

Chapter 23

Circular Economy Supporting Policies and Regulations: The Portuguese Case



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Abstract Construction is one of the critical sectors in the transition to a Circular Economy due to its contribution to resource depletion, waste, and emissions. Despite its acknowledged limitations (e.g., low productivity), the construction sector has been the focus of policies and regulations to improve its sustainability and circular economy capabilities. This study focuses on circular economy policies and regulations related to the construction sector in the European Union and Portugal, identifying political and regulatory barriers and opportunities. The analysis identified a growing number of publications since 2019 and divided the policies and regulations for the Circular Economy into four areas: Resource and Waste Management, Sustainable Development Goals, Green Public Procurement, and Circular Economy. Four main barriers were identified: policies and regulations harmonization, digital innovation (within the twin transition), support to the transition (e.g. financial and educational), and clear and focused governance models. It then discusses the documents and barriers, analyzes the Portuguese strategy (Portuguese Action Plan for Circularity in the Construction Sector), and proposes a strategy to be followed by other countries. The findings provide a holistic understanding of why policies and regulations fail to support Circular Economy day-to-day practices and provide insights on how to trigger the transition.

Keywords Construction sector · Circular Economy · Policies and regulations

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23.1 Introduction

Worldwide, the Construction Sector (CS) has been following a linear production and consumption model—based on a “take/make/dispose” approach—with the main focus on the economic dimension [1]. When considering the European built environment, the CS is responsible for approximately 50% of natural raw material consumption, 30% of the waste generated, and 30% of greenhouse gas (GHG) emissions [2]. This inefficient approach continues to contribute to the depletion of non-renewable virgin resources, the generation of GHG emissions and waste, and the loss of biodiversity, colliding with the Sustainable Development Goals (SDG) [3].

The transition to a circular CS is imperative to overcome these burdens and contribute to waste and pollution elimination, avoid raw material depletion, and nature regeneration goals [4]. However, the resistance to change, the CS complexity (e.g., long life span, different materials, and numerous stakeholders), and the lack of productivity associated with the resistance to adopting digitization (proven to boost productivity and efficiency [5]), are significant barriers to the transition to a Circular Economy (CE)—based on a “return/(re)make/(re)use” approach [6–8]. This context led the European Commission to draw policies and regulations framing CE objectives and goals to support this paradigm shift [9–12], after being translated by different stakeholders (mainly industry leaders and policymakers) in each member-state. The growing literature focuses on the barriers and opportunities for CE adoption in the CS [8, 13, 14], and policies and regulations framing CE objectives through the slowing, narrowing, and closing of material and energy loops. However, these studies [7, 15–18] present a broad scope, simultaneously presenting distinct realities (countries) and neglecting each country’s specificities: stakeholder needs, industry leaders, and policymakers.

Focusing on Portugal, this study reviews the EU and Portuguese policies and regulations and identifies the perceived barriers and opportunities. Considering the CS, three main objectives were recognized: *(i)* mapping and relating the main policies and regulations for adopting a CE in the EU and Portugal; *(ii)* identifying the barriers and opportunities; and *(iii)* discussing possible strategies to overcome the barriers to CE adoption. As a result, this study aims to provide an integrated understanding of the main causes of the unsuccessful transition to CE in the CS, namely between the existing policies and regulations and the identified barriers and opportunities. The paper is organized into four sections: Sects. 23.1, 23.2, 23.3 and 23.4.

23.2 Research Methodology

23.2.1 Research Strategy

This research strategy includes two complementary approaches: (i) documental research to identify the circular economy (CE) main policies and regulations published by the EU and Portugal; (ii) working sessions with Portuguese construction industry stakeholders to recognize policy and regulation barriers and opportunities in CE adoption.

First, the document research categorized and characterized the policies and regulations published by the EU and their influence on the Portuguese context. To draw the regulatory framework, the websites of European and Portuguese organs responsible for policies and regulations were mapped to evaluate the adoption of a CE.

Afterwards, the working sessions with the main stakeholders allowed to identify, prioritise, and categorise the critical barriers and opportunities felt by Portuguese stakeholders in the Construction Sector (CS) in the CE adoption within policies and regulations. This research strategy was based on design thinking and discussion sessions in which all stakeholders were represented, as discussed in Tavares and Pedroso [19].

23.2.2 Data Collection

Data collection was undertaken between January 2021 and November 2022, considering only the CE documents influencing the CS. The document research started by querying the following sources: European Commission Environment [20], EUR-Lex [21], Journal of the Republic (*Diário da República*) [22], Portuguese Environment Agency (APA) [23] and the National Laboratory for Civil Engineering (LNEC) [24] using the following keywords (also in Portuguese), isolated or combined with synonyms and acronyms: ‘Circular Economy’, ‘barriers’, ‘opportunities’, ‘Construction and Demolition Waste’, ‘Green Public Procurement’, ‘resources’, ‘Sustainable Development Goals’, ‘sustainable’, and ‘decarbonization’. Although the EU showed concerns about raw materials depletion for many years, the document “Towards a circular economy” [25] was only published in 2014 with the clear objective of adopting CE across the EU and economic sectors. Therefore, 2014 was considered the most relevant starting point.

The sessions, further discussed by Tavares and Pedroso [19], were possible due to the project that funded the execution of the “Portuguese Action Plan for Circularity in the Construction Sector” [26]. These eleven sessions took place between January 2021 and November 2022, allowing to: (i) identify barriers, (ii) prioritize those barriers and (iii) identify opportunities. Altogether, the sessions [27] involved more than 800 Portuguese individuals connected to the CS, with the following distribution: Academia and research centres (10%), Contractors and builders (16%), Demolition

and CDW management teams (3%), Manufacturers (6%), Government and regulators (14%), Investors, developers, and insurance providers (4%), Designers (17%), Users and owners (30%).

23.2.3 Data Analysis

During documental research, relevant data were extracted from each document into an Excel matrix, including the document name, type, publication date, sectorial scope, and a summary of its objectives and goals. This information was analysed, and documents were removed when redundant, old (before 2014), or had limited influence on the CS.

The identified barriers and opportunities were then divided and organized according to priorities into different pillars, following the methodology presented by Tavares and Pedroso [19] and others [8, 28]. This paper focuses on Policies and Regulations.

23.3 Results and Discussion

23.3.1 Policies and Regulations Linked to CE in the EU and Portugal

The EU Framework

Table 23.1 presents the results obtained for the EU document search in terms of the main policies and regulations regarding the adoption of circular economy (CE) with a focus on the construction sector (CS), since 2014.

Although CE started to be more relevant in 2014, most CE-related documents were published in 2020, due to the publication of “*The European Green Deal*” in 2019, considered to be the document which started this transition.

After “*The European Green Deal*”, several aspects were addressed through different instruments such as green financing (e.g., EU Taxonomy) and major policies (e.g., Renovation wave and NEB) promoting the adoption of sustainability and CE goals in the CS. The most recent documents promote the CS twin transition (green and digital) aiming at increasing productivity, efficiency, decarbonization and circularity of the built environment, as in the “*Circular Economy—Principles for buildings design*” [12]. The growing number of documents published in the last four years shows the importance of CE adoption. When clustered, these documents follow four main topics: Resource and Waste Management (RWM), Sustainable Development Goals (SDG), Circular Economy (CE), and Green Public Procurement (GPP).

Table 23.1 Policies and regulations on CE in the EU (since 2014)

Name type date scope	Summary
Towards a circular economy (COM/2014/0398 final) Communication 2014 CC ●	Reduce carbon emissions, increasing energy efficiency, sustainable reindustrialisation of economy, and securing access to raw materials, whilst reducing environmental impacts and GHG emissions. Tackle Construction and Demolition Waste (CDW) challenges and use the “Resource efficiency opportunities in the building sector”
Resource efficiency opportunities in the building sector Communication 2014 CS ●	Promote efficient use of resources consumed by new and renovated commercial, residential, and public buildings and reduce their overall environmental impacts throughout the full life cycle
EU action plan for the CE (COM/2015/0614 final) Communication 2015 CC ●	Ensure recovery of valuable resources and adequate waste management in the construction and demolition sector and assess the environmental performance of buildings. Develop a monitoring framework for the CE
Green Public Procurement—Buying green! Book 2016 CC ●	Help public authorities buy goods and services to lower environmental impact which can also have benefits in terms of CE. Identifies office buildings and linear infrastructures, providing guides for them
A renewed EU Industrial Strategy (COM/2017/0479 final) Communication 2017 CC ●	Guidelines to strengthen the industry’s ability to adapt and innovate by facilitating investment in new technologies and embracing changes brought on by digitisation. Companies must upgrade the technology base, future-proofing business models, internalise sustainability principles and embrace innovation
Directive (EU) 2018/849 to 852 (PE/9 to 12/2018/REV/1) *All from 2018 CC ●	Guidelines to improve waste management in the EU, to protect, preserve, and improve the quality of the environment, protect human health, ensure prudent, efficient, and rational utilisation of natural resources, promote the principles of the CE, and reducing the dependence on imported resources
Measuring progress towards CE —(COM(2018)29 final) Communication 2018 CC ●	Establishes the framework to measure progress and assess the effectiveness of actions towards CE in the EU. Concerns towards the construction sector and the raw materials consumed and waste generated. The recovery rate of construction and demolition waste: mandatory with a recovery target (70% by 2020) under the Waste Framework Directive (2008/98/EC)

(continued)

Table 23.1 (continued)

Name type date scope	Summary
The European Green Deal (COM(2019) 640 final) Communication 2019 CC ●	Need for a ‘renovation wave’ of public and private buildings; enforces the energy performance of buildings; reviews the CPR; ensures that the design of buildings is in line with CE, and lead to increased digitalisation of the building stock. GHG emission targets to at least 50% and towards 55% (by 2030, considering 1990) and climate neutrality by 2050
Sustainable Europe Investment Plan Plan 2020 CC ●	The investment pillar of the European Green Deal to achieve its goals. The construction industry referred to contribute to climate neutrality in 2050
New Industrial Strategy (COM/2020/102 final) Communication 2020 CC ●	Address the sustainability of construction products and improve the energy efficiency and environmental performance of built assets. The world’s first climate-neutral continent by 2050, and creating 700,000 new jobs across the EU by 2030
Taxonomy Regulation (PE/20/2020/INIT) Regulation 2020 CC ●	Promotes the financing of the increase in the durability, reparability, upgradability, and reusability of products, but also the reduction of the use of resources through the design and choice of materials, facilitating repurposing, disassembly and deconstruction in the buildings and construction sector
Level(s) Framework 2020 CS ●	A common language for the sustainability performance of buildings. Entry point for applying CE principles in the built environment (16 indicators), promoting, among others, the reduction of GHG emissions, raw materials consumption, and CDW generated
A new Circular Economy Action Plan (COM/2020/98 final) Communication 2020 CC ●	Promotes CE principles throughout the lifecycle of buildings by: sustainability of construction products (revision of CPR); improving durability and adaptability; developing digital logbooks; integrating LCA in public procurement and the EU sustainable finance; revise material recovery targets for CDW; reduce waste and raw materials consumption; achieve the 2030 SDG and carbon neutrality in 2050
CE—Principles for Building Design Report 2020 CS ●	To inform and support stakeholders along the construction value chain about the principles for the circular design of buildings

(continued)

Table 23.1 (continued)

Name type date scope	Summary
A Renovation Wave for Europe (COM/2020/662 final) Communication 2020 CS ●	Decarbonisation and integration of renewables; Lifecycle thinking and circularity; High health and environmental standards; Twin challenges of the green and digital transitions. In the construction sector, double the annual energy renovation rate (by 2030) and foster deep energy renovations
New European Bauhaus (COM(2021) 573 final) Communication 2021 CS ●	Places, practices, and experiences that are: Enriching; Sustainable, in harmony with nature, the environment, and our planet; Inclusive; Provide citizens access to goods and constructions that are circular and less carbon-intensive, supporting regeneration and biodiversity
Proposed Directive on the energy performance of buildings (COM/2021/802 final) Communication 2021 CS ●	Vision for achieving a zero-emission building stock by 2050, focusing on energy efficiency and minimising whole life-cycle GHG emissions of buildings through resource efficiency and circularity. Require calculating the life-cycle Global Warming Potential (GWP) of new buildings. Prevention and high-quality treatment of CDW
Revision of GPP tba tba CS ●	Scope expansion to other buildings, in particular schools and social housing. Criteria proposal in line with recent policy developments relating to the Renovation Wave, the Level(s) framework, and the EU Taxonomy
Revision of the Construction Product Regulation (CPR) tba tba CS ●	Two objectives: (1) achieve a well-functioning single market for construction products; (2) contribute to the objectives of the green and digital transition
Ecodesign for Sustainable Products Regulation tba tba CS ●	Wide range of requirements, including: product durability, reusability, upgradability, and reparability; presence of substances that inhibit circularity energy and resource efficiency; recycled and remanufactured content; carbon and environmental footprints; Digital Product Passport

Caption CC ●—cross-cutting considering the CS; CS ●—dedicated to the CS

The Portuguese Framework

Table 23.2 presents Policies and regulations on CE in Portugal (since 2016). Although Portugal showed concerns towards sustainability since 2006 with Decree-Law 178/2006 (revoked by Decree-Law 102-D/2020) on waste management, only from 2016

Table 23.2 Policies and regulations on CE in Portugal (since 2016)

Name type date scope	Summary
New strategy to Green Public Procurement (Resolution 38/2016) Resolution under revision CC ●	Encourages a Green Public Procurement (GPP) policy for office buildings and linear infrastructures. Public Procurement budget contemplates environmental criteria until 2020, 40% rate in the business sector); and a 60% rate in direct and indirect state administration
Material specifications by the National Laboratory for Civil Engineering (LNEC) Specification 2016 CS ●	Establishment of the minimum requirements that a given material must comply with to be used (recycled). Increase the use of recycling and recycled materials in the Portuguese construction industry
Portuguese Circular Economy Action Plan (Resolution 190-A/2017) Resolution under revision CC ●	Increase the introduction of secondary raw materials into the economy. Reducing: waste production; the demand for raw (primary) materials; the emission of GHG; water consumption. Additionally, presents a framework to create an action plan for the construction industry
Legal Regime for Urbanization and Edification (DL 555/99 revision 118/2019) Decree-Law 2019 CS ●	It lacks further references to CE principles in the construction sector but addresses the need to treat CDW
Roadmap for Carbon Neutrality 2050 (Resolution 107/2019) Resolution 2019 CC ●	Establishes the trajectory to achieve carbon neutrality by 2050. CS should adopt CDW recycling, use natural materials, and lower the energy consumption. Compensation of emissions through land use and forests. Emissions reduction: 45–55% by 2030, and 65–75% by 2040 (ref 2005)
National Plan to Energy and Climate 2030 (PNEC 2030) (Resolution 53/2020) Resolution 2020 CC ●	Decarbonisation, energy efficiency, security of supply, internal energy market and research, innovation, and competitiveness. Lower GHG emissions through construction and buildings, incorporating renewable energy, energy efficiency, and energy security. Application of the RNC2050
General Waste Management Scheme (RGGR) (DL 102-D/2020) Decree-Law 2020 CC ●	Portuguese general waste management scheme (RGGR). CE in the CS: >70% (by weight) of materials prepared for reuse, recycling, and other forms of recovery, including site filling; >10% of recycled materials or incorporating recycled materials; reduce by 5% (by 2025) the amount of non-urban waste per GDP unit, and (by 2030) by 10% (ref 2018)

(continued)

Table 23.2 (continued)

Name type date scope	Summary
Public Procurement Code (CCP) (DL 18/2008 rectified by DR 25/2021) Decree-Law 2021 CS ●	Aligned with the previous GPP strategy. Promotion of CE, short distribution circuits and environmental sustainability. The sustainability and CE concerns can be (sub)factors of the award and tie-breaking criteria
Climate Law (Law 98/2021) Law 2021 CC ○	Public policy that addresses climate change goals applied crosswise (including CS). GHG reduction targets (ref 2005) exclude the use of soil and forests: (a) >55% (2030); (b) >65–75% (2040); (c) >90% (2050). Net CO ₂ eq sink in the land use and forestry sector >13 Mton (2045–2050)
Action Plan for Circularity in Construction in Portugal (PACCO) Plan 2022 CS ●	Guides the CS in the transition from a linear to a CE model with 30 measures and 100+ actions. Increase reuse and recycling to lower the depletion of virgin natural resources; lower GHG emissions by the built environment to contribute to the European 2030 and 2050 goals

Caption CC ○—cross-cutting considering the CS; CS ●—dedicated to the CS

(as in the EU was from 2014) appeared policies towards embracing CE principles, showing Portugal as an early adopter. Most documents were published or revised since 2019, showing the EU’s influence on national policies and regulations. Although the “*Action Plan for CE*” was published in 2017 [29], already identifying specific CE measures towards the CS, the “*Portuguese Action Plan for Circularity in the Construction Sector*” [26] was only published at the end of 2022. As in the EU, Portuguese documents on CE can be divided into the same four scopes: RWM, SDG, CE, and GPP.

The “*Material specifications*”, developed by the Portuguese National Laboratory for Civil Engineering, supports designers and other stakeholders in choosing materials (reused, recycled, etc.) and proposes tests (ideally non-destructive) to ensure their performance. However, these documents need to be revised (last publication in 2016). Additionally, the construction-specific legislation needs to be renewed to include reused and recycled materials, and aspects such as disassembly, adaptability, and flexibility.

23.3.2 *Political and Regulatory Barriers and Opportunities in Portugal*

Although numerous studies have identified CE barriers and opportunities in the CS, the ones identified in this study (Table 23.3) were obtained directly from different Portuguese stakeholders during the previously described sessions.

Since the economic driver in Portugal is crucial [30], a significant number of barriers are related to the lack of financial incentives and the need to create financial policies that promote and recognize sustainability (e.g. LCA and LCC methodologies) and CE efforts in both projects and companies. GPP can promote case studies, showing stakeholders the benefits of the transition to a CE, without compulsory measures.

Other barriers and opportunities are centred on documentation harmonization and interconnection, as well as policies, legislation, and regulations simplification with streamlined access. The definition of certain degrees of obligation and the need to make processes and procedures faster and more efficient (due to harmonization) were identified, with the twin transition being of significant relevance in this aspect.

23.3.3 *Discussion and Implications*

Policies and regulations mapping (in EU and Portugal) shows that since 2019, there is a rising concern regarding decarbonization and the adoption of a CE in the CS (e.g., by the document “*Circular Economy—Principles for buildings design*” [12]). Several EU documents have been published and influenced Portuguese policies and regulations, with Portugal being able to keep up with the most recent objectives. Nonetheless, Portugal can follow other countries’ examples (e.g., The Netherlands) to move forward in terms of CE in the CS, since the existing political and regulatory documents seem to lack clarity and assertiveness to the Portuguese stakeholders.

As described in Sect. 3.1, the EU and Portuguese policies and regulations intended to push this paradigm shift (linear to circular economy) can be divided into four large groups based on their scopes and descriptions: Resource and Waste Management (RWM), Sustainable Development Goals (SDG), Green Public Procurement (GPP), and Circular Economy (CE). This demonstrates the importance of articulation within each document macro-group. GPP can promote and finance case studies. RWM documents can support resources/waste identification and classification, which will support CE principles and procedures and how SDG objectives can be reached.

Barriers and opportunities identified by the Portuguese stakeholders were analysed, and aggregated into four groups: (i) **development of policies and regulations** properly integrated, thus supporting the transition through finance, case studies using GPP, and other mechanisms; (ii) **new and innovative digital tools and platforms** that allow, for example, to collect large amounts of data and convert it into information, thus supporting the twin transition (green and digital) and the conversion

Table 23.3 Political and regulatory barriers/opportunities identified by Portuguese stakeholders

<i>Barriers</i>
<ul style="list-style-type: none"> • Complexity and contradiction of some legislation and regulations, blocking the transition • Lack of policies that compel the Bill of Quantities to include the reuse/recycling of materials • Lack of policies and regulations that enforce the accounting of environmental and social costs • Lack of discussion, information and of a schedule for applying Green Public Procurement: case studies • Lack of political support to accelerate the transition using digital tools: Digital Twin; etc. • Lack of incentives and benefits for projects that integrate the principles of sustainability and circularity • Difficulty in establishing a fluid/continuous relationship between the different value chain operators • Lack of political and economic stability: different political parties usually create distinct policies • Lack of benefits in municipal fees when considering sustainable and circular projects • Lag between legislation and state of the art (in content and in time) • Need to integrate Life Cycle Assessment (LCA) and Life Cycle Cost (LCC) in public procurement • Lack of a common classification basis and concrete goals • Lack of robust official statistics and uncertainties regarding the end of life • Need for new material specifications (e.g., LNEC material for reuse and recycled materials) • Lack of risk financing when using recycled (or reuse) materials or even the incorporation of CDW; • Create and promote a green building permit, to reward the environmental performance of companies
<i>Opportunities</i>
<ul style="list-style-type: none"> • Incentives for new circular business models (e.g., material recycling businesses) • De-bureaucratize processes and procedures making them faster and more efficient • Simplified certification of processes and procedures • Municipalities define fee exemptions/reductions for projects with circularity/sustainability concerns • Specifications adjusted to the new requirements (e.g., including LCA information) • Promote Pre-audit demolitions and the use of the Waste Management Plan as a strategic element • Creation of a digital platform/portal that brings together updated legal information in this area • Creation of new “obligations” or “incentives” to be considered from the beginning of the project • Improve the separation and sorting of material/waste and its classification • Promote the execution of pre-demolition audits and the development of supporting digital technologies • Promote funding mechanisms for training stakeholders in the AEC sector • Dissemination and sharing of knowledge, including the recommendations of the European Union • Taxonomy based on performance quantified by LCA and LCC • Support and encourage entities to apply the LCA (clarifying the economic benefits: LCC) • Legislation should allow/support, based on technical opinions, the options intended to be implemented • Energy efficiency legislation extended to a life-cycle approach

of residues into resources; (iii) **education and capacitation** of the different stakeholders, supporting clarity and empowering them to surpass new challenges and promote their resilience; and (iv) **governance model** that supports the paradigm shift across the society, based on a continuous flux of information and discussion between the government and the stakeholders, for policies and regulations adapted to the needs identified on the terrain.

The recently published “*Portuguese Action Plan for Circularity in the Construction Sector*” [26] can be an effective starting point to ignite and accelerate the transition, as this document is expected to help the government and other stakeholders to have a more holistic view of the barriers and opportunities specific to the CS and of the reality.

23.4 Conclusions

This study investigated and identified policies and regulations in the EU and Portugal for the Construction sector (CS) and presented the barriers and opportunities identified by Portuguese stakeholders for those policies and regulations. It employed a systematic document review procedure to search, retrieve, evaluate, and extract relevant data from various sources and consultation sessions with stakeholders.

The analysis revealed a growing number of policies and regulations in the EU and Portugal, mainly from 2019. These documents can also be divided into four main areas of interest for the transition to a Circular Economy (CE): Resource and Waste Management (RWM), Sustainable Development Goals (SDG), Green Public Procurement (GPP), and dedicated to CE. The study also identifies four main barriers and opportunities related to policies and regulations found in Portugal: (i) **development of policies and regulations**; (ii) **new and innovative digital tools and platforms**; (iii) **education and capacitation**; and (iv) **governance model** adequate to needs. The study then discussed the possible interactions between the documents and barriers and opportunities, showing that the chain reaction mechanisms leading to a CE tend to fail since policies and regulations lag the needs identified in the field by stakeholders. However, the current Portuguese strategy, with a recently published sectorial Action Plan and where all stakeholders took part, can be an important tool to identify the most significant measures to take. This type of strategic document is relevant for any EU member that wishes to embrace a CE in the CS. Despite fulfilling the objectives, the study has some recognized limitations and uncertainties, such as: different countries can show different policies and barriers due to their own realities; a more even distribution of the participating stakeholders, can influence the identified barriers; and the national policies can significantly influence the perceived barriers by the stakeholders.

In this research it was identified further research, such as gathering workgroups with similar contributions from different stakeholder groups, as well as applying a similar research approach to other countries.

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