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Circular Economy in Portuguese Organizations – A Systematic Literature Review.

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ABSTRACT

Purpose: The objective of this study is to know the state of Portuguese organizations in relation to the transition to circular economy (CE), identifying the main CE practices adopted, barriers and motivations to CE implementation.

Design/methodology/approach: A systematic literature review was conducted for the period 2006 to 2021 and included academic, gray and practical literature that focus on the CE at the micro level, i.e., at the organizational level for the Portuguese context.

Findings: The results show that the CE practices implemented in the analyzed organizations reveal a little advanced state in relation to circularity and emphasize the implementation of CE practices associated with waste management. The motivations are mainly associated with improving environmental and economic performance. The main barriers are: legislation, lack of guidelines and support in the transition process to CE, and high investments.

Research limitations/implications: The results contribute to the current state of CE research in Portugal at the organizational level and highlight opportunities for future research in this area. However, the number of studies on CE in the Portuguese organizational context, and analyzed, is very scarce, which constitutes an important limitation of this study.

Originality/value: This study contributes to the knowledge of the CE adoption at the organizational level.

Keywords: Circular Economy, Organizations, Portugal, Literature Review, Sustainability.

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1. INTRODUCTION

Circular economy (CE) is a concept that has become popular among different governments and organizations, particularly in North America and European countries, China, and Japan. Many countries and regions, such as the European Union (EU), have invested and promoted several initiatives, including in the legislative sphere, in order to foster the interest and implementation of the CE. This interest has been shared by the scientific community, resulting in an increasingly research output in different topics related to CE (Martinho & Mourão, 2020). This attention is related to the fact that CE has the potential to break the linear economy model of unsustainable production and consumption (Kristensen & Mosgaard, 2020) and produce positive impacts, namely at an environmental and economic level, thus assuming an important role for sustainability (Geng et al., 2009; Suarez-Eiroa et al., 2019).

Despite the increase in the number of publications on CE, there is no consensual definition on how to define CE or on how it relates to the concept of sustainability. On the other hand and considering that CE can be implemented at three levels (macro, meso and micro), most efforts focus on the macro and meso levels. Many of the companies that have implemented CE policies often adopt different terminologies, implementation practices and interpretations of the concepts present in CE (Barreiro-Gen & Lozano, 2020). However, research at the micro level is limited (Barreiro-Gen & Lozano, 2020).

Portugal has followed the interest in the CE, having adopted, in line with the position of the EU, several relevant initiatives. In the Portuguese context, several studies analyze the CE at national, regional and industrial levels of symbiosis (meso level), but research at the micro level also seems to be scarce along the lines of Barreiro-Gen and Lozano (2020) and there is no knowledge about the research work carried out in this area.

This study aims to fill this gap and contribute, through a systematic literature review, to a greater knowledge of the various studies carried out and aspects addressed in Portuguese companies, which can be important to foster CE in this context and guide the level of research in this topic.

The structure of this study is organized as follows: After the presentation of the concepts of sustainability and CE, a literature review is carried out where the relationship between the concepts is deepened. Then, a summary is made of the way in which the CE has been approached in Portugal and the research questions are presented; Then follows the methodology section where the different phases followed in the systematic literature

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review are described; The results of this review are presented and discussed below, concluding the study with the presentation of the main conclusions.

2. LITERATURE REVIEW

2.1. SUSTAINABILITY AND CE CONCEPTS

Sustainability

Sustainability has been the subject of wide debate, and there is still no consensus on the concept and its definition, given its complexity and scope, with more than 300 definitions of sustainability (Geissdoerfer et al., 2017). The term sustainability is often used as equivalent to sustainable development (SD) (Geissdoerfer et al., 2017) which is defined as "development that meets the needs of the present without compromising the ability of future generations to meet their own needs" (Brundtland, 1987). The Triple Bottom Line (TBL) approach is based on a triple vision that assumes a balance between the three dimensions of economy, environment and society (Elkington, 1997) has figured as the basis for the operationalization of the concept. Based on the TBL concept, Geissdoerfer et al. (2017) define sustainability as "the balanced and systemic integration of economic, social and environmental performance within and between generations".

Circular Economy

The concept of CE has gained importance since the 1970s, with several definitions of CE appearing in the scientific literature (Geissdoerfer et al., 2017; Fonseca et al., 2018). For example, Geissdoerfer et al. (2017, p. 3) define CE as "a regenerative system in which resource input and waste, emission, and energy leakage are minimized by slowing, closing, and narrowing material and energy loops. This can be achieved through long-lasting design, maintenance, repair, reuse, remanufacturing, refurbishing, and recycling". For Murray et al. (2017), CE can be defined as an economic model wherein resourcing, purchasing, production, reprocessing is designed to consider environmental performance and human well-being. This model means changing the linear economic model "resource – product – waste", which raises economic, environmental and social concerns, since it depletes resources and pollutes the environment, to a "resource – product – waste – renewable resource" model, which translates into the use of resources more effectively and more protective of the environment (Ying & Li-jun, 2012). According to the Ellen MacArthur Foundation (2012), CE aims to leverage global sustainable production and consumption through the implementation of closed loops and regenerative and restorative

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physical and economic cycles and the combination of maintenance, repair, reuse, renovation, remanufacturing and recycling processes. To promote economic development and environmental conservation, the CE thus incorporates policies and strategies that seek a more efficient consumption of energy, materials and water and a waste management that reduces those that return to the environment (Geng et al., 2013; Centobelli et al., 2021).

For an effective implementation, CE requires implementation at three levels (micro, meso and macro). Liu et al. (2018) and Li et al. (2010) define these levels as follows: i) Micro level – CE practices are implemented at company level and include cleaner production, eco-design, green purchasing/consumption and product recycling or reuse practices; ii) Meso level – CE practices focus on developing eco-industrial parks. An eco-industrial park can be defined as "a community of businesses aiming to synergistically achieve joint economic and environmental gains by effectively and efficiently utilizing resources (Côté & Cohen-Rosenthal, 1998); iii) Macro level – CE represents a new pattern of economic operation and aims to create a recycling-oriented society (Li et al., 2010). At this level, CE can be used to understand regional or national scale flows of resources and materials (Murray et al., 2017).

In line with the CE concept, specific CE practices are defined in literature such as eco-design, reuse, refurbishment, remanufacturing, repair, product sharing, and industrial symbiosis (Lombardi & Laybourn 2012). Other approaches consider cleaner production and internal environmental management as practices, or categorise CE practices according to frameworks such as the 9R Framework of Circular Approaches (Potting et al., 2017). Since there are different approaches regarding CE practices, we must admit that there may be overlaps between the practices considered (Schroeder et al., 2019). There are several factors that motivate the implementation of these practices: the environmental benefits that result from the adoption of CE. For example: consumption fewer environmental emissions, decrease in resources (EEA, 2016); increased competitive advantage as a result of cost reduction (Masi et al., 2018); and, decreased risks (Rizos et al., 2017). On the other hand, there may be resistance to the implementation of these practices by managers and workers (Liu et al., 2014). Lack of knowledge about CE, lack of technologies and reduced consumer demand for green products are, among others, barriers for the CE to consider (Rizos et al., 2017).
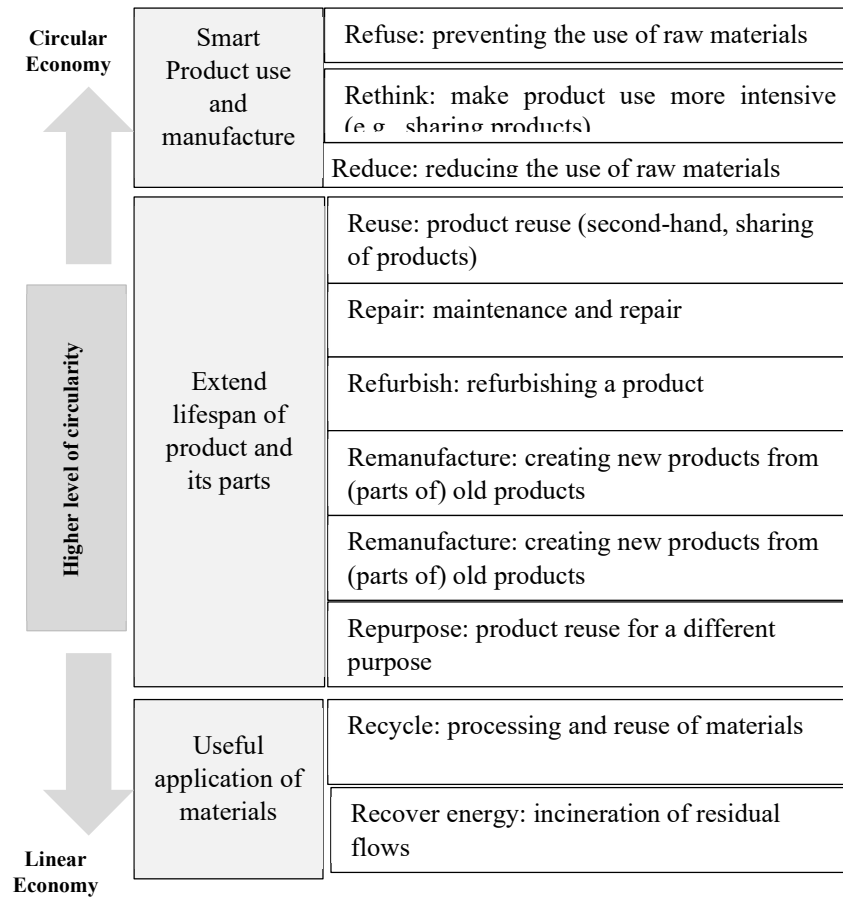
	Smart Product use and manufacture	Refuse: preventing the use of raw materials
		Rethink: make product use more intensive (e.g. sharing products)
		Reduce: reducing the use of raw materials
	Extend lifespan of product and its parts	Reuse: product reuse (second-hand, sharing of products)
		Repair: maintenance and repair
		Refurbish: refurbishing a product
		Remanufacture: creating new products from (parts of) old products
		Remanufacture: creating new products from (parts of) old products
		Repurpose: product reuse for a different purpose
	Useful application of materials	Recycle: processing and reuse of materials
		Recover energy: incineration of residual flows

Figure 1. The 9R Framework of Circular Approaches

Source: Adapted from Potting et al. (2017, p. 5)

As can be seen in Figure 1, only a few practices are related to waste management such as recycling or recovery. The CE goes further and also seeks to reduce the consumption of materials and this goal can be achieved through practices such as Reuse or Repair.

2.2. CE AND SUSTAINABILITY LINKAGES

Despite the growing interest of the CE and sustainability in academic terms, Geissdoerfer et al. (2017) argue that their concepts are not explicit in the literature. The authors seek to clarify these concepts by identifying differences and similarities between. Table 1 shows some of the most relevant differences and similarities.

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Table 1. Similarities and differences between CE and Sustainability

Similarities	Differences		
		Circular Economy	*Sustainability*
o More agency for the multiple and coexisting pathways of development o Global models o Integrating non-economic aspects into development o System change/design and innovation at the core o Multi-/interdisciplinary research field o Potential cost, risk, diversification, value co-creation opportunities o Cooperation of different stakeholders necessary o Regulation and incentives as core implementation tools o Central role of private business, due to resources and capabilities o Business model innovation as a key for industry transformation o Technological solutions are important but often pose implementation problems	o Origins of the term	o Different schools of thought like cradle-to-cradle, regulatory implementation by governments, lobbying by NGOs like the EMF, inclusion in political agendas, e.g., European Horizon 2020	o Environmental movements, NGOs, non-profit and intergovernmental agencies, principles in silviculture and cooperative systems
	o Goals	o Closed loop, ideally eliminating all resource input into and leakage out of the system	o Open-ended, multitude of goals depending on the considered agent and her interests
	o Main motivation	o Better use of resources, waste, leakage (from linear to circular)	o Diffused and diverse reflexivity and adaptive/past trajectories
	o What system is prioritised? o To whose benefit?	o The economic system (hierarchical) o Economic actors are at the core, benefitting the economy and the environment; Society benefits from environmental improvements (less resource depletion and pollution) and certain add-ons and assumptions, like more manual labour or fairer taxation	o Triple bottom line (horizontal) o The environment, the economy, and society at large.
	o Perceptions of responsibilities	o Private business and regulators/policymakers	o Responsibilities are shared, but not clearly defined

Source: Adapted from Geissdoerfer et al. (2017)

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In the literature, several studies highlight the relationship between CE and sustainability and sustainable development (SD) (e.g., Korhonen et al., 2018; Suarez-Eiroa et al., 2019). Some authors (e.g., Suarez-Eiroa et al., 2019) emphasize the proximity between the different concepts of CE and sustainability and the positive contributions that CE can have to sustainability. Ying and Li-jun (2012) consider that in addition to the benefits at an environmental level, the CE has positive effects at the economic and social level, which is in line with the concept of SD. However, Geissdoerfer et al. (2017) conclude that the type of relationship between concepts is not always consensual.

Another aspect present in the discussion about CE and sustainability is how these approaches relate to the three dimensions of sustainability. The CE's contribution to environmental and economic performance is recognized (Sarkis, 2012). However, attention to the social dimension is considered to be less developed or as there is empirical evidence of the CE's contributions to a social dimension (Suárez-Eiroa et al., 2019), being even ignored in the CE conceptualization. For example, Fernandez et al. (2014) state that the social sphere has no place in the concept of CE, although it can be included as a long-term effect of CE. The lack of attention to the social dimension can be verified even through an analysis of CE definitions present in the literature. Kirchherr et al. (2017) conclude, based on an analysis of 114 CE definitions, that most definitions focus on the economic and environmental dimension: 46% emphasize economic benefits as the CE objective; between 37% to 38% highlight environmental benefits, and the remaining definitions (18 to 20%) consider social equity. Only 13% of the definitions of the three dimensions of sustainability. Kirchherr et al. (2017) point out that this reveals the lack of a holistic sustainability perspective in the conceptualization of the CE. On the other hand, the focus on the social dimension is also seen when analyzing the indicators used to measure and document the CE's progress at the micro level. In light of the above, several authors highlight the need to pay special attention to the social dimension of sustainability in the CE in order to highlight the contribution of this approach to sustainability (Geissdoerfer et al., 2017; Kristensen & Remmen, 2019; Walker et al., 2021).

2.3 CE IN PORTUGAL

CE concept has been introduced at the global scale. CE initiatives occur in countries and regions such as the EU, the USA, Japan, Korea, China and Vietnam (Ghisellini et al., 2016;

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Fonseca et al., 2018). The EU has defined its own plans for the CE (European Commission, 2015). In 2015 the EU adopted the first CE action plan. In 2020, the EU launched a new Action Plan for the CE with a view to accelerating the change required in the context of the European Ecological Pact and based on the actions developed in the field of the circular economy since 2015. The new plan includes measures to help stimulate Europe's transition towards the circular economy, boost global competitiveness, foster sustainable economic growth and generate new jobs. This plan proposes a set of measures whose objectives are: to ensure the sustainability of the products; empower consumers; focus action on the most resource intensive sectors where the potential for circularity is high; and, the reduction of waste production (EU, 2021). Portugal, a member of the EU, approved in 2017 an Action Plan for the CE aligned with the European pillars of the CE (Portuguese Government, 2017). As mentioned above, CE can be implemented at three levels: macro, meso and micro. With regard to Portugal, several studies have been carried out seeking to analyse various CE initiatives at national and regional level (e.g., Medeiros, 2020), at the level of industrial symbiosis (e.g., Medeiros, 2020) and also at the micro level, focusing on in companies and products. However, and although companies play an important role in the results at the national level, constituting an engine for the transition to an CE, research studies focusing on Portuguese companies are scarce (CIP, 2021; Fonseca et al., 2018). Thus, research concerning the motivations, the barriers, the knowledge, the adoption and the suggestions to promote CE within Portuguese companies is required. This study focuses on CE at the micro level, more specifically on companies, and our objective is to know the main insights presented through scientific literature on CE in Portuguese companies. Considering the importance of CE for sustainability and the need to know how this approach is applied in Portuguese companies, the following research questions were defined, which will serve as the basis for our analysis and guide our research:

RQ1. How is CE implemented in the Portuguese companies?

RQ2. What are the main motivations and barriers to CE in the Portuguese companies?

To answer these questions, a detailed literature review was made as the main methodology.

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3. METHODOLOGY

The Systematic Literature Review was the method selected to answer the research questions. A systematic literature review is defined as "a systematic, explicit, and reproducible design for identifying, evaluating, and interpreting the existing body of recorded documents" (Fink, 2005, p.3). It is a decisive tool that supports mapping, consolidating and evaluating the existing theoretical and empirical work "that allows reasonably clear conclusions to be reached about what is and is not known," (Denyer & Tranfield, 2009, p. 671), in a replicable and transparent process. It also allows developing the scope of further opportunities through identifying key research gaps in the existing body of research (Tranfield et al., 2003). The process employed in this type of review is replicable and transparent (Tranfield et al., 2003). A systematic literature review reviews the existing literature based on a set of search criteria. We adopted the process model proposed by Tranfield et al. (2003) that admits the two-phase approach. The first phase consists of a set of steps related to Material Collection: i) Scope of the research work, ii) Generation of keywords, iii) Database Selection, iv) Sample selection. The second phase includes several steps related to Content analysis: i) Preparation of analysis, ii) Specification of categories, and iii) Data collection and analysis

The objective of our study led to the definition of keywords for the selection of articles to be analyzed. The following keywords were used: "Circular economy" or "CE" or "industrial symbiosis" or "circular business" AND "Portugal" or "Portuguese" AND "organization" or Organization" or "company" or companies" or "sector" or "industry" and the search made sequentially by title, terms (subject) and abstract. The search was carried out on B-on, a platform that integrates several databases (Academic Search Complete, Business Source Complete, Science Direct, MEDLINE, JSTOR Journals, IEEE, Springer, ISI, Web of Science, Elsevier, Wiley Interscience, Taylor and Francis, Emerald, Complementary Index, Directory of Open Access Journals, Academic Search Complete, MEDLINE). For the purpose of selecting the articles obtained in the database search, the PRISMA (2020) approach was used.

To obtain the sample to be analyzed, several inclusion and exclusion criteria were established, which allowed the selection of material. In a first phase, articles published between January 2006 to 2021 were considered for the analysis. The time period was chosen because there is a large increase in publications on CE after 2006 (Merli et al., 2018). Since the CE is a concept that have received attention from both academia and practice the search was extended to gray and practical literature (Homrich et al., 2018; Merli et al., 2018; Reike

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et al., 2018). All studies were included regardless of the methodology used, as this could allow for greater knowledge on the topic. The Figure 3 shows the documents selection process. In this process, some exclusion criteria were defined, even having to obtain the sample for analysis: duplicate material was excluded, and those that do not meet the main objective defined in this study as those that focus on the EC at the macro and meso level and outside the Portuguese context. In the end, it resulted in 12 documents for analysis: 8 academic articles and 4 master's theses.
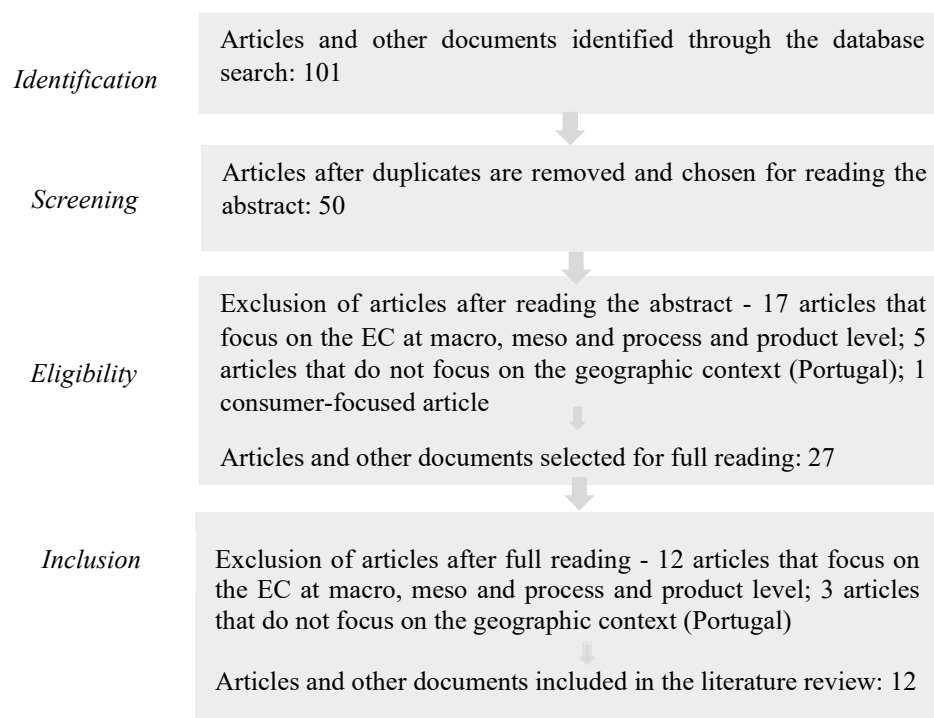
Identification	Articles and other documents identified through the database search: 101
Screening	Articles after duplicates are removed and chosen for reading the abstract: 50
Eligibility	Exclusion of articles after reading the abstract - 17 articles that focus on the EC at macro, meso and process and product level; 5 articles that do not focus on the geographic context (Portugal); 1 consumer-focused article
	Articles and other documents selected for full reading: 27
Inclusion	Exclusion of articles after full reading - 12 articles that focus on the EC at macro, meso and process and product level; 3 articles that do not focus on the geographic context (Portugal)
	Articles and other documents included in the literature review: 12

Figure 3. Process of research articles selection
Source: Adapted from diagram PRISMA

The second phase of the systematic review includes content analysis. For this, some categories of analysis were defined by theme. This categorization is important to know the main trends in publications (Ferreira Gregorio et al., 2018). Table 2 presents the categories defined for content analysis.

Table 2. Categories defined for content analysis

Categories	Description
Research objectives	Objectives defined in the studies (Correia et al., 2017)
Theoretical/conceptual framework	Works based mainly on the definition of concepts and the theoretical framework of the topics (Ferreira Gregorio et al., 2018)
Empirical	Experimental design (e.g., experimental empirical design), statistical sampling (e.g., surveys or expert panels), case studies, content analysis, mixed methods (Correia et al., 2017)
Sectoral application/cluster	Applications of the studied topics in a specific sector or in a cluster of companies (Ferreira Gregorio et al., 2018).

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CE motivations	Companies` motivations to adopt CE`s initiatives and practices (Authors' definition)
CE barriers	Identified barriers by companies to adopt CE (Authors' definition)
CE practices	Elements for the transformation to systems of sustainable consumption and production (UNEP, 2012)
CE implementation assessment	Instruments and tools used by companies to the implementation of CE (Authors' definition)

Source: Authors` own elaboration

4. RESULTS` PRESENTATION AND DISCUSSION

This section starts by analyzing the publication character of articles relating to its objectives, methodology and sector of application in applicable studies. Table 3 presents this information. One aspect that stands out is the recent nature of the studies. Despite the period of analysis being from 2006 to 2021, we only found studies involving Portuguese companies from 2015 onwards, which may be related to the attention placed in the CE at European and national level with the approval and dissemination of Action Plans for the CE of the EU and Portugal in 2015 and 2017 respectively. As can also be seen, there is great diversity in terms of activity sectors in most studies. In methodological terms, empirical studies using a wide variety of methods prevail.

Table 3. Objectives, Types of study/methodology and Sector of activity of the articles in the sample

Author(s)	Main objective(s)	Type of study/ Methodology	Activity sector
Droege et al. (2021)	To present the challenges that currently prevent public sector organizations from implementing CE assessment and derives strategies to overcome them.	Empirical/ Case study	Public administration
Ramos and Martinho (2021)	To evaluate the relationship of the presence of environmental technicians, registration of the construction and demolition waste generated, commitment to the legal framework, the subcontracting regime, and construction works' oversight with construction company size.	Empirical/ Survey	Construction industry
Ferreira and Matias (2021)	To map competencies of technology centers to support companies in the transition to the CE.	Empirical/ Survey	Technological Interface Centers (Technological Centers, Technology Transfer Centers, Institutes of New Technologies)
Ferreira et al. (2019)	To study the CE in the pulp and paper industries in Portugal and Spain and to develop a comparative index to support a cross-country analysis	Empirical/ Mixed methods (interviews and Index development)	Pulp and paper industries of Portugal and Spain
Marmelo (2019)	To know the CE implementation practices in the companies of textile and clothing industry	Empirical/ Case study	Textile and clothing

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Oliveira et al. (2019)	To propose an integrative approach for wine production, where a simple calculation model has been developed and validated to preview water consumption and wastewater production,	Empirical/ Case study	Wine industry
Fonseca et al. (2018)	To provide knowledge that can support successful moves towards CE in Portugal through the identification of factors that might promote CE and its models and practices.	Empirical/ Survey	Various sectors: Industry, Services, Commerce, Construction and others activity sectors
Pizarro (2018)	To identify and analyse the barriers and the incentives to the implementation of new models of business in the CE area.	Empirical/ Survey	Various sectors (Logistics, transport and financial activity, wine and olive industry, metalworking, electricity, chemical industry)
Rocha (2018)	To know the CE implemented practices	Empirical/ Case study	Wine and olive industry
Rodrigues (2018)	To analyze the CE implementation in Portugal	Empirical/ Case study	Various sectors (food, distribution, finance, footwear, cork, waste treatment)
Marques et al. (2017)	To analyze the wastes on Portuguese footwear industry	Empirical/ Mix methods (case study and sectorial and statistics data)	Footwear industry
Leal (2015)	To know some of the CE practices, the advantages and barriers of implementation of a new business model	Empirical/ Mix methods (survey and case study)	Various sectors (textile, cork, metalworking, hygiene and cosmetics, packaging, wood processing and footwear)

Source: Authors' own elaboration

CE Practices

The analysis of the various studies in the sample allowed us to identify some of the CE practices implemented in Portuguese organizations/companies and thus respond to RQ1.

One of the practices most discussed in the studies are those related to waste management. For example, Marques et al. (2017) draw attention to the importance of the footwear industry in Portugal and the large amount of waste produced by it. This situation has major environmental impacts that can be reduced through waste management practices and the opportunity to search new solutions, involving design in several dimensions and approaches. Waste management is also one of the practices analysed by Leal (2015). This study seeks to analyze whether companies are familiar with the CE model and if they use some of the CE practices in 10 companies from different sectors of activity (textiles, cork, metalworking, hygiene and cosmetics, packaging, wood processing and footwear). It is noteworthy the fact that companies remain in a linear model where products are not designed to be reused. According to the data collected, companies in terms of waste management practices, recycle some waste with low recycling rates, but these are destined for landfills and incinerators.

Ramos and Martinho (2021), although not analysing waste management practices, do analyze, in construction companies, some factors that can influence this management and that are associated with the size of these companies.

Aiming to know the CE implementation practices in textile and clothing industry companies in Portugal, Marmelo (2019) analysed 5 cases. Practices relating to the implementation of CE were found, such as recycling materials and their integration in the production process, reusing clothing through its reuse or temporary rental and increasing the durability of materials, which promotes the extension of the lifespan useful products. Similarly, Rocha (2018) analysed the case study of a group of companies linked to the production of wine and olive oil, seeking to know how companies put CE concepts into practice. As for the study mentioned above, the focus was placed on waste management. The study analyses the various management practices of the company to reduce environmental impact in the following categories: "Refuse", "Rethink", "Reduce", "Reuse", "Repair", "Recondition", Remanufacture", "Relocate", " Recycle" and "Valorise". Several actions and initiatives that fall under these practices are presented. The possibility and opportunity of transforming grape pomace residues into new value-added products (e.g., biofuel) was also analysed. Fonseca et al. (2018) use the 9R framework (see Figure 1) to question organizations about the actions taken. As most important, the following are considered: promoting the improvement of productivity and efficiency of processes, segregate and value waste (residues), recycle waste (residues) and raw materials and reduction of raw materials and energy consumption.

Rodrigues (2018) analyze the implementation of CE in Portuguese companies from different sectors of activity. They describe different projects associated with each of these companies that seek to reduce the environmental impact and/or can be examples of sustained circularity in the Sustainable Circular Business Model approach. However, they do not directly address CE practices.

Motivations, Enablers and Barriers

The implementation of CE can be promoted in organizations based on various motivations, existing conditions and support that facilitate this implementation and barriers that are obstacles to it. The results of the analysis of the studies present in the sample and which allow answering RQ2 are described below.

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The results of the study carried out by Fonseca et al. (2018) shows that Portuguese companies identify as the three most important factors for the implementation of the CE, in descending order: the need for the Academy to focus on the dissemination and creation of knowledge in the CE; the existence of a tax (fiscal) policy that positively discriminates organizations that work in the CE, and the need for the Government to take legislative initiatives to support the CE. Without these conditions in place, the transition to the CE becomes more difficult. This transition is, for Ferreira and Matias (2021), the complex and multifaceted process that requires the acquisition of new competences and knowledge. The authors emphasize that technology centers can play an important role in supporting the implementation of CE by Portuguese companies. Its study seeks to identify the main competences of these centres. The results show that these centers have competences mainly in the areas of Eco-design and Guidance and Awareness. Resource Efficiency is the domain with the least richness in competences. Thus, the intervention of these centers will tend to be more intense in supporting companies in the areas in which they have more skills. Considering that the Portuguese business fabric is mostly made up of small and medium-sized companies, as seen in Europe (Rizos et al., 2017), and that these have the monetary and financial resources and whose skills shortages in the CE area are scarce (CIP, 2021), these results should have the attention of political agents.

Pizarro (2018) intends to identify not only the incentives that act as a lever for the implementation of circular business models, as well as the barriers that act as an impediment to it. The analysed companies belonging to different activity sectors identify as main motivations the need for innovation, the possible economic benefits for the company and the company's environmental concern. Government support and consumer pressure are seen as less relevant motivations. The companies point out as the main barriers: the habits and mindsets of consumers; and, the lack of strategic guidelines, information and support for the transition to more circular business models. Legislation, the large investment required for the transition and the risk associated with it, as well as technological limitations are also significant obstacles (Pizarro, 2018). For Leal (2015), this model is considered by the companies analysed as of little advantage as it produces recyclables. it increases the cost of production and the final product which can lead to the loss of customers.

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Ramos and Martinho (2021) focus only on companies in the construction sector and focus on conditions for more effective waste management. Their study assesses the relationship between the size of construction companies that is associated with factors that can influence waste management practices. Through the statistical treatment of data obtained through a questionnaire, the authors conclude that the dimension influences the conditions for waste management. Larger companies have specialized technicians with knowledge in the environmental area, more information on procedures in relation to legal requirements. For example, registrations at the waste platforms, which are mandatory for these companies, are done consistently only by large or medium-sized companies. Most micro and small companies have knowledge gaps about the adopted waste management practices. For example, in relation to Incorporation of recycled materials in public construction works by Portuguese construction companies, many do not know if they meet the goals defined in legislative terms for companies in the sector.

The majority of CE assessments are implemented in private companies and implemented in public sector organizations is low. Droege et al (2021), based on interviews of experts from the Portuguese public organizations, verify that public sector organizations also face barriers to the implementation of CE. Cultural barriers and resistance to change are considered to be the main challenges. In terms of cultural barriers, the lack of leadership commitment is particularly important. In structural barriers, the voluntary nature and a missing clear governance for CE assessment are considered very important. Technical (e.g., difficulties in selecting a and adequate CE assessment approach) and financial (e.g., lack of skilled people) challenges, contrary to previous findings of the literature, are not prioritized and are seen as a result of the cultural and structural challenges.

Table 4 presents a synthesis of the main motivations and barriers addressed in the studies present in the sample.

Table 4. Motivations and barriers mentioned in the studies

Motivations	Barriers
To reduce costs (Fonseca et al., 2018)	Resistance to change (Droege et al., 2021)
To seize the opportunity of the transition to CE (Fonseca et al., 2018)	Lack of leadership commitment (Droege et al., 2021)
To improve environmental performance and create environmental value (Fonseca et al., 2018; Oliveira et al., 2019; Pizarro, 2018)	Missing clear governance for CE assessment (Droege et al., 2021)
To have a better access to raw materials to prevent its scarcity (Fonseca et al., 2018)	High production costs (Leal, 2015)

To improve profitability (Fonseca et al., 2018; Pizarro, 2018))	Potential loss of customers (Leal, 2015)
To acquire new competencies (Fonseca et al., 2018)	Consumer habits and mindsets (Pizzaro, 2018)
Answer to external pressures to adopt CE (Fonseca et al., 2018)	Lack of strategic guidelines, information and support for the transition (Pizzaro, 2018)
To have access to novel markets and consumers (Fonseca et al., 2018)	Legislation (Pizzaro, 2018)
Desire to have a sustainable business model (Fonseca et al., 2018)	Large investment needed for transition (Pizzaro, 2018)
Need for innovation (Pizarro, 2018)	Risk associated with transition (Pizzaro, 2018)
	Technological limitations (Pizzaro, 2018)

Source: Authors' own elaboration

From the analysis of the sample, it was possible to identify another theme related to CE present in some studies: the CE implementation assessment.

CE implementation assessment

One of the aspects mentioned in the CE literature is the need to assess CE progress and have instruments that allow benchmarking. Some of the studies analyzed focus on these issues. Oliveira et al. (2019) seek to develop a 'Global Indicator' of wastewater production. The study focuses on the wine industry. To respond to the demands of this industry in relation to a more integrated environmental management, the authors seek to develop one whose interest for this industry lies in the fact that it is a major consumer of this resource, which is increasingly scarce. The suggested approach aims at 'closing the cycle' by reusing treated industrial wastewater onsite. This plays a key role in wine production water management.

Ferreira et al. (2019) develop a cross-county study comparing the CE situation of companies in the pulp and paper industry sector in Portugal and Spain. The comparison is based on an index that incorporates several indicators associated with the pulp and paper industries' environmental and production variables such as: i) eco-efficiency indicators (Wood utilization, energy consumption, inefficiency of water usage, CO2 emissions, and solid waste depositions in landfill); ii) reuse indicators (Reuse of water, use of biofuels, industrial symbiosis).

5. CONCLUSION

The aim of this study is to know the state of the art on the implementation of CE in Portuguese organizations, namely regarding the type of CE practices implemented, the motivations and barriers to this implementation. To this end, a systematic literature review

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was used as a methodology. The results of this review allow us to conclude that studies on this topic involving organizations in the Portuguese context are very scarce in the literature. Even so, we can conclude that most of them emphasize the implementation of practices associated with waste management, which means that efforts towards circularity are still not intense. In fact, practices linked to the smarter use of resources or that seek to prolong the life of products and their components are less highlighted. On the other hand, the barriers mentioned are of different order: from legislation and the lack of guidelines and support in the transition process, to the high investments and lack of adequate technologies. These barriers deserve to be highlighted since the Portuguese business fabric is mostly made up of SMEs and these usually have less important resources for this transition (CIP, 2021). The most relevant motivations are: the desire to improve environmental performance, reveling companies' environmental concern; and the companies' possible economic benefits such as to improve profitability.

It should be noted that the studies in the sample are very small in number, which constitutes a limitation of this study. For the literature review only, academic databases were used. Future studies may extend the search to other databases, including databases of organizations such as business associations and similar ones, as the CE has received attention from both academia and practice. In addition, the articles analyzed focus on very different sectors and mostly use case studies. Thus, categorical conclusions cannot be drawn either in relation to the implemented practices or in relation to the motivations and barriers in the implementation of CE practices in Portuguese organizations. This results in new opportunities for future research. More in-depth and detailed studies on organizations are needed to provide a broader perspective of the Portuguese reality and to understand how Portuguese organizations are making the transition to the CE. They are particularly interested in research in the sectors defined as priorities in the Action Plan for CE of the EU. The EU defines as the focus of action those sectors that use the most resources and where the potential for circularity is high, such as textiles, construction, buildings, plastics, food, packaging, batteries and vehicles, and electronics and information and communication technologies (EU, 2021).

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