objective by analysing how circular innovation is embedded within Kymia's business model. The analysis draws on the Business Model Canvas framework (Osterwalder & Pigneur, 2010) and the Urbinati et al. (2017) taxonomy. The section is structured as follows: Section 4.1.1 introduces the pistachio hull as the strategic raw material at the core of Kymia's circular model; Section 4.1.2 establishes circularity as the foundational logic of the firm; Section 4.1.3 maps and classifies the business model components using the Business Model Canvas and the Urbinati et al. (2017) taxonomy; and Section 4.1.4 analyses how circular principles are distributed across those components.

4.1.1 The Pistachio Hull: From Agricultural Waste to Strategic Resource

The pistachio hull — known in Italian as mallo — is the outer shell that encloses the woody casing of the pistachio fruit. It constitutes approximately 35 to 45 per cent of the weight of the entire harvest (Barreca et al., 2016) and is produced in considerable volumes: with global pistachio production exceeding one million tonnes annually (FAOSTAT, 2022), the hull alone represents a substantial agricultural by-product stream, with the Bronte area alone accounting for more than 1,000 tonnes during the biennial harvest (Startup Italia, 2022). Due to its rapid oxidation and degradation after harvesting, the mallo has historically been considered a difficult and costly by-product to manage and was typically incinerated — with negative environmental consequences in terms of toxic emissions — or discarded without further processing (A. Cacopardo, personal communication, May 2026; Italia Che Cambia, 2022).

The scientific foundation for Kymia's core value proposition was established by a study conducted at the Department of Chemical, Biological, Pharmaceutical and Environmental Sciences of the University of Messina. Bellocco et al. (2016) identified cyanidin-3-O-galactoside as the dominant bioactive compound present in ripe Bronte pistachio hull — constituting over 96 per cent of the total anthocyanin content — and demonstrated that this compound possesses antioxidant and cytoprotective properties. This discovery provided the scientific rationale for valorising the pistachio hull as a primary productive input. Building on this foundation, Kymia subsequently engaged the University of Catania and private research laboratories to conduct further tests confirming and expanding the understanding of the hull's bioactive potential (A. Cacopardo, personal communication, May 2026). The pistachio hull is characterised by a biennial production cycle — the harvest alternates between a year of high yield and a year of lower yield. Kymia addresses this operational challenge through an internal stockpiling system: the hull is collected, treated, and conserved immediately after each biennial harvest using proprietary protocols that prevent oxidation, ensuring a continuous and consistent supply of raw material throughout the production cycle (A. Cacopardo, personal communication, May 2026). This stockpiling capability, managed internally, represents a critical operational resource that insulates the company from the seasonal variability inherent in its circular input supply.

4.1.2 Circularity as a Foundational Logic

The first and most fundamental finding to emerge from the empirical analysis is that the company has organised its entire value creation architecture around the recovery and valorisation of pistachio hull — an approach consistent with the circular economy principle of maintaining the value of resources in use and eliminating waste from production systems (Kirchherr et al., 2017; Bocken et al., 2014). As Anna Cacopardo confirmed, noting that circularity represents a deliberate strategic choice for the company, Kymia was designed with circularity embedded from the outset (A. Cacopardo, personal communication, May 2026), underscoring the uniqueness of this circular choice as both a strategic and a market position.

This finding is theoretically significant in light of the distinction drawn by Urbinati et al. (2017) and Lüdeke-Freund et al. (2019) between firms that transition towards

circularity from linear models and firms that are born circular. Kymia belongs unambiguously to the second category — a configuration that illustrates how the identification of value in waste streams can constitute the founding logic of an enterprise rather than a subsequent strategic adaptation (Donner et al., 2020). As Finner et al. (2026) argue, circular startups serve as key agents of innovation in the CE transition precisely because their lack of legacy structures enables more experimental approaches to business model design — a characteristic that distinguishes them structurally from incumbent firms and makes their circular configurations theoretically significant.

4.1.3 Circular Business Model Components and Classification

The following analysis maps the circular dimensions of Kymia's business model using the Business Model Canvas framework (Osterwalder & Pigneur, 2010), examining how each of the nine building blocks reflects and embeds circular principles, and subsequently classifies the overall configuration using the Urbinati et al. (2017) taxonomy. Figure 2 presents the Business Model Canvas of Kymia, as reconstructed from primary and secondary data. Each of the nine building blocks is discussed in detail below.

BUSINESS MODEL CANVAS — KYMIA (2026)				
KEY PARTNERS • Pistachio farmers — (long-term agreements) • University of Catania — R&D and product testing • University of Naples — research collaboration • International universities (ongoing) • Private research labs	**KEY ACTIVITIES** • Collection, conservation & stockpiling of pistachio hull • Patented aqueous extraction of bioactive compounds • Waste reuse within the production process • R&D (externalized to universities & private labs) • Regulatory compliance (EU cosmetic certifications) • Patent development and management	**VALUE PROPOSITION** • Pistactive-H® — 130x more antioxidant than astaxanthin • 100% natural bioactive ingredient from pistachio hull • Solvent-free aqueous extraction process • Scientifically validated • Made in Italy • EU-certified for cosmetic market • Transparent supply chain (future: blockchain traceability)	**CUSTOMER RELATIONSHIPS** • Long-term B2B partnerships • Scientific and technical support • Analytical data and circularity documentation	**CUSTOMER SEGMENTS** • Cosmetic companies (B2B) Note: no B2C sales, no e-commerce, no licensing at this stage

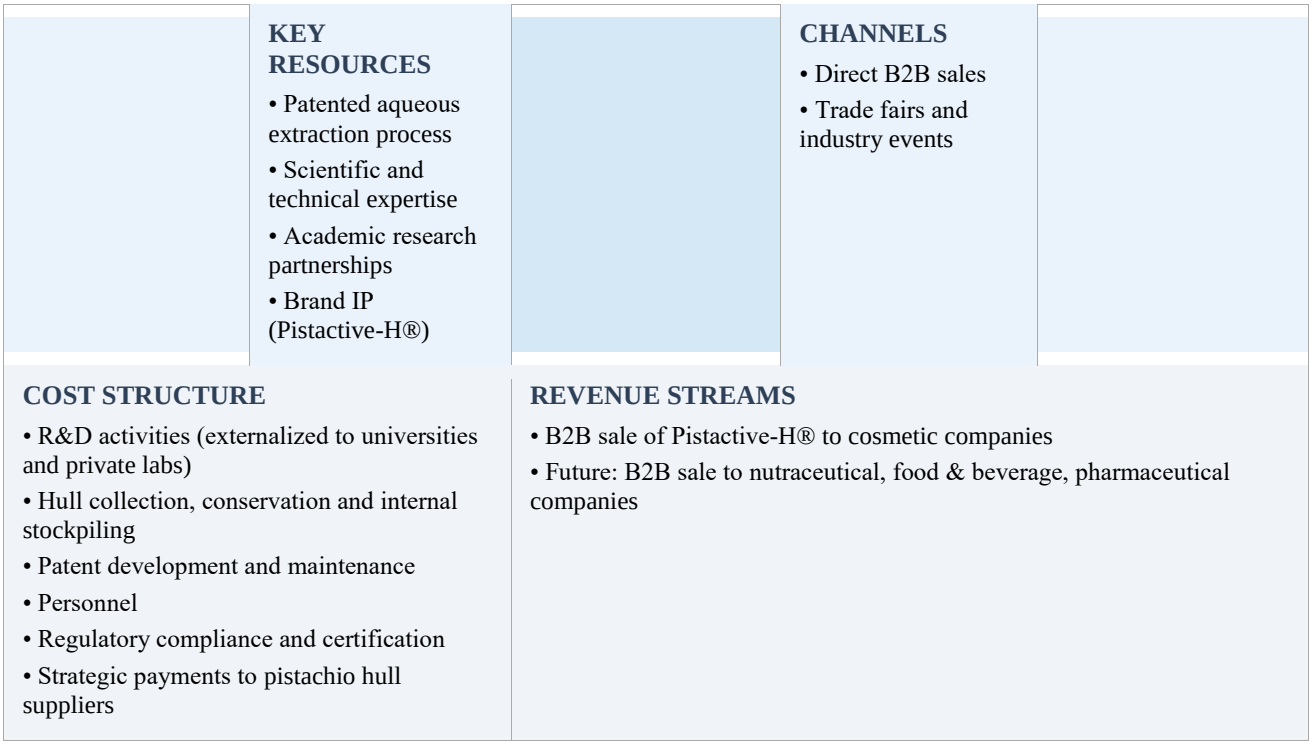


Figure 2. Business Model Canvas

Note. Source: author's elaboration based on primary and secondary data

Key Partners

Kymia's circular business model is sustained by a multi-layered network of strategic partnerships spanning the agricultural, academic, and private research domains. At the core of this network are the pistachio farmers and processors of Bronte and Raffadali, with whom Kymia maintains long-term exclusive supply agreements. These contracts guarantee the company a continuous stream of raw material that meets defined quality standards, while simultaneously providing farmers with an economic return for what would otherwise be a waste stream. Notably, Kymia deliberately chooses to financially remunerate its suppliers even though it could theoretically obtain the pistachio hull at no cost, framing this decision explicitly as a strategic investment in the valorisation of the territory and the long-term sustainability of the supply relationship (A. Cacopardo, personal communication, May 2026).

Academic partnerships constitute a second critical pillar of the network. While the foundational scientific basis for the company was established by research conducted at the University of Messina (Bellocco et al., 2016), the University of Catania is the

principal active academic partner, engaged in ongoing research and testing activities, alongside the University of Naples which has been more recently incorporated into the network (A. Cacopardo, personal communication, May 2026). Beyond domestic academic relationships, Kymia has also established research collaborations with international universities, reflecting a deliberate strategy of accessing specialised expertise across multiple scientific domains (A. Cacopardo, personal communication, May 2026). Private research laboratories complete the network, providing experimental and testing capabilities. The R&D function is deliberately externalised across this entire network, rather than being built in-house.

Key Activities

Kymia's core activities revolve around four interrelated processes. First, the collection, conservation, and internal stockpiling of pistachio hull — a critical activity that requires specific and rapid treatment of the raw material immediately after harvest to prevent oxidation, ensuring continuity of supply across the biennial production cycle. Second, the patented aqueous extraction process through which bioactive compounds are isolated and concentrated from the hull. Third, the reuse of production waste: the residual materials generated during the extraction process are reintroduced into the production cycle rather than discarded, adding a further layer of circularity to Kymia's operations (A. Cacopardo, personal communication, May 2026). Fourth, ongoing R&D activities conducted in partnership with universities and private laboratories, aimed at developing new products and processes to be patented. It should be noted that, at present, Kymia does not have access to the Chinese market due to regulatory restrictions, which represents a constraint on its international commercial expansion.

Key Resources

The most distinctive resources of Kymia are twofold: Pistactive-H®, the patented natural bioactive ingredient derived from pistachio hull, and the patented aqueous extraction process through which it is produced. This technology — which produces significantly more than 2 litres of active ingredient per kilogram of raw material, with the exact yield not disclosed — constitutes a strategic asset (A. Cacopardo, personal communication, May 2026). The company's scientific and technical expertise, embodied

in its founding team — Anna Cacopardo bringing financial and commercial competencies, and Arianna Campione contributing cosmetological expertise — and complemented by its network of external research partners, represents a second critical resource. The established long-term supply network with pistachio producers, the brand equity associated with the Pistactive-H® trademark, and the internal stockpiling capability complete the portfolio of key resources.

Value Proposition

Kymia's value proposition is currently directed exclusively at B2B clients in the cosmetic industry — the only market in which the company is commercially active — and rests on several interconnected dimensions. The company offers Pistactive-H®, a natural bioactive ingredient characterised by an antioxidant capacity declared to be 130 times superior to astaxanthin specifically, and generally superior to competing natural ingredients currently available on the market (Kymia, 2026). The ingredient is produced without chemical solvents, making it consistent with clean-label and sustainability requirements among cosmetic manufacturers. The Made in Italy provenance, the association with the prestigious Bronte DOP pistachio, and the Sicilian and Mediterranean origin strengthen the perceived quality of the offering. All necessary certifications for commercial sale in the European cosmetic market have been obtained, enabling Kymia to supply B2B clients. In the future, the company intends to expand its value proposition into the longevity segment — encompassing nutraceutical, pharmaceutical, and food and beverage applications — subject to the obtainment of the relevant regulatory approvals.

Customer Segments, Channels, and Customer Relationships

Kymia operates exclusively in B2B markets. The company has discontinued all direct-to-consumer channels, including its previous e-commerce platform and sales through Sicilian hospitality venues, in favour of a fully B2B-oriented model that is more scalable and operationally efficient (A. Cacopardo, personal communication, May 2026). The current target segment consists of cosmetic companies operating in the EU and internationally, for which Kymia holds all the necessary certifications. The future target segments — nutraceutical, food and beverage, and pharmaceutical companies — are

being developed progressively, subject to the completion of the respective regulatory pathways. Customer relationships in the B2B segment are characterised by long-term partnership orientation, supported by the provision of analytical data, purchase documentation, and contracts with farmers that certify the circular origin and traceability of the ingredient. In the future, Kymia plans to implement a blockchain-based traceability system that will allow clients to quantify and communicate the circular credentials of their own formulations in a fully transparent manner (A. Cacopardo, personal communication, May 2026). Distribution relies entirely on direct B2B sales and participation in trade fairs and industry events.

Cost Structure and Revenue Streams

The primary cost drivers of Kymia's model are externalized R&D activities, internal hull collection and stockpiling, patent development and maintenance, personnel, regulatory compliance, and the strategic financial contributions to pistachio hull suppliers. Revenue is generated exclusively through the B2B sale of Pistactive-H® to cosmetic industry clients. Future revenue streams are expected to expand progressively into nutraceutical, pharmaceutical, and food and beverage markets as the relevant regulatory approvals are secured (A. Cacopardo, personal communication, May 2026).

Urbinati et al. (2017) Classification

To complement the descriptive analysis provided by the Business Model Canvas, Kymia's circular business model can be systematically classified using the taxonomy proposed by Urbinati et al. (2017). This framework positions CBMs along two dimensions: (1) the degree of circularity embedded in the value proposition, and (2) the extent of integration across the value network. Based on these dimensions, four types of CBMs are identified: linear-oriented, partially circular (product), partially circular (network), and circular-oriented or fully circular.

Table 5. Classification of Kymia's CBM according to Urbinati et al. (2017) — author's elaboration

CBM Type	Value Proposition Circularity	Value Network Integration	Kymia
Linear-oriented	Low	Low	—

Partially circular (product)	Medium	Low	—
Partially circular (network)	Low–Medium	Medium–High	—
Circular-oriented / Fully circular	High	High	✓

As illustrated in Table 5, Kymia can be classified as a circular-oriented or fully circular business model on both dimensions. With respect to the value proposition, circularity is not an add-on or a secondary feature of the company's offer, but constitutes its very foundation: the entire business is built around the recovery and valorisation of a previously discarded agricultural by-product, and the circular origin of the ingredients is central to the company's market positioning and brand identity. With respect to value network integration, Kymia operates within a tightly integrated circular ecosystem that spans agricultural suppliers, academic research partners, private research laboratories, and B2B industrial clients — demonstrating a high degree of value network coordination consistent with a fully circular configuration.

4.1.4 Circular Principles Embedded Across Business Model Components

A closer examination of Kymia's business model components reveals that the circular principles discussed in Chapter 2 — including the recovery and reintroduction of material flows and the closing of resource loops (Bocken et al., 2014; Kirchherr et al., 2017) — are not concentrated in a single element but are distributed across multiple building blocks, in a manner consistent with Lewandowski's (2016) argument that circular business models require the integration of circular principles into all components of the business model.

At the level of key resources and activities, circularity is most visibly embedded in the choice of raw material. The pistachio hull is systematically collected from local agricultural suppliers rather than sourced as a virgin material (A. Cacopardo, personal communication, May 2026). The collection and conservation of the hull is managed internally through a proprietary stockpiling system that treats the material immediately after harvest to prevent oxidation, ensuring continuous supply across the biennial production cycle. This operational capability represents an instance of what Bocken et al.

(2016) describe as the "closing of resource loops" — the recovery of a material that would otherwise exit the economic system as waste and its reintroduction as a productive input. A further layer of circularity operates at the level of production processes. As Anna Cacopardo noted during the second interview, the residual materials generated during the aqueous extraction of bioactive compounds from the hull are not discarded but reintroduced into the production cycle (A. Cacopardo, personal communication, May 2026). This practice aligns with what Kirchherr et al. (2017) identify as a core characteristic of circular economy systems: the maintenance of material value at the highest possible level through continuous reuse.

At the level of key partnerships, circularity is embedded in the structure of supplier relationships. Kymia maintains long-term agreements with pistachio farmers and processors in Bronte and Raffadali, providing financial remuneration for what would otherwise be a waste stream. This remuneration is framed by the co-founder as a deliberate strategic investment in the valorisation of the territory and in the long-term sustainability of the supply relationship (A. Cacopardo, personal communication, May 2026). This approach reflects a broader conception of circular value creation that extends beyond the firm's operational boundaries to include the social and territorial dimensions of the supply network.

Finally, at the level of value proposition and customer relationships, circularity is embedded in the way Kymia communicates and documents the circular origin of its ingredients. The company currently provides B2B clients with analytical data, purchase orders, and supplier contracts that certify the traceability and circular provenance of Pistactive-H® and is developing a blockchain-based traceability system that will enable clients to quantify and communicate the circular credentials of their own formulations (A. Cacopardo, personal communication, May 2026). This forward-looking approach to circularity communication reflects an understanding that the value of circular practices extends beyond the firm to the entire value chain — consistent with the emphasis placed by Geissdoerfer et al. (2017) on the systemic nature of circular business model patterns. This supplier configuration also reflects the cross-industry collaboration pattern identified by Finner et al. (2026) as characteristic of circular startups that establish partnerships with upstream agricultural producers to repurpose by-product streams — a value network

integration strategy that enables the closure of agricultural resource loops while generating new commercial value.

4.2 How CBMI Contributes to Strategic Value Creation

This section addresses the second research objective by examining how CBMI contributes to strategic value creation through three interrelated mechanisms: waste valorisation, the development of an academic and research partnership network, and the construction of a multi-dimensional value proposition. The analysis draws on the dynamic capabilities framework (Teece et al., 1997; Teece, 2007; 2010) to interpret Kymia's sensing, seizing, and reconfiguring processes.

4.2.1 Value Creation Through Resource Efficiency and Waste Valorisation

The technological foundation of Kymia's circular business model has undergone a significant evolution since the company's foundation. Kymia originally employed a hyperfermentation-based extraction process — a biotechnological method involving enzymatic activity and microbial biotransformation. Following further research and development, the company seized the opportunity to improve its production technology by transitioning from this hyperfermentation-based process to a patented aqueous extraction process — a concrete change in how the bioactive compound is extracted from the hull. This process improvement increased the yield of active ingredient per kilogram of raw material well beyond the 2 litres originally achievable, substantially enhancing the commercial viability and scalability of the business model (A. Cacopardo, personal communication, May 2026). The resulting extract Pistactive-H® has been validated for its antioxidant, antibacterial, and metabolic properties through scientific testing conducted by the University of Catania and Kymia's research partners (A. Cacopardo, personal communication, May 2026). Moreover, the natural bioactive extract is characterised by an antioxidant capacity declared by the company's co-founder and published on the company website to be 130 times superior to astaxanthin (Kymia, 2026; A. Cacopardo, personal communication, May 2026).

This technological approach distinguishes Kymia from competitors relying on conventional chemical or mechanical extraction methods, including solvent-based

techniques such as maceration or percolation. Synthetic molecules still held over 53% of the cosmetic antioxidants market in 2025, insulated by proven stability and low unit costs, with conventional ingredients such as Vitamin E acetate remaining staples in high-volume formulations (Mordor Intelligence, 2026a). Among natural alternatives, Astaxanthin — a carotenoid derived primarily from microalgae, widely regarded as one of the most potent natural antioxidants currently available (Ambati et al., 2014) — represents a principal reference competitor. According to Kymia's co-founder, Pistactive-H® demonstrates superior antioxidant performance relative to Astaxanthin; however, this claim was not independently verified within the scope of this study and should be treated as a company declaration pending scientific publication (A. Cacopardo, personal communication, May 2026).

An additional and important dimension of circular innovation characterises Kymia's production process: the residual materials generated during the aqueous extraction of bioactive compounds are not discarded but reintroduced into the production cycle, creating a closed-loop system within the company's own operations (A. Cacopardo, personal communication, May 2026). This internal waste reuse represents a further layer of circularity that extends beyond the primary value proposition of hull valorisation and aligns with the principle of maintaining material value within the system at the highest possible level (Bocken et al., 2014).

The most direct mechanism through which Kymia's circular business model innovation contributes to strategic value creation is the conversion of an agricultural waste stream — the pistachio hull — into a high-value commercial ingredient. As highlighted by Bocken et al. (2014) and Geissdoerfer et al. (2020), this kind of resource efficiency strategy — the recovery and valorisation of materials that would otherwise be discarded — is one of the principal mechanisms through which circular business models generate economic value. This value creation trajectory illustrates the sensing-seizing-reconfiguring dynamic that Teece (2007) identifies as characteristic of firms with well-developed dynamic capabilities. Kymia identified and leveraged a pre-existing scientific discovery (Bellocco et al., 2016) that had not yet been commercially exploited — an instance of sensing in Teece's (2007) framework in which the opportunity was embedded in existing scientific knowledge rather than generated internally. Moreover, it seized the

opportunity to improve its production technology by transitioning from a hyperfermentation-based extraction process to a patented aqueous extraction process.

4.2.2 Value Creation Through Innovation and Research Partnership Network

Another mechanism of value creation emerges from the way Kymia has systematically built and managed a network of academic and research partnerships to develop and continuously strengthen the scientific foundation of its commercial offering — a capability that distinguishes it from competitors who lack equivalent access to specialised research expertise.

This finding resonates with the argument advanced by Pieroni et al. (2019a; 2019b) that CBMI involves not only technological changes but also broader organisational and relational transformations. In Kymia's case, the development of scientific knowledge was a capability built progressively over time. While the company was founded on the basis of a pre-existing scientific discovery (Bellocco et al., 2016) that confirmed the bioactive potential of the pistachio hull, the translation of this initial finding into a commercially viable ingredient required years of experimental work — including the optimisation of extraction yields, the identification of the most efficient extraction technology, the transition to the patented aqueous process, and the rigorous validation of performance claims.

Anna Cacopardo identified two key turning points in Kymia's value creation trajectory that are illuminating in this regard: the scientific validation of the efficacy claims associated with Pistactive-H®, which in her own words 'allowed Kymia to move from a circular narrative to a performance narrative' (A. Cacopardo, personal communication, May 2026); and the transition to the aqueous extraction process, which represents a concrete act of seizing in Teece's (2007) framework. Having identified a more efficient production technology through its research network, Kymia deliberately implemented it, unlocking a new level of productive scalability and strengthening the commercial viability of its business model (A. Cacopardo, personal communication, May 2026). Both turning points reflect the exercise of dynamic capabilities in the service of enhanced value creation (Teece, 2007; 2010).

4.2.3 Value Creation Through New Value Propositions and Market Access

A third mechanism of value creation emerges from Kymia's progressive construction of a commercially distinctive value proposition. The company's decision to target the cosmetic B2B market as its initial commercial focus was driven by two complementary factors: the cosmetological expertise of co-founder Arianna Campione, and the comparatively more accessible regulatory environment for cosmetic ingredients relative to nutraceutical or pharmaceutical applications (A. Cacopardo, personal communication, May 2026). Kymia obtained all the necessary European certifications for the cosmetic market rapidly, allowing it to sell Pistactive-H® to B2B clients across Europe and, where possible, internationally as well (A. Cacopardo, personal communication, May 2026).

The value proposition constructed around Pistactive-H® rests on four interconnected dimensions that collectively constitute a commercially distinctive offer: the superior antioxidant performance of the ingredient, its 100 per cent natural and circular origin, its Made in Italy provenance, and its full regulatory compliance for European cosmetic sales. Each of these dimensions contributes to the value proposition in a distinct way — performance, sustainability, authenticity, and regulatory accessibility — creating a multi-dimensional offer that is distinctive in its specific combination of attributes (A. Cacopardo, personal communication, May 2026). This multi-dimensional value proposition is consistent with the argument advanced by Urbinati et al. (2017) that circular business models can generate distinctive value propositions that embed circular principles across multiple commercial dimensions. It also reflects the argument advanced by Pieroni et al. (2019a; 2019b) that CBMI can give rise to new forms of value creation when circular capabilities are deeply embedded in a firm's operational processes and is consistent with Teece's (2007; 2010) broader argument that dynamic capabilities enable firms to generate new value through the reconfiguration of resources and processes.

4.3 How CBMI Shapes Competitive Positioning as an Outcome

This section addresses the third research objective by exploring how CBMI shapes Kymia's competitive positioning as an outcome of its value creation processes. The analysis draws on the resource-based view (Barney, 1991; 2001; Barney et al., 2011; 2021) and the VRIO framework to assess the distinctiveness and defensibility of Kymia's

circular resource configuration. The section opens with a brief overview of the competitive landscape and market context in which Kymia operates, followed by the empirical analysis of competitive positioning across three dimensions: resource-based uniqueness, market differentiation, and the role of market awareness.

4.3.1 Competitive Landscape and Market Context

Kymia operates in the natural bioactive ingredients market, with its current commercial activities focused on cosmetic ingredients and prospective expansion into nutraceutical and food applications. The global bioactive ingredients market reached USD 55.3 billion in 2025 and is forecast to grow at a CAGR of 5.89 per cent, reaching USD 94.0 billion by 2034, driven by rising consumer demand for natural, functional, and scientifically validated ingredients across personal care, food, and pharmaceutical applications (IMARC Group, 2026). Within this broader market, the global cosmetic bioactive ingredients segment was valued at USD 3.3 billion in 2024 and is estimated to grow at a CAGR of 7 per cent to reach USD 6.4 billion by 2034, fuelled by rising demand for multifunctional personal care products (Research and Markets, 2025). The global natural cosmetics market, valued at USD 23.19 billion in 2025, is similarly projected to grow at a CAGR of 6.43 per cent through 2034, driven by increasing consumer preference for clean-label, plant-derived, and non-toxic beauty products (Straits Research, 2026).

In Italy — Kymia's home country and operational base — the cosmetics industry represents a significant and internationally oriented manufacturing sector. In 2025, the Italian cosmetics industry generated a record turnover of €18 billion, while the broader cosmetics value chain generated €49 billion in revenues and employed approximately 500,000 people. Exports represented 48 per cent of the industry's total turnover, reaching a record value of €8.6 billion in 2025 and increasing by 4.1 per cent compared with the previous year (Kosmetica, 2026). Export performance has been particularly strong, with a 12 per cent year-on-year increase in 2024, reaching €7.9 billion, while Italy's role as Europe's contract-manufacturing hub — producing 67 per cent of makeup consumed in Europe and 55 per cent of global volumes — further strengthens its strategic position in the global supply chain (Mordor Intelligence, 2026b). In the nutraceutical ingredients segment, the global market reached USD 95.73 billion in 2025 and is expected to reach

USD 204.47 billion by 2035, growing at a CAGR of 7.88 per cent (Precedence Research, 2026).

4.3.2 Competitive Positioning Through Unique Resources and Barriers to Imitation

The empirical evidence gathered from the case of Kymia suggests that CBMI, when deeply embedded in the firm's business model, can contribute to the development of a distinctive competitive position. However, the defensibility of this position remains nascent, as the company has yet to translate its resource configuration into established market traction. The most fundamental source of competitive distinctiveness identified in the case is the raw material. When asked about what differentiates Kymia from competitors, Anna Cacopardo was unequivocal: ‘Nobody uses pistachio as a raw material. It is the only company that uses this raw material’ (A. Cacopardo, personal communication, May 2026). This configuration may constitute a barrier to imitation, as competitors seeking to develop a comparable ingredient would need to acquire the specific knowledge of pistachio hull chemistry accumulated by Kymia through years of scientific research in collaboration with the University of Catania and other partners, establish supply agreements with pistachio farmers, and obtain the relevant patents and commercial certifications.

Analysed through the resource-based view (Barney, 1991; 2001; Barney et al., 2011; 2021), and the VRIO framework as a diagnostic tool, Pistactive-H® is valuable — it is reported by the company to deliver performance advantages over competing natural antioxidants; it is difficult to imitate in the short-to-medium term — the combination of scientific knowledge accumulated through years of academic partnerships, long-term supply agreements, the patented extraction process, and the patent protection of Pistactive-H® creates a multi-layered barrier to imitation; and it is organisationally embedded — the capabilities required to produce and commercialise Pistactive-H® are distributed across the firm's network of academic partners, private laboratories, and supply relationships in ways that cannot easily be separated from the organisational context that has generated them. As Anna Cacopardo noted when asked specifically about the difficulty of replication: 'they are very difficult to replicate due to the patents, but also due to knowledge of the raw material and agreements with raw material suppliers' (A.

Cacopardo, personal communication, May 2026). This VRIO configuration suggests that the competitive position emerging from Kymia's CBMI is not merely transient but potentially sustainable over time.

4.3.3 Competitive Positioning Through Market Differentiation

Beyond the resource-based dimensions of competitive positioning, the empirical evidence points to certain market-level differentiators that have emerged as outcomes of Kymia's CBMI. The first is the performance advantage of Pistactive-H® achieved through the deliberate circular valorisation of a waste stream. In other words, although antioxidant performance is an intrinsic chemical property of the pistachio hull, the company sought to leverage this by utilizing an agricultural by-product. In this regard, the natural antioxidant cosmetic ingredient market is currently dominated by synthetic ingredients, while natural alternatives — typically derived from conventionally cultivated botanical sources such as vitamin E, polyphenols, and carotenoids — are growing but represent a smaller share (Mordor Intelligence, 2026a). Among circular alternatives, hydroxytyrosol derivatives sourced from up-cycled olive-press waste represent an emerging example of ingredients derived from agricultural by-products (Mordor Intelligence, 2026a). As Anna Cacopardo stated, Pistactive-H® is positioned within this emerging circular segment as the most powerful bioactive ingredient, whose antioxidant properties were identified and validated through Kymia's academic partnerships and whose valorisation defines the circular logic of Kymia's business model (A. Cacopardo, personal communication, May 2026). While this claim was not independently verified within the scope of this study and should be treated as a company declaration pending scientific publication, it underscores the commercial significance of Kymia's scientifically grounded performance narrative.

A second differentiator rooted in the circular logic of the business model is the supply chain configuration that Kymia has developed around the pistachio hull, having built long-term supply relationships with pistachio farmers in Bronte and Raffadali over several years. This configuration exists only because Kymia identified value in a material that conventional supply chains treat as waste and invested in building the relationships and processes necessary to valorise it at commercial scale.

4.3.4 The Role of Market Awareness as a Competitive Challenge

Despite the strength of Kymia's resource-based and market-level competitive differentiators, the empirical evidence also points to a significant competitive challenge that tempers an overly optimistic reading of the firm's positioning: the absence of market awareness. As Anna Cacopardo noted, the principal competitive challenge currently faced by Kymia is not product differentiation — 'the company's ingredient is demonstrably distinctive' — but visibility: making Pistactive-H® known to a sufficiently broad base of B2B clients in the cosmetic and future longevity markets (A. Cacopardo, personal communication, May 2026). This observation resonates directly with the 'Organised' dimension of Barney's (1991) VRIO framework, which holds that resources must not only be valuable, rare, and difficult to imitate, but also supported by the firm's organisational structures, processes, and systems in order for competitive advantage to materialise in practice. In the case of Kymia, the organisational challenge is not internal, but external: building the market awareness and commercial infrastructure necessary to translate a distinctive resource configuration into sustained revenue and competitive positioning. This temporal gap between resource accumulation and commercial traction represents a theoretically relevant finding for the study of born-circular startups, where the organisational challenge of market development may be as significant as the challenge of resource development. The competitive positioning emerging from Kymia's CBMI is therefore best characterised as nascent rather than consolidated: the foundations are in place, but the translation of distinctive capabilities into market share and revenue is a process that is only beginning. This finding resonates with the broader literature on barriers to CBMI, which identifies lack of market awareness as a significant challenge for firms adopting circular strategies (Islam et al., 2025).

This nuanced finding is consistent with the broader observation that the realisation of competitive advantage through CBMI depends on factors that extend beyond the circular configuration of the business model — including market communication, commercial relationships, and the pace of regulatory approval in adjacent markets (Geissdoerfer et al., 2020; Islam et al., 2025). It also resonates with Anna Cacopardo's observation that the circular economy more broadly remains underexploited in Kymia's operating environment, not because of technological limitations, but because its potential

is not yet sufficiently understood or communicated — a condition that simultaneously represents a challenge and a first-mover opportunity for the company (A. Cacopardo, personal communication, May 2026).

4.3.5 Kymia as a Born-Circular Startup: Theoretical Implications

The empirical evidence presented in this section supports the classification of Kymia as a born-circular startup — a category identified in the literature (Urbinati et al., 2017; Lüdeke-Freund et al., 2019; Finner et al., 2026) but rarely examined empirically. From its inception, Kymia has organised its activities around the recovery and valorisation of an agricultural by-product. This characteristic makes it a relevant case for investigating the pathway of firms that embed circular principles from inception. Moreover, the company has extended circularity beyond the primary input valorisation to include the reuse of production waste within its own process.

From a dynamic capabilities perspective (Teece et al., 1997; Teece, 2007; 2010), Kymia's development trajectory illustrates how a firm can build and accumulate circular capabilities over time through sensing opportunities in waste streams, seizing them through process innovation, and reconfiguring its operational model in response to strategic imperatives. The company sensed a latent scientific opportunity in the University of Messina's findings on pistachio hull bioactivity (Bellocco et al., 2016), subsequently confirmed and expanded through testing conducted at the University of Catania and other institutions; seized that opportunity through the development of the patented aqueous extraction process, the creation of Pistactive-H®, and the establishment of long-term supply agreements with pistachio farmers; and reconfigured its operations — most notably through the transition from hyperfermentation to aqueous extraction — in pursuit of greater scalability and productive efficiency.

5. Discussion and Conclusion

5.1 Discussion

With respect to the first research objective — to analyse how circular innovation is integrated into firms' business models — the evidence from the case of Kymia supports the theoretical distinction drawn by Urbinati et al. (2017) and Lüdeke-Freund et al. (2019) between firms that transition towards circularity and those that are born circular. Kymia exemplifies the latter configuration: circularity is not an operational add-on but the foundational logic of its value creation architecture. The finding that circular principles are embedded simultaneously across key resources, activities, partnerships, and the value proposition is consistent with Lewandowski's (2016) argument that circular business models require systemic integration rather than partial adoption. A particularly noteworthy dimension is Kymia's deliberate choice to financially remunerate its pistachio hull suppliers despite having no economic obligation to do so. This reflects a conception of circular value creation that extends beyond operational efficiency to encompass social and territorial responsibility, adding a relational dimension to the firm's circular logic.

With respect to the second research objective — to examine how circular business model innovation contributes to firms' strategic value creation — the three value creation mechanisms identified in Chapter 4 — waste valorisation, research partnership network, and multi-dimensional value proposition construction — collectively illustrate how CBMI generates strategic value through the exercise of dynamic capabilities (Teece et al., 1997; Teece, 2007; 2010). These three value creation mechanisms align with the three core dimensions of circular startup business models — value creation, value network, and value proposition — identified by Finner et al. (2026).

With respect to the third research objective — to explore how circular business model innovation may shape firms' competitive positioning as an outcome of value creation processes — the resource-based analysis conducted in Chapter 4, operationalised through the VRIO framework, suggests that Kymia's resource configuration — combining a distinctive raw material, patented product and extraction process, long-term supply agreements, and deep know-how — exhibits the characteristics associated with sustained competitive advantage (Barney, 1991; 2001). However, possessing VRIO resources is

necessary but not sufficient for actualising competitive advantage. The principal challenge currently faced by Kymia is market awareness — the company possesses a technically distinctive and legally protected ingredient, yet its commercial trajectory is still in its early stages and Pistactive-H® remains largely unknown to the broader base of potential B2B clients. This finding suggests that, for early-stage born-circular firms, the accumulation of valuable resources (patents, supplier agreements, scientific validation) does not automatically translate into competitive advantage: commercial visibility and market penetration constitute a necessary additional step. Furthermore, the finding that sustainability and circularity is not yet a primary purchasing criterion for most B2B clients — but rather a commercial trend that companies engage with instrumentally — suggests that firms, and in particular born-circular firms such as Kymia, are more likely to succeed commercially by leading with performance claims rather than with circularity messaging. As Anna Cacopardo observed, B2B clients engage with circularity 'as a trend rather than as a primary purchasing criterion' (A. Cacopardo, personal communication, May 2026).

5.2 Theoretical Contributions

This study makes three contributions to the literature. First, it contributes to the empirical literature on born-circular firms — a category, alongside SMEs, underrepresented in the existing CBM literature (Ferasso et al., 2020; Islam et al., 2025; Finner et al., 2026; Schulze Brock et al., 2025) — by providing an in-depth account of how a born-circular startup embeds circularity across all business model components from inception, develops value creation mechanisms through dynamic capabilities, and builds a nascent competitive position in a B2B ingredient market. Second, it supports the dynamic capabilities framework by identifying the development of academic and research partnerships as the primary sensing mechanism through which born-circular firms may identify and seize new value-creation opportunities. Third, the case suggests that market awareness can be an important condition for translating potential competitive advantage into actual competitive advantage in early-stage born-circular firms. This finding may be particularly relevant for firms whose value proposition is built around circular principles, though it is not exclusive to born-circular startups. Unlike firms commercialising established product categories, born-circular firms may need to

simultaneously build awareness of their product and educate the market about the circular logic that underpins it. The case of Kymia illustrates this gap clearly: the company possesses a technically distinctive, patented, and scientifically validated ingredient, yet its potential B2B clients are largely unaware of its existence. Possessing a multi-layered barrier to imitation is therefore not sufficient — the market must also recognise and value the firm's offering for competitive advantage to materialise in practice.

5.3 Managerial Implications

For managers, the evidence from this case suggests that investing early in scientific validation may be strategically important for born-circular firms. In the case of Kymia, Anna Cacopardo explicitly identified this as one of the key turning points in Kymia's commercial trajectory, noting that scientific validation 'allowed to move from a circular narrative to a performance narrative' (A. Cacopardo, personal communication, May 2026). This finding suggests that scientific validation may be better understood as a commercial investment rather than purely a research activity, although further empirical evidence across multiple cases would be needed to confirm this. Relatedly, the evidence from this case suggests that, in the B2B cosmetic ingredient market, circularity may be most commercially effective when communicated in performance terms — such as antioxidant superiority, regulatory compliance, traceability as observed in the case of Kymia — rather than in ethical or environmental terms, at least at the current stage of market development. For policymakers, the case highlights the disproportionate regulatory burden that novel natural ingredients face relative to synthetic alternatives. Simplifying and accelerating regulatory approval processes — particularly for novel food classification — could substantially accelerate the commercial scaling of born-circular firms operating in the natural ingredients sector. For investors, the case suggests that market awareness should be considered when assessing the commercial potential of early-stage born-circular firms with distinctive resource configurations.

5.4 Limitations

This study is subject to four principal limitations. First, the single-case design limits statistical generalisability; findings are extended analytically to theoretical propositions rather than to populations of firms, consistent with the logic of analytic generalisation in

case study research (Yin, 2018). Second, both interviews were conducted with a single respondent, which may introduce bias and limits triangulation of perspectives. Third, data were collected at an early commercial stage, providing a snapshot of a nascent rather than consolidated competitive position. As Finner et al. (2026) note, circular startups face challenges specific to their early-stage configuration — including limited resources, uncertain markets, and underdeveloped regulatory environments — that may constrain the pace at which their circular capabilities translate into competitive advantage. These structural conditions should be considered when interpreting the findings of this study, as they may limit the generalisability of the competitive positioning outcomes observed in Kymia to more established circular firms. Fourth, certain performance claims — including the claim of 130 times antioxidant superiority relative to astaxanthin or the general superiority of Pistactive-H® over other natural ingredients — could not be independently verified and are treated as company declarations throughout the analysis.

5.5 Directions for Future Research

Four directions emerge from this study. First, comparative case research across multiple born-circular firms in different sectors and national contexts would enable a more robust assessment of the three value creation mechanisms identified in this study — namely, the valorisation of agricultural or industrial waste streams as primary productive inputs, the development of academic and research partnerships, and the construction of multi-dimensional value propositions combining circular origin, technical superiority, and regulatory compliance. Comparative research would help establish whether these mechanisms are specific to the agri-food and natural ingredients sector or whether they generalise to other born-circular configurations, and under what conditions each mechanism contributes to strategic value creation. Second, research following early-stage born-circular firms over time would clarify whether and how nascent competitive positions are consolidated as markets evolve. Third, incorporating the perspectives of B2B clients and supply chain partners would provide a fuller picture of how circular value propositions are received and evaluated — and of the conditions under which the circular origin of ingredients influences purchasing decisions. Fourth, research examining how regulatory environments shape the strategic options of born-circular firms would contribute to the policy-relevant dimension of the literature.

5.6 Conclusion

This dissertation investigated how circular business model innovation contributes to strategic value creation within a born-circular startup, focusing on Kymia as an empirical case. The main research question — how does CBMI contribute to strategic value creation? — can be answered as follows: in the case of Kymia, CBMI contributes to strategic value creation through three interrelated mechanisms — waste valorisation, the development of an academic and research partnership network, and multi-dimensional value proposition construction — collectively enabled by the dynamic capabilities through which the firm has sensed, seized, and reconfigured opportunities in pistachio hull valorisation. These mechanisms have generated a resource configuration — a distinctive raw material, patented product and process, long-term supply agreements, and accumulated scientific know-how — that is consistent with the conditions for sustained competitive advantage, though the inimitability of patented elements is inherently limited to the patent-life period. The competitive positioning emerging from this configuration is currently nascent: the principal challenge is market awareness rather than product distinctiveness.

More broadly, the evidence from this case suggests that born-circular firms in the natural ingredients sector may be able to generate distinctive competitive positions through the systematic valorisation of agricultural waste streams, particularly when circular principles are combined with scientific validation and a multi-dimensional value proposition integrating performance, circular origin, and regulatory compliance. While the findings cannot be generalised beyond the specific context of this study, the strategic logic embodied by Kymia — valorising agricultural by-products through scientific validation and building a defensible competitive position on this foundation — may offer insights for other born-circular firms operating in analogous contexts, subject to further empirical investigation.

Appendix

Appendix I – Interview guide

This appendix presents the full semi-structured interview guide used in both interview sessions conducted with Anna Cacopardo, co-founder of Kymia, in May 2026. The guide was structured around the three research objectives of this dissertation, ensuring direct correspondence between each thematic block, the theoretical framework, and the conceptual model presented in Section 2.4. The guide was used flexibly as a thematic anchor rather than a fixed script, in keeping with the semi-structured format (Bryman, 2016; Kvale & Brinkmann, 2009). Both interviews were conducted in Italian.

Research Questions	Theoretical Concept and References	Purpose	Block Interview Questions	Interview Questions
RQ1 — How is circular innovation embedded in firms' BMs?	Circular Economy Principles, BMC (Osterwalder & Pigneur, 2010), and CBM typologies (Bocken et al., 2014; 2016; Urbinati et al., 2017; Lewandowski, 2016; Lüdeke-Freund et al., 2019)	To understand the foundational logic of circularity in the firm and map how circular principles are embedded across business model components.	**A** Company profile and circular logic	Q1. What is Kymia and how would you describe the company's business model? Q2. What is the final product that Kymia offers to its clients? Q3. What stage of development is the company currently in? Q4. What are the three main factors that have contributed to Kymia's success? Q5. Was the decision to enter the cosmetic segment driven by regulatory opportunity, strategic market evaluation, or both?
		To map how circular principles are embedded across BM components using the BMC framework	**B** Business model components and circularity	Q6. What do B2B clients primarily look for in your products? Q7. To what extent do sustainability and circularity influence B2B purchasing decisions? Q8. How do you currently communicate the circular origin of your ingredients to B2B clients? Q9. Did working with agricultural by-products require specific operational adaptations compared to conventional raw material suppliers? Q23. What are the main operational challenges associated with using agricultural by-products as raw material? Q24. How do you manage the variability in hull supply due to the biennial harvest cycle of Bronte pistachio? Q25. Are there waste materials generated by your production processes? How are they managed?

RQ2 — How does CBMI contribute to strategic value creation?	Dynamic Capabilities (Teece et al., 1997; Teece, 2007; 2010; Eisenhardt & Martin, 2000)	To examine how CBMI contributes to value creation through sensing, seizing, and reconfiguring	**C** Innovation and value creation	Q12. Were there significant turning points in Kymia's competitive trajectory that are relevant to understanding how the company has developed its capabilities over time? Q17. What competencies and resources do you consider most fundamental and difficult for competitors to replicate? Q18. How has Kymia developed its technical competencies over time? Q19. How does the transition to aqueous extraction connect to your innovation strategy and value creation? Q20. How has this change concretely influenced the scalability of your business model? Q21. Are there other important technological innovations beyond the aqueous extraction process and Pistactive-H®? Q22. How is R&D managed within the company? Q26. What are the core competencies that underpin Kymia's innovation capability? Q27. Are you considering internalising production activities in the future?
RQ3 — How does CBMI shape competitive positioning?	Resource-Based View (Barney, 1991; 2001; Barney et al., 2011; 2021)	To explore how CBMI shapes competitive positioning.	**D** Competitive positioning	Q10. How would you describe Kymia's strategic positioning relative to other natural antioxidant ingredient suppliers in the B2B cosmetic market? Q11. In what ways does Kymia differentiate itself from potential new entrants in the same market? Q13. Have regulatory frameworks or institutional incentives influenced Kymia's strategic choices? Q14. To what extent does the regulatory pathway for the longevity segment condition your expansion plans? Q15. How difficult are your circular processes and patented technologies to replicate for other market operators? Q16. What are the main competitive challenges Kymia faces today? Q28. Which kind of supply agreements with pistachio hull farmers do you have?
RQ1, RQ2, RQ3	(Geissdoerfer et al., 2017; Finner et al., 2026; Geissdoerfer et al., 2023)	To contextualise the case within broader CE trends, future trajectory, and to identify additional dimensions not covered by the theoretical framework.	**E** Circular strategy and future vision	Q29. How has the market changed in terms of attention to sustainability and the circular economy since Kymia was founded? Q30. Are there new market trends you are currently monitoring and evaluating? Q31. How do you see Kymia's development over the next three to five years in terms of business model evolution? Q32. Is there anything important for understanding Kymia's business model and strategy that we have not yet covered?

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