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Organizational capabilities and institutional pressures in the adoption of circular economy

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A B S T R A C T

Are companies adopting circular economy strategies or are they just adopting specific circular practices? To what extent are external pressures and organizational capabilities effective in driving these changes? To answer these questions, we propose and test a model that allows for analyzing the differentiated effects of institutional pressures (mimetic, coercive, and social) and organizational agility on the adoption of a circular business model at a strategic level and on the implementation of specific circular practices (in product innovation, production, and recycling). The results obtained on a sample of 218 manufacturing firms show that institutional pressures and organizational agility drive changes at a strategic level in companies, and these changes are ultimately reflected in specific circular practices. Organizational capabilities have a stronger influence on changes in circular product innovation and production, whereas external pressures have a higher impact on changes in recycling processes.

1. Introduction

In December 2015, the European Union Commission adopted the Circular Economy (CE) Action Plan (COM 614, 2015), a strategic program based on 54 key measures for the development of a carbon-free, resource-efficient, and competitive economic system. Since then, the CE represents the central paradigm advocated by the EU to achieve a more habitable planet and meet the Sustainable Development Goals (SDGs) (United Nations, 2015). The CE constitutes the antithesis of the traditional linear production and consumption model in which (1) resources are obtained from the natural environment, (2) goods are produced and consumed, and (3) waste is discarded. CE, on the contrary, is achieved using cyclical flows of materials, renewable energy, and cascade-type energy flows (Kirchherr et al., 2017) to ensure the sustainability of resources and ecological diversity. Accordingly, CE conceptually represents a holistic, restorative, and regenerative model that provides significant social, environmental, and economic benefits for companies and for society (WBCSD, 2017).

From an economic perspective, CE offers firms new opportunities for cost reduction (e.g., energy and raw material costs), synergies, and innovation of business models, products, and production processes (Khan et al., 2021; Tura et al., 2019). From a social perspective, CE contributes to new employment opportunities, social inclusion, distributive justice, the development of the sharing/collaborative economy, and healthier and safer societies (Galatti and Baruque-Ramos, 2022; Padilla-Rivera et al., 2020). From an environmental perspective, CE reduces the consumption of fossil raw materials, CO_2 emissions and waste generation and thus contains the environmental degradation, destruction of ecosystems, and climate change that threaten human survival (Takalo and Tooranloo, 2021).

Global awareness about CE is also driven by the business environment, which is characterized by intense stakeholder activism on sustainability issues (Tura et al., 2019) that urges public and private institutions to adopt CE (Prieto-Sandoval et al., 2019). In other words, as CE is increasingly acknowledged as an essential competitive tool for the development of the global economy (Korhonen et al., 2018) and for improving industrial sustainability competitiveness (Khizar et al., 2022), governments and public institutions increasingly promote and finance CE activities to help companies transition from linear production systems toward circularity. Furthermore, some administrations establish barriers to entry when bidding in the public sector such that only those that engage in circular practices can access the corresponding tenders (Tura et al., 2019).

As a result, an increasing number of companies are adopting a circular approach to capture the benefits of CE and respond to external pressures. However, developing managerial practices that lead to reuse, repair, redistribution, renewal, remanufacturing, and closing loops in productive ecosystems and minimize both energy consumption and waste requires transforming organizations' business model and operations (Malik et al., 2022).

Specifically, it has been claimed that to adopt CE, the firm must transform the way it creates, delivers, and captures value (Frishammar

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and Parida, 2019). This involves transforming the business strategic approach to incorporate the principles of CE, along with new ways of configuring and executing the firm's operations to implement the organizational commitment toward circularity (Gusmerotti et al., 2019). Thus, *"the implementation of circular economy principles often requires new visions and strategies"* (Ferasso et al., 2020, p. 3007) and *"a set of strategic decisions designed to preserve the embedded environmental and economic value of a product or service into the system"* (Centobelli et al., 2021, p. 1,740). From an operational perspective, in addition to meeting increasingly stringent regulatory constraints, CE entails significant challenges in terms of stakeholder management, resource management, product innovation, production management, and organizational structure (Gusmerotti et al., 2019; Heredia et al., 2022; Khan et al., 2022; Stewart and Niero, 2018; Tura et al., 2019).

Nevertheless, there is another trend in the literature that focuses on resistance to change in organizations and organizational inertia (Colombo and DelMastro, 2004; Hannan and Freeman, 1984). From this perspective, it is questionable whether companies truly respond to external pressures and internal dynamics through changes at the strategic level or through ad hoc changes at the operational level (Colombo and DelMastro, 2004; Hannan and Freeman, 1984). A strategic change often entails high costs not only in economic terms but also in organizational and psychological terms (Yamoah et al., 2022). Although the effects may be perceived as beneficial in the long term, there may be organizational inertia and resistance that lead to less ambitious solutions that focus on specific aspects of production or product.

Therefore, the question arises whether one of these two approaches provides a more adequate overview of the business reality. The aim of this paper is to analyze the impact of internal and external pressures on companies to adopt a circular business model and/or specific circular practices. The current literature reveals several gaps in this area of research. First, the drivers of CE adoption, either in terms of a shift in the firm's strategic orientation towards a circular business model or the adoption of CE operational actions or circular business tactics that allow value creation from a circular perspective, have not been explored in depth (Centobelli et al., 2020; Reim et al., 2021). Second, to the extent of our knowledge, the literature has not incorporated in the same analysis the study of the adoption of a circular business model and the implementation of operational circular practices; thus, it has not been possible to thoroughly analyze the hypothetical mediating role that the business model serves in the development of circular practices. Third, any progress in circularity is generally considered positive in the literature. However, certain firms may consider it more efficient to respond to external pressures with specific circular practices. The real effectiveness of pressures to generate major changes in business models is an issue that requires further empirical analysis.

To address these gaps, in this study, we analyze: (1) the drivers (institutional pressures and organizational agility) of the firm's strategic shift toward a circular value creation approach, referred to as the adoption of a circular business model, together with (2) the firm's implementation of operational actions, or circular business tactics, in three core domains of CE: (a) circular product innovation (Zhang et al., 2021), (b) circular production practices, and (c) recycling practices (Bag et al., 2021; Khan et al., 2021).

We combine two theories on CE that have been used independently in the literature (Bag et al., 2021): (1) dynamic capabilities theory (Fernández de Arroyabe et al., 2021; Khan et al., 2021; Reim et al., 2021) and (2) institutional theory (Centobelli et al., 2020; Do et al., 2022). Thus, we analyze the role of organizational agility, which is a key organizational capability to compete in modern markets, as an internal driver in the adoption of CE and the role of institutional or contextual pressures (mimetic, coercive and social) as external drivers of CE implementation.

Organizational agility reflects the organization's capability to identify and take advantage of market opportunities and adapt quickly to market changes, developing the necessary flexibility to adjust the internal structures and processes in response to these changes and opportunities (Zhou et al., 2019). Thus, organizational agility is considered a key dynamic capability and a critical driver of firms' innovation and long-term survival and success in modern markets (Zhang et al., 2021). Previous studies have analyzed the role of dynamic capabilities in CE adoption by considering firms' ability for "market sensing," "seizing," and "reconfiguring" resources (Khan et al., 2021). Some studies have also addressed the moderating effect of agility on the CE-performance relationship (Salandri et al., 2022). The literature moreover acknowledges the impact of dynamic capabilities in circular supply chains (Chari et al., 2022). However, to our knowledge, this is the first study that compares the roles of organizational agility and institutional pressures as drivers of CE implementation.

Institutional pressures reflect the role of market (such as customer demands, social norms, and market stakeholders' pressures) and nonmarket (such as the current and/or expected environmental regulations and policies) constituents in firms' isomorphic behavior (Zhang et al., 2021) or, in our case, in the adoption of CE practices (Do et al., 2022). The literature shows that institutional pressures act as external drivers for the adoption of CE (Bag et al., 2021). However, little is known about the magnitude of their effect on each of the specific circularity practices. Moreover, it is worth asking whether these pressures are sufficient for companies to adopt a circular business model or whether, on the contrary, their effectiveness is reduced to driving specific practices that respond to external pressures but do not fundamentally change the company's strategic positioning in terms of circularity.

Recent studies also underline that the implementation of CE continues to be relatively slow (Santa-Maria et al., 2022). Transforming businesses' strategic approach and operations toward circularity entails high levels of complexity. Additionally, internal inertia and resistance may render the adoption of CE to be partial and of restricted operational scope. However, previous studies have not addressed the relationships between CE strategic and operative dimensions within the firm, i.e., the extent to which the adoption of a circular business model approach reinforces CE practices (Centobelli et al., 2020). Accordingly, we consider the mediating effect of circular business model adoption on the implementation of circular product innovation, circular production practices, and recycling practices to shed light on how the CE builds within organizations in a holistic manner.

Therefore, by determining the mediating role of the business model dimension, our study contributes to the literature by responding to recent calls that underline the need to improve our understanding of: (1) the organizational capabilities needed to adopt the CE (Ferasso et al., 2020; Fernández de Arroyabe et al., 2021; Khan et al., 2021); (2) the role that contextual factors play in enhancing the transition to the CE (Centobelli et al., 2020); and (3) how the transformation toward circularity occurs (Reim et al., 2021). Our conceptual model allows assessing the relative influence of organizational capabilities versus institutional pressures in the context of heterogeneous organizational responses to circularity and the extent to which CE principles, reflected in this study in the circular business model construct, reinforce CE practices. Therefore, the purpose of this paper is to answer four research questions:

RQ1 – Are organizational agility and institutional pressures effective in promoting firms' adoption of a circular business model and CE practices?

RQ2 – What is the relative influence of firms' internal dynamism versus external pressures in CE adoption?

RQ3 – Do these drivers promote a holistic strategic implementation of CE in the firm, or do they only drive the adoption of isolated dimensions of CE without fostering the implementation of a comprehensive circular model?

RQ4 – Does the circular business model mediate the impact of organizational capabilities and external pressures on circular business actions? Is it a total mediation effect, or are there influences beyond this indirect effect?

2. Literature review

Scholars and practitioners are immersed in the study of the CE concept and its adoption in future business models. The CE concept first appeared when Boulding (1966) proposed a circular economic system capable of fostering sustainable development. Nevertheless, the CE concept was later formalized by Pearce and Turner (1989), based mainly on the 3Rs principle (i.e., reduce, reuse, and recycle). Therefore, the CE concept was introduced in opposition to the current linear economy, which directly transforms natural resources into waste (Winans et al., 2017). According to Stewart and Niero (2018), the goal of CE is to maximize value at every stage of a product's life. Thus, the Ellen MacArthur Foundation (2015) defines CE as an attractive alternative that seeks to redefine growth to benefit society. It involves decoupling economic activity from the consumption of finite resources and eliminating waste from the system by design.

European administrations, international organizations, and other institutional forces, such as business stakeholders and consumers, play a key role in driving the adoption of CE (Fernández de Arroyabe et al., 2021), which is widely acknowledged to yield businesses an important advantage in competitive markets in terms of economic, social, and environmental benefits (Mathivathanan et al., 2022). As a first step, the transition to CE requires an adequate circular business orientation (Jabbour et al., 2020), which is referred to as the circular business model in this study. However, CE adoption also entails implementing other organizational transformations, such as designing new circular products, using circular production practices, and promoting recycling practices (Bag et al., 2021; Khan et al., 2021).

2.1. Circular business model

According to Geissdoerfer et al. (2020), for industry professionals, business model innovation is a key factor for implementing CE at the organizational level as it enables systematically changing the core logic of companies and aligning incentives for different stakeholders. Following this idea, Nussholz (2018) defines the circular business model as the process of reconfiguring an existing linear business model to include circular components to recreate, redistribute, and recapture value in each stage of a product's life cycle and to ensure an attractive value proposition for customers in each product cycle. Thus, circular business models aim at "*cycling, extending, intensifying, and/or dematerialising material and energy loops to reduce the resource inputs into and the waste and emission leakage out of an organizational system*" Geissdoerfer (2020, p. 7). In sum, adopting CE entails an important change in the strategic approach and positioning of the company, which will have consequences both at the level of: (1) internal practices and (2) in the relationship with the companies in the market setting (Ferasso et al., 2020; Reim et al., 2021). Previous studies have focused on the specific actions or policies required to adopt CE principles, such as the ReSOLVE framework (Ellen McArthur, 2015) used by Lewandowski (2016) or the recycling, extending, intensifying, or dematerializing framework proposed by Geissdoerfer et al. (2020). Similarly, previous studies underline that cooperation between the different stakeholders involved in the value chain (e.g., partners, suppliers, customers, public administrations) becomes essential. Building circular ecosystems includes cooperation with other companies to manage resources, cooperation along value chains, cocreation with partners of new circular products or services, or collaboration with public and private entities in circular initiatives that include final consumers to develop innovative business models that use fewer resources (Centobelli et al., 2020; Klein et al., 2021).

Having clearly distinguished the necessary change in the firm's strategic orientation to adopt CE principles and the actions that need to be implemented to reconfigure value creation and provision from a circular perspective, in this study, we use the term circular business model to identify the company's strategic shift toward CE or the company's strategic commitment to apply the principles of CE in transforming their value proposition toward circularity. To complete the vision of firms' CE adoption, we consider three critical domains of CE implementation: (1) circular product innovation, (2) circular production, and (3) recycling practices.

2.2. Circular product innovation

The role of continuous product innovation is highlighted in the literature because it affords companies the ability to cope with changing environments, seize opportunities, and achieve sustained competitive advantage (Guo et al., 2022). Therefore, product innovation constitutes an essential element for assessing effective CE implementation (Saidani et al., 2017), as it determines companies' capability to anticipate and implement the circular principles demanded by the market (Alsaad et al., 2022). To achieve circular product innovation, it is essential to integrate the concept of circularity in the early stages of product design. Bocken et al. (2016) identify two types of strategies for designing a circular product: (a) designing long-life products based on the concept of trust, reliability, and durability; (b) designing long-life extension, i.e., designing products to ensure that they are recyclable and/or biodegradable, easily repairable and maintainable, ready for disassembly and reassembly (and thus for adaptability and upgradeability), with readily available spare parts, and without programmed obsolescence (Khan et al., 2021; Zhang et al., 2021). The use of nonpolluting or nontoxic materials as a part of designing biodegradable packaging is equally important (Bag et al., 2021; Gusmerotti et al., 2019).

2.3. Circular production

Production processes have a major impact throughout the product cycle on supply, resource use, and waste generation and are one of the main components related to the circular economy (Suzanne et al., 2020). There are two approaches to minimizing the consumption of inputs: (1) reusing waste from production processes, or (2) designing and investing in more efficient processes and equipment. To this end, companies design and implement systems that improve efficiency in the consumption of inputs such as reducing their CO_2 footprint, reducing the consumption of fossil raw materials and energy, minimizing waste production, reusing, refurbishing, and remanufacturing products, including recycled products to extend a product's useful life, and recycling or improving maintenance commitments for longer product lifetimes (Bag et al., 2021; Frishammar and Parida, 2019; Gusmerotti et al., 2019; Khan et al., 2021). Overall, these actions will enable the adoption of a more circular production approach. Often, circular product innovation is accompanied by changes in production processes. However, circular innovation in production can go beyond these requirements such that even if there are no design changes to the product, it may still be possible to improve the production process by incorporating circular practices and reducing input consumption.

2.4. Recycling practices

Recycling has become a global challenge in recent years to obtain more value from natural resources, extending products' lives, and reducing harm to the environment (Ervasti et al., 2016). Either the CE innovation in the product or in its production processes may involve or encourage practices that reuse or recycle waste, materials, or components. However, recycling/reuse policies may be adopted without involving relevant innovation in the product or in the production process. Thus, circular recycling practices include recycling companies' own products, those of their customers, or used product components to manufacture new products (Bag et al., 2021; Khan et al., 2021). Thus, recycling/recycling processes are their own entity, which, together with their central character within the concept of circularity, make it convenient to treat them as a differentiated dimension (Cainelli et al., 2020).

The adoption of CE entails profound organizational changes in terms of attitudes, processes, and even data management (Chari et al., 2022), as well as high setup costs and the uncertainty associated with multiple external and internal constraints. In this respect, institutional pressures play a very important role in explaining the degree to which companies implement circular practices. External pressures from legislation, suppliers, or customers can be very effective drivers in the decision to adopt CE policies, as failure to adopt them could result in a significant loss of business opportunities. Companies, however, also need to have the organizational capabilities to transition toward circularity (Bag et al., 2021). Although most previous studies focus on static capabilities, dynamic capabilities help firms take advantage of dynamic and uncertain environments (Teece et al., 2016); therefore, the CE literature acknowledges their contribution to the adoption of circular practices. Accordingly, we focus on the role of institutional pressures and organization agility as a key dynamic capability in the adoption of CE to determine the relative influence of these two variables.

2.5. Organizational agility and CE

Organizational agility is defined as "*a firm's ability to cope with rapid, relentless, and uncertain changes and thrive in a competitive environment of continually and unpredictably changing opportunities*" (Lu and Ramamurthy 2011, p. 932). Thus, agility is an organizational capability that involves both rapidly sensing and responding to opportunities and threats and proactively anticipating changes in the business ecosystem. Accordingly, organizational agility reflects firms' ability to take advantage of uncertain situations and respond to a volatile environment by making necessary organizational changes (Salandri et al., 2022). Agility can be domain specific where firms may be agile in one or more domains, such as customer-based processes or product development. In this study, organizational agility denotes the firm's ability to rapidly sense and seize marketing opportunities, proactively take advantage of opportunities, and reconfigure resources quickly and flexibly according to market evolution.

Organizational agility is deemed a key dynamic capability to compete in modern markets, as it allows firms to rapidly deploy and adjust their resources and to better handle the inherent uncertainty of a fast-changing competitive environment. The adoption of CE also entails an intense organizational innovation process that requires assuming risks and the completely reconfiguring an organization's resources and operations (Ferasso et al., 2020).

Organizational agility encourages organizational innovation for several reasons. First, agile organizations are more likely to commit to innovation since agility allows them to cope with deep uncertainty and complexity, such as that generated by innovation (Teece et al., 2016). Second, organizational agility, as a dynamic capability, facilitates change, reconfiguration, and renewal of processes and promotes innovation to achieve a better environmental fit. In other words, organizational agility facilitates a firm's willingness and ability to implement the organizational changes required by CE (Khan et al., 2021). Third, agility entails speed to anticipate and respond to market opportunities and threats rapidly and effectively, as well as the flexibility to efficiently and effectively produce different combinations of products that match market needs (Zhou et al., 2019). Moreover, in this study, an important component of organizational agility is the company's proactivity, i.e., the propensity to innovate in all those aspects that can lead to a competitive advantage or to first exploit new opportunities to generate profitable business. Given the importance of circularity in many sectors of the economy, organizational agility can reinforce the adoption of EC-based policies and strategies.

Prior research has analyzed the moderating role of organizational agility in the green practices-operation performance relationship (Chari et al., 2022; Salandri et al., 2022). However, the literature has not analyzed the role of organizational agility in the development of CE. To adapt to the requirements of CE, business model transformation, circular product innovation, production systems reconfiguration, and even recycling practices involve organizational, product, and production innovation, respectively. This process is not exempt from complexity, risk, and uncertainty. Agile firms more rapidly achieve an understanding of externalities and the full set of advantages of CE and can obtain valuable insights into how to quickly accommodate new market requirements, redefine their business model, transform product offerings, and envision key partners for strategic cooperation. Similarly, although very few studies have analyzed the specific capabilities that can influence circular production, recent research suggests that organizational agility may reinforce agile and sustainable production systems (Shams et al., 2021). Therefore, we argue that agile companies will be more likely to adopt CE both at the strategic and tactical or operational level. From this perspective, we hypothesize the following:

H1: *Organizational agility has a positive effect on the adoption of: (a) a circular business model, (b) circular product innovation, (c) circular production practices, and (d) recycling practices.*

2.6. Institutional pressures

Innovation in firms not only arises from internal dynamics but also from external pressures that are becoming increasingly important (Naqshbandi and Jasimuddin, 2022). The literature has demonstrated that environmental pressures are very significant dimensions that explain the adoption of sustainable practices (Huang and Chen, 2022) and are also related to CE adoption (Arranz et al.; 2022; Centobelli et al., 2021). Institutional theory (DiMaggio and Powell, 1983) analyzes such pressures by identifying different types of factors that may lead firms to adopt similar business structures or practices, generating what is described as isomorphism, i.e., "*a constraining process that forces one unit in a population to resemble other units that face the same set of environmental conditions*" (p. 149).

In this sense, three types of pressures have been identified as drivers of isomorphic institutional change (DiMaggio and Powell, 1983): (1) coercive pressures, (2) normative pressures, and (3) mimetic pressures.

Coercive pressures are formal and informal pressures imposed by other organizations or institutions (DiMaggio and Powell, 1983). Here, the conditioning factors generated by legal regulations and control by public authorities are particularly important. For example, environmental regulation, specific regulatory frameworks (e.g., European Green Deal) or specific financial support are powerful factors that encourage companies to adopt environmental and circular innovations (Arranz et al., 2022). However, other coercive pressures may arise from rules and standard operating procedures established by nongovernmental organizations such as business or consumer associations. Moreover, the demands of suppliers and customers (and even other stakeholders), especially when the company depends on them, can be factors of a coercive nature that push corporate policy change (Boutry and Nadel, 2021).

Normative pressures refer to informal norms and practices adopted by professionals in a specific field or sector. In their professional training, professionals assimilate norms and forms of action that will condition their subsequent actions. This is reinforced by subsequent professional activity within the sector, such as interacting with other professionals, other companies (customers and suppliers), and organizations that have also adopted these values and practices in their corporate culture. The pressure to adopt CE practices arrives, in this case, not through coercion or the imposition of rules but through the internalization of social norms and cultural values both directly by the company and its employees and indirectly through the attitudes of its customers and other partners. These pressures push companies to change their linear business model toward a more circular one, thus aligning the interests of the different stakeholders (Scarpellini et al., 2020; Witjes and Lozano, 2016). Additionally, they stimulate collaboration with other organizations to develop closed-loop strategies (Arranz

et al., 2022), generating added value for internal and external stakeholders (Urbinati et al., 2017). In this way, Bag et al. (2022) argue that normative pressures have a direct impact on companies to achieve effective circular product innovation and circular production and improve recycling practices.

Finally, mimetic pressures are related to the tendency of firms to "*model themselves after similar organizations in their field that they perceive to be more legitimate or successful*" (DiMaggio and Powell, 1983, p. 152). Companies tend to imitate competitors that are more successful or that constitute a reference in the sector (Dubey et al., 2016). The adoption of CE practices would come neither by the existence of explicit rules or coercion nor by the internalization of values or social norms but by following the path that other successful competitors have taken. Compliance with production demands is a crucial path for companies to keep moving forward, especially in this era of cutthroat competition (Bag et al., 2022). In this sense, just-in-time availability of requirements related to demand needs reduces uncertainties in circular product or process development and encourages suppliers to invest in circular developments.

CE decision-making is an area where all three types of institutional pressures can be observed and which entails encouraging companies to not only adopt certain specific practices but also to adopt a strategic circular orientation. First, authorities pressure on companies to adopt these practices, and as companies adopt them, they also pressure their suppliers and customers to adopt circular practices, as many practices require long-term collaboration along the supply chain (Centobelli et al., 2021; Witjes and Lozano, 2016). Second, climate change and sustainability concerns have spread worldwide. Therefore, new social norms about what practices are or are not acceptable have emerged. Some norms pertain to pushing the adoption of a CE orientation by all economic agents as an immediate societal objective (Centobelli et al., 2020). Third, CE is a relatively new field of decision-making, where many companies must adapt quickly and where imitation of the most successful models can be a favorable strategy. Thus, all three types of institutional pressures drive the adoption of a circular business model and circular operational tactics. Although some institutional pressures may be aimed at driving specific aspects of business circularity (e.g., waste recycling), and this could imply that contextual factors may directly affect some circularity operations, recent literature reinforces the importance of contextual factors in driving changes in the company's strategic positioning in terms of circularity, as well as its corresponding tactical actions. In other words, some companies could adopt specific circularity practices that would allow them to meet the minimum requirements of their environment without making a substantial change in their business model, thus avoiding the cost of assuming a complete strategic shift toward circularity. However, we argue that institutional pressures relate to both organizational change and strategic response (Oliver, 1991). We therefore hypothesize the following:

H2: *Institutional pressures have a positive direct effect on the adoption of: (a) a circular business model, (b) circular product innovation, (c) circular production practices, and (d) recycling practices.*

2.7. The mediating role of a circular business model

In addition to the direct effect of organizational agility and institutional pressures on the dimensions of CE, we analyze the mediating role of a circular business model in the relationship between the internal and external drivers of CE and product circular innovation, circular production practices, and recycling practices. Transforming business models toward circularity involves redefining firms' positioning in terms of resource use and a set of strategic decisions aimed at narrowing, slowing, and closing resource loops (Centobelli et al., 2021). Effective adoption of a strategic repositioning toward circularity implies relevant changes in the firms' strategic orientation to implement operational actions in areas such as product design, production processes, and recycling. Value creation is completed with the design and production of a product offer that preserves economic and environmental value in accordance with CE principles (Centobelli et al., 2021) and when the production and consumption loops are closed by recycling, reuse, and remanufacture of products (Ferasso et al., 2020). A circular business model as defined in this study should be, in fact, the first step toward circularity, steering company operations toward circular practices. However, previous studies have not analyzed the effect of circular business models on the rest of the dimensions of CE adoption. In this study, we contend that the firm's strategic approach to CE by redefining the business model toward long-life solutions and reassessment of suppliers and partners for long-term efficiency in value chains is the initial cornerstone to produce circular products with circular practices and recycle resources, materials, and components (Reim et al., 2021).

Therefore, beyond the direct effects proposed in H1 and H2, we believe that the internal and external drivers of CE are oriented to generate a change at a strategic level in the organizations, not just specific responses at an operational level. Accordingly, we propose the existence of a partial mediating effect of the business model on the relationship between internal and external drivers and implementation practices. Therefore, we hypothesize the following:

H3: *The impact of organizational agility on the adoption of: (a) circular product innovation, (b) circular production practices, and (c) recycling practices is mediated by circular business model implementation.*
H4: *The impact of institutional pressures on the adoption of: (a) circular product innovation, (b) circular production practices, and (c) recycling practices is mediated by circular business model implementation.*

3. Research method

3.1. Research model

The research model proposed in Fig. 1 attempts to establish the causal relationship between organizational agility, institutional pressures, and CE adoption (circular business model, circular product innovation, circular production, recycling practices).

3.2. Sample and data collection

The research hypotheses proposed in the previous section were evaluated by means of primary information sources obtained through surveys of directors and managers in companies that implement any type of circular innovation in their products or processes. First, a database of potential Spanish companies susceptible to executing some type of circular innovation was prepared. For this proposal, information was sought in CE associations, ministerial reports, company search engines by sector, and news. Finally, a database of 1,357 Spanish companies that met the aforementioned requirements was obtained.

The data for this study were collected from firms that operated in Spain from November 2021 to March 2022. General managers and department managers are considered to be in the best position to provide critical insight into firms' strategic orientation toward CE and CE practices implemented in their companies, so they were selected as key informants in each sampling unit (Covin and Wales, 2019). Finally, after eliminating incomplete questionnaires, 218 valid responses (16.06% response rate) were obtained. Table 1 describes the main characteristics of the respondents and companies that participated in this study.

In terms of firm profile, Table 1 shows that most of the responses were received from firms in the plastics and rubber (15.84%), metallurgy and metal products (10.41%) and automotive (9.95%) sectors. These sectors have shown more interest in adopting CE, partly due to the institutional pressures that they face to adapt their processes and products toward more circular ones. In terms of turnover level, all companies are represented in this study. However, as shown in Table 1, the firms with the highest turnover are the ones that had the most

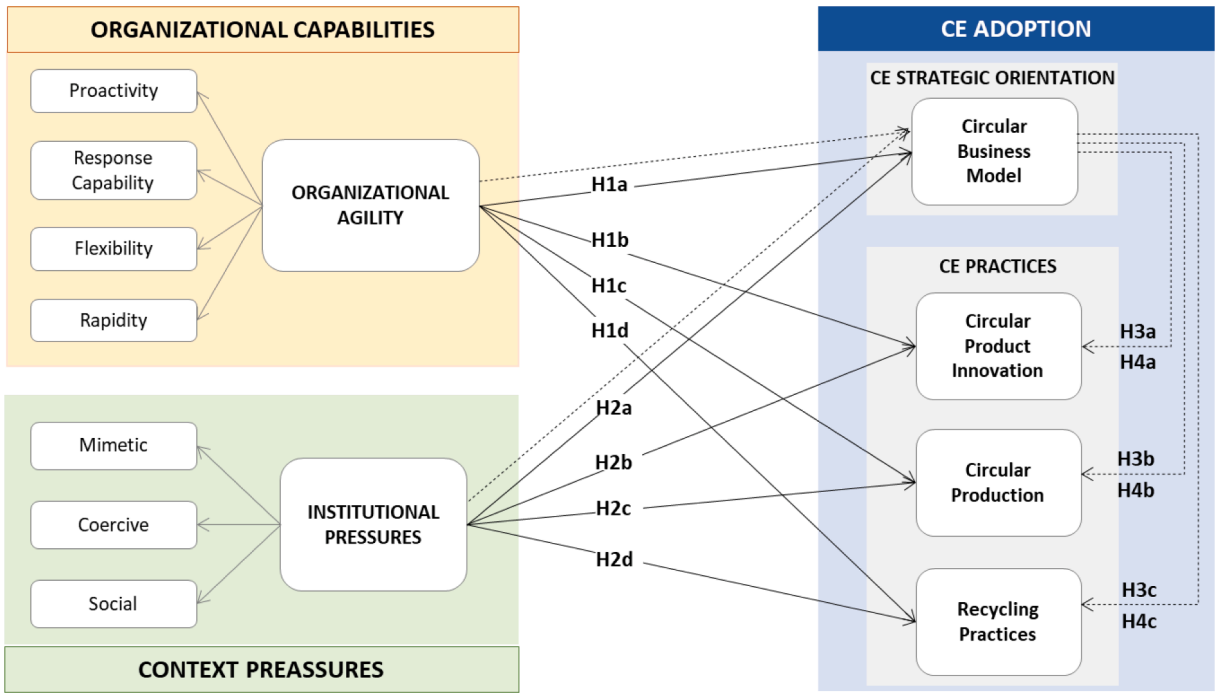

Fig. 1. Research model.

Table 1
Sample description.

	Frequency	*Percentage (%)*
Firm age (years)		
Under 10	26	11.76
10–25	56	25.34
26–40	85	38.46
Over 40	54	24.43
Industry sector		
Automotive	22	9.95
Chemicals	15	6.79
Construction	18	8.14
Electronics and TIC	10	4.52
Food and beverages	11	4.98
Furniture, wood and cork	17	7.69
Mechanical machinery and equipment	14	6.33
Metallurgy and Metal products	23	10.41
Packaging and packing	18	8.14
Plastics and rubber	35	15.84
Textil and apparel	21	9.50
Other non-metallic products	17	7.69
Turnover		
≤ 300.000 €	16	7.3
300.001 € – 600.000 €	19	8.7
600.001 € – 1.500.000 €	32	14.7
1.500.000 € – 3.000.000 €	30	13.8
> 3.000.000 €	121	55.5
Firm side		
< 10 employees	37	17.0
11–49 employees	85	39.0
50–249 employees	60	27.5
More than 250 employees	36	16.5

responses to this survey. This may be because these types of companies that may be under greater pressure to adapt their products and processes to the CE principles and, therefore, have a greater interest in this context. Finally, in terms of the number of employees, as illustrated in Table 1, all types of firms are represented in this study.

Following Armstrong and Overton (1977), we tested for significant differences between the first quarter and last quarter of respondents. An ANOVA test for mean differences along with Bartlett's test for differences in variances were applied for firm characteristics (turnover, number of employees, and age) and for the constructs in the model (each scale was averaged for this purpose). None of the differences reached significant levels. This result points to the inexistence of a nonresponse bias.

To analyze the possible presence of common method bias, we followed Harman's single-factor procedure. All self-report variables of the model were entered into a principal component factor analysis without rotation. The analysis identified ten distinctive factors with eigenvalues greater than one. The highest proportion of variance explained by a single factor was 30.19%, far below the 50% threshold.

3.3. Instrument development

The theoretical constructs of the conceptual model were measured using multiple-item scales. The questionnaire includes items adapted from the literature and some new items, as illustrated in Table 2. For this purpose, all items were scored on a seven-point Likert-type response scale between *"strongly disagree"*=1 and *"strongly agree"*=7.

The *organizational agility* scale is adapted from Chen, Li, & Evans (2012), Chen, Chang, & Wu (2012), Miroshnychenko et al. (2021), Srinivasan and Swink (2018), and Zhou et al. (2019). In this sense, the construct is measured as a second-order construct comprising four first-order dimensions: (1) proactivity, (2) response capability, (3) flexibility, and (4) rapidity. In this respect, the scale of organizational agility mirrors not only the firm's ability to reactively respond to changes in an agile way but also its proactivity and propensity to seek and take advantage of business opportunities.

The measurement scale for *institutional pressures* is adapted from Bag et al. (2021), Huang and Chen (2022), Lin et al. (2020), and Zhang et al. (2021) and includes three dimensions: (1) mimetic, (2) coercive, and (3) social pressures. In recent work, Huang and Chen (2022) compared several models with different structures about the relationship of these components with the underlying construct. They found that a second-order model is the better option. Following this approach, institutional pressure is conceptualized as a second-order multidimensional construct comprising the three mentioned dimensions.

In addition, we developed an original scale for the circular business

Table 2
Results of the measurement model.

Constructs	Measurement items	Factor Loading	α; CR; AVE
Proactivity (PA)	Our firm … recognizes an addresses first new market opportunities	0.837***	α = 0.912; CR = 0.932; AVE = 0.694
	… seizes new opportunities being first to market with new products and services	0.871***	
	… puts emphasis on exploiting first new opportunities for generating new profitable business	0.870***	
	… can anticipate new opportunities for market growth.	0.827***	
	… initiates actions to which the competitors then respond	0.822***	
	… creates new customer preferences from the new advantages of our products	0.769***	
Response capability (RC)	If our markets change, our organization is ready to react	0.863***	α = 0.900; CR = 0.926; AVE = 0.714
	If the competitive context/ environment changes, our organization can respond appropriately	0.858***	
	When an unexpected threat/ opportunity arises, we can adjust appropriately to the new reality by reconfiguring our resources	0.859***	
	We can react effectively to changes in the environment resulting from competitors' actions	0.835***	
	We can adapt our offer to the needs of the market when necessary	0.809***	
Flexibility (FL)	If circumstances change … our organization is flexible to modify our current plans	0.773***	α = 0.865; CR = 0.909; AVE = 0.713
	… our organization has the knowledge and experience necessary to make changes in its daily practices and routines if competitive conditions require it	0.871***	
	… our organization is flexible to adapt to new projects with a probability of success	0.878***	
	If our business priorities change, our organization is flexible to manage a change in strategy.	0.853***	
Rapidity (RA)	We can meet customer's changing needs faster than our competitors.	0.805***	α = 0.907 CR = 0.931; AVE = 0.731
	We compress time from product concept to marketing to respond quickly to the changes in customer needs.	0.773***	
	We can quickly change our product mix in response to changing market opportunities.	0.890***	
	We can respond quickly to changes in our markets (entry of new competitors, change in customers' product/service preferences…).	0.911***	
	We can respond quickly to changes in the competitive context (new business threats, opportunities, new technologies, etc.).	0.887***	
Mimetic pressures (MP)	Our main competitors… who have adopted CE practices are greatly benefitted	0.761***	α = 0.870; CR = 0.912; AVE = 0.722
		0.892***	
	… who use CE practices are favorably perceived by others in the same industry		
	… who implement CE practices are favorably perceived by their suppliers	0.836***	
	… who use CE practices are favorably perceived by their customers	0.902***	
Coercive pressures (CP)	The local government requires our firm to use CE practices	0.798***	α = 0.893; CR = 0.921; AVE = 0.699
	Regulation forces more and more to improve circular practices	0.838***	
	Public organizations expect companies like ours to adopt CE initiatives	0.844***	
	The industry association requires our firm to use who use CE practices	0.855***	
	Competitive conditions require our firm to use CE practices	0.845***	
Social pressures (SP)	Customers highly respect the adoption of circular practices	0.868***	α = 0.839; CR = 0.887; AVE = 0.613
	Customers are prone to circular product ideas	0.866***	
	Society expects CE initiatives from our industry	0.763***	
	Our suppliers participate in CE initiatives	0.724***	
	CE attracts collaborations with other potential partners	0.674***	
CE Business model (BM)	To progress in the adoption of CE … we are moving forward to transform our company into a circular business	0.871***	α = 0.946; CR = 0.954; AVE = 0.700
	… we seek to achieve value creation by changing our product/service portfolio to be more circular	0.865***	
	… we promote cooperation with other market actors to close or slow material loops	0.777***	
	… we promote circular strategic collaborations throughout the value chain to focus on long-term efficiency	0.853***	
	… we promote the co-creation with partners of new circular products or services	0.864***	
	… we promote collaboration with public and private partners, including end-users, to optimize the virtual value of our offer	0.786***	
	… we seek to ensure the availability and reliability of data on material flows in value chains to close loops	0.756***	
	… we promote resource efficiency with supply-side and demand-side market agents to enlarge the network of circularity	0.890***	
	… we seek to transform our resources and capabilities to become more circular	0.856***	
Circular product innovation (PI)	We design our products … to minimize consumption and try to use renewable or recyclable resources as much as possible	0.801***	α = 0.897; CR = 0.914; AVE = 0.572
	… to be easily recyclable (e.g., separation of components, information on chemical contents) and/or biodegradable	0.773***	
	… to facilitate repair and maintenance	0.776***	

(*continued on next page*)

Table 2 (*continued*)

Constructs	Measurement items	Factor Loading	α; CR; AVE
	… to ensure spare parts availability	0.685***	
	… to be easily upgradable (modular, upgradeable …)	0.753***	
	… to be reusable	0.793***	
	… to have a good durability (i.e. avoiding premature or programmed obsolescence)	0.750***	
	… to use non-polluting or non-toxic materials	0.736***	
Circular production (PR)	We use closed production cycles (integration of waste and residues in the process).	0.651***	α = 0.840; CR = 0.888;
	We increase efficiency in the use/consumption of materials and energy	0.879***	AVE = 0.615
	We reduce raw material and energy consumption	0.799***	
	We reduce our CO_2 footprint	0.817***	
	We strive to improve the efficiency of our production equipment to become more efficient and less wasteful	0.757***	
Recycling practices (RE)	We recycle our own production waste	0.704***	α = 0.641; CR = 0.807; AVE = 0.583
	We recycle residual products from customers and consumers	0.753***	
	We recycle used product components to manufacture new products	0.829***	

Note: *** p < 0,01; α (Alpha de Cronbach); AVE (Average Variance Extracted); CR (Composite Reliability).

model, inspired by Bocken et al. (2016), Centobelli et al., (2021), Fernández de Arroyabe et al. (2021), Geissdoerfer et al. (2020), Khan et al. (2021), Lewandowski (2016), and Reim et al. (2021), that tries to capture the firm's strategic repositioning toward CE. Finally, the measurement scales for circular product innovation, circular production, and recycling practices are adapted from the studies of Bag et al. (2022) and Khan et al. (2021). We also include turnover and firm age, which are the usual control variables for firm.

4. Results

This study used SmartPLS 3, a statistical tool to examine the data through partial least square equation modeling (PLS-SEM). For the analysis of the results, a two-step approach was used (Hair et al., 2011). First, we measured the interitem reliability, internal consistency reliability, and convergent validity of the proposed model. Second, we tested the hypotheses and the predictive capability of the structural model (Henseler et al., 2009). The following sections describe the results of the reliability and validity analysis of the scales.

4.1. Reliability and discriminant validity

The two-step approach of Anderson and Gerbing (1988) was used to calculate reliability, where the convergent validity and discriminant validity of the constructs were calculated. For this purpose, the reliability of the constructs was tested through confirmatory factor analysis (CFA), and then composite reliability (CR) and average variance extracted (AVE) were calculated.

According to Hair et al. (2011), the loading factors should preferably be higher than 0.70. Nevertheless, loading factors between 0.40 and 0.70 are also acceptable if the AVE of the construct is higher than 0.50. In this case, the loading factors are in the range between 0.651 and 0.911. Thus, the results satisfy the reliability criteria for the factors. Later, for internal consistency, CR values should ideally be higher than 0.70 (Hair et al., 2011). In this study, the CR values are in the range between 0.807 and 0.954. Hence, the results satisfy the internal consistency criteria. Finally, convergent validity requires an AVE for each construct above 0.50 (Hair et al., 2011). Here, the AVE values are in the range between 0.572 and 0.731. Therefore, the results satisfy the convergent validity criteria. The detailed results mentioned above are described in Table 2.

4.2. Discriminant validity

There are two main approaches to assess discriminant validity (Khan et al., 2021): (1) the Fornell and Larcker (1981) criterion and (2) the Heterotrait-Monotrait ratio of correlations (HTMT) criterion (Henseler et al., 2015). The Fornell and Larcker (1981) criterion suggests that the square root of the AVE of each construct should be greater than the cross-correlations between each construct and the others in the model and not<0.50. Furthermore, HTMT is defined as the mean value of item correlations between constructs related to the average value corresponding to the mean of the average correlations of items that measure the same construct (Henseler et al., 2015). According to Hair et al. (2019), the HTMT value should be<0.90 for conceptually similar constructs. Therefore, as shown in Table 3, this study meets the HTMT criterion, and consequently, discriminant validity is demonstrated for all constructs of the proposed model.

4.3. Structural model

The hypotheses proposed in this study were evaluated through the structural equation modeling (PLS-SEM) approach. For this purpose, bootstrapping with 10,000 resamples was used to assess the significance of the path coefficients (Hair et al., 2019). The results are illustrated Table 5. Table 4 also includes the coefficient of determination (R^2) (Falk & Miller, 1992) that presents substantial values (<0.75) in the cases of coolness, flow status, and loyalty and moderate values (<0.50) for the rest of the variables (recognition, health improvement, and satisfaction). The values of criterion Q^2 range between 0.083 and 0.267, which indicate moderate predictive power of the PLS model to predict the endogenous constructs of the circular business model, circular product innovation and circular production and low levels of predictive relevance in the case of recycling (Hair et al., 2017).

H1 suggests a direct effect of organizational agility on the circular business model and on the three CE operative practices considered (product innovation, production, and recycling). All the coefficients reached positive and significant levels except the last one: H1(d) ($\beta = 0.311$, $p < 0.01$); H1(b) ($\beta = 0.192$, $p < 0.05$), and H1(c) ($\beta = 0.316$, $p < 0.01$), are supported, whereas H1(d) ($\beta = -0.069$, $p = 0.40$) is rejected.

The direct effects of institutional pressures are proposed in H2. The coefficient that reflects the influence on the business model is positive and significant. However, the direct effects on the implementation variables are not significant. Therefore, H2(a) ($\beta = 0.450$, $p < 0.01$) is supported, but H2(b) ($\beta = 0.005$, $p = 0.93$), H2(c) ($\beta = 0.107$, $p = 0.15$), and H2(d) ($\beta = 0.085$, $p = 0.27$) must be rejected.

The mediating role of the business model variable has also been analyzed to test H3 and H4. All the indirect effects through this variable of organizational agility and institutional pressures on CE implementation practices are positive and significant (see Table 4). The mediating effects predicted in H3a ($\beta = 0.115$, $p < 0.01$), H3b ($\beta = 0.111$, $p < 0.01$), H3c ($\beta = 0.114$, $p < 0.01$), H4a ($\beta = 0.170$, $p < 0.01$), H4a ($\beta = 0.160$, $p < 0.01$), and H4a ($\beta = 0.165$, $p < 0.01$) are supported.

We have extended the analysis to determine whether this mediating role is partial or total. The basic condition for partial mediation is that the direct and indirect effects of an independent variable on a dependent variable are both significant. In contrast, full mediation occurs when the direct effect is not significant. Thus, the circular business model fully mediates the impact of institutional pressures on circular product innovation, circular production, and recycling practices. Regarding the

Table 3
Correlations between latent constructs.

	MP	CP	SP	PA	RC	FL	RA	BM	PI	PR	RE
MP	**0.850**	0.499	0.721	0.183	0.235	0.195	0.235	0.399	0.206	0.361	0.245
CP	0.562	**0.836**	0.728	0.305	0.206	0.173	0.239	0.451	0.211	0.350	0.321
SP	0.620	0.633	**0.783**	0.313	0.357	0.249	0.307	0.609	0.291	0.420	0.243
PA	0.160	0.276	0.360	**0.833**	0.619	0.570	0.628	0.494	0.407	0.438	0.189
RC	0.266	0.227	0.411	0.675	**0.845**	0.855	0.848	0.435	0.333	0.583	0.192
FL	0.224	0.153	0.291	0.626	0.754	**0.845**	0.736	0.369	0.242	0.525	0.106
RA	0.212	0.218	0.347	0.578	0.771	0.658	**0.855**	0.337	0.276	0.390	0.188
BM	0.368	0.425	0.680	0.527	0.408	0.340	0.354	**0.837**	0.465	0.614	0.480
PI	0.212	0.207	0.306	0.432	0.308	0.220	0.306	0.450	**0.756**	0.374	0.375
PR	0.305	0.308	0.493	0.426	0.511	0.453	0.438	0.556	0.335	**0.784**	0.564
RE	0.176	0.247	0.334	0.130	0.115	0.023	0.139	0.380	0.296	0.394	**0.764**

Note: Fornell-Larcker: the diagonal elements (in bold) indicate the square root of the shared variance between the constructs and their measures (mean variance extracted), below is the correlation between constructs. The HTMT ratios are above the diagonal.

Table 4
Structural model results (bootstrapping).

	Sample Mean	T Statistics
Control variables		
Firm Age → Circular business model	−0.016	0.351n.s.
Firm Age → Circular product innovation	−0.036	0.565n.s.
Firm Age → Circular production	0.041	0.942n.s.
Firm Age → Recycling practices	−0.053	0.912n.s.
Turnover → Circular business model	−0.075	1.136n.s.
Turnover → Circular product innovation	−0.014	0.290n.s.
Turnover → Circular production	0.040	0.738n.s.
Turnover → Recycling practices	−0.122	2.011**
Direct effects		
Organizational agility → Circular business model	0.311	4.780***
Organizational agility → Circular product innovation	0.192	2.226**
Organizational agility → Circular production	0.316	4.288***
Organizational agility → Recycling practices	−0.069	0.841n.s.
Institutional pressures → Circular business model	0.450	7.043***
Institutional pressures → Circular product innovation	0.005	0.082n.s.
Institutional pressures → Circular production	0.107	1.429n.s.
Institutional pressures → Recycling practices	0.085	1.102n.s.
Circular Business model → Circular product innovation	0.375	4.359***
Circular Business model → Circular production	0.356	4.248***
Circular Business model → Recycling practices	0.366	4.182***
Indirect Effects		
Organizational agility- Circular business model - Circular product innovation	0.115	3.525***
Organizational agility- Circular business model - Circular production	0.111	3.140***
Organizational agility- Circular business model -Recycling practices	0.114	3.031***
Institutional pressures - Circular business model - Circular product innovation	0.170	3.318***
Institutional pressures - Circular business model - Circular production	0.160	3.525***
Institutional pressures - Circular business model -Recycling practices	0.165	3.431***
Latent variables	**R^2**	**Q^2 predict**
Circular business model	0.414	0.267
Circular product innovation	0.274	0.121
Circular production	0.423	0.236
Recycling practices	0.199	0.083

Note: n.s.; **p < 0.05; ***p < 0.01.

Table 5
Comparison of total effects.

	Sample Mean	T Statistics	P Values	Bootstrap 95% BC CI	
Organizational agility – Circular product innovation	0.307	3.757	0.000	0.134	0.450
Institutional pressures – Circular product innovation	0.175	2.145	0.032	0.013	0.329
Organizational agility – Circular production	0.427	5.667	0.000	0.273	0.571
Institutional pressures – Circular production	0.268	3.899	0.000	0.125	0.395
Organizational agility – Recycling processes	0.045	0.579	0.562	−0.098	0.188
Institutional pressures – Recycling processes	0.250	3.466	0.001	0.095	0.377

effects of organizational agility, there are significant direct and indirect effects. The variance accounted for (VAF) determines the extent to which the mediation process explains the dependent variable variance and, therefore, the strength of the mediation (Carrión et al., 2017). VAF values are in the interval between 0.2 and 0.8 (0.378 and 0.259, respectively), reinforcing the idea that the effects posed in H3(a) and H3 (b) should be considered partial mediation (Hair et al., 2014). In contrast, since the direct influence of agility on recycling practices is not significant, the effect proposed in H3(c) must be considered as total mediation.

To determine what type of drivers (internal or external) have the greatest influence on CE implementation, we calculated the total effects (i.e., aggregating direct and indirect effects) of each driver on each of the aspects involved in CE implementation. The results are shown in Table 5.

Organizational agility is the driver with the strongest total effect on product innovation and circular production ($\beta = 0.307$, $p < 0.01$ and $\beta = 0.427$; $p < 0.01$, respectively). However, its overall effect on recycling practices is not significant ($\beta = 0.045$; $p = 0.56$). The indirect effect of agility on this variable is positive and significant ($\beta = 0.114$; $p < 0.01$), but the direct effect is negative and nonsignificant (β = -0.069; p = 0.40). This negative effect lessens the total effect, making it nonsignificant.

On the other hand, institutional pressures have a significant total influence on circular product innovation ($\beta = 0.175$; $p < 0.05$), circular production ($\beta = 0.268$; $p < 0.01$), and recycling practices ($\beta = 0.250$; $p < 0.01$). Therefore, although institutional pressures do not have a direct impact on circular product innovation, circular production and recycling practices, institutional pressures prove to exert a positive and significant total effect on these dimensions thanks to the mediating effect of the circular business model, and in this way, institutional pressures are the only force that fosters (indirectly) the firm's recycling practices.

5. Conclusions and discussion

This research aims to determine how the transition to CE takes place in existing companies (Centobelli et al., 2020). Specifically, our study attempts to determine the effect of organizational capabilities and environmental forces on the adoption of CE, combining dynamic

capabilities theory and institutional theory, which are two management theories that explain organizational behavior from internal and external approach, respectively. In this sense, our research makes three relevant contributions to the extant knowledge. First, in response to recent literature calls, we reinforce the idea that there is a need to integrate the role of internal and external drivers of CE to achieve an in-depth understanding of firm adoption. This approach allows for comparing the relative effectiveness of internal dynamics (organizational agility) and external pressures (institutional pressures) in the adoption of CE. Second, this research introduces a strategic level construct of CE adoption, the circular business model, in addition to the analysis of circular practices. The introduction of this variable in the model allows us to analyze whether the adoption of circular policies follows a strategic pattern (holistic and with long-term effects on positioning and development of resources and capabilities) or if it is an operational response to external pressures or internal dynamics. Third, we distinguish three areas of CE implementation (circular product innovation, circular production, recycling practices), which allowed us to observe the different effects of internal dynamics, external pressures, and the role of circular business model adoption in each of these areas.

Thus, our findings shed light on the response to the four research questions posed in this study. RQ1 refers to the effectiveness of organizational agility and institutional pressures in encouraging firms' adoption of a circular business model and CE practices. By analyzing the total effects of each of these drivers on CE implementation practices, we can confirm that both dynamic capabilities and institutional pressures play a significant role in the adoption of CE.

On the one hand, it is confirmed that organizational agility is fundamental to incorporating a circular business model, as well as designing circular products with a circular production system. Relatively few studies have analyzed the role of dynamic capabilities in the context of CE (Ferasso et al., 2020). However, proactivity and propensity to seek and take advantage of business opportunities, which are important components of business agility, can drive faster and more complete adoption of circular models and practices. The results of our work confirm the idea that organizational agility is beneficial to companies to transform toward CE and develop circular product innovation and circular production. On the other hand, institutional pressures have significant total effects on the adoption of circular business models and on the implementation of all CE practices analyzed. The effectiveness of external pressures in the adoption of CE is in line with theory (e.g., Do et al., 2022) and with the empirical literature (Bag et al., 2021; Huang and Chen, 2022).

In answer to RQ2, to determine the relative influence of internal dynamism versus external pressures in CE adoption, comparative analysis of the total effects of each driver shows that the internal driver (organizational agility) has a greater effect on product and production circular innovation, but its effect on recycling policy implementation is lower than that of external pressures. Perhaps the explanation lies in the fact that complete recycling implementation is more likely to involve collaboration with other entities, such as suppliers or customers (Kalverkamp and Raabe, 2018). This would suggest that internal agility may be insufficient as a driver of these policies, while institutional pressures, which may substantially affect all entities simultaneously, would be more effective in their implementation.

RQ3 is whether organizational capabilities and institutional pressures promote a holistic implementation of CE in the firm or only drive the adoption of isolated dimensions of CE without fostering the implementation of a comprehensive circular model. Firms may perceive as more efficient the adoption of specific practices that respond to internal and external drivers without a change in their positioning and strategy, which may be hampered by relevant barriers (costs, cultural resistance) or conditioning factors (Tura et al., 2019). Our results have shown that both organizational agility and institutional pressures favor the strategic shift toward circularity, repositioning the conception of the business model. If barriers exist, they are not strong enough to render the effect of these drivers on the adoption of a circular model insignificant.

However, this does not mean that these drivers also do not have direct effects on CE implementation beyond the effect through the business model. The joint analysis of direct, indirect, and total effects has allowed us to deepen our knowledge of the effects of each driver and the role that it plays in the adoption of a circular business model in each case.

On the one hand, organizational agility not only has indirect effects through the circular business model but also a direct influence on circular product innovation and the implementation of a circular production system. The internal dynamics of the firm generate additional impulses for the implementation of these policies beyond those generated through the implementation of the circular business model. The firm's proactivity and dynamic capabilities are also specifically manifested in specific skills for product innovation or redesign of production processes (Scarpellini et al., 2020). In contrast, this driver does not have a significant direct effect or a significant overall effect on the implementation of recycling practices. External pressures, rather than internal drivers, effectively drive these practices.

On the other hand, institutional pressures, though they do not have a direct effect on any of the circular practices, do have a positive and significant indirect and total effect on circular product innovation, circular production, and recycling practices.

Institutional pressures only have a significant direct effect on the change of the business model concept toward circularity, but the effects on CE practices are all indirect. Huang and Chen (2022) found that institutional pressures have a significant direct effect on green product innovation. However, although they considered another possible mediating variable (firm green slack), they did not include the circular business model in their analysis. The results obtained in our study suggest that institutional pressures do indeed have a significant effect on the adoption of circular product innovation, as well as on other forms of CE implementation. Nonetheless, at least in the scope of our study, these pressures assert their influence through the adoption of a circular strategic orientation and thereby on each specific dimension of implementation. The response of firms to institutional pressures has an impact at the business strategic level and, through this change, on the adoption of specific policies.

The business model exerts a very important mediating effect on the influence of organizational agility and institutional pressures on the implementation of circular business actions. Therefore, in response to RQ4, we can say that the adoption of a strategic organizational positioning toward circularity plays a critical role in reinforcing organizational capabilities and external pressures. All the indirect effects of these drivers on the three implementation practices are significant. This result highlights the importance of the definition of a clear circular strategic orientation in organizations as a preliminary step to implementing circular practices. Our study supports the idea that effective adoption of CE usually starts and is reinforced by the strategic approach toward CE.

5.1. Managerial implications

The results and conclusions obtained in this study can be useful for practitioners' decision-making. First, the evidence observed shows that the effective implementation of circular practices in companies does not happen as isolated adoptions of specific policies but as a consequence of the application of corporate strategies linked to circularity. Practitioners should take this into account when designing and implementing CE plans, which should involve changes at the corporate strategy level (including strategic positioning and networking with preferred partners) and not a set of tactical actions in response to environmental or internal stimuli.

Second, the development of dynamic organizational capabilities (agility) is more powerful than external pressures as a driver of change toward circularity in terms of circular product innovation and the implementation of circular production processes. This result is in line

with previous empirical evidence that reinforces the role of companies' proactiveness and entrepreneurial orientation in the adoption of innovations (Santos-Vijande et al., 2022). When the objective is focused on these aspects, the company's management must first take care to promote these types of capabilities, since deficiencies in this area are shown to be a disadvantage for these objectives. However, external pressures are more effective in driving recycling practices. Getting partner companies to share circularity objectives and have a similar perception of environmental constraints can play a key role.

5.2. Limitations and future research lines

To avoid additional complexity in the model, we aggregated the effects of institutional pressures (mimetic, coercive, and social) into a second-order construct. Although this is common in the literature (e.g., Huang and Chen, 2022), there is a possibility of differential effects (e.g., Bag et al., 2021). A study with a larger sample size could analyze these effects on CE adoption variables in more detail and elaborate on the specific effects of each type of external pressure. Sample size is also a limitation when analyzing whether there are differences by sector in terms of CE implementation. We used a multisectoral sample, thus widening the scope of the study and achieving variability in the explanatory variables, but this means that the CE policies are more heterogeneous than they would otherwise be in a one-sector sample. Applying the model to specific sectors would allow more precise conclusions to be drawn about the effectiveness of external and internal drivers in each sector and how firms react to them.

The literature is also interested in the possible effects of different barriers to the adoption of CE strategies and policies (Govindan et al., 2022; Mishra et al., 2022). The effect of these barriers is not reflected in our model, but they can undoubtedly play an important role in eroding the effect of external and internal drivers on CE adoption. However, one question remains unanswered: are these barriers holding back this adoption at the strategic level or only holding back the adoption of specific policies? An extension of the model presented here could be used to answer this question.

Similarly, in this study, we focus on organizational agility as a key organizational capability to compete in modern markets. However, other relevant capabilities, such as exploitative and exploratory capabilities and their balanced and combined effects, are critical to building and enhancing sustainable competitive advantage through innovation (Sun and Hu, 2022) and therefore warrant a detailed analysis in the context of CE development.

Another topic for further research could be to analyze the role of environmental dynamism in the process of CE adoption as institutional pressures are not the only significant environmental factor. The literature suggests that market turbulence, competitive intensity, and technology turbulence can condition the adoption of CE innovations (Chen, Li, et al., 2012; Chen, Chang, et al., 2012). Nonetheless, there is a lack of empirical studies that analyze whether these effects have repercussions at the operative level or at the business model adoption level.

Moreover, recent research suggests a strong connection between frugal innovation practices and CE principles (López-Sánchez and Santos-Vijande; 2022). Therefore, considering the implications of CE in the development of product and service innovation to achieve optimal performance while preserving core functionalities and reducing both costs and resource usage (frugal innovation) constitutes a promising line of research. Finally, the model could be enhanced by incorporating firms performance (i.e., commercial, environmental, and financial results) following the adoption of the CE. Are the results better when adoption incorporates a change in the business model? Alternatively, is the adoption of specific policies more effective? New studies could provide answers to these questions.

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CRediT authorship contribution statement

Adrian Castro-Lopez: Visualization, Validation, Supervision, Software, Resources, Project administration, Methodology, Investigation, Funding acquisition, Formal analysis, Data curation, Conceptualization, Writing - original draft, Writing - review & editing. **Victor Iglesias:** Visualization, Validation, Supervision, Software, Resources, Project administration, Methodology, Investigation, Funding acquisition, Formal analysis, Data curation, Conceptualization, Writing - original draft, Writing - review & editing. **María Leticia Santos-Vijande:** Visualization, Validation, Supervision, Software, Resources, Project administration, Methodology, Investigation, Funding acquisition, Formal analysis, Data curation, Conceptualization, Writing - original draft, Writing - review & editing.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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