Adapting to Change: the Impact of Circular Economy Practices on the Business Model

Adaptación al cambio: el impacto de las prácticas de economía circular en el modelo de negocio

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Abstract

The transition to a circular economy is driving companies to introduce significant changes in their business models. This research study has two objectives. First, to detail the types of practices adopted by a company to transition from a linear to a circular business model and the critical components of the business model that are affected by them. Second, to propose a method for assessing the level of circularity achieved by a firm's business model. For this purpose, the case study of an industrial company in transition to a circular economy was analyzed in depth. In addition, Osterwalder and Pigneur's business model and existing literature on circular business practices were used as a theoretical framework for this research.

The main findings of the research indicate that circular practices can be very heterogeneous. Moreover, the critical components of a company's business model are not equally affected by the adopted circular business practices, with three components of the business model (activities, channels, and customer relationships) being the most affected by the changes. Finally, the level of circularity within the value network and the value proposition of a business model can be measured systematically, and the level achieved depends strongly on the type of practices adopted and the objectives set by a firm.

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Keywords:

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Resumen

La transición hacia una economía circular está impulsando a las empresas a introducir cambios significativos en sus modelos de negocio. Este estudio de investigación tiene dos objetivos. En primer lugar, detallar los tipos de prácticas adoptadas por una empresa para pasar de un modelo de negocio lineal a uno circular y los componentes críticos del modelo de negocio que se ven afectados por ellas. En segundo lugar, proponer un método para evaluar el nivel de circularidad alcanzado por el modelo de negocio de una empresa. Para ello, se analizó en profundidad el caso de una empresa industrial en transición hacia una economía circular. Además, se utilizaron como marco teórico para esta investigación el modelo de negocio de Osterwalder y Pigneur y la bibliografía existente sobre prácticas empresariales circulares.

Las principales conclusiones de la investigación indican que las prácticas circulares pueden ser muy heterogéneas. Además, los componentes críticos del modelo de negocio de una empresa no se ven afectados por las prácticas empresariales circulares adoptadas, siendo tres los componentes del modelo de negocio (actividades, canales y relaciones con los clientes) los más afectados por los cambios. Por último, el nivel de circularidad dentro de la red de valor y la propuesta de valor de un modelo de negocio pueden medirse de forma sistemática, y el nivel alcanzado depende en gran medida del tipo de prácticas adoptadas y de los objetivos fijados por la empresa.

Palabras clave:

modelo de negocio; red de valor; propuesta de valor; nivel de circularidad.

Introducción

Economic growth and development based on a linear economy model is no longer feasible on a planet with finite resources and an increasingly limited capacity to absorb the large amounts of waste produced by a global industry (Prieto-Sandoval et al., 2018). The circular economy, as a new paradigm and alternative for economic and business development, promotes the adoption of a cyclical, regenerative production system in which the use of resources, raw materials, energy emissions, and waste is minimized, either by slowing down the production cycle or simplifying it (Valencia et al., 2023). This can be achieved, for instance, through practices such as repairing, reusing, remanufacturing or refurbishing products, as well as through modifications and redesigns that extend their useful life (Geissdoerfer et al., 2017). The circular economy has gained significant global attention. Some scholars have approached the topic theoretically from diverse schools of thought such as Industrial Ecology (Saavedra et al., 2018), Biomimicry (Quirós,2020), Natural Capitalism (Yu et al., 2022), Environmental Governance, (Flynn, 2019) among several other perspectives. Despite this, empirical studies on the subject remain scarce.

Recently, the circular economy has begun to be examined from a business perspective, particularly due to the growing research interest in its impact on a firms' business models (Centobelli et al., 2020; Fraccasia et al., 2019; Planing, 2018). To date, scholars argue that existing literature remains insufficient to fully understand how these practices, when implemented by firms, impact their business model (Fraccascia et al., 2019; Centobelli et al., 2020). Conversely, other authors emphasize the importance of closely examining circular economy practices to identify those that truly create, transfer, and capture value for firms and their customers (Linder & Williander, 2017; Mass et al., 2017). As Centobelli et al. (2020) states, "There is

fertile ground for additional and systematic research at the intersection between circular economy and the strategic management field, which calls for scholars to deepen the role of circular economy for firms' business model design" (p. 1734).

The aim of this research is twofold. First, it seeks to detail the types of practices adopted by a firm in its transition from a linear to a circular business model and to identify the critical components of the business model most affected by these practices. Second, it aims to propose a method for measuring and monitoring the level of circularity achieved by a business model because of the circular practices adopted by the firm. To achieve these objectives, a case study will be conducted on a renowned Costa Rican industrial company that has publicly embraced circular economy practices and is currently undergoing a transition process towards a circular economy. The literature on the circular economy and the principles of business models and their critical subdimensions proposed by Osterwalder and Pigneur (2011) and Urbinati et al. (2017) are used as the main theoretical basis.

Costa Rica is considered a global benchmark in environmental management and protection. The country has made notable efforts to promote sustainable management in production, corporate carbon neutrality, protection of forests and reserves, and environmentally responsible government procurement. At the private level, many firms engage in concrete actions such as recycling, waste and water management, conservation, and protection of natural resources. Firms have initiated energy eco-efficiency and organizational decarbonization processes, with some even obtaining certifications for these efforts. While these corporate actions are commendable, they are not sufficient for a true transition to a circular economy. According to some scholars, genuine business transformation toward a circular economy implies an adaptation or radical change in their firm's business models (Planing, 2018).

Only a few firms have explicitly declared their adoption of circular economy principles. It is therefore valuable to conduct exploratory studies on the actions and strategies implemented by firms that have decisively adopted the circular economy, and to examine how this decision impacts their business models. The following key findings emerge from the present study: the practices implemented by firms to increase the circularity of their business models can be quite heterogenous. They tend to focus on influencing the value network of the business model. Lastly, the level of circularity in a business model can vary significantly in both the value proposition and the value network, depending on the specific types of initiatives each firm implements. The remainder of this article is organized as follows: first, the theoretical framework is presented; then, the methodology employed is explained; followed by the study's findings of the study and the conclusions of this research.

Theoretical Framework

Circular Economy as an Alternative for Economic Development

For decades, the global economy has followed a linear approach to materials management. Materials are produced, used, and then discarded. This linear model has had a significant environmental impact. For example, around 8 million tons of plastic are dumped into the oceans each year. Cement production releases as much carbon dioxide annually as 300 million cars. Greenhouse gas emissions have skyrocketed, and despite this, global consumption is projected to double by 2050 (UNEP, 2017). In the face of such environmental stress -coupled with global competition for increasingly scarce raw materials- many scientists and academics now consider the linear model of economic development to be unsustainable (Geng et al., 2019). Within this context, the circular economy emerges as an alternative development that could yield both ecological and economic benefits. According to the World Economic Forum (2014), the circular economy represents worldwide business opportunities worth trillions of dollars and holds immense potential

for innovation and job creation. However, it is estimated that only 8.6 % of firms worldwide have even begun to implement circular economy practices.

As a concept, the circular economy is relatively recent and still evolving. It represents a regenerative system that minimizes waste and emissions through actions such as recycling, repairing, reusing, and redesigning products. It also involves refusing to consume certain materials and innovating environmentally sustainable products (Geissdoerfer et al., 2017). The goal in a circular economy is to keep products, materials, and components in use for as long as possible. This helps reduce climate impact, creates new products and services, and makes economic efficiency and resource productivity better (Design et al, 2020; Ghosh, 2020).

According to Ellen MacArthur Foundation (2013), the circular model is grounded in three fundamental principles: eliminating waste and pollution by design, keeping products and materials in use, and regenerating natural systems. Literature refers to these key practices succinctly and simply as the 3Rs: "reduce", "reuse" and "recycle" (Geng, et al., 2019; Kirchherr et al., 2017; Liu et al., 2017; Suárez-Eiroa et al., 2019). Additional circular economy practices -hereafter referred as "CE practices"- have been incorporated to the 3Rs, such as "recover", "repair" and "remanufacture", "reject", "redesign" and "rethink" to obtain a 9R framework, which promotes a more closed production cycle and multiple product life cycles resulting in a more sustainable production (Potting et al., 2017; de Melo, 2022)

	CE practices	Concept
R0	*Refuse*	Avoid using or purchasing materials and products that are wasteful, non-recyclable, or harmful to the environment.
R1	*Rethink*	Design and adopt products that minimize waste and maximize sustainability.
R2	*Reduce*	Decrease resource and energy consumption and materials by optimizing product manufacturing, and usage.
R3	*Reuse*	Extend the lifespan of products by using them multiple times or finding new users for them.
R4	*Repair*	Fix broken or damaged products to extend their usability and delay disposal.
R5	*Refurbish*	Restore used products by upgrading or replacing components to ensure they function like new.
R6	*Rebuild*	Remanufactured products using a combination of reused, repaired, and new parts to achieve a quality standard equivalent to a new product.
R7	*Repurpose*	Look for new applications for discarded materials, giving them a second life with a different function.
R8	*Recycle*	Process waste materials into raw materials for creating new products, reducing the need for virgin resources.
R9	*Recover*	Burning waste to create energy. It is one of the last options for dealing with waste before it is sent to a landfill.

Table 1. *The 9Rs of the Circular Economy (CE)*
Note: based on data by the Netherlands Environmental Assessment Agency (2017).
Source: Author's own elaboration.

In Table 1, R0 has the highest level of circularity, while R9 has the lowest. Regardless of the number of CE practices considered, the circular economy assumes a continuous production cycle that preserves and

enhances natural capital, optimizes resource yields, and minimizes system risks by managing finite stocks and flows of renewable material flows. Nevertheless, as Planing (2018) asserts, the transition to a genuine circular economy inevitably implies an adaptation of firms' business models. The crucial role of firms will be to reinvent themselves in alignment with the circular economy principles (Crainer, 2013). Adopting CE practices requires companies to rethink their supply chains and how value is created while adhering to these principles (Lüdeke-Freund, et al., 2019). However, their transformative impact on business models has rarely been empirically explored, representing a significant research opportunity for business scholars (Centobelli et al., 2020).

Business Model Framework

The term *business model* is not new to academics and business management practitioners. In general, it serves as a description, a conceptual tool, or a type of architecture for a business idea (Massa et al., 2017; Zott, et al., 2011). One of the most recognized theoretical frameworks to understanding business models come from Osterwalder and Pigneur (2011), who describe it as "the blueprint for strategy", the basis on which a firm creates, delivers, and captures value.

According to these authors, a business model can be represented by a set of nine blocks: five of them (market segments, value proposition, channels, and customer relationships, revenues) determine the firm's cash flows and sources of income; while the other four (key partners, key activities, resources and costs) define the general cost structure. In summary, a business model comprises two major dimensions: one focused on generating revenue and the other on determining costs. Good strategies and management practices within these blocks create value, while poor practices can lead to value destruction (Osterwalder & Pigneur, 2011). Figure 1 depicts the two dimensions and nine building blocks of a business model.
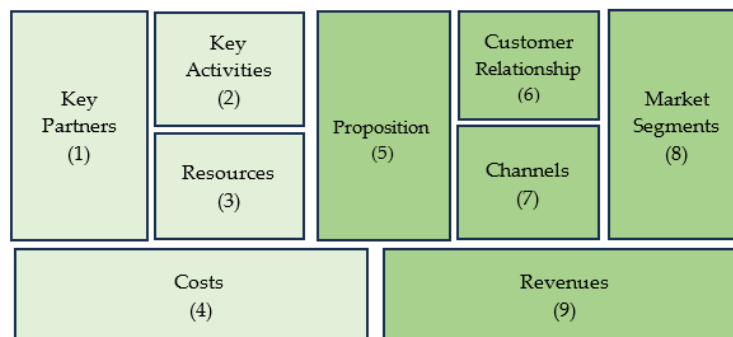

Figure 1. *Key Business Model Components: Two Dimensions and Nine Blocks*
Note: Business model key components.
Source: Osterwalder and Pigneur Pigneur (2010).

It is also worth noting that, although various predefined circular business model schemes exist for firms to "adhere to" or "copy" (Antikainen & Valkokari, 2016; Bocken & Ritala, 2021; Lüdeke-Freund et al., 2019; Saidini et al., 2019), their transferability across firms is highly challenging. This is because each firm's approach to circular economy practices is distinct and shaped by its context. Therefore, implementing a given scheme for a circular business model is rather limited due to the wide range of potential circular economy practices that firms can adopt to transition from a linear to a more circular business model. This challenge is compounded by diverse resources available to each firm during this transition.

Therefore, for most firms, adopting a fixed circular economy model is not feasible (Lewandossky, 2016). Instead, a more generic business model (as defined by Osterwalder and Pigneur) is preferable, as it is universally applicable across firms and provides a flexible framework to analyze which critical components of the business model are most affected by the adoption of circular economy practices.

Level of Circularity of a Business Model

Scholars have proposed ways to determing the level of circularity of CE practices (Calzolari et al., 2022; Moraga et al., 2019; Roos, et al., 2020; Saidini et al., 2019). One particularly relevant line of research is that of Urbinati et al. (2017), who were the first to integrate the concept of circularity levels with the concept of the business model. These authors propose a methodology for evaluating a firm's CE practices and offer a general taxonomy for assessing the level of circularity within a business model. Specifically, Urbinati et al.'s methodology aims to identify the potential impacts of CE practices on the value proposition and value network dimensions of a firm's business model. In this regard, CE practices that create, transfer, or capture value for the firm or its customers, and that affect key business model blocks, must be considered.

Importantly, the methodology outlined by Urbinati et al. (2017) aligns with the two business model dimensions outlined by Osterwalder & Pigneur (2011). The taxonomy enables the classification of CE practices into four levels of circularity: low, medium-low, medium-high, and high. For example, practices such as reducing, reusing, or recycling materials can lead to significant changes in a firm's key suppliers and the types of resources and materials used, thereby transforming the value network. Similarly, the introduction of new eco-design practices may influence both value dimensions and enhance the overall value of a business model.

On the other hand, practices that increase circularity in a firm's business operations, such as virtualizing activities and service channels, implementing marketing strategies like B2C (business-to-customer), or introducing new "green leasing" services tailored to specific market segments, can impact customer relationships and channels, and ultimately affect the value proposition of the business model (Urbinati et al., 2017).

Level of Circularity	Guidelines for Categorizing the CE Practices in the Value Network
Low	Focus on energy efficiency: reduction of emissions and environmental footprint
Medium-low	Focus on materials: recyclable, repurpose, durable, easy to separate, reuse, reduce.
Medium-high	Focus on rethinking product design (i.e., design for reducing, design for remanufacturing, designed for extending the lifespan, designed for the environment among others).
High	Emphasis on materials and product design that are fully respectful of the environment and the excellency.
Level of circularity	**Guidelines for categorizing the CE practices in the value proposition:**
Low	Focus on the product's single sale and price
Medium-low	Focus on the product's single sale and price plus payment for additional services (i.e., return programs of material, reduction programs or equivalent).
Medium-high	Emphasis on rental or leasing strategies for products
High	Emphasis on "pay-per-use", "pay-per-function" of the product or equivalent commercial strategies.
Low	Focus on communication regarding CE practices any aspect of the product, or manufacturing process reported on the website.
Medium-low	Focus on communication regarding CE practices in-store through advertising and sales personnel.
Medium-high	Focus on direct customer involvement in circularity initiatives.
High	Focus on communication of circularity through all firm's channels.

Table 2. *Guidelines for Evaluating Practices at the Circularity Level*
Note: Based on the taxonomy proposed by Urbinati et al. (2017).
Source: Source: Author's own elaboration.

Methodology

Case Study Technique

To meet the two objectives of the study, a case study of a firm transitioning to a circular economy was analyzed. Case studies have been demonstrated to be an advantageous research method when investigating emergent phenomena in exploratory research (Gerring, 2004), or in contexts, where conclusive theories are not yet available (Gammelgaard, 2017). However, case studies are sometimes criticized for a perceived lack of objectivity and reliability of its results and the lack of a reference protocol that guarantees the rigor and objectivity of its analysis (Baskarada, 2014, Patton & Appelbaum, 2003).

To address these concerns, we adopted the case study protocol proposed by Yin (2009), which outlines four criteria designed to ensure the systematic development of case studies that are relevant, accurate, and objective. The four criteria are as follows: a) clearly define the unit of study and justify the appropriate number of cases to be conducted (single case or multiple cases); b) determine the relevance and feasibility of the study; c) strengthen the case study evidence by collecting multiple sources of information; and d) define a priori an adequate process to analyze the evidence.

a) The unit of study:

As some scholars have noted, there is a growing need to focus on "the relevance of business models' issues for a circular economy transition" (Centobelli et al., 2020 p.1735). The objective of analyzing the results with great scrutiny justifies limiting the study to one case (Meyer, 2001). The rationale for selecting a single case study is twofold: First, it allows for an in-depth examination of the unit of analysis, which enhances our understanding of the relatively novel phenomenon of firms transitioning to a circular economy. Second, the number of firms that have explicitly adopted circular economy principles remains limited, and the academic research in this area is still in an early stage. Previous studies on circular economy and business model have similarly used single case study designs (Bressanelli et al., 2018; Campos et al., 2020, Krummeck et al., 2022; Piispanen et al., 2020). For this study, the unity of analysis was defined as a firm that has openly embraced the circular economy principles and is transitioning to a more circular business.

b) Relevance and feasibility of the study:

According to Prieto-Sandoval et al., (2018), the current global context is particularly conducive to the adoption of the circular economy. Approximately 90 % of commodity prices and the increasingly global competition for access to raw materials have created a pressing need to safeguard resource supplies, which are becoming increasingly scarce (Prieto-Sandoval, et al., 2018). On the positive side, circular business models are estimated to generate business opportunities worth billions of dollars and create new employment (Velenturf & Purnell, 2021). Thus, investigating how the circular economy impacts business models is a current topic of relevance.

A firm that fits the defined unit of analysis was identified and selected for the study. This firm will be referred to as *A Grener World*, or simply (hereafter, the firm). The primary reporting units were the firm's environmental department -responsible for CE practices- and a key manager. The manager served as a crucial informant since key managers often play a pivotal role in decision-making processes that shape business models (Sandoval & Rank, 2022). The firm agreed to participate in the study and committed to providing sufficient data to ensure the feasibility of the proposed research.

c) Strengthening the evidence:

The study was conducted using interview sessions. A general set of guiding questions was developed, and interviews were conducted in four rounds. The firm facilitated interviews with individuals directly responsible for both its business operation and CE practices. In this regard, the key manager and the staff responsible for the environmental management of the firm were interviewed. Firm's websites and social media channels were then thoroughly reviewed. The public management reports were also reviewed. Finally, site visits were also conducted at retail locations where the firm's products are displayed. The diversity of sources allowed for triangulation of information, identify any gaps in the interviews and increase the robustness and reliability of the data obtained.

d) Define an appropriate process for analyzing evidence:

Yin (2009) recommends employing a documented and relevant framework to reduce subjectivity in the analysis. To this end, the model of Osterwalder and Pigneur (2011) was selected, in combination with the taxonomy developed by Urbinati et al. (2017) for the classification of CE practices as low, medium-low, medium-high, or high level of circularity. Integrating these two frameworks ensures a systematic approach to data analysis and reduced potential biases. Figure 2 shows the step-by-step methodology that has been developed for this study.
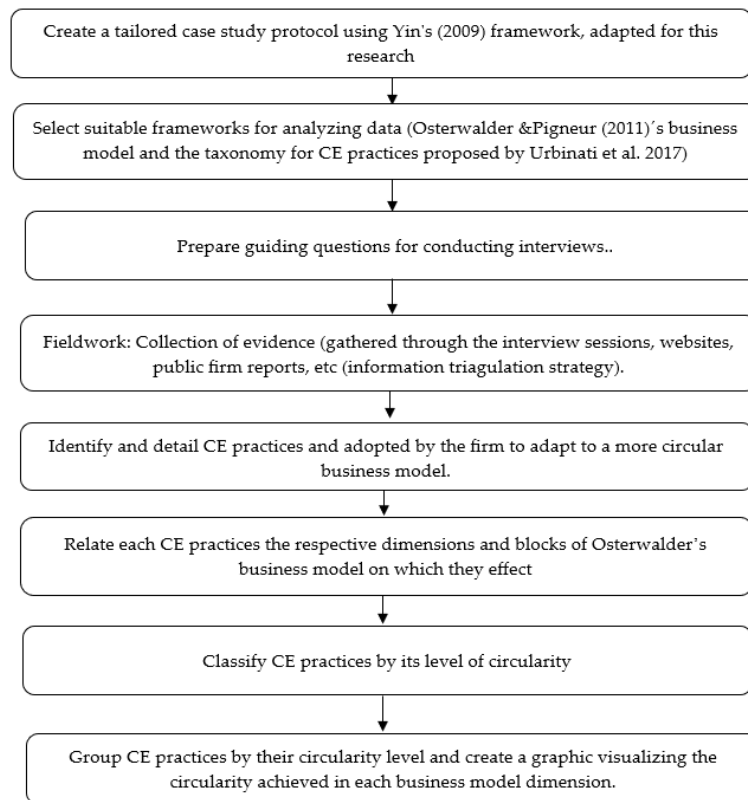
Figure 2. *Stepwise Description of the Methodology Protocol Performed*
Source: Source: Author's own elaboration.

Figure 2 outlines the study's step-by-step methodology used in this study to analyze the evidence collected. In summary, interviewees described the practices implemented by the firm in its transition toward a circular business model. These practices were then mapped onto the business model blocks defined by Osterwalder and Pigneur's (2011). The firm's website and sustainability reports were reviewed to identify any additional CE practices that may have been overseen in the interviews and then assigned to the blocks they impacted. These additional practices were classified using Urbinati et al.'s (2017) taxonomy to assess their level of circularity. Finally, the CE practices that shared the same business model dimension and level of circularity were categorized together.

Results and Discussion

To achieve the primary objective of this study, it was essential to map all the circular economy practices implemented by the company, along with the supporting measures undertaken to enable their adoption. Table 3 outlines each CE practice and supporting measure that has influenced the firm's business model. It also identifies the specific business model block(s) impacted by each initiative.

#	Type	Description	Block Affected
1	SME	Investing in infrastructure as an "environmentally friendly production plant" from the start.	*Resources*
2	SME	Installing solar panels to lower energy consumption.	*Resources*
3	SME	Investing in equipment to grind containers into plastic pellets.	*Resources*
4	CEP	Creating an energy efficiency program to reduce its consumption.	*Actitivities*
5	CEP	Updating product messaging to circularity features for consumers.	*Customer Relat.*
6	CEP	Introducing behavior practices to lower direct GHG emissions at the main plant.	*Activities*
7	CEP	Producing packaging in-house using 100% recycled resins.	*Actitivities*
8	SME	Partnering with environmental auditors to validate production practices.	*Partners*
9	SME	Adding new suppliers based on environmental criteria for their inputs.	*Partners*
10	SME	Expanding the network of eco-friendly distributor partners.	*Partners*
11	SME	Invest in a system to collect post-consumer packaging.	*Resources*
12	CEP	Training employees on CE practices and improved process oversight.	*Activities*
13	CEP	Developing concentrated formulas to reduce water and plastic containers used.	*Activities*
14	CEP	Publishing information and circular economy targets on the firm website.	*Channels*
15	SME	Join-venturing with other manufacturers of recycled resins.	*Partners*
16	CEP	Rethinking and developing new biodegradable product formulations.	*Activities*
17	CEP	Establishing a program to recover used packaging in -house.	*Activities*
18	CEP	Providing tailored advice and communication to industrial clients on green products.	*Customer Relat.*
19	SME	Partnering with NGOs organizations collect and recover plastic containers.	*Partners*
20	CEP	Converting plastic waste into pellets for reuse in new packaging.	*Activities*
21	SME	Collaborating with other firms focused on environmental and recycling education.	*Partners*
22	CEP	Reducing the use of virgin plastic and replacing it with recycled resins.	*Activities*
23	CEP	Promoting environmental awareness at packaging delivery points among customers.	*Customer Relat.*
24	SME	Creating alliances with authorized recicling collection centers for materials.	*Partners*
25	SME	Establishing a dedicated sustainability department within the firm.	*Resources*
26	SME	Partnering with environmental and state associations.	*Partnered*
27	SME	Hiring an environmental manager to oversee sustainability programs.	*Resources*
28	CEP	Manufacturing new containers from recycled materials (recover).	*Activities*
29	CEP	Innovating with "solid formulas" for dilution to reduce resource packing and water consumption.	*Activities*
30	SME	Introducing discount prices for products for industrial clients.	*Revenues*
31	SME	Gradual change from the current fleet of combustion vehicles to electric vehicles	*Resources*
32	CEP	Offering discounts to customers for returning used containers.	*Activities*
33	CEP	Auditing approximately 70 suppliers for environmental commitment.	*Activities*
34	SME	Using blockchain technology to track the origin, use, and recycling of materials, ensuring transparency and accountability	*Resources*
35	CEP	Switching to recoverable cardboard and separators in packaging.	*Activities*
36	CEP	Share official sustainability reports with customers via virtual platforms.	*Customer Relat.*
37	SME	Implementing metrics to control the reduction of industrial waste.	*Resources*
38	CEP	Offering discounts on products in exchange for returning post-use packaging.	*Costs*
39	CEP	Updating packaging and labels with eco-friendly messaging.	*Customer Relat.*
40	CEP	Using social media to encourage consumers to return post-consumer packaging.	*Customer Relat.*
41	CEP	Conducting talks, plant visits, and merchandising for consumers and the public.	*Customer Relat.*
42	CEP	Providing personalized technical advice to key clients on sustainable and CE practices.	*Customer Relat.*
43	CEP	Implementing plans to reduce water consumption in production processes.	*Activities*
44	CEP	Reducing GHG emissions on the administrative buildings by setting up an efficiency program.	*Actitivities*
45	CEP	Reduce plant solid waste by implementing a manufacturing program.	*Activities*
46	CEP	Promote environmental awareness and product usage at retail outlets.	*Customer Relat.*
47	CEP	Setting up a reverse logistics system to recover post-consumer packaging.	*Channels*

Tabla 3. *Circular Economy Practices (CEP) and Supporting Measures (SME) Implemented by the Firm in Transition from a Linear to a more Circular Business Model Note:* Business Model Blocks affected by CEP and SME. *Source:* Author´s own elaboration.

Table 3 shows that this firm underwent significant changes and implemented different CE practices in their "value network" dimension of the business model, specifically in the "Key Activities" block of their business model. CE practices implemented that impacted this business model block include, for example, actions to reduce greenhouse gases (GHG), switching from virgin plastic to recycled resins, changes to more concentrated product presentations to reduce water and packaging use, designing new formulations, and waste reduction programs. To support the implementation of CE practices, the firm had to invest in new infrastructure and equipment, as well as modify some of their partnerships, that means that the firm had to make changes affecting the key partners and key resource blocks, both of which are part of the value network dimension of this firm's business model. Regarding the "value proposition" dimension, the greatest impact was observed on the "customer relationship" block. Virtual platforms are leveraged to engage with customers and disseminate sustainability reports and messages. We promote our sustainable products and services with the aim of encouraging customer loyalty. Labels and packaging are reintroduced with "sustainable messages", while social media is leveraged to promote post-consumer packaging collection.

Level of circularity of a firm's business model

To accomplish the second objective of this study, it is proposed that each of the circular economy practices mentioned above (e.i., CEP) be classified as "low," "medium-low," "medium-high," or "high" level of circularity, according to the circularity taxonomy of Urbinati et al. (2017). Table 4 summarizes the results.

Item Number	Description	Level of Circularity
Practices affecting the business model's value network:		
04	Creating an energy efficiency program to reduce its consumption.	Low
06	Introducing behavior practices to lower direct GHG emissions at the main plant.	Low
07	Producing packaging in-house using 100% recycled resins.	Medium-low
12	Training employees in CE practices and improved process oversight.	Low
13	Developing concentrated formulas to reduce water and plastic containers used.	High
16	Rethinking and developing new biodegradable product formulations.	High
17	Establishing a program to recover used packaging in -house.	Medium-low
20	Converting plastic waste into pellets for reuse in new packaging.	Medium-high
22	Reducing the use of virgin plastic and replacing it with recycled resins.	Medium-low
28	Manufacturing new containers from recycled materials (recover).	Medium-high
29	Innovating with "solid formulas" for dilution to reduce resource packing and water.	High
32	Offering discounts to customers for returning used containers.	Low
33	Auditing approximately 70 suppliers for environmental commitment.	High
35	Switching to recoverable cardboard and separators in packaging.	Low
43	Implementing plans to reduce water consumption in production processes.	Low
44	Reducing GHG emissions on the administrative buildings (efficiency program).	Low
45	Reduce plant solid waste by implementing a manufacturing program.	Low
Practices affecting the business model's value proposition:		
05	Updating product messaging to emphasize circular economy features to consumers.	Medium-low
14	Publishing information and circular economy targets on the firm website.	Low
18	Providing tailored advice and communication to industrial clients.	Medium-low
23	Promoting environmental awareness at packaging delivery points among customers	Medium-low
30	Introducing discount prices for products for industrial clients.	Medium-high
36	Share official sustainability reports with customers via virtual platforms.	Medium-low
39	Updating packaging and labels with eco-friendly messaging.	Medium-low
40	Using social media to encourage consumers to return post-consumer packaging.	Medium-high
41	Conducting talks, plant visits, and merchandising for consumers and the public.	Medium-low
42	Providing personalized technical advice to key clients on sustainable/ CE practices.	Medium-low
46	Promote environmental awareness and product usage at retail outlets.	Medium-low
47	Setting up a reverse logistics system to recover post-consumer packaging.	Medium-high

Tabla 4. *Classification of Circular Economy Practices by its Level of Circularity Source:* Author´s own elaboration.

Finally, all circular economy practices within the same business model dimension and level of circularity were grouped to create a visual representation of circularity across the company's business model dimensions. Figure 3 summarizes these results. Firm A Greener World demonstrates not only a greater

variety of practices but also a broader range of circularity levels, ranging from low to high circularity. However, the data indicates that the value proposition dimension of the business model is primarily characterized by the implementation of practices with medium to low levels of circularity. In contrast, the value network dimension includes a greater proportion of low-circularity practices.
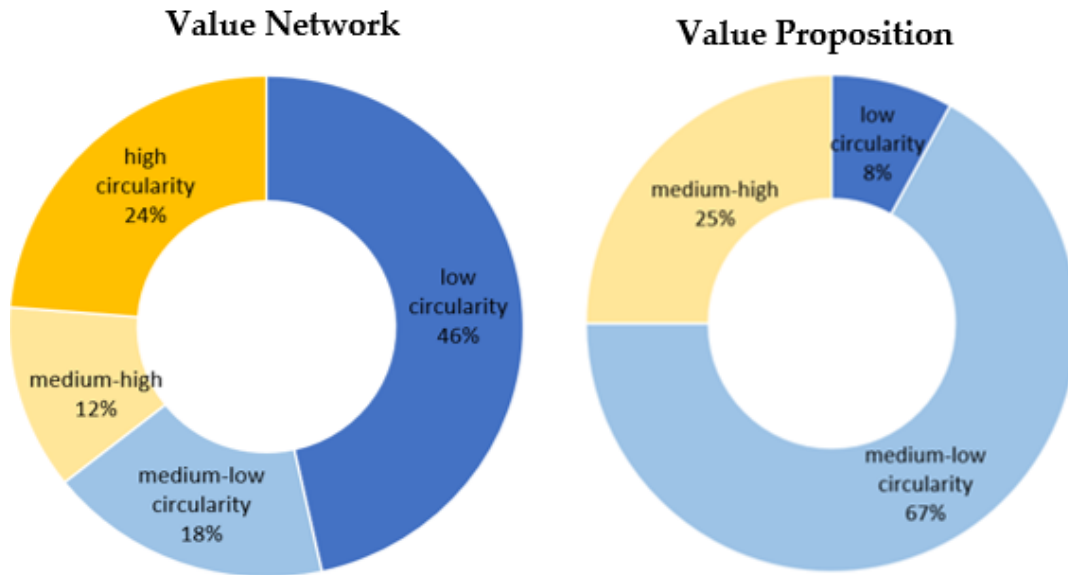

Figure 3. *Levels of Circularity in the Dimensions of the Business Model*
Source: Autor's own elaboration.

Discussion

This study aimed to explore the practices that firms adopt when implementing circular economy principles. Specifically, to detail the types of CE practices adopted by a firm to transition from a linear to a circular business model and which critical components of the business model are most affected. In addition, the study examined the level of One industrial firm undergoing a transition to a circular. The case study protocol proposed by Yin (2009) and the taxonomy for assessing circular economy practices proposed by Urbinati et al. (2019) were used to structure and objectify the evidence collected for this research. The following main insights can be drawn from the research:

Firstly, a firm's practices adopted in favor of the circular economy can be very diverse. In this case, many of the practices were primarily aimed at improving efficiency and reducing the consumption of resources, such as water and electricity, as well as mitigating emissions. A smaller number of practices focused on recovery, reuse, reduction, or transformation of materials to reintegrate them into the production cycle, while other practices are aimed at reducing the use of resources, water and electricity. These results are consistent with previous research conducted in Asia, which confirms that despite facing similar pressures to improve circularity in their operations, firms' organizational practices and responses to the circular economy are quite heterogeneous (Jakhar et al., 2019).

Second, the various components of a business model are not affected equally across firms, nor are all components or blocks impacted to the same extent within a given firm. The "Key Activities" and "Customer Relationships" blocks appear to be the most directly affected by circular economy practices. However, these CE practices are often linked to additional "supporting actions" undertaken by firms that ultimately impact other business model blocks. For example, implementing a used packaging recovery program required the recruitment of new partners and the investment in infrastructure or equipment to support the collection and recovery of used materials, thus affecting the "key partners" and "resources" blocks of within firm's value network. This evidence aligns with findings by Barros et al., (2021), who argue that firm's circular economy initiatives can have multidirectional effects, potentially triggering a chain of changes across other business areas.

Thirdly, the level of circularity achieved by a business model, in both its value network and the value proposition, can be measured and monitored. Based on the findings of this case study, the company implements CE practices that result in a medium-low level of circularity of its value proposition (67 % of the CE practices adopted). Regarding the value network, there is a broader distribution of low, medium and high levels of circularity, with practices of low circularity being only slightly more prevalent (46 % of the total of CE practices adopted).

In addition, it is also noteworthy that CE practices affecting the value network (representing 24 % of all practices) are largely driven by management decisions to innovate new biological formulas and redesign products. Specific plans have been launched to transform water-diluted formulas into more concentrated versions that require less water and reduced packaging volume, and even the development of "solid formulas" for the export markets. These initiatives suggest that a continued increase in such circular economy practices would gradually increase the level of cash flow achieved by the value network dimension of the business model, if the company were to continue with these types of practices.

Conclusion

As a general conclusion, the level of circularity across the two dimensions of the business model can measured and monitored. This study demonstrates that the degree of circularity within the value network and value proposition of a business can differ and is influenced by the specific circular economy practices adopted, which in turn depend on the strategic business and environmental objectives set by the organization.

Finally, it is important to acknowledge that this study is not without limitations. In this vein, it is not possible to exclude the possibility that the findings may represent distinctive patterns within the cases that have been examined, and within the country in question. Therefore, further research is recommended, particularly studies that examine additional business models across different countries and sectors (e.g., hospitality and transportation services), where the implementation of circular economy principles may result in the development of innovative, profitable, and climate-resilient business models.

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