Chapter 5
National Policies and the Challenge of Coherence

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Abstract This chapter explores the complexities of aligning national policies with the European Union's objectives in transitioning to a circular economy within the construction sector. While EU directives establish general frameworks, national

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governments encounter challenges in adapting these directives into coherent and context-specific regulations. The chapter identifies key obstacles to effective policy implementation, including fragmentation, institutional overlap, and inconsistent terminology. Additionally, it examines how governance structures, planning traditions, and institutional cultures influence policy coherence. The analysis is based on survey results collected in 2023. Although subsequent policy and regulatory changes have occurred in the past two years, the data remain relevant, as they capture the main trends and challenges that continue to shape national approaches to circular construction. By analyzing case studies and examples from various member states, the chapter

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emphasizes the necessity for enhanced multilevel coordination, harmonized regulatory frameworks, and knowledge-sharing platforms. Bolstering policy coherence is crucial to ensure that national initiatives make meaningful contributions to the EU's circular economy goals and the broader sustainability agenda.

Keywords Circular economy · Policy coherence · National implementation · Construction sector governance · Multilevel coordination

5.1 Introduction

The shift towards a circular economy in the construction sector presents not only technical and operational challenges but also significant policy and governance obstacles. Although the European Union has established ambitious strategies and directives, such as the Circular Economy Action Plan and the European Green Deal, the successful implementation of these initiatives relies heavily on national-level policies and regulatory coherence. However, variations in legal frameworks, institutional arrangements, and policy-making traditions among EU member states often result in fragmented approaches. This misalignment can hinder the achievement of circular economy objectives, particularly in complex sectors such as construction, where responsibilities are dispersed across multiple levels of governance.

To gain a clearer understanding of these challenges and opportunities at the national level, the following sections provide factsheets from more than 20 EU countries. Each factsheet follows a standardized structure, which includes an overview of the governance framework involved in implementing circular economy practices, a summary of policy instruments that support circular construction, and a description of implementation mechanisms such as incentives, public procurement, and certification systems. Furthermore, each country analysis identifies existing barriers and regulatory gaps, highlights successful practices that can serve as models, and concludes with recommendations for enhancing alignment with EU objectives. Through these case-based insights, this chapter offers a comparative perspective on how national frameworks contribute to, or hinder, the broader European transition towards a circular built environment.

5.1.1 Bulgaria Factsheet

5.1.1.1 Policy and Regulatory Framework

Governance

Bulgaria has significantly strengthened its governance framework for the circular economy through institutional structures, strategic planning, and alignment with EU standards.

Circular Economy Council was established in April 2024 as a permanent consultative body under the Council of Ministers. This body has mandate to: coordinate across ministries, local governments, and NGOs; issue guidelines; assess progress; and propose national legislation updates. It is supported by three specialized working groups focused on:

1. Production and Consumption
2. Competitiveness and Innovation
3. Waste Management and Secondary Raw Materials.

Legislation

The main document framing the future legislation is the Strategy for the Transition to a Circular Economy in Bulgaria 2022–2027. It also includes a plan for monitoring the implementation and updating of the Strategy and Action Plan. On October 26, 2022, the Council of Ministers approved a strategy and an action plan for transition to circular economy in the period 2022–2027. The aim of the two documents is to achieve resource efficiency through a hierarchic approach in waste management, eliminating waste generation, promoting reuse, recycling and recovery of materials and products, reduction of landfilled waste and limiting the harmful impact of waste on the environment and human health.

The strategy formulates three strategic goals: green competitive economy; less waste and more resources; economy to the benefit of consumers. Concrete measures are planned to achieve the goals formulated as concrete activities in the action plan accompanying the strategy. The implementation of the plan seeks to redress the imbalances and overcome the obstacles in achieving the goals of the strategy for circular economy.

Circular Economy Strategy, Roadmap or Action Plan

Besides the Strategy for the Transition to a Circular Economy in Bulgaria 2022–2027, and according to the ETC CE Report 2022/5—Bulgaria the circular economy policy elements included in other policies are focused on four main areas, i.e.—the material efficiency, the product design, the resource-efficient production processes, and on the waste management [86].

On the material efficiency the planned measures (an action plan is currently in preparation) will promote the sustainable and reduced use of raw materials in production, stimulating the use of alternative raw materials and increasing the use of recyclable materials. A particular focus will be on the improvement of the knowledge base on the CE and the monitoring of waste and material flows, as well as the introduction of new forms of interaction between producers and consumers to support the CE [46].

On the issues of the product design the planned activities are, for example, improving the possibilities for product recycling, including the recycling of individual materials contained in the products by, amongst other things, substituting or reducing the use of products and materials which are not subject to recycling; reducing the content of hazardous substances in materials and products throughout their lifecycles, including by replacing them with safer alternatives; and increasing the durability, repairability, updateability or reuse of the products (funding program "Competitiveness and Innovation in Enterprises" (CIE) [20].

Concerning the resource-efficient production processes the measures under consideration are the more efficient use of natural resources in production, including reducing the use of primary raw materials or increasing the use of byproducts and secondary raw materials; supporting partnerships between enterprises to achieve industrial symbiosis, sharing of resources, services and secondary products, creating a link between production through which waste from one process is recognised as raw material for another; creation of industry platforms to exchange good practices for, for example, material flows of plastics, wood and glass.

In the waste management the activities planned to foster the prolonged use of products, including reuse, design for durability, modification of the product's purpose, disassembly, remanufacturing, updating and repair, and sharing of products; support for improving waste management in enterprises, including the prevention and reduction of waste generation, preparation for reuse and recycling. Support will be provided for technologies for the treatment and reduction of pollution of industrial wastewater.

Construction and Demolition Waste Management Regulatory Framework

Bulgaria's regulatory framework for Construction & Demolition (C&D) Waste Management is comprehensive and aligned with EU standards, incorporating detailed governance, technical requirements, and enforcement mechanisms.

Waste Management Act (2012, amended) transposes EU's Waste Framework Directive into national legislation, including specific provisions for C&D waste.

Ordinance on Management of C&D Waste and Insertion of Recycled Materials, was issued in 2012 and updated in 2017 under Art. 43(4) of the Waste Management Act. This document sets binding recycling targets for public construction projects: e.g., $\geq$ 2% in buildings, $\geq$ 10% for roads, $\geq$ 12% for backfill by 2020.

Construction Waste Management Plan (CWMP) is mandatory for major C&D projects and has to be part of investment documentation. Since 2017, CWMP must

be submitted before site opening or demolition and municipal approval is required (except for minor works or emergency removals).

5.1.1.2 Platforms and Networks Facilitating the Transition to a Circular Economy

Circular Economy Platforms

Key for Bulgaria for the last year was the adoption of a new Innovation Strategy for Smart Specialization. The projects eligible for funding under the procedures of the European Regional Development Fund for Bulgaria are those that fall within the specific thematic areas defined by the Innovation Strategy for Smart Specialization 2021–2027 (ISIS 2021–2027). These areas include "Informatics and ICT", "Mechatronics and Microelectronics", "Healthy Living, Bioeconomy and Biotechnology Industries" and "New Technologies in Creative and Recreational Industries". It also includes "Clean Technology, Circular and Low Carbon Economy", which shows the programme's commitment to sustainable development and environmental innovation. Examining the current policy context and frame S3 in the broader EU agenda. We stress the importance of aligning S3 to the EU New Industrial Strategy and the European Green Deal, mustering momentum to address social and environmental challenges.

Introducing conceptual and policy frameworks which can support the development of a transformative EDP, namely Sustainability Transitions, Transformative Innovation Policy, and Responsible Research and Innovation. We then report on two pioneering policy experiences that -building on the above conceptual foundations and approaches—have attempted to imbue the S3 and EDP with transformative elements, namely the POINT Reviews [177] by the Joint Research Centre and the Shared Agendas in Catalonia.

Circular Buildings Platform

For Bulgaria there are no circular buildings platform has been established to date.

Building Materials Passport Platform

No building materials platform has been established to date.

But in parallel for the mining industry, the situation is slightly different from the traditional one—material flows are usually large and concentrated and therefore the useful use of waste occurs much more often [141]. Given the specifics of the activity, the business models that have been proven to be applicable are "Resource efficiency and recycling" and "Waste resource recovery".

An example in the circular economy is one of the best underground mines in the world—Dundee Precious Metals Chelopech. Still in 2005, the so-called chamber system was introduced with the subsequent filling of the seized mining spaces with hardening material, which includes all sterile rock masses and a large part of the flotation waste mixed with cement [268].

In Assarel Medet an oxide embankment (a hill formed by the disposal of oxide copper ores, once treated as waste) is simultaneously reclaimed and operated through a drainage system for catching and draining water to be directed to the production of cathode copper or treatment plants. Lavender is grown on the reclaimed land for oil production and honey is also extracted at the same time.

Public Procurement Platform

Under the Public Procurement Portal the Bulgarian Public Procurement Agency published a Practical Handbook for Green Public Procurement [283]. The practical tool was developed by PricewaterhouseCoopers Bulgaria EOOD under a public procurement contract of May 15, 2018 with the subject: "Study and forecasting of the potential of the national market for green public procurement in Bulgaria and preparation of a practical tool for their awarding", part of the project "Methodological Support for the Development of Green Public Procurement in Bulgaria", funded under Priority Axis 3 "Private Sector" of the Bulgarian-Swiss Cooperation Program (BCSP).

The structure is made up of three modules:

- Strategic module—presents the potential for development of the market of green public procurement in Bulgaria and the product groups included in the Operational module;
- Legal module—outlines the applicable legal framework for incorporating green criteria in public procurement throughout the life cycle of the contract;
- Operational Module—provides exemplary environmental criteria for 12 product groups: "Wastewater infrastructure", "Food preparation and delivery services", "Computers and monitors", "Imaging devices", "Copier and Graphic Paper, Furniture, Cleaning Products and Cleaning Services, Public Space Maintenance, Design, Construction and Management of Buildings, Design, Construction and Maintenance of Roads, Transportation and Street lighting." For the Lighting and Computers and Monitors product groups, models (calculators) have been applied to calculate Lifetime Costs (RLC). The examples given are illustrative and advisory in nature and are intended to serve as a reference for stakeholders.

At the Public Procurement Portal there is also a special Guidance for public authorities on Public Procurement of Innovation https://www2.aop.bg/wp-content/uploads/2019/04/PPI-Platform_Guide_new-final_download.pdf. Part of it are the recommendations for the planning of organisation's PPI strategy. One of the recommendations is on evaluating in the tender the "Whole-life and Life-cycle Costing", e.g. How

will the costs of new products and services be assessed across their life-cycle? Have relevant tools for this been developed within the sector(s) you are targeting?

5.1.1.3 Funding Opportunities

Besides the Horizon Europe that is the EU's flagship programme for funding research and innovation, in Bulgaria the circular economy promotion stands with the businesses through local financial institutions and the funding access portal, as well as instruments such as the European Agenda for Employment and Social Innovation, the European Social Fund Plus (ESF+) and the European Maritime, Fisheries and Aquaculture Fund (EMFF). Mainly the funds are fueled through the Competitiveness and Innovation in Enterprises Programme 2021–2027 supporting the Bulgarian enterprises in developing innovative products and business processes. The main objective of the programme is to strengthen the country's innovation capacity and support the transition to a more sustainable and efficient economy. It is divided into two priorities: "Innovation and Growth" and "Circular Economy".

The programme provides financial support through various mechanisms, including grants, loans and guarantees. It also offers technical assistance and advice to SMEs looking for development and innovation opportunities. Funds are allocated in accordance with the specific needs and project proposals of enterprises. The procedure provides for the financing of research and innovation activities, as well as networking between enterprises and scientific institutes. This includes the development of industrial research, experimental development, and studies to establish the feasibility of new ideas and technologies. Thus, the procedure aims to strengthen the links between the scientific sector and business and to help translate scientific discoveries into practical innovations.

For Bulgarian enterprises, procedure "Circular Economy" represents a valuable opportunity for obtaining support in the process of innovative development. It provides financial resources and expert assistance necessary for the implementation of innovative projects that can significantly contribute to the development of the Bulgarian economy and to increase the competitiveness of local enterprises on the European and global markets.

Under the priority 2 of the programme "Circular Economy" are included two specific objectives aimed at preparing businesses for the challenges of the green transition and achieving climate neutrality. The interventions under the first specific objective to promote energy efficiency and reduce greenhouse gas emissions, to which 6.87% of the CIE budget, around EUR 1493 billion, is allocated, aims to improve energy efficiency in enterprises through targeted action including the implementation and certification of energy management systems, and energy consumption monitoring and control systems.

International Cooperation and Support from International Organizations

Bulgaria's progress in the transition to a CE and resource efficiency has been analysed by the European Commission, in the context of the European Semester, in the chapter Green transition and resource efficiency and Annex 7 Resource Efficiency and Productivity of a document entitled 2022 Country Report—Bulgaria [81]. This report states that Bulgaria is "among the Member States lagging most behind in the implementation of circular economy policies" and that "the Bulgarian economy is among the most resource intensive in the EU and lags behind Member States in the implementation of the circular economy principle and eco-innovation". These conclusions are based on statistical data—the country's circular material use rate was 2.6% in 2020, almost five times lower than the EU average of 12.8%, and resource productivity was 0.82 purchasing power standards (PPS) per kilogram in 2020, compared to 2.23 PPS per kilogram in the EU. Some possible reasons for this are outlined below.

The share of SMEs offering environmentally-friendly products or services is one of the lowest in the EU, due to the low demand for environmentally-friendly products, which tend to be more expensive. Promoting the higher quality of ecolabelled products would boost demand and production. At the same time. the low interest in ecolabelling and the EU's Eco-Management and Audit Scheme (EMAS) is due to the fact that manufacturers do not take full advantage of the opportunities offered by these voluntary instruments.

In November 2023 it was decided the Bulgarian micro-, small and medium enterprises (MSMEs) along the border with Turkey will be able to apply for funding of over 6.6 million euro ($7 million) in total for projects focused on energy efficiency and the transition to a circular economy, the regional development ministry said. Companies can receive up to 200,000 euro each in financing under the cross-border cooperation programme between Bulgaria and Turkey, the ministry said in a statement. The proposed projects must target energy efficiency, greenhouse gas reduction and shifting to a circular and resource-efficient economy. The initiative will prioritise the promotion of circular production processes through the purchase of technological equipment and the development of new business models. The funds can be used to buy energy-saving equipment, upgrade production facilities for energy efficiency and implement automatic energy consumption monitoring systems. Project proposals were accepted starting mid-November 2023.

5.1.1.4 Challenges, Barriers and Potential Improvements

The beginning of 2020, in connection with INTERREG Europe project "REDUCES", a survey was conducted among the companies from the Bulgarian mining industry, in order to establish the understanding and application of the models for circular economy. The survey was provided to 65 companies in the business, with only 13 of them participating in its completion.

The analysis of the results shows that in most of the surveyed companies circular models for modernisation and innovation are applied, namely:

- Opportunity for efficient processing of poor ores;
- Industrial water supply in a closed cycle to supply the production process;
- Mounting of an installation for extraction and electrowinning of cathode copper from mine water, through which an additional by-product is obtained—pure copper;
- Technology for extraction of accompanying gold in copper concentrate, so that precious components are not lost in the waste;
- Application of a method of extraction, which includes backfilling, i.e. the ground sterile rock mass is returned to the underground mine in the form of a pasty filling, is an example of a circular economy, which not only reduces the amount of waste deposited on the surface, but is also used the waste as a raw material, which is mixed with cement and returned to the seized chambers, ensuring the stability of the rock massif;
- Use of part of the mine ballast for filling the used spaces underground, for paving during the construction of the underground roads after crushing and for upgrading the walls of the tailings pond;
- In the extraction of limestone, necessary for the production of lime, many additional fractions of material are released, which are not discarded, but sifted and placed on the market for aggregates;
- Use of earth masses and sludge for reclamation of disturbed terrains;
- Delivery to specialised companies of used oils for recycling and use in other industries;
- Recycling of metals used for drilling tool crowns.

5.1.1.5 Examples of Successful Implementation

Public Policy Initiatives

Supposing the best benchmark for public policy, and with elements of PPP is the case of the Cleantech Bulgaria (Bulgaria, project coordinator: Hamanova Mariyana) and ATHENA (Greece, project coordinator: Prof. Phoebe Koundouri, School of Economics and ReSEES Laboratory, AUEB, Director EIT Climate KIC Greece) with the support of EIT Climate-KIC will pilot the adoption of CE in their respective S3s, working together with the responsible authorities. Country will identify challenges, priorities, the potential for synergies and support instruments for CE. Participatory workshops with experts from EIT Climate-KIC will be run. Specific approaches to implementation and supporting funding instruments will be discussed and shared with participants. The end goal of the project is to stimulate the timely and systemic adoption of the CE in S3s for the 2020–2027 programming period in the EU Member States [58].

Together with the support of the Ministries of Economy of Bulgaria and the Hellenic Ministry of Energy and Environment of Greece they focus on mapping of

the key aspects of the National Strategy on Circular Economy in relation with the Research and Innovation Strategies for Smart Specialisation (RIS3) and the discussion on the implementation of these strategies identifying the needs, barriers and strengths in Greece. Mutual learning between Greece and Bulgaria was guaranteed by providing exchange visits between members of CTBG and ATHENA.

Stepping on the outputs provided, a final event in Brussels with the participation of external EU experts and other RIS countries was held during the European Week of Regions and Cities in 2019, an executive meeting for the CE in S3 project from took place at EIT House, Brussels. Both Greece's and Bulgaria's work and upgrade the project to a national based deep demonstration of the circular economy project, which will be led by ATHENA RC and the Ministry of Environment and Economy supposed. Potential synergies with existing projects of EIT Climate-KIC Greece with focused areas the ports and the plastic are discussed, while the Ministry of Environment and Energy stimulated the discussions by being represented at the meetings in Brussels with Greek delegates from the Ministry of Environment and Energy.

Another case is a project supported by the Bulgarian "Research and Education for Smart Growth" Operational programme, that just finished on December 31, 2023. The project title is MIKS-IP "Modernising Educational Solutions for Achieving Circular Economy in the Strategic Infrastructures and Industries" https://www.bfu.bg/bg/proekt-modernizatsiya-na-obrazovatelnite-resheniya-za-kragova-ikonomika-strategicheski-infrastrukturi-i-proizvodstva-miks-ip. It was run by a consortium of the Burgas Free University, the University of Chemical Technologies and metallurgy, and the International Business School, with associated partners in Poland, Hungary and Romania, and coordinated by prof. Milen Baltov. One of the achievements was introducing a Masters degree joint programme on "Circular Economy".

Private Policy Initiatives

There are more and more companies involved, but especially the three part of the European Circular Economy Stakeholder Platform https://circulareconomy.europa.eu/platform/en/main-language/bulgarian.

Three of the benchmark example are mentioned below.

The Remix, with its CE project slogan Reuse, reduce, remix. The Remix Shop, as a type of organisation or company: Private company; Key Area: Consumption; Sector: Clothing and Fashion industry, Reuse, Textiles, apparel and leather. With this company the scope is national, and EU. Remix is a shop based in Bulgaria, which sells second-hand and outlet clothing online to nine countries.

LanaTerm, with its CE project slogan: wool can keep buildings warm as well as sheep. Lana Term as a type of organisation or company is a private company. It operates both in Bulgaria and in Romania. The languages for its original content are Bulgarian, English, German, and Romanian. The key area is production, and its sectors are in construction, buildings and infrastructure. There are not many eco-friendly products on the Romanian construction market, so there was definitely a

niche in the thermal insulation market. LanaTerm uses sheep's wool to create thermal insulation for buildings.

ETV4, with its CE project slogan: Innovation for Environmental technology verification. ETV4INNOVATION is rather an organization, than a company and it's focused on Environmental Technology Verification (ETV). Besides Bulgaria it operates mainly in Ireland. The languages for original content are Bulgarian, Danish, English, French, Polish, and Spanish. Its key areas are in the waste management; the secondary raw materials, and the innovation and investments. The sector is the B2B services, Education and skills, and Environmental technology verification. Its scope is international, mostly in the EU. ETV4INNOVATION is a two-and-a-half-year long European Commission funded vocational education and training Strategic Partnership project under Erasmus + programme. It has been designed with the aim of supporting the development and the implementation of an innovative practice and a new training path in the field of Environmental Technology Verification (ETV) [75].

5.1.2 Croatia Factsheet

5.1.2.1 Policy and Regulatory Framework

Governance

According to the Implementation program of the Ministry of Economy and Sustainable Development for the period 2021–2024 [226], which entered into force on December 15, 2022, the Ministry of Economy and Sustainable Development (MoESD) determined strategic directions, developed programmes and plans for sustainable development of society based on the principle of green and circular economy in order to transform it into a just and prosperous society with a resource-efficient and competitive economy, ensuring climate neutrality, preservation and sustainable use of natural resources. The MoESD's vision was: "Sustainable growth and development based on efficient use of resources, circular economy, clean industries and new technologies with a strong reduction in greenhouse gas emissions."

The Ministry of Physical Planning, Construction and State Assets is in charge of implementing the Programme for the development of circular spatial and building management for the period 2021–2030 [227], which entered into force on December 23, 2021. According to the Programme's medium-term vision, "In the year 2030, Croatia is a country where urban areas are successfully implementing the model of circular management of space and buildings, in which unused existing spaces and buildings are renovated, the amount of total produced construction waste is reduced, innovations in the development of circular materials and products are promoted, and the principles of eco-design are applied in the design and construction of buildings. Croatia in 2030 is a country that recognizes, revitalizes, improves and values its built

environment as a fundamental resource, and its citizens are provided with a healthy, socially functional, safe living and working environment."

Legislation

The development of the Programme for the development of circular spatial and building management for the period 2021–2030 is required by the Building Act (Official Gazette 153/13, 20/17, 39/19, 125/19, 145/24) [109], which also incorporates the circular economy principles. Article 14 states that construction works and their heating, cooling, lighting and ventilation installations must be designed and built in such a way that the amount of energy they require in use shall be low, when account is taken of the occupants and of the climatic conditions of the location of the construction work. Construction works must also be energy-efficient, using as little energy as possible during their construction and dismantling. According to Article 15, construction works must be designed, built and demolished in such a way that the use of natural resources is sustainable and in particular ensure the following: 1. reuse or recyclability of the construction work, its materials and parts after demolition; 2. durability of the construction work; 3. use of environmentally compatible raw and secondary materials in the construction works.

Circular Economy Strategy, Roadmap or Action Plan

No specific political communications has been adopted in the field of circular economy on national, regional and local level to date. The Circular Economy Action Plan on Construction and Demolition Waste was proposed by the World Bank [362] as a deliverable of the project "Technical assistance to the Ministry of Economy and Sustainable Development for sustainable waste management—transition to a circular economy".

Construction and Demolition Waste Management Regulatory Framework

The Waste Management Act (Official Gazette 84/21, 142/23) [110] defines construction waste as waste generated by construction and demolition activities, and recycling centre for construction waste as any facility intended for sorting, mechanical treatment and interim storage of construction waste. In order to contribute to the circular economy of the European Union, the Republic of Croatia should achieve the following objective set in Article 54: "At least 70% of the mass of non-hazardous construction waste, other than naturally occurring materials as determined by the waste code 17 05 04—soil and rocks not listed under 17 05 03, shall be recovered by means of recycling, preparing for re-use and other material recovery operations, including backfilling operations, whereby the waste is being used as a replacement for other materials." In 2020, the recovery rate of the construction and demolition

waste was 60% (driven by two devastating earthquakes in 2020 and the large amounts of construction debris) [85] and 64% the following year. The Ministry of Economy and Sustainable Development and the Environmental Protection and Energy Efficiency Fund shall, pursuant regulations governing state funded subsidies, encourage the prevention of waste generation and waste management for the following activities related to the implementation of circular economy in the built environment: (1) prevention of waste generation; (2) the application of the waste management priority order; (3) the designing of products and parts of products that reduce environmental impact and waste quantity during their production and use, as well as ensure the recovery and disposal of products which have become waste, in accordance with the waste management priority order and the fundamental requirements of waste management, including the development, production and promotion of products and parts of products which are suitable for repeated use, contain recycled materials, are technically permanent and easy to repair, and which are suitable for preparing for re-use and recycling, when they become waste; (4) the promotion of high quality recycling based on the separate collection of waste; (5) the development of secondary raw materials markets; (6) the promotion of targeted deconstruction (disassembly) of buildings in order to extract hazardous substances and to facilitate re-use and the high-quality recycling of targeted materials that were excluded so as to ensure that a construction waste sorting system exists, at least for wood, mineral fractions (concrete, brick, ceramic tiles and other ceramics, stone), metals, glass and gypsum, as well as the establishment of recycling centres for construction waste, etc.

In addition to the Waste Management Act, the conditions for the construction waste management are regulated by the Ordinance on Waste Management (Official Gazette 106/22) [228] and the Ordinance on Construction Waste and Waste Containing Asbestos (Official Gazette 69/16) [229]. The concept of circular economy is incorporated into the Waste Management Plan of the Republic of Croatia for the period 2023–2028 [111], which was published in June 2023. In accordance with the concept of a circular economy, it is envisaged to create instructions for the selection and removal of hazardous construction waste during the removal of the building.

5.1.2.2 Platforms and Networks Facilitating the Transition to a Circular Economy

Circular Economy Platforms

Within the project "Technical assistance to the Ministry of Economy and Sustainable Development for sustainable waste management—transition to a circular economy", the creation of a national digital platform for the circular economy was planned, which would also contain a user portal for monitoring progress in achieving the goals of the circular economy set by European and national legislation. The platform would also serve as a tool for joint work and cooperation and a place for exchanging knowledge about the circular economy for citizens, businesses and local government, as defined in the National Reform Programme of the Republic of Croatia for 2020 [112].

The Circular Economy Hub as a physical location for demonstrating circular technologies and sharing knowledge, innovations, and best practices among all stakeholders is announced to be established [221].

Circular Buildings Platform

No circular buildings platform has been established to date.

Building Materials Passport Platform

No building materials platform has been established to date.

Public Procurement Platform

The national green public procurement platform was established in 2015 and was operated by the MoESD in 2023. It communicates green public procurement (GPP) criteria, publishes educational materials, runs webinars and free seminars, lists eco-labels, and contains life-cycle costing tools and good practice examples [85]. Among other, it contains EU green public procurement criteria for office building design, construction and management. According to the Croatian Government's Decision on Green Public Procurement in the Central Public Procurement Procedures (Official Gazette 49/2021) [113], the Central State Office for Central Public Procurement is obliged to apply GPP criteria in central public procurement procedures and the MoESD is obliged to measure and publish details of annual savings in carbon-dioxide emissions from GPP [85].

5.1.2.3 Funding Opportunities

National Recovery and Resilience Plan

Croatia's recovery and resilience plan will finance the post-earthquake reconstruction and energy upgrade of buildings damaged in devastating earthquakes that hit Croatia in 2020 and transitioning to circular economy. Besides increasing the seismic resilience of buildings (build back better principle), all buildings should achieve at least 30% energy savings compared to pre-renovation state and therefore contribute to a cleaner and safer environment. In the period of 1 June, 2023 to 1 September, 2023 there was an open call for the allocation of grants for the implementation of the Pilot project for the development of green infrastructure and/or circular management of space and buildings at the local level intended for the local self-government units. The Plan also foresees a programme of support for companies for the transition to an

energy- and resource-efficient economy that is aimed at companies with up to 3000 employees [85].

Cohesion Fund

The technical assistance program provided by the World Bank was financed from the European Union's Cohesion Fund. The aim of the project "Technical assistance to the Ministry of Economy and Sustainable Development for sustainable waste management—transition to a circular economy" was to integrate the circular economy (CE) into the waste management sector. This involved aligning the Waste Management Plan of the Republic of Croatia 2017–2022 with the national legislation due to amendments to the EU Waste Management Directive, preparing the starting point and elements of the CE to be integrated into the future Croatian Waste Management Plan after 2022 in order to transition towards the CE 2030 targets, and strengthening the capacity of relevant stakeholders for CE in the waste management sector. The project was implemented within the Operational Programme Competitiveness and Cohesion 2014–2020 Priority Axis 6 Environmental Protection and Sustainability of Resources, Specific Objective 6i1 Reduced amount of waste landfilled. The applicant and beneficiary of the project was the Ministry of Economy and Sustainable Development.

WeBSEFF

Western Balkans Sustainable Energy Financing Facility (WeBSEFF) is a financing facility under which the EBRD provides credit lines to partner banks (Zagrebačka banka, Privredna banka Zagreb and Erste banka) in the Western Balkans to lend to businesses and municipalities wanting to invest in energy efficiency and small-scale renewable energy projects [76].

International Cooperation and Support from International Organizations

World Bank provided technical assistance in advancing circular economy principles in the Croatian waste management sector and transitioning towards a circular economy. World Bank supported Ministry of Economy and Sustainable Development in the preparation of the new National Waste Management Plan 2023–2028, integrating the circular economy aspects in waste management, in line with the European Green Deal and Circular Economy Action Plan. During the course of this project, the World Bank prepared relevant resources including documents, presentations from workshops and webinars, and reports from study tours. The study tours included visiting Slovenia and the Netherlands as good practice examples. The Croatian Circular Economy Committee (CEC) engaged with stakeholders from Slovenia and learnt about Government's strategy to accelerate circularity by maximizing the

use of EU funds towards CE, enabling national policy framework for CE and ensuring strong stakeholder engagement, while providing business opportunities with good returns on investments [363]. The Croatian Circular Economy Committee visited Netherlands in July 2020 seeking to learn from Amsterdam's and Almere's approach to transitioning to the circular economy and managing solid waste [221]. Participants visited facilities with best practices in recycling and using waste as a resource for new products, including the construction of new buildings [363].

5.1.2.4 Challenges, Barriers and Potential Improvements

There are several challenges and barriers related to different areas of implementation of circular economy in the built environment. The World Bank [362] identified challenges and barriers in the waste management sector and proposed several measures and actions for potential improvements (Table 5.1).

5.1.2.5 Examples of Successful Implementation

Public Policy Initiatives

The new Zagreb International Airport terminal building has been designed for an annual passenger throughput of 5.5 million passengers per annum, with added resilience to allow further extension to accommodate 8 million passengers. The terminal was constructed by MZLZ (a consortium of Bouygues Bâtiment International, Aeroports de Paris Management and Viadukt) who were awarded the Airport Concession by the Croatian government in December 2013 to operate the airport for a 30-year period, including the Design and Build of a new terminal building. Arup was appointed to act as the Independent Engineer for the New Passenger Terminal at Zračna Luka Airport in Zagreb. They were responsible for tracking performance, quality and compliance of the construction works over the lifetime of the project and also supervised and witnessed the testing and completion of elements of the works as they developed. Arup reported jointly to the Concessionaire (MZLZ) and also the Grantor (Croatian Ministry of the Sea, Transport and Infrastructure), providing monthly reports of compliance and performance tracking [14]. This was the fourth new airport terminal to be built by Bouygues Bâtiment International as a Public–Private Partnership (PPP), within the framework of a project company in which it is one of the principal shareholders. As the project aimed to secure LEED certification, particular attention was paid to sustainable construction [187].

The environmental sustainability of the Airport design solution was based on [162: 477]:

- ventilation of the facade and roof, principled on the double membrane envelope
- large area of the photo-voltage cells (8500 m^2) for the environmentally friendly production of electricity

Table 5.1 Overview of challenges and potential improvements for the implementation of the circular economy in CDW sector in Croatia

Challenges	Recommended measures	Recommended actions
Absence of a shared vision among stakeholders	1. Enhance dialogue and cooperation among CDW stakeholders	1. Creation of CE platform for CDW management to discuss regulatory provisions, new opportunities and share information
	2. Enhance education and support for research, innovation, and development	1. Organization of specific annual educational programs including meetings with local administrations and the drafting of a handbook related to innovative recovered materials, reuse, and recycling within the framework of CE and CDW regulatory requirements 2. Development of R&D program for CE in CDW sector through the creation of nation or EU funds
Limited information about CDW generation and management	1. Implement educational and informative activities related to CDW reporting	1. Educational activities, including training, guidelines, and handbook, on the topic of CDW management reporting data within the framework of the CE

(continued)

Table 5.1 (continued)

Challenges	Recommended measures	Recommended actions
	2. Improve CDW management information system applications	1. Enhanced interoperability between waste registers EONTO and ROO (Environmental Pollution Register of the MoESD) for data collection regarding CDW quantities and treatment 2. Enhanced the usability of EONTO through the creation of a mobile application 3. Integration of recovered material data generated on-site in the construction permit database for building sites with an expected CDW generation greater than 200 t 4. Integration of digital applications related to CDW on the joint IT platform of waste management in the Republic of Croatia, as part of the national environmental protection and circular economy platform 5. Creation of a Materials Passport and a related database to register materials used in construction projects in order to ease the recognition of hazardous material, future dismantling phase and recovery of resources

(continued)

Table 5.1 (continued)

Challenges	Recommended measures	Recommended actions
	3. Improve availability and quality of CDW management data before and during operating sites	1. Introduction of obligations to prepare CDW Management Report as part of Main Project before issuing Construction Permit for sites with an expected CDW generation greater than 200 t 2. Drafting of standard forms and an on-line tool for compiling and submitting the CDW Management report 3. Approval of a bylaw for the enforcement of a mandatory financial bond or bank surety for construction projects to cover the cost in case of mismanagement of CDW on the building site
	4. Implement pre-demolition audit for construction sites	1. Amendment to Law on Construction to include pre-demolition audit based on EC guidelines for construction sites with an expected CDW generation greater than 200 t 2. Definition of guidelines on Selective and Removal of Hazardous Components based on the European Guideline 3. Training for the enforcement of guidelines on Selective and Removal of Hazardous Components
Uncontrolled streams of CDW	1. Increase education of relevant bodies involved in CDW management inspection processes	1. Training programs for CDW management supervision and inspection bodies and parties

(continued)

Table 5.1 (continued)

Challenges	Recommended measures	Recommended actions
	2. Strengthen regulation and controls to reduce illegal dumping of CDW	1. Enforcement of waste management regulation to strengthen the control powers of local authorities and state inspectorate on environmental crimes related to illegal waste management 2. Enforcement of construction law and introduction of mandatory cost breakdown for CDW management in technical project proposals to support companies that propose proper CDW management. 3. Investment in technological equipment such as capturing cameras and remote cameras to increase and automatize controls against illegal dumping 4. Improvement of ELOO (record of the location of discarded waste) mobile application for citizens to ease the anonymous reporting of CDW illegal dumping 5. Strengthening of sanctions and fines against illegal dumping
	3. Remove CDW from illegal dumpsites	1. Removal of CDW (or mixed waste) from locations contaminated by waste dumped into the environment

(continued)

Table 5.1 (continued)

Challenges	Recommended measures	Recommended actions
Limited capacity for CDW recovery and recycling	1. Improve End of Waste (EoW) status legislation for CDW	2. Feasibility study for the identification of potential "by-product for non-contaminated excavated soil" and "EoW status for specific CDW streams." 3. Definition of a guideline on the enforcement of EoW and relevant Ordinance No. 117/14 4. Training sessions on the guideline on the enforcement of EoW
	2. Improve hazardous waste removal and asbestos disposal system	1. Analysis and assessment (report) of the existing and required number and capacity of areas for the disposal of CDW containing asbestos and treatment of hazardous CDW 2. Grants for the development of installation for the recycling of contaminated soils (EWC 170,503*) based on BAT 3. Financial support for the collection and disposal of asbestos-containing material from existing buildings
	3. Construct and equip recycling yards for construction and demolition waste "Type A"	1. Construction and equipping of municipal or regional "Type A" recycling yards for CDW on the mainland 2. Construction and equipping of municipal or regional "Type A" recycling yards for CDW on the most populated island

(continued)

Table 5.1 (continued)

Challenges	Recommended measures	Recommended actions
	4. Construct and equip recycling yards for construction and demolition waste "Type B" for processing CDW	1. Construction and equipping of "Type B" recycling yards for processing CDW, equipped with mobile equipment to service municipal and regional requirements 2. Construction and equipping of "Type B" recycling yards for processing CDW, as part of waste management centers equipped with mobile equipment to service municipal and regional requirements
	5. Build and equip facilities for CDW analysis and quality control	1. Financial funds for the development of authorized quality control infrastructure for CDS SRM
Low market share on CDW secondary raw materials (SRM)	1. Improve the existing application to develop a CDW Exchange	1. Improvement, development, and implementation of a web-based tool such as CDW Exchange or marketplace for materials recovery and secondary materials exchange
	2. Create guidelines on GPP	1. Creation of guidelines for GPP of the office building design, construction and management 2. Implementation of GPP pilot project in accordance with guidelines for office building design, construction and management 3. Creation of guidelines for GPP of road design, construction and maintenance 4. Implementation of GPP pilot project in accordance with guidelines for road design, construction and maintenance 5. Feasibility study for the introduction of a minimum quantity of recycled/reused materials in public constructions and infrastructures in the construction law

(continued)

Table 5.1 (continued)

Challenges	Recommended measures	Recommended actions
Increasing generation of CDW	1. Develop guidelines for the reuse of building components, conversion, and renovation of buildings	1. Drafting of a guideline on identification of reusable component including a positive list of elements such as doors, windows, and other non-structural parts 2. Development of guidelines for sharing, conversion and renovation of buildings including recommendation for amendments and supplements to spatial plans 3. Dedicated grants to support the local administration and private companies on restoring buildings instead of demolition in accordance with guidelines and to promote sharing, conversion, and multifunctional uses of the public buildings
	2. Enhance take-back systems in CDW to increase reused and recycled content	1. Feasibility study for the introduction of "take back system" on specific CDW scraps and unused materials as: 17 01 concrete, bricks, tiles and ceramics; 17 03 bitumen mixtures, coal tar and products containing tar; 17 08 building material based on gypsum 2. Pilot project to enhance "take back system" on select CDW stream based on result of the aforementioned study

(continued)

Table 5.1 (continued)

Challenges	Recommended measures	Recommended actions
	3. Implement educational and informative activities on eco-design in public and private buildings	1. Implementation of educational and informative activities on the topic of eco-design in public and private buildings to raise technical knowledge and education for engineers, architects, technicians, contractors and public administration 2. Design and construction of an eco-design pilot project in a public building 3. Reduction of planning fees for construction projects that use recycled or reused materials or adopt eco-design criteria focused on future reduction of CDW generation
	4. Develop guidelines for sharing, conversion and renovation of buildings	1. Development of guidelines for sharing, conversion and renovation of buildings including recommendation for amendments and supplements to spatial plans 2. Dedicated grants to support the local administration and private companies on restoring buildings instead of demolition in accordance with guidelines and to promote sharing, conversion, and multifunctional uses of the public buildings

Source World Bank [362]

- trigeneration plants for synergetic production of electricity and preparation of warm and cold water
- collection, processing, purifying and managing of water from all parts of the complex, such as roofs, aprons, runways, sanitation facilities, etc.
- centralized control and management of all power and utility resources by means of the efficient management systems (EMS)
- selection of best technological solutions and usage of materials which contribute to quality and ecological sustainability.

The roof structure is made up of 45,000 elements, each different from the others. The works switched to post-tensioned concrete for the floors and connected the drainage system to the city's water treatment plan. To avoid any risk of flooding, 40 km of pipe were installed under the 66,000 m^2 of the terminal, the 100,000 m^2 of taxiways, and the 40,000 m^2 of aircraft parking stands. LEED silver certification acknowledges measures taken to increase its environmental performance, including a rainwater recovery system to provide water for the toilets and the use of concrete with titanium content to capture CO_2 [18]. Zagreb Airport received an Airport Carbon Accreditation from the ACI (Airport Council International) in 2021, which confirms the level 3 of management and reduction of CO_2 emissions in everyday airport activities. According to the classification of the global ACI ACA program (Airport Carbon Accreditation), this level is called "Optimization" and represents a significant step towards fulfilling the commitment of the Zagreb Airport to achieve zero CO2 emissions by 2050. In recent years, Zagreb Airport has introduced a wide range of energy management measures that have enabled it to monitor and reduce overall energy consumption, such as the installation of efficient LED lighting, low voltage reconstruction in transformer station, boiler room reconstruction, reconstruction and modernization of the heating/cooling substation and hot water using solar collectors. Thanks to all these activities, the carbon emissions at the airport were reduced by 4% between 2017 and 2019, despite a significant increase in the number of passengers in that period. Plans for the airport include the construction of a photovoltaic power plant that will enable the direct conversion of solar energy into electricity and the replacement of existing vehicles and equipment in an environmentally friendly way [368].

Private Policy Initiatives

Valamar Amicor Green Resort is the first family resort on the Croatian Adriatic to be built according to the principles of sustainable construction and designed to exist in harmony with nature. Valamar Amicor Green Resort was built in 2022 in partnership with the German Sustainable Building Council (*Deutsche Gesellschaft für Nachhaltiges Bauen*—DGNB). The interior design used natural and recycled materials from local sources, reinterpreted by local artists. Wood, as one of the most sustainable building materials, has been used to build the villas, and the paint on the walls does not contain harmful particles, so maximum air quality is achieved

inside the accommodation units. With regard to the new accommodation units, the prefabricated construction was used, which saves energy, speeds up the construction process, creates controlled production conditions, and allows easy disassembly of parts of the building that can be reused later [352].

5.1.3 Cyprus Factsheet

5.1.3.1 Policy and Regulatory Framework

Governance

Circular Economy policy in the Republic of Cyprus is under the jurisdiction of the Ministry of Energy, Commerce and Industry (MECI), which in 2021 launched the Cyprus Action Plan for Circular Economy [301], in collaboration with the Ministry of Agriculture, Rural Development and Environment (MoA) and the Deputy Ministry of Research, Innovation and Digital Policy (DMRID). The development of the national action plan was a follow up of the development of the European Action Plan [83] providing member states to take the lead in circular economy transition according to their Smart Specialization Strategies and national targets. At the launch of the National Action Plan, the then Minister of Energy, Industry and Commerce, Ms Natassa Pilidou, mentioned that: "..beyond the fact that Circular Economy contributes directly in the reversal of climate change effects, due to the decrease of greenhouse gas emissions, serving towards our national targets for net zero emissions by 2025, Circular Economy Best Practices, create opportunities for the transformation of our businesses and industry, in order for them to acquire more competitive advantages and become more competitive and sustainable locally, and more importantly internationally. Circular Economy, just as any green investment, creates new jobs and new novel products" (DMRID Press release, 27/7/2021). The collaboration of the two ministries and the deputy ministry is key in the implementation of Cyprus Circular Economy goals through incentives, waste management regulation and digitilisation which can play a significant role in the success of the action plan. Actions from the action plan are part of the Cyprus National Recovery and Resilience plan [82].

Legislation

Circular Economy appears in the Republic of Cyprus Legislation under the Waste Management Law (Cylaw, 185(I)/2011 and its latest amendment 48(I)/2022). The latest amendment to contains an act for Construction and Demolition Waste (CDW) which is segregated from the municipal solid waste (under the jurisdiction of Ministry of Interior) and is now under the jurisdiction of the Department for the Environment (DfE) of MoA. In 2023 the DfE issued new regulations for CDW management (Κ.Δ.Π. 112/2023) which aim to protect the environment and human health

by adopting new measures for the rational management of CDW, targeting the reuse and exploitation of at least 70% of the volume generated.

Circular Economy Strategy, Roadmap or Action Plan

In June 2021, MECI in collaboration with MoA and DMRID issued the National Plan for supporting the implementation of Circular Economy in Cyprus 2021–2027. The plan includes prospects for circular economy in Cyprus, the priorities and special goals and the governance of the plan which includes participation, implementation and monitoring.

The national plan implementation budget is set to 90 m Euros, elements of which are included in the Cyprus Recovery and Resilience Plan. The four pillars of the plan are as follows:

- Development of Culture (mindset) for Circular Economy
  - Developing awareness of the business community and consumers for the prospects and opportunities of circular economy, public campaigns for sustainable waste management strategies and training in circularity topics.
- Provision of incentives
  - Creation of a plan for the provision of consulting services and guiding grants (1 m Euro total, up to 15 k per organization),
  - Creation of grant schemes from the Cyprus Research & Innovation Foundation (RIF) "Go Circular" for new circular products and services (1 m Euro).
  - Utilization of courses certified by the Authority for the Development of Human Resources (ADHR) for circular economy training.
- Infrastructure
  - Investigation for the identification of waste categories fit for decharacterisation,
  - Creation of online platform which will allow organisations to share infrastructure, services, waste management etc.
  - Development of an integrated system for monitoring waste management projects (2 m Euros)
- Municipal Solid Waste (MSW) Management
  - Development of "pay as you waste" programme (25 m Euros)
  - Segregated collection systems for mountainous areas and operation of "Green Points" (Recycling centres) for remote areas (3.5 m Euros)
  - Domestic composting of organic waste (7 m Euros)
  - Creation of Product Repair and Reuse centres (4 m Euros)
  - Reduction and segregated collection of MSW (5 m Euros)
  - Plan for utilization of MSW through segregated collection (15 m Euros)

  The plan has targeted four priority areas

- Primary Sector
- Food and Beverage Sector
- Construction
- Hotels, Restaurant, Café (HoReCa)
- Other individual industries

The mechanism to monitor the implementation of the plan is through a committee under the realm of the two ministries (MECI and MoA) and deputy ministry (DMRID) and it will also include representatives from EPSA (DG Growth RoC), industrial stakeholders and experts. The committee will be convening at regular intervals to:

- Ensure the achievement of the action plan targets.
- Keeping all stakeholders committed to the plan.
- Monitoring of actions included in the plan.

Construction and Demolition Waste Management Regulatory Framework

In 2023 the DfE issued new regulations for CDW management (Κ.Δ.Π. 112/2023) which aim to protect the environment and human health by adopting new measures for the rational management of CDW, targeting the reuse and exploitation of at least 70% of the volume generated. The regulations apply to the construction project owners, the producers of CDW and any entities involved in CDW management as long for projects that generate a minimum of $12m^3$ of CDW. For the first time these regulations include CDW management as part of the owner obligations and it is incorporated in the technical specifications of the project. CDW producers (i.e. construction companies, etc.) have the obligation to organize or participate in a collective CDW Management System or to run their own. The regulations include templates for all the CDW management actions to be fully documented and monitored in order to achieve the targets at hand. The CDW Management plan includes:

- Name and address of owner in case of a natural person or legal entity
- Description of the project including timeline and land registry/town planning details of the plot on which the construction activity will take place
- Estimated quantities per type of CDW (either by volume or weight) expected to be produced during the project, as well as the expected quantities to be reused or recovered, taking into account the opinion of the project consultant.
- The CDW management methods to be implemented, the necessary equipment which could be used for processing CDW.
- The agreement with a licensed CDW Management unit for collecting and processing CDW.
- The location within the construction site for temporary storage and processing of CDW.

The regulations further describe the obligation of single and collective CDW systems in order to achieve the 70% target as well as the necessary licenses and certifications required according to the legal framework.

5.1.3.2 Platforms and Networks Facilitating the Transition to a Circular Economy

Circular Economy Platforms

Following the European and National action plans a number of platforms and networks have begun appearing in Cyprus pertinent to Circular Economy. Most of the initiatives are still in their infancy, but in all cases the composition of this initiatives engages a diverse spectrum of stakeholders including academia, policymakers and industry amongst others. A few of these initiatives are presented below:

- Cyprus Circular Economy Network (CCEN)
  - The first pioneering network for Circular economy in Cyprus founded by the Cyprus Federation of Industrialists and Employers (OEB), the Cyprus Institute of Management (CIIM), the Cyprus Institute (CyI), the Cyprus University of Technology (CUT) and the Cyprus Organisation for Standardisation (CYS)
  - The ultimate goal of the CCEN is to enable and accelerate the transition of Cyprus economy to a circular and green economy, especially after the COVID-19 pandemic, offering its services in a multilevel stakeholder approach; businesses, academia and public sector, contributing to the achievement of the economic and social resilience of Cyprus, for a sustainable future.
- The mission of CCEN is
  - Promote the implementation of the European and Cyprus strategy, policy and contribution for achieving the national goals for the circular economy.
  - Enhance the multilevel development of the circular economy, resource efficiency and sustainable production and consumption in Cyprus.
  - Ensure the application of the circular economy principles to reduce value loss by recovering resources via reusing, repairing, refurbishing, remanufacturing, repurposing, and/or recycling.
  - Promote the implementation of the circular economy principles in the design of products, services, infrastructure and processes.
  - Support the utilization of green procurement and ensure circular supply chains and green contracts and supplies.
  - Facilitate the development of smart and circular cities, smart and circular industrial zones/areas with zero waste.
- KyklOIKOdromio (KYK)

  - kyklOIKOdromio is a non-profit organization, which aims to implement educational and research programs, conduct studies, as well as organize events, workshops and other activities in the fields of energy, environmental protection, climate change and Circular economy. It also aims to develop information technologies on related topics.

- Circular Economy Alliance (CEA)
  - The Circular Economy Alliance is a training and consulting organisation for the transition to circular economy offering courses and certifications to several aspects of CE. The mission of the organisation is to strengthen the global workforce by giving professionals and organisations the complete, accredited, reliable, actionable skills and knowledge they need to become change agents while deploying Circular Economy best practices.

Circular Buildings Platform

No circular buildings platform has been established to date.

Building Materials Passport Platform

No building materials platform has been established to date.

Public Procurement Platform

The national action plan for Green Public Procurements was established in 2014 and is operated by the MoA. It communicates green public procurement (GPP) criteria, the categories and national targets. It has been approved by the Council of Ministers of the Republic. Organisations like the Cyprus Energy Agency are GPP Supporter organisations and provide supporting materials and training for achieving the GPP targets. The revised action plan has 4 annexes:

- Annex A: Summarises 12 groups of products/services, n 30 categories. This annex further includes measures and application targets, alongside some guidelines to be included in the procurement documents.
- Annex B: Refers to environmental management pertinent to:
  - Paper consumption
  - Ink cartridges
  - Batteries
  - Electric appliances
  - Hazardous waste
  - Packaging recycling
  - Energy savings

  - Food purchases
  - Noise
- Annex C: EU and National Criteria for GPP
- Annex D: Includes lists of contracting authorities and bodies

The target for Cyprus for GPP is 50% of green public procurement contracts, subject to exceptions. The target for each category is cited in annex A.

5.1.3.3 Funding Opportunities

National Recovery and Resilience Plan

Circular Economy features in the Cyprus National Recovery and Resilience Plan funding schemes and specifically in Measure 3.1 "New growth model and diversification of the economy" and particularly intervention 3.14.—Strengthening Circular Economy in industry which includes the following actions:

- Promotional campaign for building awareness in consumers regarding the advantages of circular economy.
- Operation of a Grant scheme to support the transition of business organisations in a circular economy model.
- Development of a Sharing Marketplace platform for Circular Economy.

Cyprus Research and Innovation Foundation (RIF)

The Circular economy action plan includes provisions for research and innovation grants from RIF which are in the pipeline ("GoCircular grants"). In the meantime, Circular Economy is considered as one of the priorities in horizontal research and innovation calls. A successful integrated project includes the Development of an innovative insulation fire resistant façade from CDW, [311] funded from the EU Regional Fund, the RoC and the Structural Funds through RIF.

International Cooperation and Support from International Organizations

Cyprus through the Cyprus Organisation for Standardisation (CYS) participates in Technical Committees for standards on Circular Economy, including TC350/SC1 Circular Economy in the Construction sector [24].

Challenges, Barriers and Potential Improvements

There are several challenges and barriers related to different areas of implementation of circular economy in the built environment. A pathfinder study [186] for the development of a roadmap for the implementation of Circular Economy Thinking for the Construction sector in Cyprus has identified the following challenges and barriers in 2018.

- Regulations were until very recently in transition. New regulations just published.
- No strict control and enforcement of environmental policy on the precautionary principle, the "polluter pays" principle and the principle of collaboration between industry, regulators and academia.
- Manufacturers and distributors in their majority, are most likely not designing their products in such a way as to minimize the amount of waste produced during manufacturing and to facilitate an ecological removal of those components of the waste which can no longer be reused.
- The absence of a policy requiring designers, builders, and contractors to use an appropriate percentage of recycled CDW materials.
- Lack of environmental inspectors and low organizational capacity for implementation and/or enforcement of the law, causing delays in the administration of fines or non-conviction of CDW management rules violators.
- The general mentality in the construction sector and of the general public in Cyprus is based on the misperception that CDW can be disposed somewhere and left there, since its inert nature makes it harmless for human health and the environment.
- There is a preference to avoid the cost of CDW management (illegal fly tipping or re-use on site) even if it means paying the fine for not complying with the regulations due to the high cost of transport and disposal in collection areas, and general lack of skills and knowledge to organize effective systems of CDW management.
- No perceived value in recycled CDW due to virtually no market demand natural materials are always preferred over recycled materials in the construction works
- Lack of knowledge from construction industry professionals regarding the implementation of CDW legislation, including on knowledge on how to prevent and minimise CDW.
- No market demand for recycled CDW, virgin materials are usually preferred
- There is no implementation of secondary raw material regulation and standards in Cyprus's waste framework policy that would specify: the nature of the waste which could be used as a secondary raw material in construction and/or the minimum concentrations of heavy metals and aromatic hydrocarbons.
- Lack of confidence in the quality of construction and demolition recycled materials restricts the demand for CD recycled materials, which inhibits the development of CDW management and recycling infrastructures in the EU.

A lot of these barriers and issues have been addressed with the recent regulations and their implementation will accelerated the implementation of circular economy

and achievement of the action plan targets. On the other hand, the small scale and isolation (island state) of the Republic of Cyprus, amplifies a number of challenges that can make Circular Economy principles seem unachievable.

5.1.3.4 Examples of Successful Implementation

Public Policy Initiatives

No data to this point.

Private Policy Initiatives

- Nicolaides & Kountouris Metal Company.
  - Circular products: THERMINK and PS THERMINK
  - The company is manufacturing metal panels with polyurethane core. They are using their polyurethane waste stream to create a circular thermal insulation mortar (THERMINK), reducing their polyurethane trimmings waste to zero and managing polyurethane waste from others too. A few years later they developed a similar (lower quality) product using styrofoam waste.
- Elysee plastics
  - Elysee strategically approaches circular economy model, moving on to a sustainable world. GreenDrip project aims to recycle post-industrial polypropylene (PP) material (PPM) generated through the manufacturing processes of piping fittings, producing high-quality recycled PP thermoplastic material—green PP—to be used as secondary material in co-injection molding. GreenDrip project runs for 9 months, a sufficient timeframe for successfully fulfilling all industrial research and development activities/tasks and falls within (TRL) 3–4 (TRL 3—experimental proof of concept, TRL 4—Technology validated in lab) Technology Readiness Levels. The project's implementation plan consists of the creation and lab validation of GreenDrip prototypes.
- KAMERIS GALLERY (no website)
  - Kameris group is a leading Demolition Company. Over the years they began salvaging building material and household components and appliances and created a depot on the outskirts of Nicosia.

5.1.4 Czech Republic Factsheet

5.1.4.1 Policy and Regulatory Framework

Governance

The responsibilities in relation to the implementation of circular principles in the building industry are divided between three ministries and their departments.

The key actor in the implementation of a circular economy in the Czech Republic is the Ministry of the Environment. On its behalf, the strategy "Cirkulární Česko" was issued in 2021 [199]. This ministry has several competencies related to circularity such as waste legislation and protection of nature. On the other hand, the competencies concerning the production of materials and products (even secondary raw materials) are covered by the Ministry of Industry and Trade. Moreover, this ministry also organizes national funding schemes to support business development and circularity of SMEs.

Concerning buildings, another key actor is the Ministry of Regional Development, which has competence over the Building Act and related documentation. Therefore, the parameters of buildings and their limits for building permits and permits for building demolition are defined by departments of this Ministry. As the building industry is an important part of the economy, the parameters of buildings are also developed in coordination with the Ministry of Industry and Trade.

There are also national agencies, which are responsible for the development of knowledge for ministries and the preparation of background data for preparation of strategies. One of the key agencies is the Czech Standardization Agency, which is currently supporting the development of BIM and digitalization standards and standards for demolition audits. Another agency is the Czech Environmental Information Agency, which collects for example data about waste management. On the other hand, the collection of data about raw materials is the responsibility of the Czech Geological Survey.

Legislation

The main act, which regulates the circularity of materials in the Czech building industry, is the Waste Management Law and linked regulations [198]. This act defines the obligation of a producer of waste to manage it properly in compliance with the waste hierarchy. However, recycling of waste is limited by regulations to disable the possibility for recycling of hazardous waste. The key regulation for recycling of aggregates, as a main part of construction and demolition waste, is regulation about waste management [197], which defines the limits of hazardous compounds, methods of sampling and possible final use. Furthermore, the recycling of some materials is then subject to other regulations such as regulation about asphalt [200], which defines the limits of polyaromatic hydrocarbons concerning the final use of

asphalt. A similar regulation considering also final use and function of the recycled material is also being prepared for concrete and other materials.

The Building Act in the Czech Republic supports circularity only in a general way. At first, the act declares that the building must be used only as a product, which supports the proper and safe function of the building, which can often be used as an excuse to not use recycled materials. On the other hand, the act refers to the regulation of building documentation. A new version of this regulation, which is being prepared will define in more detail the documentation needed for pre-demolition audits, which should support higher use of recycled materials.

Circular Economy Strategy, Roadmap or Action Plan

The main strategic document related to circular building industry in the Czech Republic is "Cirkulární Česko 2040" [199]. This document introduces the principles of circular economy in the main areas of industry and economy in the Czech Republic. One of these areas is the building industry as a part of the chapter about resources consumption, the building industry and energy consumption. In this part, the state of the art is described in eleven paragraphs pointing out the significance of European initiatives such as the renovation wave, waste management goal (70% rate of recycling), energy refurbishment of the old housing etc. Based on this state-of-the-art description, main goals are set with the support of principles and measures. Concerning the building industry, the main measures cover support of digitalization in the building industry, increased rate of recycling materials, and support of secondary materials in green public procurement. Unfortunately, no specific indicators are defined for these measures.

Construction and Demolition Waste Management Regulatory Framework

The main document affecting waste management is the Waste Management Plan of the Czech Republic. This document declares the goal of a 70% recycling rate and defines measurable indicators and measures. Following this document, regions and cities have the same goal stated in their local waste management plans.

The reaching of the above-mentioned goal is regulated mainly using the Waste Management Act. Also, the circular strategy for the Czech Republic was published to indicate key activities to increase circularity of the Czech Republic.

5.1.4.2 Platforms and Networks Facilitating the Transition to a Circular Economy

Circular Economy Platforms

One of the key platforms is a working group on circular economy and sustainable materials organized by the Czech Green Building Council [28]. The main aim of this working group is to support their members in the adoption of circular measures and communicate the needs of the building industry to the state representatives.

The Circular Economy Hotspot organized by the Institute for circular economy covers different areas of industry and economy and creates a space for networking and raising awareness about topics for circular building economy [153].

The demolition companies and recycling companies are grouped in ARSM., which is the association for the development of construction materials recycling [2].

Circular Buildings Platform

No circular building platform has been established to date.

Building Materials Passport Platform

No building materials platform has been established to date.

Public Procurement Platform

The national green public procurements platform was founded with the support of the Ministry of Labour and Social Affairs in 2021 [196]. The platform aims to raise awareness about public procurement and implementing other facilities concerning social and environmental perspectives of sustainable development. The platform creates space for networking and sharing of good practices among cities, state and regional authorities.

5.1.4.3 Funding Opportunities

The National Recovery Plan of the Czech Republic is organized by the Ministry of Industry and Trade and it aims to support tackling of challenges of green transition and innovation [176]. It covers multiple activities and supports research via the Technology Agency of the Czech Republic.

International Cooperation and Support from International Organizations

No data to this point.

5.1.4.4 Challenges, Barriers and Potential Improvements

Based on the discussion with stakeholders grouped in professional organization for building industry—Czech Green Building Council [28], the main barriers were summarized in the Table 5.2 below with recommended actions.

5.1.4.5 Examples of Successful Implementation

Public Policy Initiatives

No data to this point.

Private Policy Initiatives

No data to this point.

5.1.5 Finland Factsheet

5.1.5.1 Policy and Regulatory Framework

Governance

According to the Government Resolution on the Strategic Programme for Circular Economy [230], which entered into force on April 8, 2021, the Ministry of the Environment is the official body of Finland that shapes circular economy policy. The aim of the Ministry of the Environment [231] is a circular economy that provides a foundation for all economic activities so that the production and consumption are within the Earth's carrying capacity. A circular economy offers solutions to mitigate climate change and halt the decline in biodiversity. In a circular economy natural resources are used more sustainably and they are kept in circulation safely and for a longer time. At the Ministry of the Environment, work on a circular economy is being done at the Department of the Built Environment, Environmental Protection Department and Department of the Natural Environment.

According to the Government Programme, "Finland's role as a pioneer of the circular economy will be strengthened and a cross-administrative, Strategic programme to promote a circular economy and its indicators will be implemented.

Table 5.2 The main barriers

Barrier	Recommend action
Removing legislative barriers	Definition of waste and related terms Proper waste transfer approach Monitoring of national policies and strategies (ask someone from MIT's industrial ecology department to join the group) Sharing good practice on donation contracts (waste donation, valuation) Definition of guarantees for reused elements Mapping the implementation of mandatory pre-demolition audits
Increasing the demand from contracting authorities for environmentally friendly materials	Sharing examples of how to make selections to favour environmentally friendly materials
Adjustment of standards	Support for the extension of standards for individual product categories to take into account (and therefore allow) the recycled content Definition of the content of the pre-demolition audit documentation Support for the preparation of a standard for pre-demolition audits
EPD support	EPD mandatory only from 2028 (CPR)—map what is covered, help/support/require to implement earlier
Increase the availability of information on materials contained in buildings	Obligatory statements of works for refurbishments, BIM standards, passporting, how to store and submit data and who should do it (for new and existing buildings)
Education—circular and green products and building design	Architects, designers—circular buildings: recycling myths, design for deconstruction Contractors and suppliers—concerning circularity, wood and other natural materials Good circular practice in building management—fit-outs
Increase the take-back capacity of manufacturers and other processors	Mapping the readiness of manufacturers and other processors to take back used products (list of materials and entities able to take it back)
Information support for investors and developers	Mapping the readiness of producers to decarbonise production Sharing of good examples for reaching 70% recycling for taxonomy (DNSH)—technical solutions for realistic achievement and reporting (for funding)

The programme sets objectives, defines the necessary measures and allocates the necessary resources. The transition to a circular economy is an important opportunity for Finland. The circular economy offers a way to strengthen Finland's export-driven economy and employment. At the same time, it will reduce the consumption of natural resources and the resulting CO_2 emissions and other environmental impacts. The circular economy is not just about the economy and technological solutions. The transition to a carbon–neutral circular economy will require a comprehensive change both in decision-making and planning by society and in the attitudes and behaviour of companies, households and consumers." [224].

Legislation

The Government Resolution on the Strategic Programme for Circular Economy [230] has been prepared in cooperation between key ministries (Ministry of the Environment, Ministry of Economic Affairs and Employment, Ministry of Agriculture and Forestry, Ministry of Finance, Ministry of Transport and Communications, Ministry of Education and Culture and the Ministry of Foreign Affairs) and research institutes (Natural Resources Institute Finland, Finnish Environment Institute, VATT Institute for Economic Research, VTT Technical Research Centre of Finland) as well as SITRA and Business Finland (BF). The steering group has been led by Professor of Working Life Reijo Karhinen, and the Ministry of the Environment and the Ministry of Economic Affairs and Employment have been responsible for the practical preparation. This resolution outlines the key measures that the ministries have committed to implementing in their areas of responsibility in 2021–2024 to the extent that this is possible within the framework of their resources.

According to the Government Resolution (2021), the vision of the programme is that in 2035, a carbon–neutral circular economy society will be the foundation of successful economy in Finland, in which:

- Sustainable products and services will be part of the mainstream economy and the sharing economy will a normal part of daily life.
- Our choices will be future-proof and strengthen a fair welfare society.
- More for less: The use of natural resources will be sustainable and materials will remain in circulation for longer and safely.
- The circular economy breakthrough has been made with the help of innovations, digital solutions, smart regulation and responsible investors, companies and consumers.
- Circular Economy Finland will influence the world and provide sustainable solutions in international markets.

The implementation of the vision will require the sustainable and efficient use of natural resources. This is outlined by the following steps and objectives:

- The consumption of non-renewable natural resources will decrease, and the sustainable use of renewable natural resources may increase to the extent that

the total consumption of primary raw materials in Finland in 2035 will not exceed what it was in 2015. The natural resources used to manufacture exported products are not covered by the objective.
- The profitability of resources will double by 2035 from what it was in 2015.
- The circular economy rate of materials will double by 2035.

Circular Economy Strategy, Roadmap or Action Plan

National. Leading the cycle—Finnish road map to a circular economy 2016–2025 [324] is a Finnish circular economy roadmap, published in 2016 by the Finnish Innovation Fund SITRA [325]. Finland's circular economy road map describes the concrete actions that can accelerate the transfer to a competitive circular economy in Finland. The road map highlights best practices and pilots that can be easily replicated and provide added value on a national scale. According to the SITRA [314], the target of the Finnish government and the road map is to make Finland a global leader in the circular economy by 2025. The goal and mindset are the starting points for the road map according to which the road map will make Finland a leading circular economy country by 2025. This change will emphasise the state's role as a facilitator and supporter, research, development and innovation activities, and a strong company, export and technology orientation combined with the search for comprehensive solutions and co-operation covering the entire value chain.

Finland will seek a pioneering role by focusing on five interlinked focus areas: (1) a sustainable food system, (2) forest-based loops, (3) technical loops, (4) transport and logistics, and (5) joint actions. Synergies between these areas will also be taken into account. The actions in the different focus areas of the road map are divided into three levels: policy actions, key projects and pilots. Out of more than 100 ideas, the pilots with the greatest opportunities for expansion and best supported the target were included in the project portfolio. The process of compiling the road map also identified areas in which Finland should be active but where the necessary initiatives haven't been clarified or responsible parties still have to be found [314].

The Roadmap was revised in 2019—Finland 2016–2025 Circular Economy Roadmap 2.0. [326]—and includes the following strategic objectives [315]:

- Renewal of the foundations of our competitiveness and vitality, putting the focus of circular economy solutions on competitiveness and an economic growth strategy.
- Making a shift to low-carbon energy; in addition, we need to promote the efficient use of energy and set more ambitious goals in our climate and energy policies.
- Natural resources are regarded as scarcities, because to reach the climate targets of the Paris Agreement consumption and production in Finland can no longer be based on the limitless use of natural resources.
- Everyday decisions act as catalysts for change. Cutting our carbon footprint in half by 2030 requires the adoption of a new kind of approach to ownership, in terms of culture, taxation and income distribution.

Regional. Ostrobothnia in Transition—Roadmap for sustainable development and circular economy [163] is based on the UN's 17 Sustainable Development Goals. The report has been prepared by Ostrobothnian development companies in co-operation with the Regional Council of Ostrobothnia and the EU Regional Development Fund. The report is published as part of the CERM project, Circular Economy Road Map and Action Plan for Ostrobothnia Region in Finland. The CERM project creates a roadmap including a strategy and an action plan for the three regions in Ostrobothnia, Finland to develop a society that is based on circular economy and sustainable principles. The goal is to identify the most important branches in each region that have the biggest volumes and where circular economy can be implemented in the easiest way. The strategy and action plan are based on statistics, structure of the society, inhabitants and business life.

Local. The City of Helsinki's Roadmap for Circular and Sharing Economy [38] was laid out in 2020. The City of Helsinki's Roadmap for Circular and Sharing Economy is one of the 147 actions in the Carbon–neutral Helsinki 2035 Action Plan. The roadmap includes the following four focuses: construction, procurements, green waste, and sharing economy and new business opportunities in circular economy. One topic in the roadmap is the reduction of the consumption of plastics and increased utilization of recycled plastics. The roadmap has been processed in workshops in collaboration with experts from both inside and outside the City. A team consisting of representatives of the City's Environmental Services has coordinated the work. The goals for each focus are set until 2035. At this point, more detailed reviews cover only the council terms of 2020–2021 and 2021–2025. Interim goals and supporting practical actions have been set for each focus and for both of these terms. The intention is to update the interim goals and actions in the roadmap during each council term starting from 2025 and until 2035.

Construction and Demolition Waste Management Regulatory Framework

The National Waste Plan to 2027 [331] has been approved is 2022 (in Finnish, only abstract in English). The plan presents the objectives for waste management and for preventing the creation of waste and the measures to reach the objectives. In accordance with the Government Programme, the Waste Plan sets out a vision extending to the 2030s that supports the recycling and circular economy objectives. The aim is to increase the recycling rate at least to the level of the recycling targets of the EU.

The National Waste Plan to 2027 includes both a plan to reduce the volume and harmfulness of waste and a waste management plan. In terms of the geographical area, the plan covers the whole of Finland except for the Åland Islands. Vision of the National Waste Plan to 2030:

- Material-efficient production and consumption save natural resources and mitigate climate change.

- The volume of waste has decreased from the present. Recycling and reuse have risen to a new level.
- High-quality waste management is part of a sustainable circular economy.
- Circular economy markets function well. Recycling and reuse create new jobs.
- Valuable raw materials present in recycled materials even in small concentrations can be recovered.
- Material cycles cause no harm and hazardous substances are used less and less in production.
- Cooperation between operators in the sector promotes high-quality material cycles.
- Reliable and comprehensive data supports the circular economy. Information is available for use in digital form.
- There is high-quality research and experimentation in the waste sector and expertise on waste management is of a high standard.
- Legislation supports circular economy innovations and the conditions where it operates.

The Waste Plan proposes measures to reach the vision and objectives. The implementation and impact of the Waste Plan will be monitored annually.

5.1.5.2 Platforms and Networks Facilitating the Transition to a Circular Economy

Circular Economy Platforms

Circular Economy Finland (KiSu) [35] is a hub for circular economy know-how. Circular Economy Finland (KiSu) is a hub of skills and knowledge which unites those who seek solutions with those who offer them. The network supports different actors in finding their own circular economy paths. KiSu is one of the actions launched by the national circular economy programme of Finland. The programme is coordinated by the Ministry of the Environment and the Ministry of Economic Affairs and Employment.

KiSu creates a shared image of the current situation of circular economy, the direction for the future, and state of mind. KiSu:

- Unites networks and actors in developing solutions and promoting the spread of the best circular economy practices
- Compiles and shares information on concrete actions, benefits, solutions, and possibilities related to circular economy
- Helps in finding the right partners, channels, and sources of funding, and supports the search for solutions to bottlenecks
- Works together with municipalities to build ways of committing to the long-term advancement of circular economy in the different sectors where the municipality operates
- Supports companies in developing circular economy-based business activities.

Circular Buildings Platform

No circular buildings platform has been established to date.

Building Materials Passport Platform

The Green Building Council Finland (FIGBC) [134] is a non-profit association founded in 2010 that gathers and refines sustainability know-how in the building and construction sector. FIGBC's network consists of around 300 member organizations and other active partners.

FIGBC's core functions regarding the built environment are advancing sustainable development practices, providing knowledge and know-how, activating dialogue and conversation, and connecting Finland to the international Green Building Council network.

Within that, the MADASTER materials passport [179] is set to become the new standard in the real estate sector. Generating a digital materials passport for every building opens up the possibility of creating a circular economy within the construction industry.

FIGBC's vision is that by 2035 Finnish built environment is a fundamental part of the solution to climate change and functions according to the principals of circular economy. The association's strategic goals for the years 2021–2023 include urging over 50% of the Finnish professional real-estate owners to set a goal for carbon–neutral energy use, produce in cooperation with the built environment sector a carbon neutrality action plan for the building and construction sector and ensuring that in all major built environment projects low-carbon solutions and circularity are considered.

Public Procurement Platform

KEINO [142] is a network-based Competence center for Sustainable and Innovative public procurement in Finland. KEINO started its operations on March 2018. KEINO started its operations on March 2018. KEINO is part of the Government Programme's implementation. It is funded and steered by the Ministry of Economic Affairs and Employment. The strategic management of KEINO is supported by a secretariat appointed separately from the representatives of the ministries and a broad-based cooperation group.

The priorities of KEINO's activities in 2022–2023 are:

- procurement of new solutions,
- implementation of ecosystem agreements with cities and
- refining lessons learned into practical tools and operating models for procurement units.

The value of the Finnish public sector's procurements is approximately EUR 47 billion annually, or on average 20% of the country's GDP.

5.1.5.3 Funding Opportunities

According to Finnish Ministry of Environment, the EU regional and structural policy programme Innovation and Skills in Finland (2021–2027) [232] to an external website aims to promote energy efficiency and the circular economy and to reduce greenhouse gas emissions. Funding will also be targeted to actions to prepare for climate change. Responsible organisations: Ministry of Economic Affairs and Employment and Ministry of the Environment.

SITRA [327] launches and implements projects together with the private, public and third sector, all aimed at increasing sustainable well-being in Finland. There is no specific funding call for applications or application form, and interested stakeholders should contact SITRA directly.

International Cooperation and Support from International Organizations

Nordic Circular Hotspot [248] is a network and facilitator that aims to accelerate the transition to a sustainable and circular economy in the Nordic countries. Circular economy is an economic system that designs out waste and pollution, keeps products and materials in use as long as possible, and regenerates natural systems.

Vision—The Nordic Circular Hotspot envisions a vibrant, prosperous and regenerative region that will be fully circular and a role model for others in the world to follow. The old ways of achieving success are no longer working and, therefore, the Nordic Circular Hotspot envisions a new status quo in the Nordics. Through its strategic and systemic approach, the Nordic Circular Hotspot aims to accelerate the transition to an inclusive, circular and sustainable economy in the Nordics.

Mission—Through propelling collaboration, knowledge, capacity building and investments in circular economy solutions, the Nordic Circular Hotspot's mission is to accelerate the transition to an inclusive, resource-efficient, regenerative and circular market in the Nordic region and contribute in a meaningful way to:

- reinventing how the Nordics design, produce and market products;
- rethinking how the Nordics use and consume goods and services; and
- redefining growth in the Nordics and what is possible through reuse, reduction, repairing, regeneration and, most importantly, systems change.

The World Circular Economy Forum 2023 [365] gathered together nearly 1900 forward-looking thinkers and doers and presented the game-changers in the circular economy. The Forum brought together representatives from 155 countries, and the main event had more than 12,500 online views. The annual World Circular Economy Forum (WCEF) presents the world's leading circular economy solutions with business leaders, policymakers and experts participating from around the world. Circular economy approaches can help businesses seize new opportunities and gain a competitive advantage, as well as contribute to achieving the United Nations Sustainable Development Goals. WCEF is a global initiative of Finland and SITRA, the Finnish Innovation Fund. The first Forum, WCEF2017, identified key elements of a circular

economy and showcased solutions and learnings from around the world, bringing together 1500 people from more than 100 countries.

5.1.5.4 Challenges, Barriers and Potential Improvements

Despite its leadership in thought, Finland—like most other countries in the world—is, in practice still far from circular economy objectives. In an assessment of Finland's sustainable development policy, climate change, the state of the environment and overconsumption as well as the increasing inequality of society were identified as the greatest challenges in Finland. Finland is a European leader in competitiveness and in the number of eco-innovations that save the environment in new ways, which their demanding environmental legislation acts as an incentive for. They have also traditionally been strong in research, development and innovation funding. In the 2010s, Finland lost its position as a pioneer in innovation activities [224]. Bottlenecks in the progress of the circular economy include attitudes, a shortage of experts, investments in established operating models and a high threshold for the introduction of new business models, as well as the poor steering effect of prices, as harmful external impacts are not sufficiently priced [224].

5.1.5.5 Examples of Successful Implementation

Public Policy Initiatives

CIRCWASTE [96] is a seven-year LIFE IP project that promotes efficient use of material flows, waste prevention and new waste and resource management concepts. It is a regional cooperation network—regions and forerunner municipalities. The project is implemented during the years 2016–2023. All actions contribute to implementing the national waste management plan and directing Finland towards a circular economy. CIRCWASTE is a creation of 20 partners and 10 funding organisations. The project is coordinated by the Finnish Environment Institute. CIRCWASTE is funded in large part by the EU LIFE programme.

Fisu [97] (Finnish Sustainable Communities) is a network of Finnish municipalities committed to working towards becoming carbon neutral and waste-free and curbing overconsumption by 2050. Today, the network consists of 11 municipalities: Forssa, Hyvinkää, Ii, Joensuu, Jyväskylä, Kuopio, Lahti, Lappeenranta, Riihimäki, Turku and Vaasa. The Fisu network is a competence community of resource-smart pioneer cities and municipalities. They help their members to develop new low-emission operating methods and solutions that create sustainable wellbeing and growth based on local strengths.

Private Policy Initiatives

EcoUp [69] is a circular economy group that manufactures carbon–neutral thermal insulation and reuses the side streams from construction. They promote green construction by developing and manufacturing construction products and raw materials from discarded materials. To solve the waste problem, they develop equipment and methods to give new life to construction and demolition waste as ecological and competitive construction end products. They turn waste fractions that traditionally have been difficult to utilize into resources for new building and infrastructure products. By licensing the technology to their customers and partners, they multiply the benefits for the environment.

Environmental management company Remeo [299] invested 35 million euros in a recycling plant in Vantaa that uses artificial intelligence to recycle waste from the construction industry and to reuse it much more efficiently than before. Thanks to artificial intelligence, they can sift out pure raw material from waste and recover it to be reused by companies and industry. Domestically generated secondary raw materials raise the recycling rate in Finland and reduce the carbon dioxide emissions by removing the need to transport waste abroad [316].

5.1.6 France Factsheet

5.1.6.1 Policy and Regulatory Framework

Governance

The Ministry for an Ecological and Solidary Transition [235] is the official body for shaping circular economy policy. According to the competent Ministry, in France, the transition to a circular economy is officially recognized as one of the objectives of the energy and ecological transition and as one of the commitments of sustainable development.

It requires progress in several areas.

- Sustainable sourcing: taking into account the environmental and social impacts of the resources used, in particular those associated with their extraction and exploitation.
- Eco-design: taking into account environmental impacts over the entire life cycle of a product and integrating them from the design stage.
- Industrial and territorial ecology: synergizing and pooling between several economic actors the flow of materials, energy, water, infrastructure, goods or services in order to optimize the use of resources in a territory.
- Functionality economy: favoring use over possession, selling a service rather than a good.

- Responsible consumption: taking into account the environmental and social impacts at all stages of the product's life cycle in purchasing choices, whether the buyer is public or private.
- Extending the useful life of products through the use of repair, sale or second-hand purchase, through donation, within the framework of re-use and re-use.
- Improving the prevention, management and recycling of waste, including reinjecting and reusing materials from waste in the economic cycle.

Further, the National Circular Economy Council (CNEC) [236] is a consultative body created in 2021 to replace the National Waste Council (CND), set up in 2001 and dealing solely with the field of waste. This body makes it possible to ensure regular dialogue and close association of the main stakeholders in the areas of action of the circular economy in the construction of Government policy. CNEC is the forum for dialogue on the circular economy. It succeeds the National Waste Council, a consultative body created in 2001 and informally replaced in 2017 by the Circular Economy Roadmap Steering Committee. This committee included the members of the National Waste Council but was also open to all the themes of the circular economy beyond waste management. It had also associated with its work "*circular economy ambassadors*" whose mission is to contribute to the Government's roadmap and to the dissemination of best practices in this area to citizens, businesses and communities. The CNEC's field of action goes beyond waste management to encompass areas of action for sustainable consumption and production such as the eco-design of products, the functional economy, repair, reuse, etc.

The National Council for the Circular Economy *is an advisory administrative body, attached to the Ministry* responsible for the environment and which, as provided for in the Environment Code (article D. 541-1), has the following missions:

- The ministers responsible for the environment and the economy can call on it for advice on issues relating to the circular economy, from the extraction of materials to waste management, etc. Opinions are submitted to the Government.
- The National Council for the Circular Economy can be consulted on draft legislative and regulatory texts having an impact in this area.
- The National Council for the Circular Economy can take up any question of national interest concerning the circular economy.
- The National Circular Economy Council participates in the development and monitoring of national circular economy strategies.
- It monitors the implementation of circular economy policy guidelines, in particular as defined by European directives and related laws.
- The National Council for the Circular Economy is kept informed of the orientations of the strategic committees of the industrial sectors of the National Council for Industry in terms of the circular economy and in particular the extension of the lifespan of products, eco-design, recycling and waste recovery.

Legislation

France adopted in 2020 an ambitious law to shape a system-wide transition towards a circular economy—Loi relative à la lutte contre le gaspillage et à l'économie circulaire [98] (the anti-waste law for a circular economy) referred to in short as the Anti-waste Law or AGEC. The French law on the fight against waste and for the circular economy encourages businesses across various sectors, municipalities, and citizens to eliminate waste and adopt more circular practices. The law also aims to promote a societal transformation and support the solidarity economy. It introduced several measures that are a world first, such as the ban on the destruction of unsold goods and the repairability index. The law originates from France's climate change reduction commitments and successive national policies, such as the 2015 Energy Transition Law for Green Growth and the 2017 French Climate Plan, which have helped to build the momentum towards its adoption [73].

According to the Ministry's official website, the anti-waste law for a circular economy aims to transform the French system in depth, with its 130 articles addressing all forms of waste. The law aims to transform the linear economy (produce, consume, throw away) into a circular economy.

It is divided into five main axes:

- phasing out of disposable plastic;
- better inform consumers;
- fight against waste and for solidarity reuse;
- act against planned obsolescence;
- produce better.

It sets new objectives for the years to come.

France's new regulation, known as RE2020 law [237], significantly tightens the existing energy efficiency requirements on the construction industry, aiming for a 50% reduction in embodied carbon emissions of buildings by 2030 and full decarbonization by 2050. Under this law, a project's carbon footprint will be calculated based on the emissions created during its whole life cycle, including the construction phase and even the manufacture and transportation of the building materials, which puts emphasis on the use of environmentally sustainable materials and manufacturing. Developers are required to create more comfortable spaces in extreme temperatures without having to rely on air conditioning, and users should be provided with buildings which consume less energy and generate a lower carbon footprint [160]. The law forcing the construction industry to reduce its carbon footprint took effect on 1 January, 2022, and becomes more stringent in 2025, 2028 and 2031 to ensure emissions go down. It currently applies to new offices, residential buildings, and primary and secondary education facilities, and will also apply to specific tertiary buildings (hotels, restaurants, retail, and gyms) before the end of 2023 [330].

Circular Economy Strategy, Roadmap or Action Plan

The roadmap for the circular economy (FREC) operationally describes the transition to be made to move from a linear economic model "manufacture, consume, throw away" to a circular model that will integrate the entire life cycle of products, from their eco-design to waste management.

In April 2018, the Ministry for an Ecological and Solidary Transition issued the Circular Economy Roadmap: 50 measures for a 100% circular economy [233]. The document charts a path for rapid progress towards the ambitious goals of the Climate Plan in matters relating to the circular economy. It is the results of 4 workshops between stakeholders around 4 topics: territories, plastics, sustainable consumption/production and economic instruments. At the same time, an online platform was opened to collect citizens' opinions. The French roadmap includes 50 measures for a 100% circular economy, divided into four key priority areas:

1. A Roadmap for Better Production;
2. A Roadmap to better consumption;
3. A Roadmap for Better Managing Our Waste;
4. A Roadmap for Mobilizing all Actors.

Objectives:

- Reduce natural resource use related to French consumption: 30% reduction in resourceconsumption in relation to GDP between 2010 and 2030.
- A 50% reduction in the amount of non-hazardous waste landfilled by 2025, compared to 2010.
- Aim towards 100% of plastics recycled by 2025.
- Reduce greenhouse gas emissions: avoid the emission of 8 million additional tonnes of CO_2 each year thanks to plastic recycling.
- Create up to 300,000 additional jobs, including in new professions.

The Roadmap development and the implementation of the AGEC law is the joint responsibility of the Ministry for the Ecological Transition and the Ministry of the Economy, Finance and the Recovery. The strong coordination between these two key ministries enhances the coherence and impact of the law, ensuring that it will significantly influence the economic growth path of the country.

Construction and Demolition Waste Management Regulatory Framework

The 2018 revision of the 2008 Waste Framework Directive, which follows the Grenelle French Environmental Act, is the new reference text for waste management policy in the European Union. The Grenelle Act is an example of a national legislative framework that has set the tune for all the European Member States until they adopted the CE Principles for building design by 2020. In addition, consultation work was carried out in 2012 and 2013 within the framework of the National Waste Council's prevention working group and resulted in the drafting of a National Waste

Prevention Programme for the period 2014– 2020. The programme has provided a reduction of 7% in the production of household and similar waste per inhabitant in 2020 compared to the 2010 level, as well as a stabilization of waste production from economic activities (DAE) and construction [53].

The plan stands for a gradual implementation of 54 concrete actions, divided into 13 strategic areas, which will contribute to achieving 4 actions in the B&C sector, the first of which has already been completed [53]:

1. Sector-wide voluntary recycling protocol for construction and demolition waste;
2. Whitepaper of possible uses of the environmental footprint of products, including certain materials in the construction sector, to measure and indicate environmental information (PEF) (in progress);
3. Guidelines on pre-demolition analysis for the construction sector, the French version of which is a diagnosis (currently being drawn up);
4. Guidelines to develop indicators for assessing the environmental performance of buildings throughout their life cycle and measures for their use, also known as Levels.

According to the information [238] about products and construction materials of the building sector (PMCB) on the website of the competent ministry, the law of February 10, 2020 relating to the fight against waste and the circular economy (AGEC) provided for the establishment of an EPR sector for construction products and materials in the building sector from 2022 with a view to:

- Reduce illegal dumping by improving collection by free collection of waste, increasing the density of collection points, and improving traceability;
- Prevent the saturation of landfills by developing material recycling as well as reuse and reuse.

EPR requires companies that sell or import waste-generating products or components and materials used in their manufacture to ensure the prevention and management of this waste [353].

Legislative and regulatory principles. Article L. 541-10-1 (4°) of the Environment Code in its wording resulting from Article 62 of the "AGEC" law provides that waste from construction products and materials in the building sector is taken back free of charge when it is subject to separate collection and when traceability of this waste must be ensured. It provides for a Conseil d'Etat decree to define the minimum conditions for the territorial network [239].

In addition, Article L. 541-10-23 of the Environment Code in its wording resulting from Article 72 of the "AGEC" law sets the obligations incumbent on eco-organizations and distributors affected by this new REP (Extended Producer Responsibility) sector. In particular, it provides for a mixed financial and operational operation for the eco-organizations which are required both to cover the costs of any person who ensures the recovery of waste from the building collected separately and to provide for this recovery when this is necessary to ensure the territorial network.

5.1.6.2 Platforms and Networks Facilitating the Transition to a Circular Economy

Circular Economy Platforms

The economiescirculaire.org [70] brings a number of free services:

- Follow circular economy news and identify opportunities;
- Promote your company locally and internationally;
- Join the cast and participate in the network
- Create partnerships and integrate project communities;
- Access implementation tools and methodologies;
- Use feedback and highlight your achievements.

Circul'R [32] is an international network of circular economy startups. Its mission is to unlock the circular economy's potential by connecting innovative startups with companies so that they can co-create solutions to accelerate their transition towards the circular economy. Its main services are [77]:

- raising awareness (conferences to explain circular economy by presenting the most innovative circular solutions),
- learning expeditions (bringing people on the field to meet with circular economy entrepreneurs and their projects),
- consultancy (business opportunities, funding, etc.),
- Circul'R Club (bringing together large companies and startups with the objective of co-creating concrete projects in the field of circular economy: waste management, eco-design, new business models, etc.).

Founded in 2013, the National Institute for the Circular Economy (INEC)—l'Institut National de l'Économie Circulaire [155] aims to promote the circular economy and accelerate its development through the dynamics of cooperation. A multi-stakeholder organization, it consists of more than 200 members, public and private organizations: companies, federations, communities, institutions, associations, non-governmental organizations and universities. The diversity of these members enables nurturing a holistic vision of the circular economy, taking into account all economic, social and environmental issues. The activity of the Institute mainly revolves around 3 axes:

- animation of reflection,
- promotion of circular economy,
- implementation of circular economy.

Eclaira [68], is the regional collaborative platform dedicated to the circular economy in the French region Auvergne-Rhône-Alpes. It aims to:

- Identify and highlight initiatives carried out in the region;
- Encourage collaborative projects in the circular economy;
- Promote the implementation of the circular economy in the region.

Its main objectives: to identify initiatives, encourage projects and thus promote the implementation of the circular economy in the territory by all the actors involved.

Circular Buildings Platform

No circular buildings platform has been established to date.

Building Materials Passport Platform

No building materials platform has been established to date.

Public Procurement Platform

The action-program "Circular procurement" [78] was a one-year experiment, inspired by the Dutch and Belgian "Green Deals" models and launched in 2018. It aimed at bringing together actors from the public and private sectors to collaborate on a project to foster the circular economy as an essential factor in their purchasing decision-making.

The objectives of this program were:

- to create and share knowledge by promoting excellent approaches
- to have real impacts on the use of resources and social and economic realities
- to raise awareness and convince on the benefits of integrating the circular economy in the purchasing process for the economy, social and environment.

5.1.6.3 Funding Opportunities

The ambitious objectives set for 2020–2025 to initiate the transition to a circular economy require a substantial volume of investment [240], as well as aid for innovation to accelerate the dynamics of transition. Certain investment projects may be the subject of public aid, in particular from ADEME [1]—the French Agency for Ecological Transition. Their mission is to accelerate the transition to a more sober and supportive, job-generating, humane and harmonious society. They support innovation and research up to the application and sharing of solutions. As such, they advise, facilitate and help finance many projects of companies, local authorities, associations and doctoral students related to the ecological transition. ADEME is an important vector for the massification of solutions and the mobilisation of stakeholders. As such, we have several financing levers. Through the Renewable Heat Fund, the Circular Economy Fund and the Air-Mobility Fund, we finance all stages, from research to development to industrialisation, including demonstrators.

ADEME also relies on the State's major investment plans, such as the Investments for the Future Pogramme, the Recovery Plan and today the France 2030 plan. The

France 2030 plan, launched in October 2021, offers unprecedented ways to meet ecological, economic, industrial and social challenges. This innovation and industry plan aims to sustainably transform key sectors of our economy (energy, automotive, aeronautics, digital and space) and to position France as a leader by bringing out future technological champions. France 2030 builds on the achievements of the Investments for the Future Programmes (Programmes d'investissements d'avenir—PIA), and in particular PIA 4 endowed with €20 billion that it integrates and exceeds in ambitions and means. In total, France 2030 mobilises €54 billion to ensure that companies, universities and research organisations fully succeed in their transitions in strategic sectors.

Their financial aid to companies, local authorities, research organisations and advocacy structures covers four areas of intervention:

- Reducing energy consumption and greenhouse gas (GHG) emissions,
- Developing renewable energies and the circular economy,
- Converting brownfields and polluted sites,
- Improving indoor and outdoor air quality.

International Cooperation and Support from International Organizations

A multi-stakeholder association created in 1992, ORÉE [254] has for 30 years brought together and led a network of stakeholders committed to exchanging and implementing an environmental dynamic serving the territories. Today, ORÉE brings together, supports and equips a network of more than 200 members, companies, communities, professional and environmental associations, academic and institutional organizations, etc.

The association's action focuses on three priorities:

- Biodiversity and economy, or how to integrate biodiversity into organizational strategy
- Circular economy covering approaches focused on both products/services/equipment (functionality economy, eco-design), sectors (recycling/recovery) and territories (industrial and territorial ecology)
- CSR/ESG reporting in line with French and European regulations on the publication of extra-financial information.

ORÉE offers a global, systemic and integrated approach to all physical flows in order to benefit from the potential of the circular economy and to propose the bases and trajectory of a new economic model. In this sense, all the operational pillars for a systemic and integrated global economy invested by ORÉE for many years are grouped into a "Circular Economy" priority. In line with its two other priorities—CSR/ESG Reporting and Biodiversity and Economy—ORÉE promotes a vision of the circular economy that is responsible and supportive of societies, as well as respectful of biodiversity and ecosystem services.

5.1.6.4 Challenges, Barriers and Potential Improvements

According to French Roadmap 50 measures for a 100% circular economy [241] the main challenge is mass mobilization—citizens, communities, businesses, associations, government agencies, researchers and development actors in all regions—for real action and upscaling. To meet this challenge, the Roadmap aims to shake up habits, showcase good practices, convince people and inspire action.

5.1.6.5 Examples of Successful Implementation

Public Policy Initiatives

In mid-May 2021, Toulouse Métropole won the European call for projects from the Life program by proposing its Waste2Build project. It is about building a sustainable economy by optimizing resources and recovering building and public works waste on a local and then regional scale. The project follows the experimental deconstruction of the Exhibition Center. Life Waste2Build relies on public procurement (works contracts) to develop the use of second-life materials in construction, renovation or landscaping.

The operational objectives of the project are the following:

- reduce by 20% the impact of construction in resource consumption and waste production
- structure the circular construction sector
- implement more circular purchasing policies
- support the rise in skills of the circular construction sector.

This project, coordinated by Toulouse Métropole, is carried out in collaboration with 6 beneficiary partners: the National Institute of the Circular Economy (INEC), Synéthic, the Center Scientifique et Technique du Bâtiment (CSTB), Envirobat Occitanie, Toulouse Business School (TBS), the French Federation of Building and Public Works of Haute-Garonne (FFB 31) [156].

Private Policy Initiatives

VALOBAT [354] is the eco-organization by and for the building industry born from an initiative carried by 48 leading companies in the manufacture of Building Products and Materials (BPM). They offer a multi-material solution, based on a representative governance of all products and materials of the building industry. Given the implementation of an Extended Producer Responsibility channel for construction waste required by APEC law, they wish to propose a solution for each construction waste and for each stakeholder of the ecosystem of the sector. Their mission is to set up the entire collection, sorting, recycling and recovery chain of the PMCB (Construction and Building Products and Materials) waste in France, by an action at 4 levels:

1. Support and services: To support its members in their regulatory compliance as producers and to ensure the management of the end-of-life of PMCB
2. Collection and processing: Collect all separately collected waste streams free of charge, thanks to a network of adapted collection points
3. Value chain: Accelerate the development of reuse, recycling and recovery of building waste to create value
4. Information and education: Supporting the evolution of practices of all the actors of the building sector.

5.1.7 Greece Factsheet

5.1.7.1 Policy and Regulatory Framework

Governance

The government institution in charge of implementing the circular economy in Greece is the Ministry of Environment and Energy (https://ypen.gov.gr/). In 2018 it published the National Strategy for circular economy [144], which identified the sustainable management of resources, the circular entrepreneurship and the circular consumption as the main pillars for the transition to new, more sustainable and circular development models. In the first National Strategy for circular economy the main longtherm (2030) targets were formulated and included the application of ecological design criteria and life cycle analysis of products, waste management, energy improvement of the production processes, innovative consumption models, transition from the linear to the circular economy model, etc.

In line with the National Strategy for circular economy, the first National Operational Plan for 2018–2019 was published, which included specific interventions and actions towards regulatory and legislative provisions to promote circular economy and remove bureaucratic barriers; financing and incentives; improvement of knowledge and linking entrepreneurship and social economy with technological innovation; and support of the Circular economy plan through governmental actions and process acceleration.

In 2021, the operational plan was revised and the new Action Plan for Circular Economy for the period 2021–2025 [145] was entered in force, which: (i) is fully in line with the objectives and commitments of the new European Circular Economy Action Plan; (ii) is compatible with new European directives and institutional initiatives; (iii) takes into account all new legislative developments in Greece such as the new legislative framework on waste, alternative management, single-use plastics and related development policies at sectoral and national level, as well as the National Action Plans for waste and the National Plan for waste prevention. The actions that are foreseen in the new Action Plan for Circular Economy address the

following axes: (i) sustainable production and industrial policy, e.g. ecodesign, eco-certification, industrial symbiosis, tax exemptions; (ii) sustainable consumption, e.g. promotion of green public procurement, repair, reuse services; (iii) less waste with greater value, e.g. funding programmes for prevention, institutional framework for prevention, (iv) horizontal actions, e.g. national observatory, voluntary agreements, coordination body, indicators, and (v) specific product categories to be addressed as a matter of priority e.g. plastic products, batteries and vehicles.

Legislation

The national policy on circular economy, which is expressed through the relevant action plan described above, focuses on the promotion of waste hierarchy, the handling of management as a resource and the transition towards a circular production and consumption model.

The waste sector is a key pillar for the implementation of circular economy and is included in the EU Action Plan for Circular Economy. The implementation of the national waste policy is applied through the National Waste Management Plan, which was ratified by a Cabinet Act on August 31, 2020, and the National Waste Prevention Program, which was approved by the Cabinet in June 2021 and ratified on April 24 2022. These plans set out the strategic priorities and targets until 2030 for the implementation of the new EU waste legislation based on circular economy principles.

Other national plans of high relevance to the implementation of circular economy are the National Green Public Procurement Action Plan, which was announced in February, 2021, and the National Plan for Energy and Climate, which was ratified at the end of 2019.

The legislative framework includes the Framework Law on Waste (Law 4819/2021), the Law on single-use plastics (Law 4736/2020) and the Joint Ministerial Decision on landfill (90439/1846/2021).

The New Building Regulation (official gazette 79/2012) foresees in article 17 that for every activity concerning the building construction and the configuration of the surrounding open space, the measures for the alternative management of all waste should be implemented.

Circular Economy Strategy, Roadmap or Action Plan

On a regional level, the Circular Economy is among the targets that the 13 Regions of Greece have set in their operational roadmaps for 2021–2027. More specifically, the Regions of Greece have integrated specific targets, actions and indicators for the transition towards circular and resource efficient economy and pay particular attention to the management of solid urban waste. Examples of such regional strategic plans can be found here.

In 2020, the Greek Association for Local Development and Government Administration, which is the technical and scientific advisor of the Municipalities and Regions published in 2020 a guide on Circular Economy and local government administration [133], in order to provide the necessary background information and present tools and best practices to Municipalities.

On a local level, many municipalities have integrated circular economy in their strategic plans, i.e. Athens, in its Resilience Strategy for 2030 [37].

All national strategies and action plans for circular economy make reference to the construction sector. In fact, the National plan for circular economy includes the building sector as one of the 7 sectors which should have priority for implementing actions for circular economy. The targets are multiple: (1) setting a holistic national strategy for sustainable built environment, and introducing the CE principles during the whole life cycle of buildings, (2) Improvement of the performance of alternative management of excavation, construction and demolition waste, (3) development of the market for the secondary materials produced from the management of the excavatio, construction and demolition waste, (4) integration of circularity criteria on the programs for national and private buildings, (5) Creation of a financial program for the refurbishment and reuse of abandoned property and rehabilitation of degraded lands and areas. The specific actions for reaching these targets, along with the timeframe and the responsible bodies for implementing the actions are mentioned in the strategy plan.

Construction and Demolition Waste Management Regulatory Framework

The National Waste Management Plan (2020–2030, issued in 2020) [147] defines as CDW every material or product derived by excavation, construction and demolition procedures. It also presents the current status and its assessment, the predictions for the production of CDW till 2030, the targets for their management and the proposed measures and actions for the plan implementation, accompanied with a relevant progress monitoring indicators.

The targets concerning Excavation, Construction and Demolition Waste management (ECDW) are:

- 70% w/w preparation for reuse, recovery and ecycling (excluding however natural aggregates from the excavation).
- Increased geographic coverage of the country by Alternative Waste Management Systems (was at 63% in 2018).
- Impose the obligatory management of ECDW of public and private projects (already implemented through Law 4819/2021).
- Streamlining the Alternative Waste Management functions and fees.
- Establish separate collection of excavation waste, which is excluded from ECDW targets, as well as for concrete residue.
- Develop the secondary ECDW materials market.

Accordingly, the National Waste Prevention Program (2021–2030) [146] presents and evaluates the current situation in waste prevention, as well the national and EU legislation and strategies, defines critical material flows, sets targets and defines measures and actions to achieve them, taking into consideration goals provisioned for in National and EU legislation. Specifically concerning CDW, it proposes the following actions:

- Development of sustainable building design and renovation (through promoting correct practices, education, incorporating sustainability elements in building energy renovation programs, standardizing sustainable building design processes and developing certification systems, incentivizing building renovation rather than demolition).
- Development of CDW reuse practices (through encouraging construction materials reuse by developing selective demolition standards, promoting construction elements reuse research and education).
- Prioritization of excavation waste reuse on site (through minimizing them and balancing them with filling material).
- Creation of CDW reuse centers or spaces inside CDW processing units.
- Development of new circular construction practices (through pilot projects that focus on CDW minimization, dissemination of knowledge concerning building life cycle extension practices and structural elements recyclability).

Additionally, a joint ministerial decision, issued in 2010, addresses the management of excavation, constrution and demolition waste and foresees their alternative management within the scope of circular economy.

5.1.7.2 Platforms and Networks Facilitating the Transition to a Circular Economy

Circular Economy Platforms

The main platforms that are associated with circular economy in Greece are:

- The National Producers' Registry (for packaging, vehicles, tyres, mineral oils, batteries and accumulators, electrical and electronic equipment). Its aim is to record all domestically produced or imported quantities of the aforementioned products. It should be mentioned though that this does not currently apply to ECDW producers.
- The Digital Waste Registry (CDW included). It is used to collect waste production and management data for all materials of the European List of Waste, from waste producers and organizations/bodies/private companies active in the collection, transportation and processing of waste, in order to facilitate monitoring the waste management supply chain. It also allows searching for appropriate management companies by material code.

Other platforms that accelerate the implementation of circular economy in Greece are:

- The Hellenic Recycling Agency, a public organization aiming to develop and apply national policies for the sustainable—alternative management of waste, including ECDW (www.eoan.gr).
- The Hellenic Solid Waste Management Association, a non-profit, non-governmental organization that promotes the adoption of socially and environmentally acceptable methods for Solid Waste Management, including ECDW (ΕΕΔΣΑ—Hellenic Solid Waste Management Association (eedsa.gr)) The objectives of HSWMA are to promote the adoption of socially and environmentally acceptable methods for Solid Waste Management, the development and dissemination of relevant scientific methods and applications, the protection of the quality of our environment, and the preservation of natural resources and energy.
- Circulargreece, the website of the integrated LIFE project LIFE-IP CEI-Greece (https://circulargreece.gr/), which aims to contribute towards the implementation of the National Waste Management Plan, the National Waste Prevention Plan and the National Strategy for Circular Economy. According to the project's website, a new concept for waste management emerges with-in this project; based on circular economy principles, promoting behavioral changes and supporting actions to increase product life cycle, convert waste into valuable resources and implement successfully the legislative framework for waste.

Circular Buildings Platform

No circular buildings platform has been established to date.

Building Materials Passport Platform

No building materials passport platform has been established to date.

There is the national Product contact point, https://pcp.ggb.gr/?lang=en, which provide information on goods and products, in order to enable their free movement across the member states.

Public Procurement Platform

The Green Public Procurement (GPP) is defined by the European Commission as "a process whereby public authorities seek to procure goods, services and works with a reduced environmental impact throughout their life cycle when compared to goods, services and works with the same primary function that would otherwise be procured". Contracting authorities and contracting entities are major buyers of goods, services and works, therefore public procurements are a great way for implementing environmental, social and economic policies. By using their purchasing power to

choose environmentally friendly goods, services and works, they contribute locally, regionally and nationally to the achievement of national and international sustainability and environmental policy objectives. Green public procurements (GPPs) are related to the principles of Circular Economy. According to European Commission, Circular Public Procurements are defined as "a process whereby public authorities seek to procure goods, services and works with a reduced environmental impact throughout their life cycle when compared to goods, services and works with the same primary function that would otherwise be procured". GPPs play a main role in circular economy, that's why European Commission uses this in its own supplies and emphasizes on aspects such as durability and ability to repair.

In February 2021 the National Action Plan for the Green Public Procurement (2021–2023) [143] was approved. Its main objectives are:

- Establishment and implementation of an elementary level of adoption of green criteria in public procurement of products, services and projects.
- Gradual increase of GPP during the next three years in certain sectors of goods, services and projects.
- Wider integration of life cycle cost estimation in public procurement.
- Dissemination of environmental and economic benefits of GPP.
- Raising awareness, building capacity and active participation of stakeholders (contracting authorities and economic operators) in GPP.
- Monitoring the achievement and updating the objectives.

The Green Public Procurement National Action Plan has set obligatory targets for certain service/product categories (copying and graphic paper, imaging equipment, consumables, and print services, computers, monitors, internal lighting—LED lamps, road lighting and traffic signals, road transport, reclaimed or biodegradable lubricants). According to the plan, services and products associated with road design, construction and maintenance and office building design, construction and management are sectors where the green public procurement can be applied on a voluntary basis. One significant aims mentioned in this specific plan is the use of recycled aggregates at a minimum rate of 15% for the construction of public works and public buildings.

5.1.7.3 Funding Opportunities

At the moment, there are no specific instruments, private–public partnerships or private institutions which provide financial support explicitly to the implementation of circular economy at a national level.

However, the Economic and Financial Affairs Council of the European Union has approved the National Recovery and Resilience Plan Greece 2.0 on 13 July 2021, which ncludes an integrated and coherent set of reforms and investments structured in four Pillars that make up eighteen components (Greece 2.0—National Recovery and Resilience Plan (greece20.gov.gr)). Among them, the 1st Pillar "Green Transition"

includes the component "Sustainable use of resources, climate resilience and environmental protection", whose main objective is the promotion of the green transition through alignment with the principles of circular economy, efficient use of natural resources, climate change adaptation and mitigation via protection of the natural environment. Among others, the first set of actions addresses waste management, following the principles of waste hierarchy and circular economy.

Additionally, the Cohesion Fund supports investments in the field of environment to member states with a gross national income (GNI) per capita below 90% EU-27 average. Within this framework, cross border, transnational and interregional programmes that address circular economy, such as Interreg VI-A Greece-Bulgaria, Interreg VI-B Adriatic Ionian and NEXT Mediterannean Sea Basin, as well as the national regional programme Peloponisos, are being funded for the period 2021–2027.

On a national basis, there are some funding opportunities that address circular economy and the building sector:

- The "Green Transition" action, funded by the National Strategic Reference Framework (https://www.espa.gr/el/Pages/ProclamationsFS.aspx?item=5666).
- The National Development Plan (2021–2025, epa.gov.gr). The pillar "Green Developmen" includes targets for the circular economy transition, environmental protection and climate change mitigation.
- The Green Fund (Prasino Tameio—| Official Website), which funds projects and programs set by the Ministry of Environment, Energy and Climate Change or other Ministries that promote the national environmental strategy.
- Through the Public–Private Partnership Scheme (Implementation of PPP development projects—ependyseis.mindev.gov.gr), monitored by the Ministry of Development, which promotes large scale projects between the private and the public sector resulting to to significant positive impact in favour of the local societies and the Greek economy.
- The Joint European Support for Sustainable Investment in City Areas—JESSICA and the European Investment Bank (Infrastructure Fund of Funds—Greece (eib.org)) invest in local and regional projects that contribute to job creation and a sustainable and healthy European economy.

Moreover, the European Commision has established programmes and funding opportunities, such as the Urban Initiative Action initiative (UIA—Urban Innovative Actions (uia-initiative.eu)), which provides urban areas throughout Europe with resources to test new and unproven solutions to address urban challenges, etc. For more information: Circular economy in cities (europa.eu).

International Cooperation and Support from International Organizations

The European Circular Economy Stakeholder Platform is a joint initiative by the European Commission and the European Economic and Social Committee (EESC), launched in March 2017. The objective of the platform is to serve as a space for the

exchange of ideas and information, addressing all stakeholders, i.e. public authorities, businesses, trade unions and civil society (Homepage | European Circular Economy Stakeholder Platform (europa.eu)).

5.1.7.4 Challenges, Barriers and Potential Improvements

The implementation of circular economy principles in the built environment is at its initial stage in Greece. This is due to several challenges and barriers, which can be identified as regulatory, market, technological and cultural-societal. More specifically:

- Regulatory and legislative barriers: Currently the regulatory framework for implementing the principles of circular economy is mainly associated with the waste prevention and management. Although provisions for CDW have been made, there are no specific regulations and legislative contexts for applying the circular economy principles in the built environment across the whole lifespan of the constructions. Additionally, there is no specific framework for assessing circularity in buildings and constructions. The application of international standards is also
- Market barriers: In Greece, selective demolition, source separation and collection of wood, concrete, bricks, tiles and ceramics, stone, metals, glass, plastics and plaster for all types of construction works are established in Law 4819/2021. For implementing the management of the CDW, several companies have been established, which mainly focus on recycling the waste. The lack of business models limits the potential of reusing and repairing the waste in order to create more closed loops of materials. Furthermore, it must be highlighted that not all of the Greek regions have licenced units for CDW management. Additionally, high investment costs are needed for implementing CE in the building industry, not only for the design of new, circular materials, but also for the whole value-chain. The lower prices of virgin materials create an additional obstacle for the wider use of circular ones, while landfilling is often cheaper than other waste management processes. In case of products/materials reuse, the logistics (transportation, storage and resell) are not always supported. In general, it is very difficult for all building industry players to make the transition from a linear to a circular construction model. Many of the above barriers were identified as challenges for the Greek Enterprises in the study on the Circular Economy in Greece, published in 2016 from the Hellenic Federation of Enterprises. The study concluded that, among others: (i) there is a fragmented adoption of circular models, in the context of inefficient systemic approach; (ii) Emphasis is placed on the 'end-of-life' stage, rather than on the design stage; recycling and recovery of construction and demolition waste requires considerable improvement, (iii) the waste market in Greece faces several distortions most important of which is that the established price mechanism does not reflect the environmental benefits of recycled materials, hindering their competitiveness and resulting in low demand.

- Technological barriers: The implementation of circular economy principles in the building industry requires the transition to new design and construction techniques. For Greece, it is particularly difficult to change the conventional structural system of the buildings, the vast majority of which are made of reinforced concrete and clay bricks, to other building types, such as prefabricated or modular ones, made of wood or steel. Accordingly, the use of reclaimed, reused, or repaired materials/products is very limited, namely because their quality and performance is not yet certified. The lack of protocols, data and information (e.g. material passports) create insecurity to the stakeholders, including architects and engineers. At the moment, there are not many materials and products in the market that promote circularity. Moreover, there is a lack in necessary equipment and infrastructure to implement circular economy principles.
- Cultural-societal barriers: Knowledge and awareness on the benefits and practices of circular economy in the built environment are very limited among the stakeholders in Greece, especially the civil society and the members of the technical pyramid (architects, engineers, workers). Therefore, there is no particular interest and requests from building owners, users and investors for circular buildings. The inadequate presentation of good building practices and successful implementations limit the acceleration of circular buildings in Greece. Cultural barriers, lack of consumer interest and awareness and hesitance or reluctance due to company culture are the main barriers for businesses and policy makers.

5.1.7.5 Examples of Successful Implementation

Private Policy Initiatives

There are some good practices of implementing the circular economy principles in the built environment in Greece, initiated by private companies. Indicatively:

- Titan Greece (Home Page—Titan Greece) produces building materials. It plays an active role in implementing a circular economy model at various stages of the production process and has created synergies (industrial symbiosis) with other industries. According to the company, the main contributions to circular economy include the full inclusion of concrete in a circular economy; the promotion of sustainable construction; durable construction to adapt to climate change; recovery of materials and energy through the use of alternative raw materials and fuels.
- The ReWeee Project (ReWeee—Home) entitled Development and Demonstration of Waste Electrical and Electronic Equipment (WEEE) Prevention and Reuse Paradigms aims to reduce WEEE in Greece by preventing the production of WEEE itself, and also by demonstrating, via appropriate paradigms, that WEEE can be efficiently sorted and prepared for re-use. The goal is also to make re-used electrical and electronic equipment (REEE) acceptable to consumers. To this end, two WEEE sorting centres (SC) will open for the first time in the country, in the Attika and the Central Macedonia regions. Their core activity is the collection,

storage and sorting of WEEE, depending on their condition, and then their preparation for reuse or treatment. Moreover, a measurement tool is being developed to facilitate the assessment of WEEE reuse in Greece. In addition, a web platform has been set up to facilitate the donation and exchange of EEE. It targets households, companies and public services. Among the project partners are RReuse, the Hellenic Recycling Agency, the Ecological Recycling Society, the Green Fund and the Harokopio University of Athens.

- Sporos Platform (Sporos Platform), launched in 2019, aims to become the first platform for impact investment and collaboration that adds value to SMEs in Greece and Southeastern Europe, on the basis of the Circular Economy. Sporos utilises sustainable financing tools, combined with consultancy services and environmental, social and governance (ESG) and sustainable development goal (SDG) metrics.

5.1.8 Ireland Factsheet

5.1.8.1 Policy and Regulatory Framework

Governance

Ireland's ambition is to move beyond target compliance and to become a circular economy leader among its European peers. In order to achieve that, Ireland found it necessary to adopt a whole-of-Government approach, with the development of the circular economy led by the Minister for the Environment, Climate and Communications, but involving all Ministers and Government Departments, as well as local government and relevant state agencies. Delivering a circular economy is expected to have positive environmental, economic and social impacts, and a well-designed circular policy framework can maximise these impacts and identify cobenefits so that environmental "wins" also provide economic and social opportunities and vice versa. This is why the Programme for Government, Our Shared Future, committed to a range of actions to support the transition to a circular economy, including the establishment of a cross-Government Circular Economy Unit in the Department of the Environment, Climate and Communications (DECC) and the adoption of a Circular Economy Strategy [50]. Following the publication of the Waste Action Plan for a Circular Economy (WAPCE), a Circular Economy Unit was established within the DECC to lead circular economy policy in Ireland by developing a circular economy strategy published in December 2021. Following the Strategy's publication, the Circular Economy Unit is setting up an inter-departmental Circular Economy Working Group with relevant ministers, government departments, state agencies and local governments [251].

The Environmental Protection Agency (EPA) is in charge of leading and implementing the Circular Economy Programme (CEP) which incorporates and builds

upon the previous National Waste Prevention Programme to support national-level, strategic programmes to prevent waste and drive the Circular Economy in Ireland [62]. Construction and buildings are one of seven priority areas in the CEP aligned with the EU Green Deal. The EPA's new Circular Economy Programme will co-ordinate circular economy initiatives across levels of government and stakeholders [251].

Legislation

Ireland passed the Circular Economy and Miscellaneous Provisions Act 2022 (CE Act) [71] and defined the circular economy for the first time in Irish domestic law (Part 2, Interpretation). The legislation provides that the statutory version of the CES may feature both economy-wide and sectoral targets and specify sectors which its future versions must adopt as targets in relation to construction, agriculture, packaging, and electronic and electrical equipment [87]. According to the Sect. 7 of the CE Act, the Minister for the Environment, Climate and Communications shall, prepare and submit to the Government for their approval, with such modifications (if any) as they consider appropriate, a circular economy (CE) strategy setting out the policy, objectives and priorities for the time being of the Government in relation to the circular economy. In making a circular economy the Minister shall consult relevant documents related to national (action) plans and government programs, especially those covering waste, climate action, and sustainability. The circular economy strategy shall promote the use of criteria relating to the circular economy in public procurement and shell set out targets, in respect of the following sectors of the economy: construction, agriculture; retail; packaging; textiles; and electronic equipment. The circular economy strategy shall set out necessary actions to support Government policy on the circular economy, including measures to inform, and promote dialogue with the public regarding the challenges and opportunities in the transition to a circular economy, and actions necessary to meet the targets set out in the strategy. The CE strategy shall be publicly available together with the annual report on the implementation of the strategy and the progress made in reaching the targets and taking the necessary actions. According to Sect. 10 of the CE Act, the Environmental Protection Agency (EPA) shall establish a circular economy programme setting out measures to be taken by the EPA, including measures in respect of reporting and the provision of funding and education, to give effect to the objectives set out in the circular economy strategy. A circular economy programme shall include the waste prevention programmes established by the Agency, and shall be integrated into waste management plans or other environmental policy programmes, or operate as a separate programme.

Circular Economy Strategy, Roadmap or Action Plan

The Circular Economy Strategy (CES) and the EPA's Circular Economy Programme were published in 2021. The Whole of Government Circular Economy Strategy 2022–2023: Living More, Using Less is the first national CE strategy with the following key objectives [50]:

1. To provide a national policy framework for Ireland's transition to a circular economy and to promote public sector leadership in adopting circular policies and practices.
2. To support and implement measures that significantly reduce Ireland's circularity gap, in both absolute terms and in comparison with other EU Member States, so that Ireland's rate is above the EU average by 2030; such measures to address facets of sustainable production and consumption most impactful in an Irish context.
3. To raise awareness amongst households, businesses and individuals about the circular economy and how it can improve their lives.
4. To support and promote increased investment in the circular economy in Ireland, with a view to delivering sustainable, regionally balanced economic growth and employment; and
5. To identify and address the economic, regulatory and social barriers to Ireland's transition to a more circular economy.

Subsequent iterations of the CES will include targets and detailed actions, including specific targets for the construction and demolition sector. Potential actions in the construction sector include:

- Increased use of offsite design and manufacture
- Modular building design
- Refurbishment and retrofitting of existing stock
- Tackling dereliction and bringing stock back into occupancy
- Increase use of Construction & Demolition Waste as a secondary construction material.

The Circular Built Environment Playbook or 'CircularBuild' is a 3-year project funded by the EPA under the 2022 EPA Research Call. The project is led by the Irish Green Building Council (IGBC) in collaboration with Atlantic Technological University (ATU), Technological University Dublin (TU Dublin) and the University of Galway (UG). The project aims to:

- Co-design and develop a National Circular Built Environment Roadmap to 2040 in collaboration with industry stakeholders representing the full built environment value chain.
- Co-design, develop, and pilot an evidence-based and research-informed Circular Built Environment Toolkit in collaboration with industry across a range of selected case studies.

- Establish a dedicated Circular Built Environment Resource and Training Hub for industry, policy makers and educational audiences.

Construction and Demolition Waste Management Regulatory Framework

The primary waste legislation is the Waste Management Act 1996 [72], as amended, and Sect. 32 of the Act places a general obligation on the holder of waste to comply with legislation and ensure all wastes are managed within the requirements of the Act. In short, the obligation to manage waste legally lies with the holder of waste, which means the waste producer or the person who is in possession of the waste. At a construction site, the mandatory obligation to appropriately manage waste generated at the construction site lies with the Client and the Contractor. Under Sect. 3(1) of the Act, the requirements do not apply to the following materials, which hence are not considered 'waste' [63: 3–4]:

- Land (in-situ) including unexcavated contaminated soil and buildings permanently connected with land—relates to land and buildings prior to any construction or demolition where material remains untouched. Once it has been excavated or otherwise removed, the material may enter into the control regime set down by the Waste Management Acts.
- Uncontaminated soil and other naturally occurring material excavated in the course of construction activities where it is certain that the material will be used for the purposes of construction in its natural state on the site from which it was excavated.

There are two more important provisions within the European Union (Waste Directive) Regulations 2011–2020 that are of relevance to the construction sector and the prevention of waste, and these allow for the classification of resources out of the waste regime as follows [63: 4]:

- Article 27 allows for the notification of a material as a by-product rather than a waste where certain criteria can be demonstrated by the legal person (i.e. further use is certain, no need for further processing, produced as part of a process and further use is lawful).
- Article 28 sets out the grounds by which a material, which is recovered or recycled from waste, can be deemed to be no longer a waste and complies with a set of end-of-waste criteria (substance/object to be used for specific purposes, a market or demand exists, fulfils technical requirements and no overall adverse impact to human health or the environment).

The Waste Action Plan for a Circular Economy (WAPCE) [49], published in September 2020 by DECC, paved the way for actions to [251]:

- Ensure that materials and products remain in use for longer by rewarding circularity and discouraging waste;
- Increase producer responsibility for products and packaging;
- Support sustainable business models;

- Promote a multi-sectoral approach with the voluntary sector, R&D, producers, manufacturers, regulatory bodies and civil society; and
- Clarify and strengthen institutional arrangements for the waste sector, including through a heightened role for local authorities.
- Over the coming years, the construction and demolition sector needs to:
- Promote waste prevention in the first instance;
- Follow best available techniques;
- Expand the range and use of recycled products;
- Create a market demand for recycled products and segregating more material on-site to allow for recycling; and
- Meet the target of preparing for reuse, recycling and other material recovery (incl. beneficial backfilling operations using waste as a substitute) of 70% by weight of C&D non-hazardous waste (excluding natural soils and stone).

There is a need to plan for CDW management at the earliest possible stage in a construction project, ideally at concept stage. The 2006 Best Practice Guidelines on the Preparation of Waste Management Plans for Construction and Demolition Waste Projects needed revision, so the EPA [63] published new Guidelines in 2021. The purpose of the Best practice guidelines for the preparation of resource & waste management plans for construction & demolition projects is to provide a practical approach which is informed by best practice in the prevention and management of construction and demolition wastes and resources from design through to construction and deconstruction.

5.1.8.2 Platforms and Networks Facilitating the Transition to a Circular Economy

Circular Economy Platforms

CES announced the establishment of a national online platform that will provide an authoritative source of information about what the circular economy is and how the circular transition is taking place in Ireland, identifying key actors, ongoing initiatives at the local, regional, and national levels and areas of likely future progress.

The Rediscovery Centre [289] is the National Centre for the Circular Economy in Ireland that supports re-use of materials, shares circular skills and provides information on circular economy developments here in Ireland and abroad. The Centre receives funding from a range of public bodies. The Rediscovery Centre boiler house is used as a state-of-the-art ecological building to demonstrate best practice building design, construction and operation, and as a tool to inspire action with respect to resource management and efficiency [287].

CIRCULÉIRE [26] is the National Platform for Circular Manufacturing with a mission to demystify, derisk, and deliver circular business model innovation by

unlocking the value that resides in an Irish circular economy. It is a €4.5 m public–private partnership co-created by Irish Manufacturing Research and the Department of the Environment, Climate and Communications (DECC), the Environmental Protection Agency (EPA), and EIT Climate-KIC with 25 Founding Industry Members. CIRCULÉIRE's Circular Economy Knowledge Library seeks to support industry, entrepreneurs and policy-makers by providing an open-access knowledge repository of circular economy resources ranging from business case studies to key design guides, to sectoral reports, to circular economy policy documents for example, national and EU circular economy strategies and action plans.

Circular Buildings Platform

The Build360 Hub [19] is a unique collaboration between academia, industry, and the public sector, which aims to provide leadership in transitioning the Irish construction sector towards a decarbonized and circular built environment. The Atlantic Technological University (ATU) Build360 research group, the Regional Waste Management Planning Office and the Environmental Protection Agency (EPA) have developed this resource for a range of stakeholders who wish to learn more about how to embed circular economy principles into their everyday working practice. Considering that education is key to supporting industry professionals, academics, and students on their circular economy journey, the Build360 Hub presents educational opportunities ranging from short Continuing Professional Development programmes to dedicated postgraduate programmes.

Building Materials Platform

Irish Green Building Council created the Construction Materials Exchange (CMEx) platform [157] to unlock the potential of excess construction material. CMEx is a user friendly, digital platform that connects organisations with each other so that they can exchange or trade excess construction materials between them. The platform showcases excess materials from projects where they can be seen, traded, exchanged and reused, ensuring that materials continue to have a value beyond their initial lifecycle. Organisations can choose to have an internal account to exchange materials within the organisation or an external account where reclaimed materials can be exchanged between different organisations. The CMEx platform supports three types of users: an organisation that would like to upload materials for exchange from their projects, an organisation that would like to find materials for their projects, and an individual that would like to find material for their project.

Public Procurement Platform

The EPA has published new Green Public Procurement: Guidance for the Public Sector in September 2021 [60]. This guidance and accompanying ten criteria sets are aimed primarily at public sector procurers in central and local government, state agencies and other public bodies such as universities, hospitals and schools. They are also relevant for utility sector procurers and may be of interest to private companies whether they are responding to tenders or applying green criteria in their own procurement. They have been fully updated to reflect legislation and policy in place as of March 2021. One of the criteria sets in the EPA's Green Public Procurement: Guidance for the Public Sector is the Design, Construction and Management of Office Buildings. This sets out criteria developed based on detailed lifecycle analysis studies carried out at EU level, identification of best practice and state-of-the-art technologies, and consideration of costs over the lifetime of a building. Circular economy considerations, such as the use of recycled concrete and recovery of demolition waste, are also addressed. The role of project managers, design teams, construction and specialist contractors is addressed, as is the role of facility managers.

To facilitate use of these criteria, the Office of Government Procurement (OGP) has launched GPP Criteria Search [114]. This online search tool allows the user to rapidly find, select, and download the GPP criteria relevant to a specific procurement. This tool was developed in collaboration with the EPA and the DECC, with support from the Public Service Innovation Fund. Within the sector "Office building design, construction and management" there are seven subsectors:

1. Environmental management of the project manager, design team, and contractors;
2. Detailed design and performance requirements;
3. Strip-out, demolition, and site preparation works;
4. Construction or major renovation works;
5. Heating, lighting, and energy-related products;
6. Completion and handover;
7. Facilities management.

It is expected that future GPP criteria related to construction will explicitly incorporate the Level(s) framework to ensure all environmental impacts across the life cycle of built assets are addressed in a consistent and measurable way. The Office of Public Works is developing a roadmap to promote the greater use of lower-carbon building materials in construction, which will further support GPP in this sector and cover a broader set of building types [63].

5.1.8.3 Funding Opportunities

Circular Economy Innovation Grant Scheme (CEIGS)

The Circular Economy Innovation Grant Scheme (CEIGS) is a Government of Ireland initiative led by the Department of the Environment, Climate and Communications

(DECC). The CEIGS directly supports the growth of the circular economy in Ireland by funding circular economy projects and enterprises and provides high-profile examples of best practice. The Scheme provides annual funding for innovative medium-to-large scale projects which can support development of the circular economy at the national or regional level. The purpose of this grants scheme is to provide support to projects which work in the Circular Economy space, with the aim of advancing the Circular Economy in Ireland and raising awareness of the need to transition to a Circular Economy. Government will continue to provide direct support to circular economy initiatives, and although the support is not limited to social enterprises and voluntary and community based organisations, DECC is particularly interested in submissions from organisations of these types [115].

Environmental Protection Agency (EPA) Green Enterprise Scheme

The EPA's Green Enterprise: Innovation for a Circular Economy is an annual funding call to support innovators in Ireland to develop, demonstrate and implement circular economy approaches in their business models. It is managed through the EPA's National Circular Economy Programme and is co-funded by EPA Research. The fund is aimed at innovative projects and the maximum amount of funding available is €100,000 per grant award. All organisations applying for funding must provide written declarations that they have not been in receipt of more than €200,000 in state aid in the last three years, including funding applied for as part of this programme [61].

Green Start/Plus Programmes

Green Start and Green Plus are national Enterprise Ireland funded programmes that aim to enable companies to develop sustainable business models [50].

Climate Action Fund

The Climate Action Fund was set up under Ireland's National Development Plan (2018–2027) and is administered by Department of the Environment, Climate and Communications. In order to support innovation and capacity building for climate change mitigation, it makes €500 m available for projects over 10 years (up to €10 m per project) [40].

Disruptive Technologies Innovation Fund

The Disruptive Technologies Innovation Fund was set up under Ireland's National Development Plan (2018–2027) and is administered by Department of Business,

Enterprise and Innovation. In order to inspire enterprise participation in the development of disruptive technologies it makes €500 m available for projects over 10 years (between €5 m–€10 m per project).

EU LIFE Programme

The LIFE Programme provides funding for the support of Environment, Nature Conservation and Climate Action projects. LIFE projects under the sub-programme "circular economy and quality of life" will develop technologies and solutions to enhance the circular economy.

Horizon Europe

The EU's Horizon Europe programme funds large scale international research projects including projects related to the circular economy and sustainability.

Circular Bio-Based Europe Industry Joint Undertaking Europe

The Bio-based Industries Joint Undertaking (BBIJU) is a €3.7 billion partnership between the EU and the Bio-based Industries Consortium with the objective of developing new technologies to transform renewable natural resources into bio-based products.

C-Voucher

C-VoUCHER is a European funding programme that uses design thinking to develop new cross-sectoral and cross-border circular value chains demonstrating circularity.

The Whole of Government Circular Economy Strategy 2022–2023: Living More, Using Less sets out in the Annex 8 the range of supports to business, enterprise and third level knowledge institutions available through the Ireland's Foreign Direct Investment Agency IDA, Enterprise Ireland, Local Enterprise Offices, DECC, EPA and the EU [50].

5.1.8.4 International Cooperation and Support from International Organizations

Irish Green Building Council collaborated with Excess Materials Exchange (EME) of Netherlands to create the CMEx platform with funding from the Circular Economy Innovation Grant Scheme of the Department of the Environment, Climate & Communications [148].

Holland Circular Hotspot (HCH) [148] and The Rediscovery Centre have entered a partnership by signing the Memorandum of Understanding on Monday the 29th of May, 2023 to accelerate the transition towards a circular economy in Ireland, the Netherlands and beyond. Under the agreement, both parties provide their experience, knowledge and expertise to intensify bilateral cooperation in the circular economy space. Areas for collaboration are, for instance, sharing best practices in circularity, promoting European and international collaboration on circular economy initiatives and circular hotspots, and exploring opportunities for global initiatives and proposals [288].

5.1.8.5 Challenges, Barriers and Potential Improvements

As identified in the CES, one of major social barriers to the circular transition is lack of public awareness about what the circular economy is, how it relates to everyday purchasing and consumption decisions and the potential environmental, health and economic benefits associated with increased circularity. This lack of awareness can translate into lack of demand and then act as a drag on investment in the circular economy. A related barrier is found where consumers and/or businesses are aware of the circular economy as a concept but lack confidence to invest in circular products or services. Moreover, the CES states that challenges to improving Ireland's circularity relate to increased investment requirements, the need for more skills and training and removing regulatory barriers [50].

OECD [251: 13–14] highlights the main governance challenges for Ireland's transition towards the circular economy. Ireland has a sectoral view of the circular economy, mainly based on waste, rather than a broader view of resource management and a holistic approach to leverage the circular economy as a cross-sectoral driver of economic growth, job creation, social well-being and environmental protection. Ireland's current approach tends to focus on recycling and recovery rather than preventing, repairing and reusing. Ireland is also facing regulatory gaps related to lengthy and unreliable licensing processes, a lack of circular criteria in green public procurement, and limited government oversight of the waste sector. Funding gaps relate to the absence of a clear and coherent funding framework for the circular economy that also considers private investment, and limited use of price-based incentives. Relevant government departments, agencies and local authorities are still building the technical expertise and human resources required to lead the circular transition, while capacity gaps among Irish SMEs are hampering the adoption of circular practices and applications for funding. Finally, there is limited awareness and understanding of the costs and benefits of a circular economy among Irish businesses and civil society. Across sectors, businesses are facing operational, informational and legislative barriers, while knowledge institutions are confronted with challenges in applying for research and innovation grants and limited collaboration with policy maker. OECD [251: 14–16] highlights the significant role of the government of Ireland in promoting, facilitating, and enabling the shift toward a circular economy.

To promote the circular economy, the national government can [251: 14]:

- Clarify roles and responsibilities for circular economy policy making and implementation across levels of government by: identifying the entities responsible for the achievement of the different objectives of the Whole of Government Circular Economy Strategy and enforcement mechanisms; considering placing the Strategy under the oversight of the Department of the Taoiseach, the Prime Minister of Ireland, as is the case for the Climate Action Plan; making sure that other government departments are involved in circular economy policy making, notably via the Circular Economy Working Group; consulting the Department of Finance on decisions related to the implementation of the Strategy; clarifying the role of Regional Assemblies and broadening the role of local authorities in circular economy policy implementation.
- Complement the Whole of Government Circular Economy Strategy with (i) an analysis of stocks and flows of materials; (ii) a mapping of existing circular economy-related initiatives; (iii) clear objectives, timelines and actions; (iv) a dedicated budget; (v) a shared vision with stakeholders; (vi) a monitoring framework to measure progress and allow adjustments in the second phase based on evidence on what worked, what did not work and what can be improved.
- Raise awareness of and build trust in the circular economy through a national circular economy online platform, targeted communication campaigns, and incentives for behavioural change, such as certificates, labels and nudging.

To facilitate collaboration among a wide range of actors to realise the full potential of the circular economy, the national government can [251: 14–15]:

- Establish horizontal co-ordination to align objectives, share information, identify synergies and avoid duplications, through the activation of the inter-departmental Circular Economy Working Group to identify how circular economy principles can be applied to different sectoral policies to reduce waste, improve resource efficiency, create jobs and improve access to services; as well as better co-ordination with government departments and agencies setting standards.
- Implement formal co-ordination mechanisms between local authorities and the DECC and EPA respectively, building on current initiatives such as the Local Authority Prevention Network (LAPN) but going beyond the focus on waste; and adapt and extend current regional waste management planning co-ordination mechanisms between the DECC, EPA and local authorities, such as Regional Steering Committees and Regional Operations and Task Groups to the circular economy for effective multi-level co-ordination.
- Foster policy coherence and transcend silos by enhancing synergies and complementarity between the Circular Economy Strategy and the Climate Action Plan, as well as other relevant policy documents (e.g. the National Planning Framework, Enterprise strategy and Bioeconomy policy).
- Facilitate collaboration between public, private and non-profit actors on the circular economy by introducing stakeholder coordination mechanisms that

are broader than public consultations (e.g. representation, partnerships or co-decision); and broaden the current sectoral focus on waste by formally including new stakeholder groups such as designers, standard-setters and the research community in the Circular Economy Advisory Group.
- Leverage territorial specificities for the circular economy by facilitating local demonstration projects and urban–rural linkages, for example through establishing reuse facilities (e.g. reuse centres) among other initiatives that make reuse easy.

To enable the necessary governance and economic conditions for the circular economy transition, the national government can [251: 15–16]:

- Make the legislative and regulatory framework fit for the circular economy by making regulation conducive to ecodesign, repair, reuse and remanufacturing; streamlining regulatory processes for reusing material considered as waste through end-of-waste and by-product processes; broadening extended producer responsibility (EPR) to new waste streams and improving existing EPR schemes to facilitate reuse; mandating Resource and Waste Management Plans, which are currently recommended on a voluntary basis, for all construction and demolition projects; and ensuring that circular criteria are included alongside green criteria in GPP.
- Use economic tools to incentivise the transition to a circular economy, and identify and remove environmentally harmful subsidies preventing the application of the waste hierarchy across sectors.
- Set up a clear funding framework for the circular economy and assist local authorities in supporting and scaling up small circular initiatives by setting up dedicated local funding. The DECC could support private investment in the circular economy with alternative funding mechanisms, such as crowdfunding, leasing, equity participation, grants, loan guarantees, green bonds and loans for circular economy projects and businesses, and leverage EU funds.
- Adapt human resources to the challenges at hand by extending current capacity building programmes to the DECC and its Circular Economy Unit, as well as strengthening local authorities' capacity for local circular economy policy implementation, to enable them to take an active role in the transition. For businesses, workers and private investors, the government can design and implement sectoral circular economy training and toolkits for workers and businesses (especially SMEs) on the circular economy, in partnership with CIRCULÉIRE, the Rediscovery Centre, Ibec and Chambers Ireland, for instance. For civil society, particularly youth, the government can integrate circularity into first, second and third-level education curricula to build awareness of and foster skills for a circular economy.
- Support market innovation and business development with different initiatives, including the creation of innovation labs as open innovation ecosystems, the establishment of a one-stop-shop for information on the circular economy for businesses, especially SMEs, and the introduction of tailored advisory services to

support project promoters in making circular economy initiatives commercially viable.
- Develop a national circular economy information system to monitor and adjust policy, by harmonising data collection among data providers, expanding data collection from waste-related data to environmental, economic and social data, and collecting locally disaggregated and sectoral data, particularly in key sectors for the circular transition in Ireland (e.g. food and the built environment) to inform circular economy policy.
- Track progress on the achievement of the targets defined by the Strategy, as well as on the implementation of governance frameworks required for the circular economy transition, by inviting stakeholders to take part in regular (e.g. annual) assessments.

5.1.8.6 Examples of Successful Implementation

Public Policy Initiatives

The Atlantic Technological University (ATU) Build360 research group, the Regional Waste Management Planning Offices and the Environmental Protection Agency have developed the Build360 Hub for a range of stakeholders (industry professional, academics and students) who wish to learn more about how to embed circular economy principles into their everyday working practice.

Private Policy Initiatives

The new European Headquarters for Kerry Group's Global Technology and Innovation Centre is located in Millennium Park, Naas, Co. Kildare, Ireland and serves as a point of reference across the fields of building engineering and architecture. The facility is made up of 25,000 m^2 over four storeys, and presents a mixture of office accommodation, customer care areas, meeting rooms, research and development areas, as well as ancillary services areas to accommodate up to 895 staff. Kerry Group and Gilbane, along with the design team of RKD Architects, Arup and Bruce Shaw cost consultants visited several existing international facilities in order to form design principles and Arup provided a collaborative BIM design during the fast track design period. The project targeted a LEED system Silver accreditation from an early stage. The mechanical systems were designed to be highly efficient through state-of-the-art equipment efficiencies and also intelligent control systems to minimise energy consumption. Intelligent lighting control systems combine with an energy efficient façade to reduce overall energy consumption throughout the facility. The building façade includes twin-skin elevations with motorised interstitial blinds and high specification g and u values. This assists greatly in reducing the building's energy consumption by minimising unwanted solar gains. The system works in tandem with an intelligent lighting control system which actively dims any light fittings in

an area of plentiful daylight. Overall water demand to the site is decreased greatly by the specification of low flow type water fittings throughout. LEAN construction concepts were utilised throughout the procurement and construction phases. Weekly work plans were formulated to track the number of specific tasks to be undertaken by each sub-contractor and the task completion rate was monitored on a weekly basis. The project was delivered ahead of schedule in early 2015 and at 5% below the initial project budget. Finally, it won the Engineering Project of the Year Award at the Engineers Ireland Excellence Awards 2015 [14].

5.1.9 Italy Factsheet

5.1.9.1 Policy and Regulatory Framework

Governance

In June 2022, the Italian Ministry of Ecological Transition [206] proposed a "National strategy for the circular economy" that was accepted and promoted by the following Ministry of Environment and Energy Security. The "National strategy for the circular economy" is, therefore, a programmatic document, within which the actions, objectives and measures to be pursued in defining policies are identified as well as the institutions aimed at ensuring an effective transition towards a circular economy.

With the National strategy for the circular economy, they intend, in particular, to define the new tools, administrative and fiscal aspects to enhance the market for secondary raw materials, so that they are competitive in terms availability, performance and cost compared to virgin raw materials. To this end, the Strategy acts on the chain of purchase of materials (Minimum Environmental Criteria for green purchases in the Public Administration), on the criteria for the cessation of the status of waste (End of Waste), on the extended responsibility of the producer and on the role of the consumer, on the diffusion of sharing practices and of "product as a service". The strategy also constitutes a fundamental tool for achieving the objectives of climate neutrality and defines a roadmap of measurable actions and targets between now and 2035.

The Ministry of Enterprises and Made in Italy created a section targeted to elaborate proposals for the development of products, technologies and production processes with a lower environmental impact, the sustainable development, the transition towards a circular economy, and for the promotion of bioeconomy sectors. Moreover, the Ministry works on connection actions with state and regional administrations and with other public entities that implement programs and interventions in favor of companies for eco-sustainable development. It wants to define proposals and evaluations relating to the use of public demand for industrial policy purposes with particular reference to the circular economy and research and innovation.

Legislation

The decree n. 116/2020 (Official Gazette Series n. 226, 11 September 2020) [263]—in force since 26 September 2020—modifies Legislative Decree 152/2006 by transposing the European directives on waste EU 2018/851 and on packaging and packaging waste 2018/852. The decree is an implementation of directive (EU) 2018/851 amending directive 2008/98/EC on waste and implementation of directive (EU) 2018/852 amending directive 1994/62/EC on packaging and packaging waste. The main obligations of the manufacturer change.

This decree substantially modifies the fourth part of Legislative Decree 152/2006, the so-called Consolidated Environmental Text. All public and private entities that produce waste and that operate in the field of waste, packaging and packaging waste management will have to adapt to this new text.

Circular Economy Strategy, Roadmap or Action Plan

The main national programmatic document is the National Strategy for Circular Economy (2022) which has its basis in the National Recovery and Resilience Plan.

Moreover, the Minimum Environmental Criteria are the environmental requirements defined for the various phases of the purchasing process, aimed at identifying the best design solution, product or service from an environmental point of view along the life cycle, taking into account market availability. The Minimum Environmental Criteria have an effect on various product sectors and are widely used in the construction sector.

At regional level, there are some Regions (Lombardia, Puglia, etc.) which have a specific strategy for sustainable development. The implementation of strategies of circular economy is still framed in this context.

Construction and Demolition Waste Management Regulatory Framework

The Legislative Decree n. 76/2020 [264] (converted into Law no. 220/2020, Official Gazette Series 228, 14 September 2020) regulated the matter in terms of demolition and reconstruction of buildings, with the introduction of amendments to the rules contained in the consolidated construction text, n. 380/2001. The decree introduces definitions of demolition and reconstruction of existing buildings in order to comply with the legislation concerning the distances between buildings for demolition and reconstruction between existing buildings.

Regarding the Minimum Environmental Criteria applied to the construction sector, the main objective is to put into circulation materials and services with a high sustainable value, calculated through the use of the life cycle analysis (LCA) of the materials involved.

Italy adopted the Agenda 2030 targets set at the European levels, sharing the plan developed by the Buildings Performance Institute Europe [59].

5.1.9.2 Platforms and Networks Facilitating the Transition to a Circular Economy

Circular Economy Platforms and Networks

The Italian Circular Economy Stakeholders Platform was created in 2018 to bring together initiatives, share experiences, highlight critical issues, and indicate perspectives to represent in Europe the Italian specificities in terms of circular economy and to promote the circular economy in Italy through dedicated actions. ICESP is promoted by the National Agency for New Technologies, Energy and Sustainable Economic Development (ENEA) as an initiative integrated with the European Platform for the Circular Economy (ECESP) with the aim of spreading knowledge, mapping good practices, and fostering multi-stakeholder dialogue. The 275 members of the ICESP are representatives of local and national public institutions in education, research and innovation, but also of companies, trade associations and representatives of civil society.

Moreover, in 2017, ENEA promoted the the first Italian industrial symbiosis network, SUN—Symbiosis Users Network, which involves 42 partners including universities, political institutions, research bodies, private companies, technological networks and local bodies. The SUN network is proposed as an Italian reference for operators who want to apply industrial symbiosis, at an industrial, research and territorial level.

The Sustainable Development Foundation was established in 2008 as a point of reference for the main sectors and actors of the green economy in Italy. The foundation collects experiences and knowledge to support businesses and organizations in sharing a common vision towards the ecological transition. The Foundation has established a structure, the Circular Economy Network, for the development of studies and proposals on efficient use of materials within production, distribution, consumption and in the area of waste management. The activities target both private and public sector and include reports and assessments, prevention programs and waste management plans, evaluation and analysis of governance models, studies and legal/regulatory assistance.

Circular Buildings Platform

No circular buildings platform has been established to date.

Building Materials Passport Platform

No building materials platform has been established to date.

Public Procurement Platform

In Italy, a first signal towards the use of Green Public Procurement comes with the approval by the Inter-ministerial Committee for Economic Planning (CIPE) of resolution n. 57 of 2 August 2002 "Environmental action strategy for sustainable development in Italy", which establishes that "at least 30% of the goods purchased must also meet ecological requirements; 30–40% of the durable goods stock must be reduced energy consumption, taking into account replacement and using the scrapping mechanism".

With the decree 8 May 2003 n. 203 [262] (Official Gazette Series n. 180, 5 August 2003), the Ministry of the Environment and Land Protection has identified "rules and definitions for the regions to adopt provisions, intended for public bodies and companies with predominantly public capital, also for service management, which guarantee that manufactured goods and goods made with recycled material cover at least 30% of the annual requirement".

Funding Opportunities

The National Recovery and Resilience Plan (NRRP) is the package of investments and reforms prepared by the Italian government as part of "Next Generation EU", the programme established by the European Union. One of the aim of this program is also to make Building more modern and sustainable roads, railways, ports and airports throughout the country within five years. €25.40 billion are dedicated to this mission.

With the opportunities offered by the NRRP, tax incentives are foreseen, rewards in terms of scores for virtuous companies and certainly calls for tenders for the financing of research and development projects with the aim of increasing the scientific and technological-industry level in this area.

Moreover, funding opportunities are offered by public/private organizations such as:

- Cariplo that is a philanthropic association providing grants to social enterprises or cooperatives active in sustainable projects;
- The Italian bank Intesa Sanpaolo devoted EUR 5 billion in 2018–2021 to support projects in the circular economy in partnership with Ellen MacArthur Foundation. The bank is a major partner of the European Investment Bank (EIB) with two credit lines for the circular economy worth EUR 1 billion.

5.1.9.3 International Cooperation and Support from International Organizations

The Italian Circular Economy Stakeholders Platform (ICESP) has been selected by a jury chaired by the Holland Circular Hotspot to be the protagonist of an exclusive

video at the World Circular Economy Forum (WCEF2023), one of the main global events on the circular economy (Helsinki, Finland, from 30 May to June 2, 2023).

5.1.9.4 Challenges, Barriers and Potential Improvements

The ETC CE Report [88] highlights that Italian policy still uses voluntary instruments. As a consequence, regulations, standards, and consumer behaviour are not in line with effective circular production and consumption patterns. Moreover, primary raw materials are often cheaper than secondary raw ones, market demand for recovered products is still limited as circular products do not present clear guarantee schemes and can be more expensive than other products.

Further barriers can be individuated in:

- poor reliance on recycled building materials/products compared to traditional materials and the limited ability of companies to seize opportunities have a considerable weight;
- absence of a well-structured, monitored and participated value chain;
- limited communication between institutions and citizens;
- lack of awareness in companies, public authorities and among citizens of circular economy concepts;
- policy and regulatory;
- lack of financial support and fiscal incentives.

The report of the European project SocKETs [329] highlighted that the building and construction sector in Italy is still characterized by a linear approach. Almost all the involved subjects declared that steps ahead have been made in the field of energy efficiency, but they underlined that a major part of the way towards a circular economy in the sector is still to be covered, in almost all the other aspects, such as implementation of ecodesign principles, reduction of resources consumption, extension of product life cycle, and proper use of waste and secondary raw materials.

Potential improvements can be obtained through:

- introducing materials passport and appropriate national databases that facilitate the analysis of the life cycle on a national scale;
- publicizing good practices in terms of secondary raw materials and introducing into procurement, not only reward scores, but advantages in terms of tax deductions and incentives;
- the Italian construction sector is mainly fragmented into small and medium-sized enterprises, especially family-run ones. Thus, it is important to find an effective method to transfer what is quite easily achieved in large enterprises to the myriad of SMEs;
- adopting a secondary raw materials policy;
- training of end users on the concepts and benefits of the circular economy.

5.1.9.5 Examples of Successful Implementation

Public Policy Initiatives

Two Italian Region, Puglia and Piemonte, implemented the Regional Strategy for Sustainable Development and are partners in the pilot project "Region2030: Monitoring the SDGs in EU regions—bridging the data gap" of the Joint Research Center (JRC) of the European Commission [298].

Moreover, with Resolution n. 98-9007 of 16 May 2019, the Regional Council approved the "Technical document setting up and first guidelines of the Regional Strategy for Sustainable Development of Piedmont" identifying the Circular Economy as a model to be promoted for the sustainable development of the "regional system" (Regione [297].

The Lombardy Region, in collaboration with Unioncamere Lombardia, has allocated over 4 million euros to support SMEs and micro-enterprises in the transition towards a circular economy model to be applied, in particular, at the supply chain level (Lombardy Region Council Resolution no. 6402 of 23 May 2022) [295].

The Lombardy Region created in 2018 the Observatory for the circular economy and the energy transition for sharing the strategic objectives of regional climate policies and for the sustainability of the use of resources with all the players in the territory [294].

The Marche Region has approved the regional law (17 March 2022, n. 4) "Promotion of investments, innovation and digital transformation of the Marche entrepreneurial system" with particular focus on the implementation of a circular economy [296].

The Reginal project "Imprese green" promoted by the Lazio Region supports the green conversion of small and medium-sized enterprises (SMEs) and agricultural businesses in Lazio and develop the circular economy model. In particular, 23.3 million euros have been allocated for sustainable and intelligent mobility, green building and smart building, circular economy and energy [292].

The Lazio Region is the first in Italy that approved the Regional Ecological Transition Plan with a resolution of the Department of Ecological Transition and Digital Transformation (January 2023). The document plans public spending to achieve the global sustainability objectives between now and the next few years and up to 2050 for a total of 5.9 billion in total [293].

Private Policy Initiatives

An example of application of the circularity model in the construction sector is offered by Webuild Group, which reuses 100% of the excavated materials and developed models to achieve the recycling of 90% of the steel used. For this Ialian company, the development of the circular economy is one of the pillars on which its sustainability policy is based. For this reason, Webuild adopts practices aimed at minimizing the use of natural resources and intensifying the recovery of waste materials within the same

work or in neighboring areas. The circularity of the practices adopted by Webuild allowed the company to reduce the waste produced by 46% in 2020 compared to 2019, while the waste involved in recovery processes was 69% of the total generated. Furthermore, 100% of the excavated materials were reused and the volume of water consumed on construction sites fell by 10% compared to 2019.

Several near-zero energy buildings (NZEB) constructed in Italy gain a wider resonance and acknowledgement as made of recycled materials or from natural origin, with low environmental impact. Good examples are: Fiorita Passive House in Cesena, Biocasa_82 in Treviso, Kindergarten in Guastalla, LAGO Campus in Padova [249].

5.1.10 Latvia Factsheet

In Latvia in 2019, 70% of the collected construction debris was a mixture of construction demolition waste and inert materials, while 20% consisted of only inert materials, total construction and demolition waste accounts for around 380,000 tons per year. Latvia has developed the Waste Management Plan 2021–2028 to address the waste management system and EU objectives in the long-term, but already now it is obvious that there are several obstacles to their implementation, especially in the household sector.

In this regard, Latvian policymakers hesitate to issue strict regulations on the construction sector and react with rather soft actions. Nevertheless, the Latvian Ministry of Economy and several state administrative institutions, non-governmental organizations, and state capital companies agreed on joint cooperation to promote the production and use of wooden building materials and construction products with high added value in construction, promoting sustainable construction and the growth of Latvia's economy, by signing the Memorandum of cooperation on promoting the use of wood in construction on April 23, 2021. In addition, in order to promote the availability of low-cost, including operating costs, ergonomic, easy-to-use, and energy-efficient housing, a demo project for a multi-apartment residential building based on modular wooden construction has been developed by order of the Ministry of Economics in 2022. At the time of writing, it has not been exercised by any private or public developer.

According to Association of Latvian Construction Contractors, the construction industry in Latvia (as in most EU countries) plays a significant role in the growth of the national economy, as it is one of the largest industries in terms of material consumption. Therefore, the construction industry, by increasing the demand for circular as well as sustainable building materials and construction products produced from local renewable natural resources or recycled, downcycled materials, could endorse the pace at which Latvia achieves its sustainable development goals. As a result of the research of the current situation in the Latvia, it can be generally concluded that the principles of circular economy in construction are not currently regulated in Latvia. Article 4 of the Construction Law defines the principles to be observed in planning and construction, including the observance of economic aspects

and public interests in architectural solutions, technological and economic efficiency in engineering solutions, and the principle of sustainable construction, including circularity. However, the general regulation does not have direct technical application and implementation norms in the standards and/or regulations of the Cabinet of Ministers.

Some statistical data:

- Construction and demolition waste (CDW) volume in Latvia accounts for more than 350,000 tonnes per annum (including around 30,000 tonnes of hazardous CDW).
- CDW forms 16% of total waste generated in Latvia vs EU average 36% of total waste stream.
- Up to 95% of CDW can be recycled or reused, although much of CDW is still landfilled, mostly being mixed with municipal waste.

Although construction and sustainability specialists are familiar with the criteria proposed by BREEAM, LEED, DGNB, WELL, as well as some other sustainable certification systems and the requirements for proving their compliance, industry experts admit that the regulatory environment in Latvia actually does not allow for the requirements for obtaining this certificate in certain circulation criteria, because the process of proving and certifying the properties is not clear, as well as there are no technical standards or building regulations for working with construction waste recycling products.

Within the framework of the EU interregional cooperation program URBACT III project "Transition to a circular economy in urban construction (URGE)", the municipality of Riga City Council has developed Guidelines for sustainable construction based on EC sustainable construction principles, which define the principles of sustainable design, construction, management, and governance. For now, however, this compilation of good practices and the manual of principled solutions do not fully answer the questions about the methodology for proving, testing, checking technical compliance and certifying compliance, which would also be harmonized with the regulatory enactments regulating construction in Latvia. There is no clear regulation in Latvia on obtaining "end-of-waste status" for construction recycling products or recovered materials, as well as comprehensive technical standards for work with construction waste recycling products, all participants in the process have limited opportunities to increase the circulation of construction materials.

5.1.10.1 Policy and Regulatory Framework

Governance

Ministry of Climate and Energy of the Republic of Latvia (former Ministry of Environmental Protection and Regional Development of the Republic of Latvia) is responsible for implementing policy in three areas—environment protection, regional development as well as information and communication technologies.

With the order of the Minister of March 21, 2017 no. 1–2/47 approved the operational strategy of the Ministry of Environmental Protection and Regional Development 2017–2019 for the year, determining the goals to be achieved in the next 3 years, directions of action and tasks for achieving the goals. The second line of action envisaged the development of a policy for the transition to a circular economy.

The Latvian Cabinet of Ministers has approved Latvia's vision for achieving climate neutrality by 2050 (https://ec.europa.eu/clima/sites/lts/lts_lv_lv.pdf) and Latvia's climate change adaptation plans for the period until 2030, in order to help Latvian citizens and the national economy better adapt to the already ongoing climate change and thus reduce the damages caused by climate change. The main goal of "Latvia's climate change adaptation plan until 2030" is to reduce the vulnerability of Latvia's people, economy, infrastructure, buildings and nature in relation to the effects of climate change and to promote the use of opportunities provided by climate change. The construction sector has been assigned the third of five strategic objectives: infrastructure and construction are climate-resistant and planned according to possible climate risks.

The Ministry of Environmental Protection and Regional Development outlined 5 priorities in the Operational strategy for 2020—2022. For the second priority—Economically efficient and thoughtful use of resources as a task for the implementation of the direction of action was to introduce the principle of circular economy in Latvia. The achievable result with the deadline of 30.12.2022 was formulated as follows: "Promoting the development of the circular economy in Latvia, determining the main directions of action and measures to contribute to the development of the national economy, competitiveness, while ensuring the fulfillment of the country's international obligations". In addition, 3 sub-results were defined:

- Determining the main circular economy action directions and measures (Circular Economy Strategy)
- Implementation of the measures specified in the circular economy strategy for Latvia
- Development of the regulatory framework for the implementation of circular economy principles.

Legislation

"Latvian National Energy and Climate Plan for the 2021–2030" the seventh course of action determines measures in the development of waste management, with the main focus on reducing the volume of waste and recycling waste, especially based on the principles of the circular economy. As one of the benefits as a result of the successful implementation of this document, the introduction of the circular economy and the promotion of the emergence of industrial symbioses are mentioned. The energy consumed by the building sector accounts for up to 40% of the entire energy balance, so in this planning document, in relation to the construction sector, the greatest attention is paid directly to energy efficiency issues and the promotion of the use of emission-free technologies. The need to increase the use of timber in

construction and the integration of green infrastructure into the urban environment has also been emphasized.

In the "Guidelines of the national industrial policy for the 2021–2027" it is emphasized that in ensuring the sustainability of Latvia's economy and creating innovations, it is essential to take into account the established Latvian environmental protection and climate goals, paying special attention to the integration and development of circular economy and climate issues both in business and science.

Latvian Waste Management Law was adopted on 28.10.2010 by the Saima. The purpose of this law is to determine the procedure for waste management in order to protect the environment, human life and health, preventing the generation of waste, ensuring separate collection and regeneration of waste generated on the territory of Latvia, as well as promoting the effective use of natural resources and reducing the amount of waste to be buried. The law also mentions construction waste and its management requirements.

Circular Economy Strategy, Roadmap or Action Plan

The Ministry of Environmental Protection and Regional Development developed an Action plan for the transition to the circular economy for 2020–2027, which was adopted on 04.09.2020 by the order of the Cabinet of Ministers no. 489. The purpose of the development of the plan is to provide a policy framework for the provision of such an operating environment that would promote the country's transition to a circular economy, while contributing to the implementation of the European green course and the achievement of global sustainable development goals. The plan was developed so that the circular economy would be thoughtfully introduced in the national economy and society of Latvia, with the aim of promoting society's progress towards more thoughtful and responsible resource planning, use, sustainable production and consumption, integrating these basic considerations into all sectoral policies, regarding the priority stages of the circular cycle and resource flows.

The implementation of circular economy requires effective cooperation at all levels of state administration and cooperation between different sectors of the national economy. The Action Plan contains seven initiatives:

1. The transition from waste management to resource management. Some of the key measures include developing secondary material markets and expanding and improving extended producer responsibility (EPR) schemes.
2. Improving resource productivity in all sectors of the economy by encouraging the development of research and innovation. This initiative includes the fostering of industrial symbiosis and support for redesigning existing products and designing new ones in line with the eco-design principle. These measures are necessary for the resource productivity target value of EUR 1.55 per kilogram to be reached by 2027, up from EUR 0.90 per kilogram in 2020.
3. The establishment of pre-conditions for the reuse of goods. Measures include support for social innovation and entrepreneurship.

4. Promotion of the transition from the purchase of goods to services, i.e., the promotion of rental services and green public procurement (GPP).
5. Improving the management of materials, processes, and waste in priority sectors. This includes the preparation and distribution of informative materials on waste minimisation, especially food, textile, and furniture waste minimisation.
6. Strengthening the role of municipalities in the implementation of the principles of a CE.
7. Engagement, information, and education of the public.

At the local level, the "Riga Sustainable Development Strategy 2030" is in effect, the main goal of which is the need to use municipal resources wisely and sustainably. For example, with regard to construction, the document states: in order to promote the attractiveness of neighborhoods for living, it is necessary to prioritize the revitalization of the living environment in micro-districts designed during the Soviet era. The preference is not for the construction of new residential buildings. Requirements for sustainable use and construction of the territory should be determined, promoting the emergence of high-quality architecture and the use of modern construction technologies.

Based on the document of the European Commission "Circular economy—principles of building design", guidelines for circular construction have been developed, which, by providing examples and specific influences, are suitable for the context of Latvia and Riga. The aim of the guidelines is to provide knowledge and practical support in the construction, maintenance, renovation and demolition of buildings based on circular economy principles. They will also be useful for building and construction management and procurement specialists, as well as residents.

The developed guidelines offer eight general principles that inform and support the members of the construction chain, as well as provide principles for orderly planning of buildings:

1. Circular economy and sustainable building design principles apply to all parties involved in the value chain;
2. When making sustainable choices, total life cycle costs, financial and non-financial returns on investment should be considered;
3. A viable business model must be present at each stage of the circular construction value chain;
4. The principles should be applied with proportionality in mind—the benefits should outweigh the costs;
5. Better knowledge of construction methods is needed to facilitate deconstruction and increase building resilience and adaptability;
6. The durability of buildings depends on better design, improved performance of building products and information sharing;
7. It is necessary to develop a new design culture, not allowing premature demolition of buildings;
8. Products and systems should be chosen so that they can be easily reused, repaired or recycled.

At the regional level, the Integrated Action Plan for the transition to a circular economy in urban construction in the municipality of the city of Riga was developed with the aim to provide a framework for the next five years for the implementation of circular economy principles in urban construction in the municipality of Riga State City and to determine those responsible for the implementation and monitoring of the plan. Although the IAP is the first local planning document that directly addresses the transition to a circular economy, there are other sustainability-promoting initiatives in housing and construction. For example, a municipal support program has been established for the sustainable and energy-efficient renovation of a private multi-apartment housing stock. Also, work is underway to establish the Riga Energy Efficiency Fund in the city to finance the renovation of buildings and the production of renewable energy, as well as the creation of waste sorting areas, which will become a significant support for the development of circular economy infrastructure.

Various structural units of the council are involved in promoting the sustainability of construction, such as REA, RD PAD, RD ĪD, RD MVD, RD ĪK and others. In 2025, Riga municipality adopted the Circular Economy Strategy 2040. The strategy identifies priority directions until 2040, including the development of sustainable urban mobility, the promotion of circular construction and building renovation, waste prevention and valorisation, support for green entrepreneurship, and the creation of innovation platforms for industrial symbiosis. The main goal of the Strategy is to transition from a linear to a circular and systemic approach, thus fostering resource conservation and creating environmental and economic benefits for the municipality and its citizens. The Strategy also points out the importance of citizen engagement, education, and cooperation between municipalities, businesses, and academia in driving systemic change. This Strategy is seen as an efficient aligner of local priorities with the European Green Deal and Latvia's national circular economy policy framework. Thus, the Strategy provides both a strategic roadmap and actionable measures for accelerating the transition towards a climate-neutral and resilient urban economy. Based on this document, Riga municipality has developed Riga Circular Economy Action Plan for 2026–2030, that sets out specific measures that will promote the circularity of resources (sharing, reusing, repairing, renewing and recycling of materials and products), citizen engagement, circular entrepreneurship, as well as the adaptation of municipal governance and procurement processes to the goals of the circular economy.

Construction and Demolition Waste Management Regulatory Framework

It is not a common regulation for construction and demolition waste and its management. However, in the municipality level, different municipalieties have their own regulations. For example, the key regulations regarding construction and demolition waste management in Saldus is in the Waste management regulations, which was adopted on 28.04.2022 by the order of the Saldus Dome no. 24.

"State waste management plan for the 2021–2028" includes the principles of the circular economy and in one of the analyzed development scenarios, the implementation of the principles of the circular economy is also envisaged. The 2nd overarching goal of the document stipulates ensuring the rational use of waste as a resource based on the basic principles of the circular economy and, as far as possible, promoting the return of resources into the economic cycle in a way that is useful for the national economy. Among other things, the document envisages improving technological processes in order to prepare construction waste flows for recycling, requires municipalities to ensure separate collection of construction waste, reuse of support materials and the use of technologies that reduce the generation of waste in construction.

Construction waste management guidelines have been developed in 2023. Their purpose is to create a common understanding and provide information about the procedures for managing waste generated during construction and demolition of buildings, the activities to be performed, the division of duties and responsibilities. The guidelines are intended for those working in the construction sector, providers of waste management services, institutions supervising and controlling construction processes and the waste management sector. A separate section is devoted to the management of construction waste generated in households. The guidelines consider construction waste circulation from the moment of development of the construction project, which reflects the planned amounts of waste generated during construction and demolition of buildings and their management, until the final processing, regeneration or disposal of this waste.

5.1.10.2 Platforms and Networks Facilitating the Transition to a Circular Economy

Circular Economy Platforms

Since 2021, Latvia has been implementing the European Union LIFE programme integrated project "Waste To Resources Latvia – boosting regional sustainability and circularity" (LIFE Waste To Resources IP, No. LIFE20 IPE/LV/000014), which, as one of its pillars, has industrial symbiosis and the development of an industrial symbiosis platform. The platform is still under development, but it already provides an interactive map with companies and their production leftovers. It is planned that this platform will be used by industrial symbiosis facilitators and also by businesses to seek symbiotic connections in order to optimise resource flow, contribute to waste prevention and foster the circular economy. The web page of the platform is https://sinergia.lv/.

At the same time, few platforms exist which are working based on circular economy principles. For example, Andelemandele, is an advertising platform. The Portal is not a financial intermediary for sale/purchase transactions. The actual sale/purchase transaction takes place between the direct buyer and the seller, with both parties mutually agreeing on the most convenient way to deliver the item and pay for it.

Or, for example, OtraĒlpa, their activity is based on the interaction of three basic values—charity, conservation of the environment and social responsibility. In each of the charity shops, customers can purchase various 'second life' items donated by private persons and organizations, as well as give away things that have unnecessary to yourself.

Circular Buildings Platform

Within the project Life project "Waste to resources IP", the creation of a national digital platform for the circular economy in construction was planned, which would also contain a user portal for monitoring progress in achieving the goals of the circular economy set by European and national legislation. The platform would allow to have an accessible data system for current monitoring and trade of construction debris and its processing products.

First pilot projects have been launched on establishing construction material exchange platforms. Up to now a short-term pilot project has been launched in Riga and an ongoin project is observed in Kuldiga municipality. The idea of the project is to offer a possibility to private individuals to bring or pick up various repair materials and construction materials free of charge. Materials such as tile, paint, varnish, plumbing, cement, plasterboard, veneer, chipboard, stone wool, insulation materials and more are accepted. The main condition for handing over materials—they must be usable.

Building Materials Passport Platform

No building materials platform has been established to date.

Public Procurement Platform

Latvia has official public procurement platform. The public procurement notices are published by the Procurement Monitoring Bureau free of charge and, if necessary, are sent for publication in the Official Journal of the European Union. The platform also contains information on construction procurement.

In Latvia, the Ministry of Environmental Protection and Regional Development (VARAM) is responsible for promoting green procurement and policy development. Explanations and regulatory acts, frequently asked questions, as well as the Green Procurement Calculators are available on the VARAM website:

- GPP life cycle cost calculators
- GPP cycle calculator mobile application for energy consuming devices
- Construction Life Cycle Cost (LCC) calculator.

Requirements for green public procurement and their application procedure was developed in 20.06.2017 and were accepted by the Cabinet of Ministers.

For the construction, a couple of guidelines for green public procurement were developed:

- GPP guidelines for design, construction and management of office buildings
- GPP guidelines for recreation and sports infrastructure
- GPP guidelines for road design, construction and maintenance
- GPP guidelines for transport.

Mandatory criteria for "green public procurement" are planned to be applied in the procurement of construction works. Currently, the application of these criteria to construction works is voluntary.

No national green public procurement platform has been established to date.

5.1.10.3 Funding Opportunities

Latvia uses different financial or technical support from an international institution or EU funding programme for the process of transition towards the circular economy, mostly through the implementation of different scientific projects: both local and international.

International Cooperation and Support from International Organizations

No data to this point.

5.1.10.4 Challenges, Barriers and Potential Improvements

There are several challenges and barriers related to different areas of implementation of circular economy in the built environment. The most important in Latvia are:

Policy and regulatory barriers; market barriers for recycled or reused resources, i.e. not economic efficient, lack of demand; lack of quality standards for the use of secondary raw materials during the construction of new buildings; lack of infrastructure etc.

The concept of a circular economy is continuously gaining popularity among academics, business community and decision-makers. In recent years, the concept of "circular ecosystems" has been developed where multiple actors and stakeholders are involved to implement circularity at intra-industry and cross-industry levels. Even the role of actors within circular ecosystem differs, key players within the ecosystem are public authorities both at legislative level and municipal levels responsible for the setting up and implementation of circular economy policies including in construction waste management.

In 2021 Latvia received a significant grant under LIFE IP project—LIFE Waste to Resources IP, LIFE20 IPE/LV/000014 "Waste To Resources Latvia—boosting regional sustainability and circularity", that is being implemented within the timeframe of 2022 to 2028. Under this project, which gathers a consortium of over 20 partners from waste management, municipalities, the construction industry, etc., it was possible to undertake a study to explore the main challenges for municipalities in facilitating the circularity of construction and demolition waste streams from households. The study is based on 24 municipalities in Latvia survey and follows in-depth interviews to tackle the main barriers and possible solutions to minimize illegal dumping and to promote the circularity of construction and demolition waste generated in households. Previous academic studies on barriers to circular ecosystem development mainly focused on challenges for companies, however, the research on the local governments' view is limited. The research demonstrated that more than 60% of municipalities see illegal dumping of construction and demolition waste in Latvia as problematic and 70% of municipalities see households as the main polluters. Insufficient resources (financial and human), underdeveloped infrastructure (e.g., no specific waste acceptance areas), and inadequate legislative framework including a lack of motivation people to sort construction and demolition waste are a few of the identified main barriers towards circularity. The conclusions of the study and recommendations for the action will contribute to further academic research and policy development in the area of construction and demolition waste circularity and the enablement of a circular ecosystem (Fig. 5.1).

24 out of 43 Latvia's municipalities took part in the survey. Valuable information was obtained regarding CDW management challenges across different regions. The use of open-ended questions helped to define short-term and mid-term priorities from the public authorities' perspective. More than 60% of municipalities consider environmental pollution with CDW as an issue within the municipality. 70% of municipalities recognize households as the main source of illegal dumping. 60%

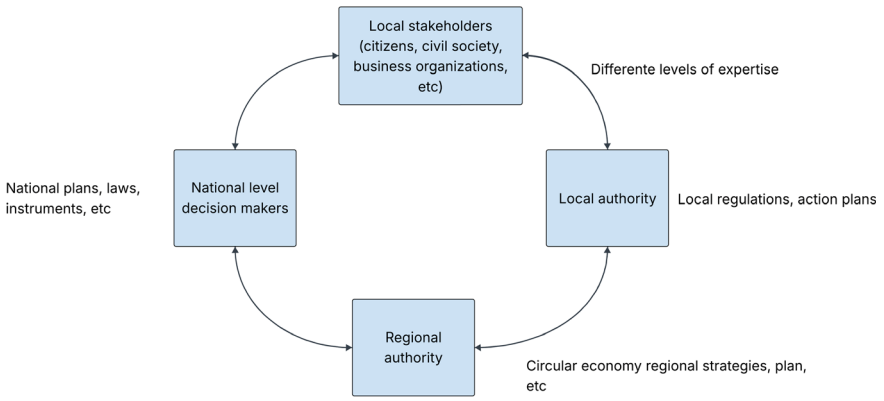

Fig. 5.1 Circular ecosystem governance

of municipalities see the management of hazardous construction waste as an issue within the municipality.

An external information on circular economy principles in construction (ec.europa.eu), according to the EC guidelines "Circular economy principles for building design", the contractor can contribute by choosing solutions with greater adaptability (e.g. modular solutions), increasing recycling and regeneration potential (for example by tracing the origin) as well as following Ecodesign principles and following life cycle costs. However, if you look at the construction process in terms of the responsibilities of its participants, then in Latvia these choices are made by the designer. It is the responsibility of the contractor to supply appropriate materials and services and to certify their compliance, as well as, if determined by the compliance certification system for the specific material or solution, to perform technical tests and inspections. By the end of 2028, the following must be achieved:

- reduction of illegal dumping of construction debris and increase of separate collection and sorting;
- reduction of unprocessed or unrecovered construction debris is planned by 30% compared to the total amount of construction waste produced in 2019.

A more detailed analysis of the data on where the sorted, recycled and reused construction waste ends up shows that most of it does not return to the industry, but is "embedded" in temporary solutions. Such actions prevent an increase in the volume of landfilled waste, but as a result, they do not reduce the initial use of resources. Taking into account the complexity of the construction industry, researchers and experts evaluated decision-making, material flows, regulation, including the requirements and opportunities of technical regulations in five stages of the construction process—design (architectural and engineering sections), construction works, demolition, construction debris management and production of construction materials.

Key Challenges as Defined by Municipalities:

- Lack of resources [human and financial].
- Underdeveloped infrastructure (e.g. no designated place to collect CDW from households).
- Lack of motivation for people to sort CDW.
- Legal framework and implementation shall be improved.

Below priority actions to address CDW management have been summarized:

1. Households: Public awareness activities (incl. on CDW sorting); Changes in the laws; Strengthening administrative and control capacity on the municipal level.
2. Businesses: Special financial support programmes for the development of infrastructure and CDW recycling capabilities; Strengthening administrative and control capacity on the state level; Development of the integrated system for the tracking of recycled CDW; Identification of challenges and barriers at national levels.

The successful development of CDW sector requires:

- Short term activities—public information/awareness raising; special events (e.g. free of charge asbestos roofing collection); control enforcment etc.).
- Mid term activities—programme for the CDW management infrastructure development; legislative changes; extended PRO discussion.

According to the OECD and the European Topic Centre on Circular economy and resource use [89], the main challenges identified were:

1. a lack of cross-sectoral coordination and of a powerful driving force to move economic ideas forward in Latvia;
2. developing and implementing sectoral strategies without considering smart natural resource management objectspainsoain ives and changing production and consumption patterns, or insufficiently integrating them;
3. insufficient use of economic and other instruments to influence consumption;
4. lack of awareness and support for social innovation and dissemination of good practice;
5. public attitudes towards consumption: it is difficult for citizens to change their habits and to start sorting waste, in addition to insufficient infrastructure availability;
6. use of environmental and natural capital in an unbalanced way;
7. lack of control—non-compliance of actual activity with the capacity specified in the documents.

5.1.10.5 Examples of Successful Implementation

Public Policy Initiatives

Circularity strategy in construction is related to the choice of materials, construction waste management and functional solutions. More use of recycled, renewable or reusable construction products promotes the implementation of circularity principles already at the design stage. Also the material important conditions in the choice are their origin, production of raw materials from renewable resources, processing techniques. On the other hand, long-term focused and thoughtful functional solutions facilitates the adaptation of the building during its operation with less resources use. In Latvia, the concept of regularity is not provided for in the regulatory acts that would lay it as a basis designers to use these principles in the development of the construction project. The experience so far is mainly based on stimulating factors of external conditions, not on direct and deliberate actions of the customer and the designer in promoting traffic.

Ziepju Street 11 renovation according to circular economy principles. The first construction project based on circular economy principles was implemented in Riga and Latvia. It is a five-story building at Ziepju street 11, which since 1970 served as a service hotel for employees of the trolleybus park. Later, the building was used as a shared house for different social groups. Since 2018, the building has not been uninhabited, its communications have been disconnected and the windows have been nailed up. After reconstruction, municipal rental apartments have been installed in it. Since the internal layout of the building was significantly changed, a large amount of construction debris was created. The resulting construction debris was maximally used on site for building renovation and area improvement works. The remaining resources (which would be called waste in the circular economy) were used in other objects and sent for recycling (https://www.riga.lv/lv/jaunums/ziepju-iela-11-parbuves-eku-pec-aprites-ekonomikas-principiem). Transition to circular economy in urban construction "URGE" is the interregional cooperation program of the European Union "URBACT III 2014–2020". for the year" project. More information: https://urbact.eu/urge.

Reconstruction of the Riga Circus. Reuse of material—the maximum of the dome structure of the historical arena interior use. Exposing the historical and modern connection, preserving the historical scope.

Temporary auditoriums of Riga Stradins University. Possibilities of adjusting and moving structures The customer's need to provide a temporary solution to the learning process for provision. After evaluating various alternatives, the most sustainable solution was found chosen adaptation of modular containers to provide educational functions. After upon completion of construction works, the temporary auditoriums will be moved to another building site, providing a learning function. At the end of the cycle, the containers will be placed in Riga On the property of Stradiņi University to provide a recreational function.

New building of Ogre Central Library. Use of construction products made from recycled materials. Participation in the open tender of projects financed by the emission allowance auction instrument "Reducing greenhouse gas emissions by developing an energy self-sufficient building construction", where one of the quality evaluation criteria was "Recycled materials assessment of use" and by including in the project that the construction of the building provides to use recycled (recycled) materials, evaluation points were received. In addition it is stated that the building will be certified according to the BREEAM standard.

Reconstruction of the New Riga Theater. Reuse of cultural and historical building elements in the rebuilt building, construction products use produced from recycling. The place of operation of the theater is a cultural monument of national importance and is located in the historical center of Riga in the center area, the goal is to create an architecturally high-quality and functional building that meets for modern theater needs. Reconstruction of the teaching building of the Faculty of Civil Engineering.

Use of recycled materials, preservation of existing building elements. Economic aspects, namely to use existing resources in case of limited funding, which is of good quality and meets the technical requirements.

Mežaparka's Great Stage. Preservation of historical building elements, development of temporary solutions for modifications. Exposition of dismantled building elements as historical evidence; construction of a temporary solution, to provide a stage function during the construction phase.

At the design stage, the most common initiative is to apply the principles of circularity related to the attraction of external funding and the reconstruction of cultural and historical buildings. External in the case of fundraising, additional requirements are set in the tender regulations, which are binding on both the customer and the designer. On the other hand, cultural and historical buildings in the case of reconstruction, the normative acts are binding, which are the basis for the construction of the building and for preservation and/or restoration of building elements. There are significant requirements for construction debris management and thoughtful selection of building materials determined in the international building sustainability certification standards. Separately Projects in the BREEAM certification process include requirements for waste management and efficient use of resources, but it is more related to reducing the future waste stream.

Private Policy Initiatives

No data to this point.

5.1.11 Malta Factsheet

5.1.11.1 Policy and Regulatory Framework

Governance

The main government institutions in charge of implementing the circular economy in Malta is the Ministry for the Environment, Energy and Enterprise [234]. The Circular Economy Malta (CE Malta) is the designated competent entity, set up by Government, for the Circular Economy under the Environment Protection Act [74]. The legal persona of the Agency is provided through the Public Administration. CE Malta was established through Subsidiary Legislation SL.595.28 [36]. The entity, originally set up as Resource Recovery and Recycling Agency (RRRA) works to create a business environment whereby producers would be responsible for the products placed on the market, from placement on market until the end of product life. The agency is active on a number of projects and initiatives, including the beverage container refund scheme, end-of-life waste tyres, construction waste, food waste, and textile waste. Overall, Malta is working towards Circular Economy and the transition can be facilitated through government action to create a favourable climate for responsible, positive impact investment by providing technical assistance and mobilising financial resources for sound investment in sustainable innovations. This has been happening in Malta, through visions, policies and regulations. The transition towards a CE is dependent on the stakeholders' willingness and capacity to collaborate and forge long-term relationships with one another.

Legislation

The Waste Regulations, S.L. 549.63, are the overarching national legislation on waste and aim to transpose the provisions of the Waste Framework Directive 2008/98/EC. The Waste Regulations, S.L. 549.63 [361] provide a framework to protect the environment and human health by preventing or reducing the generation of waste, the adverse impacts of the generation and management of waste and by reducing overall impacts of resource use and improving the efficiency of such use, which are crucial for the transition to a circular economy. The Waste Regulations set the basic concepts and definitions related to waste management as well as portray the main waste management principles such as:

- The waste hierarchy;
- The polluter pays principle;
- Extended Producer Responsibility (EPR);
- When waste ceases to be waste to become a secondary raw material (end-of-waste criteria);
- How to distinguish between waste and by-products;
- The list of waste;

- Hazardous waste;
- The difference between municipal waste, household waste and biowaste;
- Waste Management Plan.

The waste hierarchy is the cornerstone of European and national waste policies and legislation, ranking waste management options in a specific order according to their environmental impact. Its primary purpose is to minimise adverse environmental effects from waste and to increase and optimise resource efficiency in waste management and policy.

Reference is also made to the Environment Protection Act, Malta CAP 549: Circular Economy Malta (CE Malta), as the designated competent entity in Malta was set up by the Government under the Environment Protection Act.

The Action 3 of the Circular Economy Strategic Vision: Towards a Circular Economy 2020–2030 [183] refers to the deposit-refund schemes and other measures to encourage the efficient collection of used products and materials.

SL. 623.08 Construction Site Management Regulations [44] refer to the standard SM810 for Recycling oriented Deconstruction and Classification of Waste, therefore incorporating the standard within the regulatory framework. Compliance with the standards is considered as an essential requirement prior to the issuance of an executable Development Permit. Any deconstruction or excavation works on a site shall be carried out in line with sections five (5), seven (7) and eight (8) of the national standard SM 810:2022 'Recycling-oriented Deconstruction, Controlled Excavation Works and Classification of Waste' [317]. Furthermore, any apertures utilised in a residential building shall by design follow the standardisation of dimensions of internal and external apertures as specified in the Technical Document titled 'standardisation of Apertures for Residential Buildings in Malta'.

Circular Economy Strategy, Roadmap or Action Plan

Circular Economy Strategic Vision: Towards a Circular Economy 2020–2030. Malta has a Circular Economy Strategic Vision: Towards a Circular Economy 2020–2030 [183]. The Circular Economy Strategy Vision 2020–2030 was developed to go along with the government's plans to build the country's first waste-to-energy plant and continue its efforts to reduce landfilling. The vision aims to establish an environment that will lead to the development of a sustainable, low-carbon, resource-efficient, and competitive economy, in line with the EU Commission's Circular Economy Strategy. The following actions have been identified:

1. fiscal incentives for the donation of products;
2. extended producer responsibility (EPR) schemes for various types of waste and measures to increase their effectiveness, cost efficiency and governance;
3. deposit-refund schemes and other measures to encourage the efficient collection of used products and materials;
4. sound planning of investment in waste management infrastructure, including through European funds;

5. promote sustainable public procurement to encourage better waste management and the use of recycled products and materials;
6. use of fiscal or other means to promote the uptake of products and materials that are prepared for reuse or recycled; and
7. support for research and innovation in advanced recycling technologies and remanufacturing.

Construction and Demolition Waste Strategy for Malta 2021–2030: Managing Construction & Demolition Resources

There are targets and strategic goals related to the implementation of circular economy in construction sector in Malta through the Construction and Demolition Waste Strategy for Malta 2021–2030 Managing Construction & Demolition Resources [45]. This Strategy is a framework acting as a driver intended to bring about a cultural and behavioural shift within the sector in terms of its attitude towards excavation, demolition and construction methods. The Construction and Demolition Waste Strategy for Malta will further Malta's transition to a CE and hence close the loop of products' lifecycles. The CE policy element refers to the setting up of standards for the construction industry. These standards include: best practice for (de)construction; classification of construction and demolition waste; appropriate excavation activities; dimensions of internal and external apertures of residential dwellings. The Construction and Demolition Waste Strategy for Malta 2021–2030 recognises the need to set specific targets related to the reuse and recycling of construction and demolition waste. The main aims of such targets are:

- to decrease the dependency on natural resources;
- to reduce the need for virgin aggregates; and
- to move towards a CE.

The Strategy identifies the following targets to facilitate the achievement of the above aims:

- a minimum of 40% of excavated material shall be reused or recycled;
- a minimum of 15% of construction material shall be made up of reused material or materials recycled locally, with a possibility of further reuse or recycling at a building's end of life;
- at least 25% of the granular material used for construction shall be made up of aggregates recycled locally in order to decrease the dependency on virgin materials. The percentage share of recycled aggregates used will contribute to the 15% target for reuse and recycled materials highlighted above; and
- a minimum of 40% by weight of non-hazardous waste generated during demolition activities shall be prepared for reuse, recycling and/or other forms of material recovery (excluding backfilling operations), with a view to increase the minimum target to 55%. Information on the intended reuse and materials destined for recycling will be included in pre-demolitions audits to be submitted prior work starting.

The above mentioned measure is to be implemented between 2026 and 2030.

Long Term Waste Management Plan 2021–2030. The Long-Term Waste Management Plan 2021–2030 (LTWMP) [173] aims to maximise the resource value of waste through holistic waste management solutions by adopting a collaborative approach whilst fostering the necessary behavioural change. This Plan is intended to be the cornerstone of a process that will strengthen the transition to a CE. The Circular Economy Policy Element refers to support for the establishment of a reuse and repair centre to promote such practices. The Long Term Waste Management Plan, through the waste prevention programme, aims to facilitate the creation of a centre to which people can take items that are suitable for repair, upgrade or reuse. Furthermore, reuse, upgrading and repair activities will be promoted through positive economic incentives, quality assurances and warranties to improve confidence in second-hand goods.

Single-Use Plastic Products Strategy for Malta 2021–2030. The objective of the Single-Use Plastics Strategy for Malta is to reduce environmental harm from certain plastic products, and to promote the transition to a CE with innovative and multi-use alternatives. The Circular Economy Policy Element refers to the setting up of "green corners", whereby the strategy aims to encourage schemes for grocery shops to set up "green corners" for packaging-free foods: to promote responsible consumer behaviour; to reduce the generation of plastic waste; to inform consumers about the availability of reusable alternatives.

Standards for the construction industry. The objectives of the standards proposed was to:

- Establish best practice for (de)construction, aimed at reducing the generation of construction and demolition waste and purifying the resulting waste streams;
- Establish a classification for construction and demolition waste by type, material, composition and weight to encourage on-site separation as well as improve the quality of waste streams for subsequent reuse or recycling;
- Establish standards for appropriate excavation work, with the aim of reusing excavated rock for the purposes of construction.
- Establish standards for the dimensions of internal and external apertures of residential dwellings aimed at encouraging the re-use of fittings as well as reducing diversity, bringing about economies of scale.

These standards are incorporated within the regulatory framework and compliance with these standards is an essential requirement prior to the issuance of an executable Development Permit.

The above standards aim to classify construction and demolition waste according to the material type and composition in order to improve the quality of waste streams for subsequent treatment. The standards were organized into: two standards for C&D Waste (SM810: Recycling-oriented Deconstruction, Controlled Excavation Works and Classification of Waste; SM820 Classification of Recycled Aggregate (In consultation phase); and a technical guideline for apertures.

Recycling Oriented Deconstruction of Buildings Standard SM810:2022. The Recycling-oriented Deconstruction, Controlled Excavation Works and Classification of Waste was published in 2022 by MCCAA as an important and fundamental National Standard, following a public Consultation. The standard is incorporated within the regulatory framework through SL. 623.08 Construction Site Management Regulations. Compliance with the standards is considered as an essential requirement prior to the issuance of an executable Development Permit.

5.1.11.2 Platforms and Networks Facilitating the Transition to a Circular Economy

Circular Economy Platforms

The main Circular Economy Platform in Malta is CE Malta, the Government agency promoting CE through the National Strategy.

Following the European and National action plans, various initiatives have started to promote the Circular Economy in Malta. Initiatives are taken by different stakeholders, including Industry, Academia, NGOs, and other partners, including Government Agencies. The Building Industry Consultative Council's Research and Innivation work group promots Circular Economy in the Construction Industry as a key initiative and worked with the University of Malta and MCCAA towards the definition of new Standards in the Industry (SM810 and SM820).

The University of Malta has been leading initiatives and research in Circular Economy primarily in the Construction sector for several years, strengthening through funded international and national research projects. Other initiatives are taken by Non-Government Organisations, including iiSBE (International Initiative for a Sustainable Built Environment) [313], SBE Malta, Sustainable Built Environment Malta, iiSBE National Chapter, and ZIBEL environment NGOs.

The Ecohive Reuse centres support CE. These Centres offer used items that still hold value and can be reused. Unwanted items that are still in good condition can also be donated in special containers that have been placed at every Civic Amenity Site. By donating or picking items for reuse, stop them from going to the landfill, save the energy needed to recycle them, reduce the natural resources and energy used to create new products and contribute to a circular economy.

Circular Buildings Platform

EcoBuild was a new tool developed by the Building Industry Consultative Council, intended to promote Green Building Technology in Malta [17]. It is a first database in Malta for available Green Building Products and is based on an online system. The platform increased product visibility and competition, while providing building industry professionals with a wider range of information and tools to implement better

performing buildings. The platform supported also circularity in the construction industry.

Building Materials Passport Platform

A building materials passport platform at a national level was assessed and proposed by the Research and Innovation Work Group of the Building Industry Consultative Council towards implementation in the Maltese Islands.

Public Procurement Platform

The Ministry for the Environment, Climate Change and Planning (MECP) published the Green Public Procurement Second National Action Plan (2022–2027) [323], which came into force as of 01 January 2022. The scope of the Green Public Procurement Second National Action Plan (GPP 2ndNAP) is primarily to strengthen the achievements as well as address any identified challenges encountered during the implementation of the First National Action Plan. It also aims to promote, motivate and incentivise the implementation of Green Procurement practices, production and consumption, thus, reinforcing and integrating the concept of Circular Public Procurement. The mission of the GPP 2nd NAP is to 'enhance the Greener Public Procurement Function, recognising the opportunity to limit further the environmental footprint whilst driving markets towards greener products and services'. In fact, its vision is to progressively increase the share of Government's Green Public Procurement to 90% by 2027.

5.1.11.3 Funding Opportunities

EU Cohesion Funds

EU funds through the EU Cohesion Policy are key to implementing circular economy in Malta. In 2014–2020, Malta benefited from Cohesion Funds worth more than €1 billion, through which the country has improved waste management systems and sustainability practices, among others [65]. Waste management capacity has improved in Malta through the EU Cohesion Policy thanks to EU Cohesion funds [66].

Malta's Recovery and Resilience Plan

Malta's Recovery and Resilience Plan includes various measures that aim to shift Malta towards a more CE [184]. In 2021, Malta implemented measures from the Recovery and Resilience Plan [180], in particular:

- the prohibition on the imports, production, sale and distribution of certain single-use plastic items, including lightweight plastic carrier bags; and
- the adoption of the Construction and Demolition Waste Strategy, which is in line with the main aims of EU waste legislation and the EU Construction and Demolition Waste Protocol. The Strategy provides for measures to encourage options that deliver the best overall environmental outcome by promoting a shift towards a more CE and hence closing the loop of products' lifecycles.

During 2022, Malta implemented one of the measures in the Construction and Demolition Waste Strategy for Malta 2021–2030, which has also been included as a national Resilience and Recovery Plan: that is to establish standards for the construction industry in the form of mandatory guidelines for economic operators within the sector (SM 810:2022).

Malta Council for Science and Technology

The XJENZA Malta (Previously the Malta Council for Science and Technology MCST) [181] manages national funds for R&I through the development and operation of programmes, which in turn, create vehicles for research across the public, academic and private sectors. A portfolio of funding programmes provides researchers with the opportunity to translate their ideas into tangible projects and eventual products or services. Projects funded by MCST include a number of research programmes focusing on Circular Economy and Waste Recycling in particular addressing C&D Waste: RECP (Circular Economy through Recycling Poultry Waste for value-added products in Construction and Agriculture) [286] and ReCON (Large Volume Waste Recycling for Low-Impact High-Performance Concrete) [166] and 3DCONCRETE (3D Printing of Concete for Sustainable Construction).

Malta Smart Specialisation Strategy

The Malta Smart Specialisation Strategy presents Circular Economy as an important area. Niche Areas of Focus are presented and the area of sustainable use of resources for climate change mitigation and adaptation is selected as a smart specialisation area for 2021–2027 [185]. In particular, there is a strong need for R&I investment to develop tailor-made solutions for Malta. This may in turn create additional opportunities for tapping into international collaboration and markets. Any type of tailor-made solution proposed for Malta should be developed with current and future climate change scenarios in mind. Based on this, investments in niche areas have the most potential in providing such needed solutions in the coming years. A niche area presented refers to: "Turning Waste into a Resource": While the shift from a linear to a circular economy is indeed a global one, the challenges that different countries face and the solutions required may well be very diverse. Malta's insularity and lack of economies of scale are perhaps the greatest obstacles to reach the defined targets.

International Cooperation and Support from International Organizations

The University of Malta is a member of *fib* (International Federation for Structural Concrete) [93] and academics are active in the *fib* Commission 7: Sustainability with active leadership of TG7.8—Recycled Materials and industrial by-products for high performance reinforced concrete structures [332].

Malta is also active in Standardisation through the MCCAA (Malta Communication and Consumer Affairs Authority) [182] and participates in Technical Committees for standards on Circular Economy, including CEN TC350/SC1 Circular Economy in the Construction sector.

5.1.11.4 Challenges, Barriers and Potential Improvements

Challenge 1: Institutional Challenge for a Cross-Sectoral Development

Being a small island, Malta has limited economies of scale. Nonetheless, small countries like Malta do not find it economically feasible to develop treatment facilities for all waste and all types of treatment, meaning that some waste has to be shipped abroad for treatment. Community and international policies that allow small island countries like Malta to be circular even beyond national borders can certainly be of help. Actions that could help include:

- co-ordination across different levels of government to align priorities, goals, regulation and funding sources;
- system thinking to ensure policy coherence across different sectors, such as waste, water, energy and transport, to maximise synergies and ensure a coherent set of incentives;
- collaboration and dialogue between the public sector, not-for-profit actors and businesses to stimulate innovation for more sustainable production and consumption patterns.
- development within local administrations and across businesses.

Challenge 2: Companies' Ability to Grasp Opportunities

The main concerns and challenges that companies experience are:

- maintaining consumers' expectations;
- implementing government regulation;
- lack of waste treatment facilities;
- lack of recycling technologies;
- level of costs for implementing CE concepts.

Challenge 3: Market Barriers

A CE approach can support the prevention of waste at all stages of a product's lifecycle, from design, production and distribution right through to use and disposal. Designing a product to be easily repaired or upgraded can maximise its use before it reaches its end of life. As indicated in the Circular Economy Action Plan, although 80% of products' environmental impacts are determined at the design phase, the linear pattern of take-make-use-dispose does not provide producers with sufficient incentives to make their products more circular. As many goods available on the market in Malta are imported. Malta is limited in terms of influencing the products' entire lifecycles as it does not have much influence on the design and production stage.

Challenge 4: Consumer Behaviour

Consumption patterns and choices shape the amount and type of waste generated. Current consumption levels are unsustainable. A reason for this low engagement in CE practices could be that consumers lack information about product durability and reparability, as well as the lack of sufficiently developed markets, for, amongst others, second-hand products, renting, leasing or sharing services.

Challenge 5: Indicators and Targets

- Limited data on material stocks and waste created
- Necessity of investigating not only existing CE targets but also possible or advisable targets
- Identifying and establishing CE indicators and targets
- The need to examine targets beyond specific solutions, economic sectors, or geographical characteristics.

A number of barriers and issues are being addressed with the proposed regulations and their implementation will accelerate the implementation of circular economy. A key challenge refers to the economies of scale of a small Islands State with limited natural resources—where the management of resources and waste is critical.

Several challenges and barriers refer to specific areas of implementation of Circular economy in the Construction Industry and the Built Environment, including: Need of new regulations; poor implementation of existing regulations and lack of enforcement; Collaboration between partners including academic/professional and industry partners; development if new products based on recycled materials and their uptake on the market; adoption of design for deconstruction principles in new building stock to address lifetime engineering principles including building and construction techniques; regulations supporting uptake of percentage of recycled CDW materials; attitudes in the construction sector and production industry; cost of dumping and

illegal dumping; skills in the industry in the circular economy sector; upscaling of research innovation to industry scale; perceived value of C&D Waste and market dynamics where new products are preferred instead of recycling; lack of demand for products based on waste; knowledge of professionals and partners in the industry; gap in standards for the classification of recycled aggregate as national standards in Malta; lack of confidence in the quality of recycled materials; lack of space for Waste separation depots; space for building disassembly; the nature building typologies in the case of existing building stock; lack of incentives for recycling/disincentives for the use of natural products.

Particularly important areas for improving the implementation of the circular economy in the built environment in Malta refer to improved regulations for C&D Waste and stricter control, application of the classification of aggregate, the building of infrastructure (recycling plants and recycling depots) and raising awareness with the key stakeholders.

5.1.11.5 Examples of Successful Implementation

Public Policy Initiatives

The Long Term Waste Management Plan 2021–2030 aims to maximise the resource value from waste through holistic waste management solutions by adopting a collaborative approach whilst fostering the necessary behavioural change. This Plan is intended to be the cornerstone of a process that will strengthen the transition towards a CE. The Plan identifies various measures to promote resource efficiency and reduce waste generation across sectors. These measures seek to incentivise greener business processes, and prompt societal change towards smarter consumption patterns. Furthermore, such measures seek to maximise the intrinsic resource value of waste as well as reducing pressure on Malta's waste logistics and infrastructure and the islands' dependence on either exporting waste or landfilling.

- **Product-related policies, including on the R-strategies (repair, reuse, remanufacturing, etc.)**. The establishment of a reuse and repair centre: The Waste Management Plan identifies the need to the establish reuse centres, creating places to which people can take items that are suitable for repair, upgrade or reuse. In view of this, during 2022, Wasteserv Malta opened its first reuse centre, at which the public can donate items that are still in good condition for reuse/resale. It is envisaged that in the coming years more reuse centres will be opened with the money raised through them used for other environmental initiatives.
- **Change in consumption patterns and consumer behaviour. Green corners**. This initiative involves the setting up of incentives for supermarkets (at national level) to provide packaging-free areas where customers can only buy the selected food products without plastic packaging. The aim of such initiative is both to encourage consumers to move towards reusable containers as well as reducing the amount of plastic waste generation.

- **Green Public Procurement 2nd National Action Plan**. Malta's Second Green Public Procurement (GPP) National Action Plan came into force on 1 January 2022. It provides a series of targets and measures that sees a level of ambition that has never before existed in Malta. Implementing the Plan and achieving its targets will require the support and commitment of economic operators as well as those responsible for public procurement. Building on the success achieved in the first National Action Plan, the Second GPP Action Plan aims to progressively increase the share of greener products and services in government procurement to 90% by 2025—a target which although not set by the European Commission, will drive action on the ground, promoting sustainable consumption and production. An ambitious but realistic approach is considered the best way forward in order to coax the market into a smooth transition. Consequently, the Plan sets out targets for 17 product and service groups, 14 of which will be mandatory. Green public procurement will also further work towards greener consumption and contributing to increased circularity by implementing nine new initiatives to increase GPP uptake.

Private Policy Initiatives

- **Construction and Demolition, Excavation Waste Materials Recycling**. The Xrobb l-Ghagin Wildlife rehabilitation Centre (ex-Deutsche Welle Radio Relay Station) [366] Adaptive reuse of an ex Deutsche Welle Radio Relay Station, into a Wildlife Rehabilitation Centre. The project included the recycling of stone and exploitation of reconstituted stone that is reuse of stone from dismantled buildings in the construction of 1 km long boundary wall with planters surrounding the Nature Park; the recycling of dismantled materials and elements; together with the adaptive reuse of an existing building following repair and strengthening instead of reconstruction, to promote circular economy. (ERDF Funded project).
- **ReCON**: The large volumes of Construction and Demolition Waste, Excavated Waste limestone, Quarry Waste generated in the construction industry, present significant challenges in disposal with environmental impacts. Recycling presents opportunities in reducing the disposal of waste material and also resulting in lower demands on the extraction of new resources. However low-quality inert waste which is generated in construction activities, presents limited opportunity in recycling, resulting in large volume of waste disposal. The increase in construction activity is leading to higher demands for construction products, with increased pressures on natural resource extraction including the extraction of aggregate and cement for the production of concrete and concrete products. In particular there is a large demand for concrete blocks in the construction industry. Cement as a binder in concrete, has a high embodied energy with negative impacts on the environment. The project refers to the recycling of large volumes of excavation waste consisting primarily of lower quality limestone and other materials, normally considered inadequate if used as aggregate in civil engineering applications, primarily due to

low mechanical characteristics and impurities. The new product consists of a low-impact high-performance concrete, an eco-construction product based on waste excavation material. The innovation lies in the transformation of the waste into a high-performance construction product. The new product is produced through a new technological process based on a production methodology consisting of key steps and resulting in premium quality products for the construction industry. The final product is strong, stable and durable for construction applications. The new product, can effectively provide for the increasing demand for construction products. It can be presented in the form of building blocks, cladding panels or in other geometries and forms of high-performance construction products. The new product is based largely on waste, resulting in a reduction in consumption of raw materials and less waste disposed, and lower environmental impact. The new technology effectively transforms large quantities of waste into a resource, a low-impact high-performance material.

- **RECP Circular Economy through Recycling Poultry Waste for value-added products in Construction and Agriculture** The project addresses recycling options of waste generated from the poultry industry and processing techniques, with reference to bone waste and feathers. Waste from the poultry industry primarily offal, bone, skin and meat are transformed into a fertilizer for the improvement of soil fertility. The physicochemical changes during the processing of the waste render nutrients more available for plant uptake. In addition the organic matter content of the soil shall improve hence leading to the long term release of nutrients and an improvement in the structure of the soil leading to better soil aeration and water holding capacity. Feathers are processed and exploited as fibres in cement-based materials, for crack control in concrete.
- **SORĠI** is a research project on the potential of circularity in Malta, the first result of which is an outdoor furniture collection for public areas that is very critical of the increasing building sector [318]. Six seats, each inspired by a different structure damaged by the local construction boom, will serve as a reminder of today's decisions as well as a recommendation for future acts. All the bench pieces are created from recycled construction waste, inviting visitors to consider the island's growth and its influence on the environment, as well as its social and historical significance. After mapping out the building sector and waste-producing locations, numerous materials were investigated and tested, including glass fragments, recycled concrete and asphalt, and marble offcuts: all significant resources that are now being discarded in landfill sites that are already at capacity. For example, the use of pigments was tested as a way of adding colour and creating remarkable textures, increasing the uniqueness of each bench, during the development and production phases. All leftover components and possible rubbish were gathered and recycled during the production process to make small products such as coasters and pots, which are also available for purchase.

5.1.12 Moldova Factsheet

5.1.12.1 Policy and Regulatory Framework

Governance

Sustainable development and the promotion of the green economy are development priorities for the Republic of Moldova. These are reflected in the main policy documents of the Government, especially in the National Development Strategy of Moldova 2030, the Energy Strategy-2030, the Environmental Strategy 2014–2023, the Program for the promotion of the Green Economy in the Republic of Moldova for 2018–2020. These are also part of the commitments of the Republic of Moldova towards the country's development partners from outside.

The Association Agreement with the European Union expressly aims to ensure sustainable development and promote the green economy in our country. By signing the Agreement, the Republic of Moldova undertakes to harmonize national legislation with European legislation and to ensure the integration of environmental protection provisions, rational use of resources and energy efficiency, eco-labelling, eco-innovations, in all sectors of the national economy and social life.

In the process of promoting the green economy, the Ministry of Economy and Infrastructure joined international programs and platforms in the field of green economy, such as the EU Program "Greening the economy in the Eastern Neighborhood", the Eastern Partnership (Greening economies in the Eastern Neighborhood Countries, EaP GREEN Program 2014–2017), Green Industry Platform, UNIDO Country Program (launched in 2019), participates in the GREEN Action Program, OECD and, in partnership with the Ministry of Agriculture, Regional Development and Environment, is the coordinator and beneficiary of the EU Action—EU4Environment—European Union for the Environment (2019–2022).

Currently, the Ministry of the Environment announces, starting from 25.04.2023, the initiation of the development of project of the Program for the promotion of the green and circular economy for the years 2023–2027. The first policy document, which supported the implementation of green economy principles in the Republic of Moldova, was the "Green" Economy Promotion Program in the Republic of Moldova for the years 2018–2020, approved in 2018.

The institution responsible for developing the project of the Program for the promotion of the green and circular economy for the years 2023–2027 is the Ministry of the Environment with its internal structural subdivisions and subordinate institutions, as well as a number of other institutions from different sectors, among which the Ministry of Infrastructure and Regional Development with the structures its subordinates (Energy Efficiency Agency, National Office for Regional and Local Development), but also representatives of the business environment, representatives of civil society in the environmental field (EcoContact, Ecovisio, National Environment Center, etc.), representatives of development partners.

The process of developing the Program for the promotion of green and circular economy for the years 2023–2027 will be coordinated by the interministerial Working Group for the promotion of sustainable development and the green economy, created by the joint Order between the Ministry of Economy and the Ministry of the Environment "Regarding the creation of the Interministerial Working Group for the promotion of sustainable development and the green economy" (format in 2015 and updated in 2019).

The program, like the Environmental Strategy project, comes to directly support the implementation process of the key documents of the national strategic development framework reflected in National Development Strategy of Moldova 2030. The program will contribute to the development of the general objective "Ensuring a healthy and safe environment" and the specific objective 10.4.: Active transition to the green and circular economy. In addition, priority policies and interventions will be implemented in accordance with point 5 of the NDS, in particular with regard to policies and management in the field of environmental protection: Promotion of climate change adaptation and mitigation policies of the footprint of illegal human and economic activities on the environment, including through activities based on research and development.

At the same time, the priority directions and interventions included in the NDS will contribute to the achievement of the set objectives and priorities corresponding to the commitments from the Association Agreement Republic of Moldova—European Union and from other agreements concluded with the European Union, including the measures aimed at preparing the country for accession to European union.

In a broader perspective, the provisions of the Program ensure synergy with other public policy documents in force or in the process of elaboration, as follows:

- Waste management strategy in the Republic of Moldova for the years 2013–2027;
- Project of the national strategy for agricultural and rural development 2023–2030 [279],
- The Draft Strategy for an inclusive, sustainable and digital economy until 2030;—Greening program for small and medium enterprises;
- The re-technological and energy efficiency program of small and medium-sized enterprises;
- The 2030 Low Emissions Development Program;
- Water supply and sewerage strategy for the years 2014–2028;
- Project of The national forest expansion and rehabilitation program for the period 2023–2032;

At the same time, the Program will respect and take into account the commitments of the 2030 Agenda on sustainable development and will contribute to achieving the following national targets of Sustainable Development:

In the field of constructions, the institution responsible for the regulation and management of the sector is the Ministry of Infrastructure and Regional Development, which aims to approve the unitary regulatory framework for territorial development, authorization and execution of construction works, ensuring the quality of constructions.

Legislation

In the Law on quality in constructions of 02.02.1996, in article 6, it is specified that in order to obtain constructions of appropriate quality, it is mandatory to achieve and maintain for the entire duration of the constructions some essential requirements, among which *by letter G—sustainable use of natural resources.*

At the same time, the Law on the energy performance of buildings specifies that the Government exercises the following powers in the field of energy efficiency of buildings (art. 5):

> promoting the construction of new buildings whose energy consumption is almost equal to zero and the transformation of existing buildings into buildings whose energy consumption is almost equal to zero.

At the same time, by art. 7 of the Law, the public authority in the field of energy efficiency has the following basic attributions:

1. provides assistance to local public authorities in the integration, in local energy efficiency programs and plans, of actions to improve the energy performance of buildings;
2. ensures the record of coordinated national projects and projects implemented by local public authorities regarding the improvement of the energy performance of buildings;
3. promotes the implementation of international experience and practices regarding the improvement of the energy performance of buildings;
4. provides the necessary informational support for promoting the improvement of the energy performance of buildings.

Local public authorities, within the limits of financial possibilities and in the order of their priority hierarchy, have the following basic attributions in the field of energy efficiency of buildings (art. 8):

1. ensures the integration, in local energy efficiency programs and plans, of actions to improve the energy performance of buildings;
2. contribute to the co-financing of national programs regarding the improvement of the energy performance of buildings;
3. contribute to informing the local community to promote the improvement of the energy performance of buildings;
4. Contributes, at the local level, to the implementation of the state policy in the field of energy performance of buildings.

At the same time, by art. 14. It is specified that (1) New buildings and existing buildings undergoing major renovations *must use a minimum amount of energy from renewable sources*, established by the central specialized body of the public administration in the field of constructions. (2) The requirements regarding the use of energy from renewable sources are established differently, depending on the categories of buildings, and are applied if it is technically, economically and functionally feasible.

In the DECISION No. HG248/2013 of 10.04.2013 regarding the approval of the Waste Management Strategy in the Republic of Moldova for the years 2013–2027 it is mentioned that it is expected that in the period 2010–2027 the amount of construction and demolition waste per capita in the Republic of Moldova will increase in relation to the growth of the real GDP in the country. As a result, the total amount of construction and demolition waste will increase from 1.4 million tons in 2010 to 2.6 million tons in 2027. Taking into account the regulations aimed at the reuse, recycling or recovery of construction and demolition waste in the period 2013–2015, legal and organizational measures need to be taken. Consequently, the share of reuse, recycling or recovery of the respective waste will increase from 165 thousand tons in 2015 to 1520 thousand tons in 2020 and to 1850 thousand tons in 2027. Also in the strategy it is mentioned that one of the problems is *chaotic abandonment of construction and demolition waste, animal droppings, street waste,* etc.

In the ACTION PLAN regarding the implementation of the Waste Management Strategy in the Republic of Moldova for the years 2013–2027 several general and specific objectives with multiple actions aimed at the management of construction waste are given.

Specific Objective 2: Establishing the national normative framework in the field of waste management from General Objective 1 provides for the development of construction norms for the design, construction and operation of waste deposits. Those responsible are the Ministry of Economy and Infrastructure; Ministry of Agriculture, Regional Development and Environment. For this action, 155,079 MDL is allocated from the National Ecological Fund.

General objective 3: Development of systems for the collection and treatment of specific waste flows (packaging, electrical and electronic equipment waste, tires, batteries, etc.) by promoting and implementing the "producer's responsibility" principle, including hazardous ones (medical waste, oils used etc.); each collection point at the regional level includes several specific objectives, of which Specific Objective 1: Creation of the infrastructure for the management of the following waste flows: vegetable waste, manure, sawdust, waste from the industrialization of wood, packaging waste and uncontaminated waste from constructions and demolitions stipulates the following actions, out of which:

1. Creation of networks for the separate collection of plant waste, animal waste, wood processing waste. Those responsible are—the Ministry of Economy and Infrastructure; Ministry of Agriculture, Regional Development and Environment; local public authorities; non-governmental organizations. For this action, 77,539,500 MDL will be allocated from the National Ecological Fund.
2. At the same time, within Specific Objective 2: Creating the infrastructure for the management of the following hazardous waste flows: waste resulting from medical activity and from research institutions, used oils, used tires, used batteries and accumulators, electrical and electronic equipment waste and contaminated waste with hazardous substances from constructions and demolitions, point 9 stipulates—Creation of capacities to treat waste contaminated with hazardous

substances from constructions and demolitions, with a view to recovery or elimination. Responsible—Ministry of Agriculture, Regional Development and Environment; local public authorities. For this action, 38,769,750 MDL will be allocated from the National Ecological Fund.

From the point of view of legislation in the field of sustainability in construction, the Republic of Moldova has some normative acts such as: Code of Practice in Construction, Code of Practice in Construction CP A.09.04:2014—Construction and demolition waste management, Code of Practice in Construction CP B.01.01:2021—Systematization of the territory and localities. Guide to urban design in accordance with the principles of environmental protection. Access to these documents cannot be achieved online.

The provisions of the Practical Code have been adjusted with the provisions of the Community legislation such as: Directive no. 2008/98/EC on waste; Directive no. 91/689/EEC on hazardous waste; Directive no. 99/31/EC on waste storage; Decision no. 2000/532/EC on the list of waste, amended by Commission Decision no. 2001/119 (which replaces Decision No. 94/3/EC on the list of waste and Decision No. 94/904/EC on the list of hazardous waste); Regulation (EU) no. 305/2011 of the European Parliament and of the Council of March 9, 2011 establishing harmonized conditions for the marketing of construction products and repealing Council Directive 89/106/EEC. At the same time, I want to mention the draft of the Urban Planning and Construction Code, developed by the Ministry of Infrastructure and Regional Development and which is waiting its examination in the reading of the Parliament, which also provides requirements regarding the management of these types of waste.

5.1.12.2 Platforms and Networks Facilitating the Transition to a Circular Economy

Circular Economy Platforms

No circular economy platforms has been established to date.

Circular Buildings Platform

No circular buildings platform has been established to date.

Building Materials Passport Platform

No building materials platform has been established to date.

Public Procurement Platform

No national green public procurement platform.

5.1.12.3 Funding Opportunities

- In the domain of green economy promotion: European Union for the Environment Action (EU4Environment)—Assisting six partner countries to preserve their natural capital and enhance people's ecological well-being by supporting environmental action, demonstrating and creating opportunities for greener growth and establishing mechanisms for better risk and environmental impact management. The budget of the program—About 20 million euros (EU contribution: 19.5 million euros). Duration of the program—2019–2024.
- In construction: No fund available for promotion of sustainability of buildings.

The National Ecological Fund was created by the Decision of the Government of the Republic of Moldova no. 988 of 26.09.98 in accordance with the Law on the Protection of the Environment (No. 1515 of 16.06.1993), the Law on Amending and Supplementing the Law on the Protection of the Environment (No. 1539-XIII of 25.02.1998), the Law on Payment for Pollution of the environment (no. 1540-XIII of 25.02.1998) with the aim of accumulating additional means for financing activities in the field of the environment. But within the financing domains there are no circular economy or sustainability practices in construction.

5.1.12.4 Challenges, Barriers and Potential Improvements

Landfilling remains the basic method of waste management. Unfortunately, the state does not have sufficient technological capacities for the collection and recycling of waste, as well as for their use as secondary raw material for other technological processes. Under these conditions, most of the generated waste ends up in landfills, containing useful materials such as glass, metal, paper, plastic, construction materials.

There are several companies in the country that offer construction waste disposal services, but their representatives are not willing to communicate about where the construction waste is deposited and what happens to the collected waste. In the Republic of Moldova, data on the quantities of construction waste are missing, and as long as there are no legislative regulations on construction waste, most of it will continue to end up in landfills. Significant changes are needed in the field of regulation of these activities and the organization of an integrated waste management system. Following the examination, a gap was also detected in the monitoring of the situation regarding waste management related to waste from construction and demolition activities, as well as the lack of a regulation regarding their management, or some other acts that regulate this sector.

In the Republic of Moldova, some data on the quantities of construction and demolition waste are missing, this is due to the lack of strict centralized records and an inadequate method of disposal at existing warehouses, without weighing, or illegal burial or storage on surfaces undeveloped such as roadsides, riverbanks and ravines, on agricultural and forested lands, etc., which leads to the appearance of natural garbage.

At the same time, there is an internal reuse in the own household or a commercialization on an undeclared market. The current system for the regulation and management of solid waste collection and disposal in the Republic of Moldova is not effective and does not minimize the negative effects on the environment following waste disposal.

5.1.12.5 Examples of Successful Implementation

Public Policy Initiatives

No data to this point.

Private Policy Initiatives

Moldova Green Building Council is a non-profit association that encourages the emergence of the market, educational and legislative conditions necessary for the transformation of the construction industry and those adjacent to the creation and renovation of high-performing, sustainable and profitable buildings. Some achievements:

- The Council for Green Buildings from the Republic of Moldova became the partner of BC "ProCredit Bank" S.A. Through this strategic partnership, BC "ProCredit Bank" S.A. has developed a special financing program for customers who want to purchase or build certified "Green Homes" real estate. We are talking about a new type of mortgage "ECO Housing loan" intended for the purchase of green homes, through which the bank's customers are supported to make smart choices, with minimal impact on the environment.
- Through the GREEN HOMES&GREEN MORTGAGE program, the Council for Green Buildings has launched a new trend in residential housing in Moldova. Being a voluntary certification and verified by independent auditors, the Green Homes certification fully covers all the criteria necessary for a construction to be considered sustainable.

5.1.13 Netherlands Factsheet

5.1.13.1 Policy and Regulatory Framework

Governance

The government is responsible for policy on the transition to a circular economy and is accountable to the House of Representatives in this regard. Within the government the State Secretary for Infrastructure and Water Management is responsible for coordinating the transition, while the members of the government at the line ministries most closely connected with this issue are each responsible for circularity within their own remit [222]. The Ministry of Infrastructure and Water Management [116] consists of three sections: policy, implementation and inspection. In the policy section, four Directorates-General are concerned with developing policy in the areas of mobility, water management, aviation and maritime affairs and the environment. The Directorate-General for Public Works and Water Management (Rijkswaterstaat—RWS) [306] ensures that policy is implemented. Human Environment and Transport Inspectorate oversees compliance with statutory regulations by private individuals and companies. The Directorate-General for Public Works and Water Management, Human Environment and Transport Inspectorate, the Netherlands Environmental Assessment Agency [245] and the Royal Netherlands Meteorological Institute are agencies of the ministry. The Netherlands Environmental Assessment Agency is the national institute for strategic policy analysis on environment, nature, and spatial planning issues of national and international significance. The agency contributes to political and administrative decision-making by conducting outlook studies, analyses and evaluations that take an integrated approach. The Ministry of Infrastructure and Water Management [116] is also committed to organising an annual National Circular Economy Conference at which stakeholders discuss progress with the circular economy. That might lead to adjustments to the Circular Economy Implementation Programme together with the findings and recommendations of the progress report published by the Netherlands Environmental Assessment Agency.

Legislation

In the Netherlands, there is an obligation to provide information about the environmental performance of building materials that are covered by the Buildings Decree 2012 [22]. The objective of this obligation is to regulate the minimal environmental performance of materials. In the environmental performance of building materials, the emphasis is on the climatic effects and there is no requirement in the Buildings Decree concerning the degree of circularity. The environmental performance of a building is already measured as standard over a single cycle, but the stakeholders want to have a clear method for its assessment over multiple life cycles [307]. The

Dutch Soil Quality Decree (*Besluit bodemkwaliteit*) imposes conditions on the use of soil, dredging spoil and building materials on or in the ground or in surface water [21] in order to achieve a balance between a healthy living environment and the use of the soil. Anyone planning to refurbish, build, demolish or occupy a building must comply with the Building Decree 2012. All new buildings must also meet the Almost Energy Neutral Building requirements (*Bijna Energieneutrale Gebouwen*—BENG) that result from the European Energy Performance of Buildings Directive [79]. There are different requirements for different building types and there is a separate requirement for the exterior of buildings. The municipal building rules, which can differ from one municipality to another, relate to urban planning, building on contaminated land and requirements regarding the external appearance of buildings [22].

Circular Economy Strategy, Roadmap or Action Plan

National. The Netherlands' strategy A Circular Economy in the Netherlands by 2050 [117], adopted in autumn 2016, outlines a way to transform the Dutch economy into a sustainable, fully circular economy by 2050. The programme describes what needs to be done to use raw materials, products and services in a smarter and more efficient way and sets the goal of a 50% reduction in the use of primary raw materials by 2030. Priority sectors identified in the Strategy include biomass and food; plastics; the manufacturing industry; construction sector; and consumer goods.

The construction sector is distinguished in Commercial and Non-residential Building (Burgelijke en Utiliteitsbouw—C&NRB) on the one hand, and Soil and Civil Engineering (Grond-, Weg- en Waterbouw—S&CE) on the other. C&NRB largely involves private funding and a large, diverse playing field with many (major and minor) stakeholders, while S&CE often involves public commissioning and features a smaller number of more homogenous stakeholders. The implementation of a circular economy in the construction sector is related to the following vision:

> By 2050, the construction industry will be organised in such a way, with respect to the design, development, operation, management, and disassembly of buildings, as to ensure the sustainable construction, use, reuse, maintenance, and dismantling of these objects. Sustainable materials will be used in the construction process, and designs will be geared to the dynamic wishes of the users. The aim is for the built-up environment to be energy-neutral by 2050, in keeping with the European agreements. Buildings will utilise eco system services wherever possible (natural capital, such as the water storage capacity of the sub-soil) [117].

The Cabinet has set four strategic goals for construction sector [117]:

1. C&NRB and S&CE to use (mainly) renewable raw materials;
2. Optimising the use of material throughout the building's life cycle (value preservation, cost savings, more reuse, lower environmental impact);
3. Minimising CO_2 emissions by the construction sector, in both the construction and the operational phases;
4. As an innovative sector, the construction sector must proactively respond to changes in society as well as private sector and consumer demands.

As the general support for a circular economy increased, in January 2017, the National Raw Materials Agreement was signed by 180 parties from government, industry, trade unions and environmental organisations. The agreement sets out what is to be done to accelerate the transition towards a Circular Economy and to ensure the support and commitment through the whole Dutch society. The agreement started the multistakeholder dialogue on how to organise the transition and resulted in 5 transition agendas drawn up by the government and the signatories [126, 127]. Circular Construction Economy Transition Agenda describes the strategy for achieving a circular construction economy by 2050 and contains the Agenda for the 2018–2021 period [335]. This Agenda has been drawn up by a transition team made up of experts from the fields of science, the government, and market participants. The Transition Team formulated four focal points for the 2018–2021 Agenda [335]:

1. market development
2. measuring method
3. policy, legislation and regulations
4. knowledge and awareness.

Selected proposed actions and interventions based on these focal points are the following [335]:

- all public tenders will be circular in 2030
- action plan for CO_2 emission reduction in the construction industry
- decision regarding mandatory materials passport by 2020
- subsidy for circular business and revenue models
- development of a uniform circularity measuring method
- processing circularity in construction government standards
- international positioning and cooperation
- circular construction a comprehensive part of education in 2021
- creating a circular construction knowledge institute
- creating a circular construction awareness campaign.

The Circular Economy Implementation Programme translated the five transition agendas developed for priority sectors into concrete actions and projects to be put into effect between 2019 and 2023. The Ministry of Infrastructure and Water Management updated the Circular Economy Implementation Programme in 2020 and 2021. The National Circular Economy Programme 2023–2030 (NPCE) was released in February 2023 and it elaborates the ambitious circular economy goal, which is simultaneously a climate goal. Instead of focusing on voluntary measures the government decided to guide and compel measures to achieve these goals. The National Circular Economy Program 2023–2030 contains general measures, specific measures for main product chains and supporting measures. The program outlines various actions, including developing innovative business models, waste reduction strategies, and collaboration with businesses and knowledge institutions to create a sustainable economy [150].

Regional. Two relevant documents have been launched at the regional level—Northern Netherlands Circular—roadmap to a circular northern Netherlands (Noord-Nederland Circulair: Routekaart naar een circulair Noord-Nederland) (2018) and the Brabant's region Bouwstenennotitie circulaire economie 2019–2028, Brabant beweegt in kringlopen (2019, in Dutch).

Local. With the Amsterdam Circular 2020–2025 Strategy, the City of Amsterdam is setting the course towards a circular city by 2050 [33]. They aim to halve the use of new raw materials by 2030 and their ambitious targets can only be achieved if everyone plays their part. As the municipal authority, they are taking the lead and want to set a good example for Amsterdam's residents and businesses. The Strategy focuses on the three value chains to shape the circular economy—Food & Organic Waste Streams, Consumer Goods, and Built Environment. For the Built Environment chain, the City can propose further-reaching policy than for other chains thanks to its influence on the design of areas, its role as a commissioning authority for the public space and in the realisation of its own accommodation and the granting of permits for construction and demolition. Because circular chains go beyond municipal boundaries, the City of Amterdam as a local authority cooperates with the region and the national government so that together to achieve a 100% circular city in a 100% circular country by 2050.

Courses of action to foster transition to circular built environment include [33]:

- Use recycled and biobased materials in construction to reduce the need for primary raw materials in the short term
- Determine the value of the current built environment
- Defining and safeguarding the circular ambitions at the city and district levels
- Joint knowledge as a starting point (a central municipal expertise centre)
- New forms of value assessment (the total cost of ownership and total cost of use of the built environment)
- Extending the useful life of existing buildings
- Tighten internal municipal processes to encourage circularity
- Stimulate innovative projects
- Formulating and implementing agreements on circular ambitions with extra-municipal parties, etc.

At the local level the City of Rotterdam and the City of Groningen have launched circular economy roadmaps (Routekaart Circulaire Economie–Gemeente Groningen, in Dutch) [106]. The Rotterdam Circularity Programme 2019–2023 [39] is focused on four sectors with construction being the most important one. Circular construction will be promoted by creating a materials passport, a circular concrete covenant, building hubs and a digital market place for building materials.

Construction and Demolition Waste Management Regulatory Framework

In the Netherlands 77% of their waste is recycled and the residual waste is mainly used for energy production. The main five elements that helped to achieve these results are: order of preference for waste management (waste hierarchy), stringent waste treatment standards, planning on national level, producer responsibility, and use of various (economic) instruments to stimulate prevention and recycling. In order to reduce the environmental pressure arising from waste management, stringent standards were introduced such as standards for soil protection from landfilling, standards for the quality of secondary materials derived from waste (building materials), a ban on landfill for 35 waste-streams (waste streams suitable for recovery or incineration are not allowed on landfills), etc. [308]. The majority of the building and demolition waste (more than 95% in 2014) is already recycled. However, the construction sector in the Netherlands is not circular yet as a large portion of most materials used in buildings (the residential and non-residential building sector) after demolition and recycling is used in civil engineering, often as a road base material or as filler material to raise the level of industrial estates. Although in civil engineering more than 50% of the materials used consists of recycled materials, which are functionally used and replace primary raw materials, in the building/construction sector a very small proportion of secondary material is used [307]. According to the Circularity Gap Report: Built Environment the Netherlands published in 2022 [31], only 8% of the Dutch built environment's material use comes from secondary sources.

The National Waste Management Plan (NWMP) is intended for waste which is subject to the Environmental Management Act and this Act stipulates that all authorities must must take into account the National Waste Management Plan when dealing with aspects of waste management. The NWMP sets out the policy for waste management in the Netherlands. The Third Waste Management Plan [310] covers the period 2017–2023, looking ahead to the period up to 2029. The NWMP consists of a policy framework that sets out the main points of waste policy and sector plans containing the policy framework for specific categories of waste. The NWMP contains 85 sector plans and each sector plan describes the policy for the relevant waste as well as particular aspects relating to licensing and imports and exports. Construction and demolition waste is released during the construction, renovation and demolition of buildings, structures and roads. This includes not only the construction and demolition waste itself, but also the waste materials that are also released during these activities but do not directly fall under the heading 'construction and demolition waste', such as cable remnants, paint packaging, etc. Out of 85 sector plans, 19 deal with construction and demolition waste [309].

5.1.13.2 Platforms and Networks Facilitating the Transition to a Circular Economy

Circular Economy Platforms

The Circular Economy Accelerator portal (Versnellingshuis) helps businesses with its plans or ideas for the circular economy, or respond to questions about knowledge, network partners, legislation or financing. The portal is a partnership of the Confederation of Netherlands Industry and Employers (VNO/NCW), the Royal Association MKB-Nederland for SMEs, sustainability think-tank the Green Brain and the Ministry of Infrastructure and Water Management [127].

Circular Buildings Platform

Platform CB'23 (Circular Construction 2023) [270] is committed to drafting agreements to anchor circular thinking and actions in daily construction practice for the entire Dutch construction sector: both residential and non-residential construction and civil engineering. Teams consisting of professionals from different parts of the Dutch construction sector, have laid a solid basis for circular agreements on important circular topics. At this stage, they essentially are working agreements, laid down in guides, rather than formal standards. The guides 'Measuring circularity in the construction sector' [271] and 'Passports for the construction sector' [272] have been drawn up for the topics Measuring Circularity and Information and Data. Platform CB'23 also created guidelines about Circular design, Circular tendering and Future re-use (in Dutch).

Building Materials Passport Platform

Madaster serves as an online library of information on materials and products [177]. For registered buildings and infrastructure objects, this platform provides insight into the materials and products used and their location, as well as their impact on circularity and the environment. In Madaster, a digital twin, or digital copy, of a building or other construction object is created, providing a clear overview of the materials used in it, the amount of CO_2 these materials contain and the extent to which they could be reused. Madaster enables companies to create material passports by uploading a BIM or Excel document [177]. Madaster received funding through the EU Horizon 2020 framework programme in 2018, and in the following year it began its international expansion to Germany, Norway, Switzerland and Belgium [178].

Public Procurement Platform

PIANOo is the Dutch Public Procurement Expertise Centre that was set up to professionalise procurement and tendering in all government departments, with a view to improving efficiency and compliance with the rules. As of 1 January 2017 PIANOo is part of the Netherlands Enterprise Agency (RVO.nl). Netherlands Enterprise Agency (RVO.nl) is part of the Ministry of Economic Affairs and Climate Policy. PIANOo brings experts in specific areas together, pools knowledge and experience and provides advice. It also fosters dialogue between government contracting authorities and private sector companies [267].

5.1.13.3 Funding Opportunities

MIA and Vamil for Entrepreneurs

All entrepreneurs in the Netherlands who pay income or company tax can use the Environmental investment deduction (MIA) and Arbitrary depreciation of environmental investments (Vamil) schemes. For 2023, the budget for MIA was €192 million and for Vamil €25 million. The tax scheme is interesting for entrepreneurs in different sectors, such as agriculture, industry, catering companies, business services and waste processing, but also for those who invest in circular economy, sustainable transport, sustainable recreation and sustainable buildings [246].

Different types of financial support such as subsidies, loans and tax benefits for circular entrepreneurship are available at https://english.rvo.nl/subsidy-guide

International Cooperation and Support from International Organizations

Holland Circular Hotspot (HCH) is a private–public platform in which the Holland Circular Hotspot foundation, (local) government authorities, knowledge institutes and companies intensively and internationally collaborate and exchange knowledge with the aim of stimulating entrepreneurship in the field of circular economy.

The activities of Holland Circular Hotspot are [149]:

- Offer insights in and access to the network of Dutch circular pioneers;
- Develop and exchange knowledge on international market opportunities for circular economy;
- Create circular opportunities internationally by matching offer and demand;
- Support companies and organizations that want to contribute to internationalization of circular economy;
- Stimulate cooperation between the private sector, knowledge institutions, governments and other relevant parties;
- Provide international visibility of Dutch CE innovations/best practices;

- Facilitate access to Dutch and international (financing) instruments and programmes.

HCH and the Rediscovery Centre have entered a partnership to accelerate the transition towards a circular economy in Ireland, the Netherlands and beyond. The signing of the Memorandum of Understanding (MoU) took place on Monday the 29th of May, 2023, coinciding with the Dublin Circular Economy Hotspot 2023 event. Under the agreement, both parties provide their experience, knowledge and expertise to intensify bilateral cooperation in the circular economy space. Areas for collaboration are sharing best practices in circularity, promoting European and international collaboration on circular economy initiatives and circular hotspots, and exploring opportunities for global initiatives and proposals [288].

The Dutch government is also active in multistakeholder platforms, where government, business and international organisations drive shared goals towards a circular economy. One example is the Platform for Accelerating the Circular Economy (PACE), with more than 40 members. PACE is a public–private collaboration platform for global changemakers and their organizations to accelerate the transition to a circular economy. PACE was launched by the World Economic Forum and is a delivery platform of the World Resources Institute. PACE is facilitated by a full-time team in The Hague, Netherlands [266].

Challenges, Barriers and Potential Improvements

Circle Economy and Metabolic [31] applied the Circularity Gap methodology to the Dutch building sector for the first time to identify challenges, barriers and opportunities as well as provide recommendations for the Dutch built environment. The Dutch building sector is faced with numerous challenges: labour shortages, an ageing workforce, and a lack of skills needed to go circular. A core barrier to realising material circularity is that virgin materials are far cheaper than their secondary counterparts, largely due to the lack of price incentives to promote or foster the uptake of secondary materials over virgin ones. The development of circular value chains requires the large-scale consumption of secondary and renewable materials and streamlined processes that allow for efficient disassembly and high-value material recovery, reuse and recycling. Such system calls for significant investments in physical infrastructure, advanced recycling technology, the knowledge and capacity to apply secondary materials, and new, circular business models. The investments needed for training and organisational change, as well as the infrastructure needed to facilitate recycling and reuse of materials at scale, currently represent significant barriers to actors in the sector. Considering the future cash flows (e.g., through the recuperation of materials after 50 or more years) contribute very little to current valuation, the long-term investments in circular solutions are hard to be broadly adopted within the industry. Another key barrier is the investment in the necessary physical and technical infrastructure to efficiently sort, process, and store large volumes of materials. A number of key barriers to innovation in the construction

sector persist, such as a lack of information, knowledge and skills, and legal and regulatory challenges, as well as market complexities.

Based on the Circularity Gap Report: Built Environment, the Netherlands, there are several recommendations for actions needed by stakeholders in the built environment to overcome the identified barriers [31]:

- set a level playing field for circularity
- set explicit targets for secondary and biobased material use
- create long-term economic incentives
- write mandatory circular procurement into public tenders
- stimulate desired behaviour by rewarding frontrunners
- better monitor circularity in the built environment
- update regulations to remove barriers to circularity
- invest in physical infrastructure (material hubs and marketplaces)
- invest in digital infrastructure
- train employers and staff around circularity
- upgrade education and skills policy
- prioritise better working conditions throughout the transition
- address problematic labour market trends
- collaborate with private and public actors to promote career opportunities.

The Report highlights two aspects of these recommendations as key solutions—investing in human capital and creating a fair playing field. The construction sector employs 685,000 people, but it has difficulty finding new workers and current workers are getting closer to retiring age. In addition, the current workers do not have the right skills to shape the transition to be more circular. As many jobs will change towards the circular transition, upskilling and retraining will be necessary, as well as a culture shift towards lifelong learning. It is also important to invest in better working conditions, both financially and in terms of health and safety. At the moment, circular strategies have not yet been competitive with their linear counterparts, as negative environmental effects are not included in the pricing of linear materials and processes. Solutions with a lower impact on the environment should be rewarded, for example, through taxes or other economic incentives. The development of new circular business models requires more investments in innovation and the labour that is needed to build with secondary materials [30].

5.1.13.4 Examples of Successful Implementation

Public Policy Initiatives

The Central Government Real Estate Agency realised the temporary district court of Amsterdam with the DPCP consortium (an combination of Du PrieBouw & Ontwikkeling and developer Cepezedprojects) through a Design, Build, Maintain and Remove (DBMR) call for tender. The newly built construction on the grounds of the current Parnas complex at Parnassusweg is used as a temporary district court

for the period of five years. The temporary nature of the building in no way harms the representativeness and quality in terms of equipment, complex logistics, acoustics, comfort, and safety. The focus was on preventing waste and maximising the residual value after this initial use period. This makes the building highly adaptable and allows for completely different uses by different occupants. At the end of its lifespan this building can be fully disassembled and reused elsewhere. The temporary district court of Amsterdam serves as a good practice example in the Circular Construction Economy Transition Agenda.

Private Policy Initiatives

Alliander company's head office in Duvian was renovated and opened in 2015. Everything about the building exudes style and newness, even though 83% of it is made up of recycled material [25]. The existing buildings were integrated into the new design, with a curved roof creating a large atrium which connects buildings and creates space where employees and visitors can meet. Circularity has been an integral part of the design in many ways: respecting the majority of the existing constructions, using waste wood for the facades, reusing the concrete from the parts which were demolished, reusing the steel construction for the extensions of the buildings, recycling the asphalt from the existing roofs, reusing the existing toilets and ceiling plates and converting the existing doors into new furniture, amongst other things [34].

5.1.14 North Macedonia Factsheet

5.1.14.1 Policy and Regulatory Framework

Governance

The Ministry of Environment and Physical Planning (MOEPP) in its National Plan for Waste Management for the period 2021–2031 (2021) and Waste Prevention Plan for the period 2022–2028 (2022) identifies as a goal, the move in the direction of developing and implementing collection and treatment systems in accordance with the waste hierarchy and to achieve environmentally safe processing and disposal, as well as a change from a linear to a circular economy, in a way that is best adapted to the conditions in North Macedonia. In the context of the aligning of North Macedonia with the EU's objectives for the introduction of a circular economy, the Plan provides a framework of measures and foresees a period in which the country's activities could move in accordance with the new action plan for circular economies for a cleaner and more competitive Europe. The Ministry of Environment and Physical Planning has also prepared the Long-term Strategy on Climate Action for the period 2021–2050 (2021) which focuses on boosting efficient use of resources and restored biodiversity, i.e.: clean sources of energy, circular economy and cut of pollution.

The Ministry of Economy in the Industrial Strategy with a Focus on Manufacturing (2018) presents an industrial policy with a focus on: "promoting industrialization, by stimulating the growth and development of the manufacturing industry, with the aim of increasing productivity, creating good jobs, increasing incomes and strengthening human capital, while solving the challenges of the circular economy."

The Ministry of Finance according to the Growth Acceleration Plan for the period 2022–2026 (2021) proposes investments in areas such as: industrial innovations and circular economy, green buildings, clean energy resources and sustainable mobility, sustainable land use and nature, and willingness to apply the EU Internal Market Standards.

Legislation

No current legislation address the implementation of circular economy principles directly. The Law on Public Procurement [259] includes relevant provisions on green public procurement, including on lifecycle costs. These costs cover parts or all of the following costs: (a) costs borne by the contracting authority or other users (e.g. costs relating to acquisition or purchase),costs of use, such as consumption of energy and other resources; maintenance costs; end of life costs, such as collection and recycling costs; (b) costs of eliminating the impact of the products, services or activities on the environment during their lifecycle, provided that their monetary value can be determined and verified, and which may include the cost of GHG emissions and of other pollutants, as well as other climate change mitigation costs. Application of lifecycle costs as a criterion for tender is optional and the data to be provided by the tenderers and the method for determining lifecycle costs should be indicated in the tender documentation.

The Law on Industrial and Green Zones [258] is in the process of amendment to include new provisions for regulating the benefits and opportunities for zone users, unifying applicable provisions for industrial and green zones, and better defining the conditions for performing activity in these areas. The amendment law has a specific focus on carrying out activities in line with circular economy principles in the Green and Industrial Zones.

The Law on Building Construction [257], in Arcticle 9, states that the building and its devices for heating, cooling and ventilation should be designed and performed in such a way that, depending on the climatic conditions of the location, they will ensure that the energy consumption during its use is equal to or lower than the prescribed level, as well as to meet the requirements for energy efficiency prescribed in the Regulations for energy characteristics on the buildings [258].

Circular Economy Strategy, Roadmap or Action Plan

The OECD's "A Roadmap towards Circular Economy of North Macedonia" was published on March 15, 2024, providing a strategic framework for the country's

circular economy transition. The document outlines over 40 policy recommendations and a dedicated monitoring framework. It targets five priority areas: Circular business models for SMEs; Construction sector; Biomass and food; Textile industry; and Mining and metallurgy.

On a regional level North Macedonia has adopted the Green Agenda for the Western Balkans [91] and its Action Plan for the Implementation of the Sofia Declaration on the Green Agenda for the Western Balkans 2021–2030 [67]. The ten-year perspective of the Action Plan allows its alignment with the most important international and European policy objectives such as the United Nations (UN) Sustainable Development Goals (SDGs), the European Energy and Climate Policy Framework for 2030, the EU Biodiversity Strategy by 2030, the Farm to Fork Strategy, the Circular Economy and the Zero Pollution Action Plans. The Action Plan is structured so as to reflect the seven components of the Sofia Declaration (Climate Action, Energy, Transport, Circular Economy, Pollution, Sustainable Agriculture and Nature and Biodiversity Protection).

Construction and Demolition Waste Management Regulatory Framework

North Macedonia has adopted its new Law on Waste Management [260]. The new law is expected to enable the establishment of a functional system for regional waste management, such as regional collection, transport, sorting and recycling of waste, the construction of new regional landfills and closing of all non-standard landfills—in accordance with circular economy principles.

In addition a set of laws targeting specific waste streams and management schemes were adopted in 2021. These include the Law on Management of Batteries and Accumulators and Waste from Batteries and Accumulators, the Law on Management of Electrical and Electronic Equipment and Waste from Electrical and Electronic Equipment (WEEE), the Law on Packaging and Packaging Waste Management, the Law on additional Waste Flow Management and the Law on Extended Producer Responsibility (EPR). These new laws fully transpose the EU Waste Framework Directive and the Landfill Directive, and regulate EPR schemes for packaging, WEEE, batteries, waste oils and tiers, waste textile and End-of-Life Vehicles.

5.1.14.2 Platforms and Networks Facilitating the Transition to a Circular Economy

Circular Economy Platforms

No circular economy platforms have been established to date.

Circular Buildings Platform

No circular buildings platform has been established to date.

Building Materials Passport Platform

No building materials platform has been established to date.

Public Procurement Platform

No public procurement platform has been established to date. However, the Public Procurement Bureau and the Energy Agency have developed guidelines on energy efficiency measures to be used in public procurement procedures. The objective of these measures is to boost demand for resource/energy efficient, durable, recyclable, repairable products, and promote new business models based on offering functionalities and services instead of selling products. Green public procurement also allows local, regional and national authorities to set examples and standards for businesses and industries to follow. However, the introduction of green public procurement measures in tenders has remained limited since the adoption of these laws.

5.1.14.3 Funding Opportunities

Strategic Green Investment Fund (SGIF)

The establishment of the Strategic Green Investment Fund (SGIF) is also envisaged and aims at facilitating private sector financing for green transition to attain zero GHG emission target by 2050 and accelerating economic growth by attracting foreign and domestic investment in the green industries in Technological Industrial Development Zones (TIDZs). Moreover, the First Green Zone (TIDZ Gevgelija) was established in 2022, located near the border crossing to Greece [54].

Fund for Innovation and Technology Development

The Fund for Innovation and Technology Development (2021), which encourages innovation by providing additional resources for financing innovative activities, plans to include a green business facility, funded through the Instrument for Pre-accession Assistance (IPA) (the financial agreement has been signed at the end of 2021). It will provide direct subsidies and grants to SMEs, as well as awareness raising for green projects with a total budget of EUR 27 million.

Growth Acceleration Plan for the Period 2022–2026

The proposed financing instruments have yet to be established and include, among other elements, green bonds, a Hybrid National Green and Digital Fund for SMEs, Start-ups and Innovative Enterprises to invest in green and digital SMEs (with a total portfolio of EUR 27 million), an Energy Efficiency Fund (initial capital of EUR 5 million) and a Strategic Green Investment Fund (expected to be worth EUR 36.3 million) to accelerate investments in renewable energy sources and financing energy efficiency solutions [220].

International Cooperation and Support from International Organizations

The European Bank for Reconstruction and Development approved a country-wide sovereign loan of EUR 55 million for the establishment of regional landfills in five administrative regions, in line with the new set of laws on waste management. The loan covers reconstruction/construction of selected regional, sanitary landfills and procurement of bins and containers for recyclables and residual waste, transport vehicles and equipment.

The Swiss Agency for Development and Cooperation supports North Macedonia by engaging with the non-profit private sector packaging recovery organization Pakomak to enhance the effectiveness, efficiency and transparency of the national packaging waste recovery system through the digitalisation of the primary selection and collection process.

The twinning project, Supporting the implementation of the legal framework for waste management and the extended producer responsibility system (EPR) [215], which started in 2023, will enable the efficient and effective functioning of a modern and responsible industry for recycling and waste processing in North Macedonia, in accordance with the principles of circular economy. The project, for a period of 24 months, will be implemented by the Ministry of Environment and Physical Planning of North Macedonia, in partnership with the Foundation for Climate Protection "Blue Planet" as the main partner and the Republic of Austria as a junior partner, and aims to made it possible to strengthen the extended producer responsibility system.

The project for Development of the Environmental Monitoring Information System [211], funded by the EU through IPA 2014–2020, aims to improve the data collection process and introducing electronic systems for reporting,which will be capable of supporting the monitoring, processing, reporting and dissemination of environmental data.

A project for Promoting economic growth in North Macedonia, commissioned by the Federal German Ministry for Economic Affairs and Energy, aims at improving business support services for micro, small and medium-sized enterprises (MSMEs) and covers the circular and green economy [103]. Another project Developing human capital towards improved climate-change adaptation and mitigation was commissioned by German Federal Ministry for Economic Affairs and Climate Action (BMWK), in order to support the development of human capital towards improved

climate-change adaptation and mitigation, and aims to mainstream climate change in the education sector and at boosting green jobs [102].

A knowledge Alliance in Eco-Innovation Entrepreneurship to Boost SMEs Competitiveness (SMecoMP) concerns the development of an educational framework and appropriate training tools to improve the skills of business executives in Eco-Innovation Entrepreneurship [11]. The consortium of the SMecoMP project is made up of organizations from four Balkan countries and seeks to achieve cross-border co-operation between businesses and universities in order to promote and raise awareness of environmental innovation and entrepreneurship.

The World Bank has funded the North Macedonia Public Sector Energy Efficiency Project aims to reduce energy consumption in the public sector, and support the development and implementation of a sustainable financing mechanism for energy efficiency in the public sector [334].

Challenges, Barriers and Potential Improvements

Implementing a circular economy in North Macedonia comes with its own set of challenges and barriers, that can be categorized into economic, regulatory, infrastructure, and awareness-related issues. Addressing these challenges and barriers in North Macedonia will require a coordinated effort involving government, private sector, non-governmental organizations, and international organizations. Developing a comprehensive circular economy strategy, updating regulations, and raising awareness are important steps toward fostering a more sustainable and circular economy in the country (Table 5.3).

5.1.14.4 Examples of Successful Implementation

Public Policy Initiatives

No data to this point.

Private Policy Initiatives

No data to this point.

Table 5.3 Overview of challenges and potential improvements for the implementation of the circular economy in North Macedonia

Challenges	Potential improvements
High dependency on oil and coal for energy generation. Oil and coal also represent two-thirds and renewable energy only accounts for 14% of North Macedonia's energy supply	Phasing-out coal from its energy mix taking into account underlying economic and social challenges will be a priority, by diversifying of the energy mix through other renewable sources and curbing demand growth through energy efficiency measures
Domestic material consumption levels have been constant in recent years and are mainly made up of fossil energy materials and biomass, exerting growing pressures on the environment	Efforts to improve resource efficiency in mining, smelting, and refining are needed to reduce environmental impact
Inadequate recycling and waste management infrastructure limits the ability to recover and recycle materials	Investments in recycling facilities and collection systems are necessary
Limited public awareness and understanding of circular economy principles and benefits hinder adoption	Educational programs and campaigns needed to raise awareness among businesses, policymakers, and the general public
A lack of expertise and knowledge about circular economy practices hinder businesses from transitioning to more sustainable models	Training and capacity building are required to develop the necessary skills and expertise
Outdated or inadequate regulations and policies do not provide sufficient incentives for businesses to adopt circular practices	Legal frameworks need to be updated to support circular economy initiatives and incentivize recycling, reuse, and sustainable production
Access to funding and investment for circular economy projects is limited, especially for small and medium-sized enterprises (SMEs)	Initiatives to attract private and public funding for circular projects are needed
Transitioning to a circular economy requires significant changes in supply chains, which can be costly and complex	Businesses need support in reconfiguring their supply chains to incorporate circular principles
Consumer behavior, preferences for disposable and cheap products can discourage businesses from adopting circular practices	Public awareness campaigns and incentives can change consumer behavior
Insufficient demand for recycled or refurbished products makes it challenging for businesses to invest in circular practices	Encouraging consumer and industrial demand for sustainable products is essential
Circular economy practices may not always be economically competitive in the short term	Policy measures, subsidies, or incentives are needed to level the playing field
Lack of data on resource consumption, waste generation, and circular economy performance hinder decision-making and policy formulation	Investment in data collection and monitoring systems is necessary to track progress
Collaboration among government, private sector, non-governmental organizations, and academia is crucial for successful circular economy implementation	Building partnerships and engaging stakeholders can be challenging but is essential for driving change

5.1.15 Portugal Factsheet

5.1.15.1 Policy and Regulatory Framework

Governance at a National Level

- Ministry of Environment and Climatic Action/Ministério do Ambiente e da Ação Climática. In Portugal, the Circular Economy is under the responsibility of the Ministry of Environment and Climatic Action. Within this Ministry, there are four secretaries of state in different key fields: Energy and Climate, Environment, Nature Conservation and Forests, and Urban Mobility. The circular economy is a transversal subject to three of the four secretaries of state.
- **Environmental Fund/Fundo Ambiental**. The Environmental Fund concentrates the resources of previously existing funds (Permanent Forestry Fund, the Innovation Support Fund, the Energy Efficiency Fund and the Energy Sector Systemic Sustainability Fund) to obtain an instrument with greater financial capacity and with greater adaptability to the challenges posed. The Environmental Fund has an annual plan for allocating support to specific environmental and climate action projects using environmental-related revenue. The supported projects are grouped into seven different clusters:

  1. waste management and transition for a circular economy,
  2. climate change mitigation,
  3. environmental protection, radiologic protection and environmental risk and damage management;
  4. protection and conservation of nature and biodiversity;
  5. adaptation to climate change;
  6. international cooperation
  7. energy efficiency.

Moreover, recently this Fund also manages six components of the National Recovery and Resilience Plan (PRR):

- C8. Forestes
- C9. Hidric management
- C12. Energy efficiency in buildings
- C14. Hydrogen and renewables
- C15. Sustainable mobility,

Portuguese Environment Agency/Agencia Portuguesa do Ambiente (APA). The Portuguese Environment Agency is a public institute integrated into the indirect administration of the State, under the supervision of the Ministry of the Environment and Climate Action and endowed with administrative and financial autonomy and its own assets.

The Portuguese Environment Agency is the entity responsible for implementing environmental policies in Portugal aiming to contribute to a high level of protection

and enhancement of the environment through the provision of quality services to citizens. The Portuguese Environment Agency has six main fields of action:

- **Climate**, with the role of proposing and developing climate policy and designing and implementing mitigation and adaptation strategies to climate change, particularly to achieve the goals defined in national, community and international commitments.
- **Water**, being the National Water Authority, defines policies and management instruments that ensure the application of these principles.
- **Air and noise**, being is the competent authority for air, responsible for implementing the air quality assessment and management policy, particularly with regard to the quality control of information and its dissemination to the European Commission and the general public; and competencies within the scope of the noise pollution prevention and control regime, the General Noise Regulation (RGR).
- **Waste**, being the National Waste Authority, ensuring its planning and management, in order to prevent or reduce its production, its harmful nature and possible adverse impacts. On the other hand, it seeks to promote efficiency in the use of resources, based on the principles of the waste hierarchy and Circular Economy.
- **Environmental evaluation and management**, being the entity responsible for the development and implementation of environmental evaluation and management instruments, also ensuring dialogue with the European Commission.
- **Risk prevention and management**, with the role defined within the scope of each risk, which may include monitoring, the development of risk reduction strategies, the definition and implementation of rules in relevant sectors of activity, the implementation of risk reduction actions or support in emergency response.

In the Portuguese Environment Agency the framing of the circular economy within one of the fields of action is somehow unclear: currently being framed under a trans-sectional subject, has also been under the waste management field.

- **ADENE**. ADENE is an associative entity with public utility status with the purpose of promoting and carrying out activities of public interest in the energy area and its interfaces with other sectoral policies, in conjunction with other entities with responsibilities in these areas, and also promoting and carrying out activities of public interest in the areas of efficient use of water and energy efficiency in mobility. Currently has added Circular Economy to the four other interest fields: industry, buildings, mobility and hydric.
- **LNEG**. The National Laboratory for Energy and Geology and Geological Resources (LNEG) carries out research with a view to its application in advanced solutions that allow us to boost our Economy. One of the main research areas is circular economy and life cycle management towards sustainability. Among other circular economy projects, LNEG runs the Circo Hub Portugal. Creating Business through Circular Design) that emerged in the Netherlands in 2015 and is based on the application of design and design thinking to the development of circular products, services and business models. It is a program that activates and

facilitates the implementation of circular businesses by industrial companies and designers. With an exclusive and proven method, the CIRCO program offers each company a perspective to initiate circular activities and solutions, in cooperation with its value chain.

Governance at a Regional Level

- **Regional Coordination and Development Commissions/Comissões de Coordenação e Desenvolvimento Regional (CCDR)**

Portugal has 5 Regional Coordination and Development Commissions (CCDR) that correspond to the 5 regions of mainland Portugal:

– North region: Comissão de Coordenação e Desenvolvimento Regional do Norte (CCDR-N), with a Regional Agenda For A Circular Economy (2019) that has identified by the regional metabolism study four main areas: agro-food, construction, construction and demolition waste, textile, transports and cities (as an anchor for the circular economy)
– Central region: Comissão de Coordenação e Desenvolvimento Regional do Centro (CCDR-C), with a voluntary institutional pact for the valorization of circular economy in the central region (2019) inviting players to join assuming some variable commitments towards a more circular economy
– Lisbon and Tagus Valley: Comissão de Coordenação e Desenvolvimento Regional de Lisboa e Vale Tejo (CCDR-LVT), with a Regional Agenda for a Circular Economy in the LVT Region (2019), including challenges (consumption, stock and recycling); goals (leveragers and transversal); approaches (productive cycle for agro-food, productive sector for construction, industrial symbioses for industrial agglomerations) and measures focussing on institutions, companies and consumers.
– Alentejo region: Comissão de Coordenação e Desenvolvimento Regional do Alentejo (CCDR-A), with a Regional Agenda for Circular Economy in Alentejo (2019) with several projects in the CE field,
– Algarve region: Comissão de Coordenação e Desenvolvimento Regional do Algarve (CCDR-ALG) with an analysis and an Action Plan for the CDW in Algarve (2019).

- Regional Directorate for the Environment and Climate Change of the autonomous region of Madeira/Direção Regional do Ambiente e Alterações Climáticas da região autónoma da Madeira (DRAAC Madeira). In the Madeira autonomous region, the Direção Regional do Ambiente e Alterações Climáticas (madeira.gov.pt) has an interesting field named waste and circular economy with waste being the main focus of action.
- Regional Directorate for the Environment and Climate Change of the autonomous region of the Azores/Direção Regional do Ambiente e Alterações Climáticas da região autónoma dos Açores (DRAAC Açores). In the Azores autonomous

region, the Regional Directorate for the Environment and Climate Change of the autonomous region of the Azores has published a Regional Plan For Climate Change and a Roadmap for the Circular Economy in the Agricultural and Forestry Sector of the Autonomous Region of the Azores. It has participated in some Circular Economy projects with the construction sector and together with other municipalities, Ponta Delgada is part of the National Initiative Circular Cities.

Governance at a Municipal Level

At the municipal level, some actions towards a circular economy are being carried out by several municipalities. Just to cite some examples:

- **Porto Municipality** has presented the Porto Pact for Climate, which aims to awaken the action of citizens and organizations and create a large community of learning, sharing and mutual support, with a voluntary, non-binding and free-of-charge subscription.,
- **Gaia Municipality** is the leading partner of the Sustainable and Circular Cities Network and also includes Mangualde, Mértola, Oliveira de Frades, Ponta Delgada, Ponte de Sor, Ribeira Brava and Valongo municipalities.
- **Lisbon Municipality** presents the Lisbon Sustainable Companies Platform as a commitment for the 2020–2030 decade in which companies and organizations commit, within the scope of their activity, to provide measures that contribute to achieving ESG sustainability goals in their city

5.1.15.2 Legislation

Although there are several strategic documents closely related to the circular economy and a waste management regime has been established, there is currently no specific law in Portugal related to the circular economy. A legal framework focusing on buildings within the scope of energy efficiency and Building Energy Certification System (list can be found here) transposes regulations at the European level.

Energy Performance of Buildings Directive. Transposing the European Energy Performance of Buildings Directive 2002/91/CE (EPBD) the following Portuguese laws were published:

- 78/2006 (SCE), approves the National Energy Certification and Indoor Air Quality System in Buildings;
- 79/2006 (RSECE) approves the Regulation on Energy Air Conditioning Systems in Buildings;
- 80/2006 (SCE) approves the Regulation on the Thermal Behavior Characteristics of Buildings.

Following the EPBD revision 2010/31/UE national legislation was published.

- 118/2013 (SCE, REH and RECS), approves the Building Energy Certification System, the Energy Performance Regulation for Residential Buildings and the Energy Performance Regulation for Commercial and Service Buildings,

  More recently, and as a consequence of EPBD last revision 2018/844/UE.

- 101-D/2020, establishes the requirements applicable to buildings to improve their energy performance and regulates the Building Energy Certification System.

In the 101-D/2020 current law, the concept of nZEB is defined as "almost zero energy needs building" means a building with a very high energy performance (…) and in which almost zero or very small energy needs are covered, to a large extent, by energy from from renewable sources, preferably local or originating close to the building, when that is not sufficient". Moreover it is stated that new buildings must be "buildings with almost zero energy needs" (art.6) and that buildings energy certification will serve "as a support element in accessing financing instruments"; and "serve as a support element for the attribution of tax benefits, encouraging, in particular, the implementation of improvement measures, as well as the design or renovation of buildings with a view to achieving high energy performance" (art. 17).

5.1.15.3 Circular Economy Strategy, Roadmap or Action Plan

Action Plan for Circular Economy/Plano de Acção Para a Economia Circular (PAEC)

Portugal is one of the EU member states that have ongoing action plans for a Circular Economy, in line with the ambitions of the European Commission, being named Plano de Acção para a Economia Circular (PAEC) (Presidência de Conselho de Ministros n.o 190-A/2017, 2017). The content of the plan acts on the culture, market and political barriers, targeting three specific fields:

- **Political field** with political instruments that promote the efficient use of resources, from the design of the product/service to the recovery of by-products and waste;
- **Knowledge field** disseminating information about best practices, case studies, and funding opportunities, among others, and promoting the development of collaborative-based R&D initiatives in this area;
- **Economic field** through specific interventions in existing financial instruments to value initiatives that contribute effectively to the CE, namely through sectoral and intersectoral projects in this matter.

And presents actions aligned with the European pillars of Action for the Circular Economy and 3 levels of operationalization:

- **Macro level**: actions of a structural scope, which produce transversal and systemic effects that enhance the appropriation of circular economy principles by society;

- **Meso (or sectoral) level**: actions or initiatives defined and undertaken by a group of stakeholders in the value chain of relevant sectors to increase productivity and efficient use of the country's resources, capturing economic, social and environmental benefits;
- **Micro (or regional/local) level**: actions or initiatives defined and undertaken by a set of governmental, economic and social, regional and/or local agents, which incorporate the local economic profile and value it in addressing social challenges.

The summary of the plan (in English) and the report about its implementation (only in Portuguese) were publicly presented. Currently, the PAEC is under revision and in the public discussion, and comments can be submitted until the 10th of November 2023.

Action Plan for Circularity in Construction in Portugal/Plano de Ação Para Circularidade na Construção em Portugal (PACCO)

The Action Plan for Circularity in Construction in Portugal (PACCO) [4] has the objective of identifying and discussing measures that can accelerate the transition to a circular economy in the construction sector in Portugal, responding to the need identified by PAEC (Presidência de Conselho de Ministros n.o 190-A/2017, 2017) to develop sectorial plans. The executive summary of the PACCO presents the analyses done of the sector, main barriers and opportunities, the strategy of the plan including the four pillars (political, technological, market, and cultural) and sub-pillars, nine vectors (political context, certification schemes, fiscal instruments, databases, methodologies and digital tools, training and accreditation, communication plan, digital platform and e-commerce, and circular economy entity) and the 30 measures towards a circular construction. Each one of the 30 measures was presented with specific actions, implementation timeline, sustainable development goals (SDG), targets, indicators, vector of implementation, actors and financing mechanism.

Roadmap for Carbon Neutrality 2050/Roteiro Para a Neutralidade Carbonica 2050 (RNC2050)

Besides specific legislation on circular economy and waste management Portugal adopted in 2019 a Roadmap for carbon neutrality, named "Roteiro para a neutralidade carbonica 2050 (RNC2050)" (Ambiental and Ambiente 2019). This roadmap supported the transition towards a competitive, circular, resilient and carbon–neutral economy. It defined the trajectories towards a carbon–neutral economy in 2050, assessing the energy system (including eletroprodotor, mobility and transports, industry and buildings); the agro-florest role, waste and water, and circular economy.

National Plan for Energy and Climate 2030/Plano Nacional Energia e Clima 2030 (PNEC 2030)

This Plan (PNEC 2030) [276] aims to establish objectives and respective policies and measures in terms of reducing greenhouse gas emissions, incorporating energy from renewable sources, energy efficiency, energy security, internal market and research, innovation and competitiveness, as well as a clear approach to achieving the aforementioned objectives and goals. In conjunction with the objectives of RNC2050, the National Energy and Climate Plan 2021–2030 (PNEC 2030) was developed, which constitutes the main instrument of national energy and climate policy for the next decade towards a carbon–neutral future, which is now approved. The PNEC 2030 establishes ambitious but achievable goals for the 2030 horizon and implements the policies and measures for the effective application of the guidelines contained in the RNC2050 and for achieving the defined goals. The main objectives of the National Plan for Energy and Climate 2030 are:

1. Decarbonize the national economy
2. Give priority to energy efficiency
3. Strengthen the focus on renewable energy and reduce the country's energy dependence
4. Ensure security of supply
5. Promote sustainable mobility
6. Promote sustainable agriculture and forestry and enhance carbon sequestration
7. Develop an innovative and competitive industry
8. Ensure a fair, democratic and cohesive transition.

PNEC 2030 is currently under review.

5.1.15.4 Construction and Demolition Waste Management Regulatory Framework

General Waste Management Regime/Regime Geral Da Gestão De Resíduos (RGGR)

The General Waste Management Regime (RGGR) [277] was approved in 20020 in line with EU Waste directives, and as policies relating to waste management have evolved towards the sustainable management of materials, to protect, preserve and improve the quality of the environment, protect human health, ensure prudent, efficient and rational use of natural resources, reduce pressure on the regenerative capacity of ecosystems, promote the principles of the circular economy, reinforce the use of renewable energy, increase energy efficiency, reduce dependence on imported resources, provide new economic opportunities and contribute to long-term competitiveness. This document regulates the legal regime for landfilling waste and amends the management regime for specific waste streams. It includes five sections: I General provisions and principles; II Regulation of waste management; III Registration of

information and monitoring of waste management; IV Economic and financial regime for waste management; and V Administrative offence regime.

In the Article 21. Prevention objectives and targets, to decouple economic growth from the impacts on human health and the environment associated with waste production, the following calendar of targets relating to the prevention and reduction of waste production and its dangerousness is established:

- reduce the amount of urban waste produced per inhabitant by 5% (2025) and 15% (2030) compared to 2019 values
- reduce the amount of food waste in restaurant establishments collective and commercial feed and production and supply chains, including industries agri-food companies, catering companies, supermarkets and hypermarkets, by 25% (2025) and 50% (2030) compared to 2020 values;
- reduce the amount of non-urban waste per unit of gross domestic product (GDP) by 5% (2025) and 10% (2030) particularly in the civil construction and public works sector, compared to 2018 values;

Targets relating to preparation for reuse, recycling and recovery in article 27.º and aiming at promoting the transition to a circular economy with a high level of resource efficiency, entities responsible for waste management must adopt the necessary measures, through waste management plans and programs, to ensure compliance with following goals:

- From the date of entry into force of this regime, a minimum global increase of 50%, by weight, about the preparation for reuse and recycling of urban waste;
- From the date of entry into force of this regime, a minimum increase to 70% by weight about preparation for reuse, recycling and other forms of material recovery, including filling operations using waste as a substitute for other materials, of non-hazardous CDW, excluding natural materials defined in category 17 05 04 of the LER;
- A minimum increase to 55% (2025), 60% (2030) and 65% (2035) by weight of preparation for reuse and recycling of municipal waste, where at least 5% (2025), 10% (2030) and 15% (2035) is resulting from preparation for reuse of textiles, electrical and electronic equipment, furniture and other waste suitable for preparation for reuse.

Finally in article 28 about the design, production and distribution of products that generate waste, it is stated that it is mandatory to use at least 10% of recycled materials or those that incorporate recycled materials in relation to the total amount of raw materials used in construction, within the scope of contracting construction and infrastructure maintenance contracts under the Contract Code Public (Decree-Law no. 18/2008, CCP).

5.1.15.5 Platforms and Networks Facilitating the Transition to a Circular Economy

Circular Economy Platforms

- **ECO.NOMIA portal**. The ECO.NOMIA portal is one of the components of the Ministry of the Environment's action plan, serving as a space for sharing knowledge about the Circular Ecomomy. On the one hand, publicizing the advantages and financing opportunities to consumers and companies and, on the other, launching an interaction forum for collaborative investment projects in the Circular Economy.
- **eCIRCULAR**. ADENE has recently launched eCIRCULAR, the Classification System that allows the evaluation of performance and improvement of management practices in the circular economy of organizations. Focusing on the whole economy, and specifically in the first stage in the production companies, this evaluation system currently in a Beta stage, proposes the evaluation of the performance relative to resources management—energy, water and materials—and strategies and practices—internal and external focus.
- **MyWaste**. MyWaste is an online platform for hosting a national exchange that consists of a business-to-business (B2B) network for sharing waste/by-products/RES that can be recovered. This aims to inspire the circular economy, waste reduction and reuse, with each entity being able to manage and optimize its resources, offering features for managing the waste generated.

Circular Buildings Platform

Resulting from a Circular Construction research project (PRCD—Prevention of Construction and Demolition Waste), promoted by ASWP and financed by the Environmental Fund, this platform hosted at https://www.construcaocircular.pt/ aims to promote educational actions aimed at the various agents along the chain associated with RCD, supporting their interaction, to promote a more sustainable value chain organization, in line with the principles of the circular economy.

Building Materials Passport Platform

No building materials platform has been established to date, but some research projects are focused on this theme: Circular EcoBIM (3Drivers), and Edifícios Circulares (Associação Smart Waste Portugal).

Public Procurement Platform

- **BaseGOV managed by IMPIC**. The Institute of Public Markets, Real Estate and Construction, I.P. (IMPIC, I.P.) is a public institute with legal personality, administrative and financial autonomy and its assets, which carries out tasks under the supervision of the Ministry of Housing in the areas of construction, real estate, including the regulation of public contracts. The Portal BASE centralizes the information on public contracts celebrated in Portugal's mainland and autonomous regions.
- **National strategy for green procurement/Estratégia Nacional para as compras públicas ecológicas (ENCPE)**. National strategy for green procurement (Resolução do Conselho de Ministros n.o 65/2007, 2007) applies to the State, namely to bodies under its direct and indirect administration and to the State's business sector, and also, on an optional basis, to autonomous administration and other legal entities governed by public law, whenever the acquisition of goods, services or the preparation of projects for the execution of public works that are part of the list of priority goods and services and is presented in this website: https://encpe.apambiente.pt/. It had two main goals:

  1. Increase the percentage of public pre-contractual procedures for the acquisition of goods and services covered by ENCPE 2020 that include environmental criteria, in the direct and indirect administration of the State by 55% (by 2017–2018) and 60% (by 2019–2020) and in the state business sector 35%(by 2017–2018) and 40% (by 2019–2020)
  2. Increase the percentage of the financial amount associated with public pre-contractual procedures for the acquisition of goods and services covered by ENCPE 2020 that include environmental criteria in the direct and indirect administration of the State by 55% (by 2017–2018) and 60% (by 2019–2020) and in the state business sector 35% (by 2017–2018) and 40% (by 2019–2020).

  A revised national strategy for green procurement is currently under revision.

5.1.15.6 Funding Opportunities

Recovery and Resilience Plan

The Recovery and Resilience Plan (Plano de Recuperação e Resiliência—PRR) is a national program, with an implementation period of 2026, which will implement a set of reforms and investments aimed at propelling the country on the path to recovery, sustained economic growth and convergence with Europe over the next decade, guided by a concept of sustainability inspired by the United Nations Sustainable Development Goals (SDGs). The PRR is aligned with the six relevant pillars of the European 2030 strategy:

- Green transition;

- Digital transformation;
- Smart, sustainable and inclusive growth, including economic cohesion, employment, productivity, competitiveness, research, development and innovation, as well as a well-functioning Single Market with strong small and medium-sized enterprises (SMEs);
- Social and territorial cohesion;
- Health and economic, social and institutional resilience, including to increase the capacity to react and prepare for crises;
- Policies for the next generation, children and young people, including education and skills.

This programme has 20 components, grouped into three main clusters:

- **Resilience** with nine components: C01—National health service; C02—Housing C03—Social responses C04—Culture C05—Capitalisation and business innovation C06—Qualifications and competencies C07—Infrastructure, C08—Forests; and C09—Water management
- **Climate transition** with six components: C10—Sea C11—Decarbonisation of industry C12—Sustainable bioeconomy C13—Energy efficiency in buildings C14—Hydrogen and renewables C15—Sustainable mobility
- **Digital Transition** with five components: C16—Business 4.0 C17—Quality and sustainability of public finances C18—Economic justice and business environment C19—Public administration—digitalisation, interoperability and cybersecurity C20—Digital schools.

Component 11_Decarbonizing industry focuses on the promotion of the circular economy supporting the industry to make the transition. It aims to develop innovative and competitive industries, through the promotion of circular and low-carbon economies, industrial symbioses and new circular, low-carbon products and services.

Portugal 2030

Portugal 2030 puts into practice the Partnership Agreement between Portugal and the European Commission to invest 23 billion euros of European funds in projects that stimulate and develop the Portuguese economy, between 2021 and 2027. The total amount available to finance projects will be distributed across programs, organized by themes and regions. This program will support Private companies; Local authorities and other public bodies; Cooperatives, associations, private social solidarity institutions, and other private entities.

Portugal 2030 will support projects in six main areas:

1. **Portugal + Smart**: Investing in research and innovation, digitalization, the competitiveness and internationalization of companies, skills for smart specialization, industrial transition and entrepreneurship.
2. **Portugal + Connected**: With strategic transport networks, based on a strong commitment to railways, enhancing the mobility of people and goods, as well as

the qualification of territories, guaranteeing their attractiveness, competitiveness and insertion in national and international markets.
3. **Portugal + Close**: Close to citizens, supporting development strategies at the local level, promoting social and territorial cohesion, and supporting sustainable urban development, based on the concept of network interconnection, centred on people's needs.
4. **Portugal + Green:** Oriented towards the green transition, following the climate emergency and incorporating the goals of decarbonization, energy efficiency and reinforcement of renewable energy, and supporting innovation, the circular economy and sustainable mobility.
5. **Portugal + Social**: Supporting the improvement of the population's qualifications, equal access to healthcare, promoting quality employment and social inclusion, following the priorities established in the European Pillar of Social Rights.
6. **Portugal + Just transition**: To ensure that the transition to a sustainable and carbon–neutral economy is carried out fairly.

The circular economy agenda is framed under the areas Portugal + Green and Portugal + Just Transition. Some Circular Economy Business Dynamics, Training and Incentives are summarized here.

International Cooperation and Support from International Organizations

No data to this point.

Challenges, Barriers and Potential Improvements

There are several challenges and barriers related to the implementation of a circular economy in the construction sector. The Plan for Circularity in Construction in Portugal has identified the main challenges and proposed several measures and actions for implementing the Circular Economy in this sector (Table 5.4).

5.1.15.7 Examples of Successful Implementation

Public Policy Initiatives

Research projects promoted by FCT and other entities, to respond to the emergency associated with this transition. Financing through EEA grants has proven to be relevant in the area of circularity and sustainability in the AEC sector. Some of the research projects that have been supported to push the Circular Economy are:

- C + D (CERIS), Close the loop by Disclosing the benefits of buildings' deconstruction and materials re-use, aiming to develop a web-based platform to calculate

Table 5.4 Overview of challenges, recommended measures and actions for the implementation of the circular economy in the Construction sector in Portugal

Challenges	Recommended measures	Recommended actions
Political and regulatory barriers: – Complex legislation – Project without specifications circularity – Cost of environmental degradation and non-internalized social – Lack of (in)formation when hiring ecological – Lack of incentives for projects circular – Lack of actions, goals, metrics and schedule for transition	1. Proposal to reform the legislative and regulatory framework	Reform the legal framework
		Defining goals and incentives
		Define a Sectorial Agreement
	2. Ex-ante evaluation and monitoring of measures	Building the base scenario
		Assessment of consequential impact
		Monitoring of measures and data collection
	3. Develop and implement digital guides	The digital guide to support circular design
		Digital user guide
		The digital guide to support deconstruction
		Digital waste management guide
	4. Proposal for a political and sectoral support structure	(Infra)structures to support reverse logistics
		Waste sorting, storage and disposal sites
		Increase inspection capacity
	5. Proposal to create certification schemes	Certification of products, solutions and constructions
		Implement guarantee schemes
		Standards for assessing circularity and sustainability
	6. Proposal for material/ building passports	Policies that promote material passports
		Guidelines applicable to construction materials and elements
		Standardized measures for the eco-design of materials and products and the (de)construction
	7. Proposal to support green contracting	Proposal for policies that establish increasing needs for the use of materials circulars in public and later private procurement
		Promote voluntary agreements for ecological and innovative public procurement

(continued)

Table 5.4 (continued)

Challenges	Recommended measures	Recommended actions
		Progressive implementation of sustainability and circularity criteria
	8. Transition financing proposal	IDI financing proposal
		Tax incentives to support the retraining and training of HR
		Tax incentives to support new business models
		Tax incentives to support the transition of existing businesses
	9. Tax penalty	Tax penalties on the use of natural resources
		The tax penalty for waste disposal in landfills
		Finance the transition through penalized revenue
	10. Tax cuts	Reduce labor tax
		Reduce tax on secondary, recycled, and other materials or with the incorporation of recycled materials
	11. Internalization of environmental and social impacts	Policies that internalize environmental and social impacts
Technological barreiers: – Technology for deconstruction does not develop – Lack of knowledge of materials alternative and innovative – Lack of information about the performance Lack of a national database – Unique and unrepeatable works – Computer skills insufficient or inappropriate – Lack of marking including criteria circularity	12. Proposal for platform(s) and digital tools	Knowledge sharing platform
		National database platform (costs and impacts)
		Platform to support public and private procurement (e-commerce) in conjunction with the existing Portal Base
		Project support platform (incl. quality criteria, circularity and sustainability)
		Building management platform (based on Digital Twin)
		Waste/secondary materials marketplace

(continued)

Table 5.4 (continued)

Challenges	Recommended measures	Recommended actions
		Construction and updating of digital databases
		Development of digital tools to support design, construction, management and demolition of buildings
	13. Develop and disseminate collaborative methodologies	Develop collaboration methodologies based on BIM, LCA, LCC and circularity
		Develop methodologies for exchanging, verifying and sharing information
	14. Proposal to support case studies and databases	Support demonstrator pilot cases
		Support database development
	15. Proposal to support R&D new processes and technologies	Support R&D for new manufacturing processes
		Support R&D of new solutions and systems
		Support R&D for new forms of transport
		Support R&D of new technologies to support the project
		Support R&D for new building management systems
		Evaluating new processes and technologies (holistic multi-criteria approach
	16. Support R&D of new materials and products	Support R&D of materials and products with useful life extension
		Support R&D of new materials and products that incorporate recycled materials
		Support R&D of new materials and products that enhance recycling or reuse
		Evaluating materials and products (holistic multi-criteria approach)

(continued)

Table 5.4 (continued)

Challenges	Recommended measures	Recommended actions
Market barriers: – Lack of demonstrator projects – No market for CDWs – High price of recycled materials – Lack of awareness among manufacturers – Lifespan and difficult maintenance – Lack of training of sector actors – Financing that excludes environmental criteria	17. Support circular business models	Support new, more circular and/or energy-based business service models
		Support the transition of existing business models (preferential support for micro and SMEs)
	18. Foster an environment that supports R&D	Support innovation centres for the study of topics related to sustainability and circularity and serve as a knowledge transfer interface between entities' research and industry
	19. Strengthen partner networks	Support for mobilizing partners along the value chain and logistics for sustainability and circularity
	20. Regulate and support training, capacity building and accreditation	(Re)qualify the human resources of public and private entities (focus on micro and SMEs)
		(Re)qualify human resources in public administration as a regulator and construction owner
		(Re)qualify human resources in public and private vocational education and training entities
	21. Regulate and support new professions	Regulate and support new professions in a Circular Economy
		Regulate and support new courses (technical, secondary, polytechnic and university students)
		Regulate and support professional training
	22. Minimize resources, costs, impacts and waste	Minimize the use of resources, impacts and waste generation encouraging durability, and repair instead of replacement, in contractual provisions

(continued)

Table 5.4 (continued)

Challenges	Recommended measures	Recommended actions
		Minimize lifecycle cost due to performance-optimized and adequate maintenance and opting for supply chains local supplies
	23 Maximize durability, adaptability, flexibility and reuse	Maximize durability, adaptability, flexibility and products and buildings
		Maximize the reuse of materials/products (the "buildings as materials bank"
Cultural barriers: – Lack of market acceptance of recycled materials – Non-existent or unknown practical examples – Lack of awareness/training of the construction owner – Limited knowledge of society – Lack of understanding of benefits and difference	24. Promote a business culture of innovation and sustainability	Promote innovation and sustainability through the development of internal innovation, sustainability and circularity strategies
		Encourage systems thinking by challenging "business-as-usual"
		Promote business culture contrary to a fragmented approach
	25. Encourage HR and market transition	Proposal for incentives for the transition of senior staff and managers("lead-by-example" concept)
		Proposal for incentives for employee transition
		Proposal for incentives for market/demand transition ("demand-pull" concept
	26. Involve the logistics chain	Involvement of partners throughout the entire chain
		Strengthen inter-company and institutional relationships
		Develop demonstrative success stories (in companies and the state)
	27. Promote knowledge sharing	Promote knowledge sharing between the various actors within the construction sector

(continued)

Table 5.4 (continued)

Challenges	Recommended measures	Recommended actions
		Centralization and management of knowledge of entities reference in the AEC sector on CE and sustainability
		Support transparency and traceability of information (between entities and throughout the life cycle)
	28. Proposal to create the entity for Circular Construction	Create an entity responsible for transition, management, monitoring and dissemination of knowledge for CE in the AEC sector
		Define support instruments for monitoring the implementation, validation and monitoring of measures
		Defining and promoting simplex practices
	29. Communicate the plan	Communication plan on the principles of economics circular in the construction sector
		Communication plan regarding environmental benefits, social and economic
		Communication plan for a positive social image
	30. Strengthen trust	Reinforce confidence in political decisions on circularity, sustainability, and quality of the built environment
		Reinforce social awareness of causes and effects associated with climate change
		Reinforce the construction sector's contribution to environmental objectives

Source Acordo Circular [4]

the economic and environmental benefits (2E) associated with the deconstruction and reuse process.

- Circular EcoBIM (3Drivers), aims to create a BIM standard-like Product Data template, i.e., a data structure for BIM objects, and a set of applications that allow the calculation of circularity passports for buildings and components, integration and development of DAP of products and the calculation of LEVEL(S) system indicators for buildings, based on building models, thus contributing to the implementation of circularity practices in construction.
- (Des)construir para an Economia Circular (Comunidade Intermunicipal do Baixo Alentejo) made it possible to provide the Baixo Alentejo region with a strategy and an institutional model to implement a system for collecting, storing, sorting, processing and marketing RCD, to maximize the reuse of materials and recycling.
- ReBuild17 (Secret. Regional dos Transportes e Obras Públicas-LREC) is a project that aims to contribute decisively to the development of circularity in value chains, through the creation of a platform for the recovery of waste originating in the construction sector, in which the various stakeholders associated with the sector participate.
- Circular2B (FEUP), aims to combine energy efficiency with waste recovery, focusing on the development of two new materials: the insulating core of SIP panels (structural insulated panels) and the exterior finishing plaster, replacing current materials with functionally equivalent materials, the result of the recovery of plastics, RCD and slag. The focus on prefabrication (modular construction) is supported by the fact that this type of construction considerably reduces RCD.
- CirMAt (Domingos da Silva Teixeira, S.A), CIRcular aggregates for sustainable road and building MATerials, aims at industrial development and the promotion of multiple products/materials with a high degree of incorporation of waste from the construction and steel industry sectors
- Edifícios Circulares (Associação Smart Waste Portugal) aims to develop tools to support the design and construction of circular buildings, namely a set of standards for defining material passports for buildings, for defining and calculating material, water and energy efficiency metrics and, finally, to define circularity indicators in the DAP.
- UAveiroGreen Buildings (UA), a project that aims to provide UA with a methodology that allows for increased application of Circular Economy principles
- Circular Build (LNEC), development and validation of the concept of circularity applied to modular prefabricated construction
- CLOSER (LNEC), Close to Resources Recovery seeks to develop a Portuguese guide for preliminary demolition and/or renovation audits applicable to the Portuguese reality.
- GrowingCircle (Instituto de Construção), Integrated Data for Efficient and Sustainable Construction, a project that uses the digitization trends in the construction sector point to processes and technologies that allow systematizing, aggregating, managing, tracking and maintaining information about built objects and the construction products that make them up.

- Projeto 3R-2CE *(*CLEAN), three roads to a circular economy, aims at impacting three key areas that contribute to moving towards a circular economy in Portugal—Reduce, Reuse, and Recycle—by strengthening material efficiency, exploring options for the improved management of specific waste streams, and assessing urban waste infrastructures capacities.

Private Policy Initiatives

Some private initiatives that are examples of success are:

- Costa Almeida Ambiente headquarters, the rehabilitation of an unfinished industrial unit with two floors, with a reinforced concrete structure and brick partitions that make up the administrative area, that maximized components reuse and materials recycling, using CE principles;
- CREE buildings, implemented by Casais, are capable of reducing the carbon footprint by more than 60%, by using engineered wood and just 1/3 of the concrete of a traditional building, and considering circular economy principles (design for disassembly)
- Examples of successful implementation available in:
  - http://agendacircular.ccdrc.pt/boas-praticas
  - https://eco.nomia.pt/pt/exemplos
  - https://smartwasteportugal.com/boas-praticas/

5.1.16 Romania Factsheet

5.1.16.1 Policy and Regulatory Framework

Governance

Under the current governance structure, the circular economy lacks a dedicated process and/or a specific ministry or unit responsible for it. Instead, the circular economy is managed alongside other related topics such as sustainable development or climate change, while the responsibilities for the circular economy in Romania are currently shared between several authorities. The Ministry of Environment, Water and Forests (MoEWF), within its domain of expertise, plays a pivotal role in formulating national policies, regulations, strategies, and plans related to waste prevention and management. In contrast, the Ministry of Economy (MoE) spearheads the development of mid-term and long-term strategies and reforms to facilitate Romania's economic transition from a linear model to a circular model. Several other government ministries are responsible for issues related to the circular economy, which are also intertwined with larger environmental mandates, ministries such as the Ministry of Development, Public Works and Administration, the Ministry of Energy and the

Ministry of Research, Innovation and Digitalization. Depending on the theme, other ministries have also responsibilities and mandates on environmental issues.

In addition to those mentioned above, there are other relevant governmental bodies that support circular economy:

- under the aegis of the Prime Minister's Office, the Department for Sustainable Development (DSD) is responsible for the implementation and monitoring of the Sustainable Development Goals (SDGs) since 2017. Additionally, DSD has played a crucial role in the development of sustainable development strategies. Joining forces with the MoEWF, the DSD collaborated with the "Ernest Lupan" Institute for Circular Economy and Environmental Research—IRCEM to create ROCES2030 (a project named "Strategy for Romania's transition to the circular economy 2020–2030", part of the Partnership for a Green and Zero Waste Economy in Romania until 2030, in the framework of which a series of events took place, including sectoral conferences and workshops, in the main cities of Romania).
- the Interdepartmental Committee for Sustainable Development (ICSD) plays a central role in overseeing the implementation, monitoring, evaluation, and revision of Romania's National Strategy for Sustainable Development 2030 (RNSSD 2030). Headed by the Prime Minister and comprising all ministers, the ICSD ensures that the RNSSD 2030 objectives are integrated into sectoral policies and strategies, and it upholds Romania's international and European reporting requirements in the field of sustainable development.
- the National Commission on Climate Change, an inter-ministerial body without legal personality, serves as an advisory council to the Romanian government on climate change matters. It is coordinated by the MoEWF and falls under the purview of the Interministerial Council for Agriculture, Rural Development and Environment.
- The Interministerial Committee on Climate Change, established as a relatively recent addition to the Romanian government's structure, is chaired by the Prime Minister and serves as a key coordinating body for climate change initiatives. It plays a crucial role in aligning policies across various sectors that influence climate change and monitoring the implementation of these policies. The committee's main responsibility lies in amending and complementing national climate change policies to ensure their effectiveness and align with international commitments.

The Consultative Council on Sustainable Development (CCSD) was established by Government Decision 114/February 4, 2020 and it was settled at the level of academia, the scientific community and civil society to monitor the impact of policies in the field of sustainable development. The Council consists of 34 members whose role is to propose the initiation and elaboration of documents and methodologies for the implementation of the RNSSD 2030, to provide advice, scientific and technical support to the DSD and to support and encourage the implementation of good practices relevant to Romania within the mechanisms of public administrations involved in the sustainable development process [64].

Legislation

Although Romania has a large body of legislation related to the circular economy, most of them focus on waste management. In 2017, Romania took a comprehensive approach to waste management by enacting the National Waste Prevention and Management Plan (NWPMP), alongside a suite of supporting legislation including 16 laws, 23 government emergency ordinances (GEOs), and over 40 government decisions and ministerial orders. Despite a comprehensive legislative framework, effectiveness remains limited due to insufficient enforcement and monitoring. This stems from factors like resource constraints, fragmented responsibilities across diverse government bodies, and lack of long-term strategic vision [341].

Two key laws constitute the foundation of Romania's legal framework for promoting a circular economy: EO no. 92/2021 regarding the waste regime (replacing General Regime of Waste Management Law no 211/2011) and Law no. 249/2015 regarding the framework of managing packaging and packaging waste. June 2021 saw a major update to Romania's waste laws by adopting Emergency Ordinance no. 74/2018. This ordinance amended and supplemented key laws, including Law no. 211/2011 on the waste regime, Law no. 249/2015 on packaging and packaging waste management, and Government Emergency Ordinance no. 196/2005 on the Environmental Fund. EO 74 advances the goals of the Circular Economy package by integrating within national legislation various economic instruments, including pay-as-you-throw (PAYT), Extended Producer Responsibility (EPR), and the introduction of a landfill tax. In September 2021, EO no. 92/2021 on the waste regime superseded Law no. 211/2011 and amended EO 74/2018. Despite these changes, the underlying objectives of promoting a circular economy remain unchanged.

Other policies that include circular economy policy elements are Industry *De minimis* Aid Scheme (adopted through Order no. 27/August 24, 2022) for the transition to the circular economy, Waste landfilling policy (adopted through Order no. 2/August 11, 2021), Control of waste transfers from other countries policy (adopted through Order no. 1647/June 10, 2022), the policy that provides Making waste management more efficient (adopted through Emergency Ordinance no. 38/April 6, 2022) and the proposed Code of Territorial Planning, Urbanism and Construction.

Circular Economy Roadmap, Strategy and Action Plan

Romania's roadmap towards circular economy started recently compared to other European countries:

- on September 25, 2015, Romania, alongside 192 other countries, embraced the 2030 Agenda for Sustainable Development;
- on May 25, 2017, the Romanian government has decided to establish the Department of Sustainable Development (DSD), under the authority of the Prime Minister, as the national coordinator for the implementation of the 17 goals of the

2030 Agenda. In its capacity, DSD plays a pivotal role in integrating and monitoring data related to sustainable development and circular economy, while also collaborating with public institutions to achieve these goals;

- Romania, through the Ministry for Environment and Climate Change (MfECC), submitted its first Voluntary National Review (VNR) at the High-Level Political Forum for Sustainable Development in New York in July, 2018, marking a significant step in Romania's journey towards achieving the 2030 Agenda;
- on November 9, 2018, the Romanian government has adopted the National Strategy for the Sustainable Development of Romania 2030 (RNSSD 2030), developed under the guidance of the DSD, providing at the national level, among others, elements of transition to a circular economy;
- the Romanian government established on May 8, 2019, the Interdepartmental Committee for Sustainable Development (ICSD), a high-level body led by the Prime Minister to oversee and facilitate inter-ministerial collaboration;
- one year after establishing the ICSD, the Romanian government established on May 2, 2020, the Consultative Council for Sustainable Development, a body comprising 34 experts with expertise in all 17 Sustainable Development Goals (SDGs);
- empowering diverse perspectives and expertise, the DSD, on April 13, 2021, initiated the Coalition Sustainable Romania, a collective effort involving civil society organizations and private sector representatives. In an effort to foster cross-sector collaboration and expertise, the DSD, on May 25, 2021, created a network of 22 sustainable development hubs within all ministries, encompassing approximately 90 specialists.
- the Romanian government has formally adopted on June 8, 2022, the National Action Plan (NAP- RNSSD), developed under the direct guidance of the SDS, for implementing RNSSD 2030;
- on September 21, 2022, the Romanian government adopted the National Strategy for the Circular Economy (NSCE) through Government Decision no. 1.172. The Strategy was developed by the DSD, in conjunction with the MoEWF and the MoE, under the aegis of the Technical Support Instrument project.
- on October 5, 2023, the Romanian government adopted the National Action Plan for the Circular Economy Strategy (NAP-CES) through Government Decision no. 927.

In a step towards sustainable resource management, Romania's government adopted the National Strategy for the Circular Economy (NSCE) on September 21, 2022, through Government Decision no. 1.172. The overarching aim of the Strategy aligns seamlessly with the United Nations Sustainable Development Goals (SDGs) and global climate objectives embracing the principles and initiatives fostered under the EU Green Deal; its core objective is to lay a robust framework for implementing the Action Plan, fostering a clear direction for all stakeholders involved. The Strategy dives deep into 14 economic sectors, analysing their circularity potential and it identifies seven sectors with the highest potential for circular transformation: agriculture

and forestry, construction, automotive, consumer goods such as food and beverages, textiles, packaging and electrical and electronic equipment (EEE).

Through Government Decision no. 927/October 5, 2023, Romania's government adopted the National Action Plan for the Circular Economy Startegy (NAP-CES). This Action Plan targets five key areas to jumpstart Romania's circular economy journey: (1) reducing the consumption of virgin raw materials through sustainable extraction, recycling and recovery of raw materials; (2) reducing the consumption of consumer goods by extending the life of products; (3) reducing the impact of production activities on ecosystems and the environment; (4) reducing the impact of waste and wastewater management activities on ecosystems and the environment; (5) improving policy coherence and governance, communication and collaboration between local, regional, and national authorities.

At the national level, the transition to a circular economy is also addressed within Romania's National Strategy for Sustainable Development 2030 (RNSSD 2030) adopted through Government Decision no. 877/November 9, 2018, the National Action Plan for the Implementation of Sustainable Development Strategy (NAP-RNSSD) adopted through Government Decision no. 754/June 8, 2022 and the National Recovery and Resilience Plan (NRRP). This policies include circular economy policy elements such as Resource efficiency (within NRRP), Reuse of materials and reduction of waste generation (within NRRP), Improving waste management governance for the acceleration of the transition to the circular economy (within NRRP), Increasing the energy efficiency of historic buildings (within NRRP).

The National Strategy for the Circular Economy (NSCE) establishes the following overall objectives:

- Prioritizing local production: encourage the use of locally sourced products and materials over imported alternatives, supporting domestic economic activity.
- Enhancing economic competitiveness and workforce development: strengthen the competitiveness of Romanian businesses within the circular economy through investments in workforce training and upskilling initiatives.
- Responsible and sustainable raw material supply: promote the responsible and sustainable sourcing of raw materials, prioritizing recycled and recovered materials whenever possible.
- Fostering innovation and research: elevate innovation and research in the field of circular economy as a national priority, driving advancements in sustainable technologies and practices.
- Preservation, conservation and sustainable use of natural resources: ensure the preservation, conservation, and sustainable use of natural resources for present and future generations.
- Minimizing waste generation and promoting sustainable waste management: implement strategies to prevent waste generation at the source and promote sustainable waste management practices.

- Encouraging responsible consumption and environmental education: foster responsible consumption patterns among citizens and implement comprehensive environmental education programs to raise awareness and understanding of circular economy principles.
- Protecting ecosystems and public health: ensure the protection of ecosystems and safeguard public health by mitigating the environmental impact of economic activities within the circular economy framework.

In the construction sector, National Action Plan for the Circular Economy Strategy (NAP-CES), which accompanies NSCE, highlights several key areas requiring efforts to leverage the circular model and achieve improvements. These areas include:

- Stimulating demand for circular products and solutions: promoting the market uptake of circular products and solutions within the construction sector to incentivize their adoption and integration into building practices.
- Facilitating enhanced material recovery: implementing effective strategies to increase the recovery of construction materials for reuse, minimizing waste generation and maximizing resource utilization.
- Preventing illegal waste disposal: strengthening enforcement measures and fostering responsible waste management practices to eradicate the illegal dumping of construction materials, ensuring environmental protection and resource conservation.
- Developing digital infrastructure: establishing a robust digital infrastructure to support the introduction of innovative intervention practices and non-invasive methodologies. This may encompass the development of standards, technical recommendations and guidelines addressing the use of sustainable materials and solutions to improve building energy efficiency and promote circularity within the construction industry.
- Building capacity and knowledge: implementing capacity-building and knowledge-sharing initiatives to create an enabling environment for the effective dissemination and adoption of circular economy principles throughout the construction sector.

Construction and Demolition Waste Management Regulatory Framework

The 2018 proposal for a government decision on the management of construction and demolition waste (CDW) from and/or dismantling was materialised three years later in Government Emergency Ordinance No. 92/August 19, 2021 on the Waste Regime, which sets out new obligations for holders of construction and demolition permits, new recycling quotas and special waste management plans. The Ordinance on Waste Regime provides in Art. 17(4) that "the holder of the construction/dismantling permit issued by the local or central public administration authority or by the institutions authorized to authorize construction works of a special nature is obliged to have a waste management plan for construction and/or demolition activities, where applicable, establishing sorting systems for waste from construction and

demolition activities, at least for wood, mineral materials—concrete, brick, sandstone and ceramics, stone, metal, glass, plastic and gypsum for on-site recycling/reuse, as far as economically feasible, environmentally sound and safe construction, and to take measures to promote selective demolition to enable the safe disposal and handling of hazardous substances to facilitate high quality reuse and recycling through the disposal of non-valuable materials". The same regulatory framework provides in Art. 17(7) that "holders to whom construction and/or demolition permits have been issued in accordance with the provisions of Law No 50/1991 on the authorisation of construction works are required to manage construction and demolition waste in such a way as to achieve a level of preparedness for reuse, recycling and other material recovery operations, including backfilling operations using waste to replace other materials, of at least 70% of the mass of non-hazardous waste from construction and demolition activities".

Component 5—The Renovation Wave of the National Recovery and Resilience Plan (NRRP) seeks to integrate key elements of the European Green Deal and other relevant European and national strategies within the Code of Territorial Planning, Urbanism, and Construction (CTPUC). These key elements will encompass strategies such as climate change, resource efficiency, energy efficiency, circular economy and nature-based solutions. Regarding the management of CDW, the CTPUC establishes specific regulations similar to the regulations provided by the Ordinance on Waste Regime:

- "The management of construction and demolition waste shall be carried out under conditions of protection of the health of the population and the environment, in accordance with the applicable special law"—Art. 373 (1);
- "In order to prevent the accumulation and management of waste generated on the site during construction/demolition works and during the operation of constructions, in accordance with the specific legislation, the following measures shall be implemented:

  1. producers and holders of waste legal entities are obliged to classify each type of waste generated from their own activity in the list of waste, according to the special law;
  2. The development and implementation of a programme for the reduction of waste generated;
  3. the development and implementation of a waste management plan;
  4. producers and holders of waste are obliged to collect separately at least the following categories of waste: paper, metal, plastic and glass;
  5. waste producers and waste holders are obliged to recover the waste in accordance with the legal provisions;
  6. re-use, recycling and other material recovery operations, including backfilling operations using waste to replace other materials;
  7. the obligation to subject waste that has not been recovered to a safe disposal operation.
  8. the costs of waste management operations shall be borne by the waste producer"—Art. 373 (2);

- "Responsibility for waste management shall rest with the developer, producer and contractor"—Art. 373 (3).

The implementation of the waste management within the National Recovery and Resilience Plan (NRRP), settles targets regarding setting up Integrated Separate Collection Centres for urban agglomerations and Voluntary Collection Centres to ensure separate collection of household waste that cannot be collected in a "door-to-door" system, including CDW. According to Component C3—Waste management of the National Recovery and Resilience Plan (NRRP), seven integrated separate collection centres and 250 voluntary collection centres will be established in 2024, while 15 integrated separate collection centres and 565 voluntary collection centres will be established in 2025.

5.1.16.2 Platforms and Networks Facilitating the Transition to a Circular Economy

Circular Economy Platforms

Romanian Circular Economy Stakeholder Platform—ROCESP is a platform founded by "Ernest Lupan" Circular Economy and Environment Research Institute—IRCEM and it is financed by the European Social Fund. As a network of networks, the platform aspires to serve as a national hub for convergence on circular economy initiatives, experiences, challenges, perspectives, and expectations. The objectives of ROCESP are to drive knowledge dissemination across Romanian actors, creating a shared understanding of circular economy practices, cultivate collaborative networks to unlock the power of joint action within the circular economy landscape, advocate for the cross-sectoral integration of circular economy initiatives across Romania, develop a permanent and operational tool to facilitate dialogue and interaction between diverse stakeholders and to disseminate Romania's unique approach to the circular economy, drawing on its traditions, cultural context, and entrepreneurial spirit. The ROCESP Platform fosters collaboration between a wide range of stakeholders including representatives from local and central public administration, academic institutions, research and innovation centers, businesses, professional associations, and civil society organizations.

Led by industry, the Circular Economy Coalition (CEC) offers Romania a platform for policy monitoring, research development, and program implementation. Its members actively promote circularity at national and international levels through various activities, including advocating for effective legislation, contributing to technical standards, and participating in international networks. CEC fosters knowledge sharing, expertise exchange, and regulatory support, enabling a sustainable and resource-efficient economy.

- Ecoteca is a platform providing specialised information on waste management, circular economy and climate impact by informing, educating and supporting individuals and organisations on the prevention, reduction, separate collection and

proper management of waste and ensuring the transition to the circular economy and the reduction of climate impact.

- Harta Reciclării (Recycling Map) is an interactive platform that serves as the first national resource dedicated to identifying and pinpointing the locations of various recycling collection points throughout Romania. It unites individuals in a shared mission to promote waste reduction, reuse, and recycling across all categories, from paper and plastic to appliances, tires, and even hazardous materials.
- Romanian Sustainability Code is a platform launched by DSD to support companies in reporting and achieving the goals outlined in Romania's Sustainable Development Strategy. Developed in 2022, the platform and its accompanying Guide provide clear standards and guidance for companies to produce sustainability reports and offers a central hub for publishing company reports, best practices, and open data resources empowering investors and stakeholders to make informed decisions based on sustainability performance.

Circular Buildings Platform

CircularBIM is a free, open-source educational platform dedicated to empowering professionals and students with advanced strategies for reusing building materials within the construction industry. By providing access to BIM software and learning resources, it empowers learners to minimize construction waste (by discovering techniques and technologies for reducing waste generation at the source), reintegrate discarded materials (by learning how to reintroduce used materials back into the construction value chain) unlock material potential (by gaining insights into the potential revaluation of each building component), embrace circular construction (by raising awareness about circular economy principles within the construction sector) and master BIM for reusability (by leveraging BIM formats and tools to facilitate material reuse throughout the building lifecycle).

Building Materials Passport Platform

No building materials platform has been established to date.

Public Procurement Platform

No green public procurement platform has been established to date. The Romanian Electronic Public Procurement System does not yet include any functionality related to the promotion of green procurement.

5.1.16.3 Funding Opportunities

De minimis Aid Scheme for the Transition to the Circular Economy

In a move to accelerate its transition to a circular economy, Romania has launched a 'de minimis' aid scheme through Ordinance no. 27/August 24, 2022. This aid scheme offers financial support to businesses and organizations working to: develop new, innovative industries (this includes fostering the creation of new sectors focused on circularity, such as repair and refurbishment, recycling, and resource efficiency), revitalize existing resources (the scheme encourages the revaluation and reuse of existing materials and products, minimizing waste generation and pollution), drive research and development (grants will be available for projects focused on ecological design, innovative technologies, and services that promote circular principles). The scheme offers grants ranging from the equivalent of EUR 15.000 to EUR 200.000, with 85% funded by the state budget and 15% by the beneficiary. Key areas of focus include

- tech transfer for circular economy: supporting companies that bring new circular technologies to market;
- research and innovation activities: funding projects that develop eco-friendly products and services within the circular economy principles;
- repair and refurbishment centers: establishing and equipping facilities for extending the lifespan of goods;
- Waste recycling activities: encouraging the development of efficient and sustainable waste management practices [64].

National Recovery and Resilience Plan (NRRP)

Romania's recovery and resilience plan provides investment in green technologies and capacities, including energy efficiency, building renovation, circular economy, and biodiversity, while contributing to the Union's climate objectives, promoting sustainable growth, creating jobs, and maintaining energy security. Under Pillar I—Green Transition, within PNRR funding is granted (among others) for activities related to waste management, development of centres for the recovery of historic building materials and their reuse, moderate/deep energy renovation of approx. 4.3 million sqm of multi-family residential buildings and 2.3 million sqm of public buildings respectively, installation and connection to the grid of at least an additional 3000 MW of renewable energy capacity (wind and solar).

Energy-Efficient House

Starting in 2020, the Energy Efficient House Programme offers financial support to individuals to increase the energy efficiency of their buildings. The objective of the programme is to increase the energy performance and/or the use of energy from

renewable sources in existing single-family households located in a building with a maximum of three floors. In 2024, the programme was funded from the NRRP, and through it 60,000 houses in Romania will benefit from a voucher of LEI 72,500 including VAT—the equivalent of EUR 14,500 (for houses with a useful surface area between 50 and 100 m^2) or LEI 100,000 including VAT—the equivalent of EUR 20,000 (for houses with a useful surface area of more than 100 m^2). Beneficiaries of the programme will be able to choose from several types of energy rehabilitation works, including thermal insulation of facades, roofs and floors, installation of an energy efficient heating and domestic hot water system, replacement of windows and doors with double glazed windows and doors, or installation of photovoltaic panels.

Programme for Increased Energy Efficiency and Smart Energy Management in Public Buildings

The aim of the programme is to increase the energy efficiency of public buildings and improve the quality of the environment by reducing greenhouse gas emissions, reducing annual primary energy consumption and promoting the use of renewable energy sources. Within a funding session, the maximum amount that can be granted to an applicant, through one or more funding applications, starts from 6,000,000 lei (the equivalent of EUR 1,200,000) for municipalities with a population up to and including 5000 inhabitants and goes up to 24,000,000 lei (the equivalent of EUR 4,800,000) for administrative-territorial subdivisions of Bucharest municipality. In 2024, the programme was funded from the NRRP.

Funding for the Circular Economy Through the Bucuresti Environment Platform

The Environmental Platform for Bucharest, initiated by the Bucharest Community Foundation and ING Romania, regularly launches funding rounds for waste management, sustainable development and circular economy projects, with the support of Nhood Romania. The allocated funds aim to support projects that address infrastructure, education and advocacy challenges and opportunities in the field of consumption, biodiversity, air quality or waste. Funding is awarded to projects that, in addition to the proposed solutions, have a solid plan for scalability and involvement of public authorities in the adoption of the proposed measures, so that the impact goes beyond a one-off intervention and provides long-term benefits.

Photovoltaic Green House

Starting in 2019, the Photovoltaic Green House Programme offers financial support to individuals for the purchase and installation of photovoltaic panel systems using renewable, non-polluting energy sources for the production and use of electricity by

consumers connected to the national electricity grid. The aim of the programme is to increase energy efficiency, improve air quality and reduce greenhouse gas emissions through the use of photovoltaic panel systems with a minimum output of 3 kW for the production of electricity for own consumption and the delivery of the surplus to the national energy system. Funding is granted up to a maximum of 20,000 lei (approximately 4000 euro), subject to the beneficiary's own contribution of 2000 lei (approximately 400 euro).

Horizon Europe

The EU's Horizon Europe programme funds large scale international research projects including projects related to the circular economy.

International Cooperation and Support from International Organizations

The International Finance Corporation (IFC), a member of the World Bank Group, significantly increased its support through strategic investments in key areas in Romania. These included landmark investments aimed at strengthening the capital markets and promoting climate-friendly financing. In 2023, a €100 million investment in Banca Comercială Română S.A.'s MREL green bonds issuance allocated proceeds towards renewable energy, green building projects, and green mortgages. In addition to the aforementioned investment, IFC committed another €40 million loan to Garanti BBVA Romania specifically to expand access to green housing financing through green mortgages and home improvement loans. Furthermore, a $48 million investment in UniCredit Bank S.A.'s senior bonds issuances aimed to reinforce the green housing loan market in Romania.

5.1.16.4 Challenges, Barriers and Potential Improvements

Although Romania has established a comprehensive framework of green transition strategies, national plans, and policies over the past decade, its effectiveness hinges on robust implementation and enforcement. The transition to circular economy in Romania is slowed by multiple factors, as presented in the World Bank Diagnostic Analysis for Circular Economy Interventions in Romania:

- The lack of standards in the field of circular economy development: firstly, the absence of a national dashboard hinders progress by obscuring key data and trends; secondly, the private sector lacks fiscal incentives to embrace circular practices, limiting its participation. Finally, Extended Producer Responsibility (EPR) schemes are inadequately implemented for certain materials like CDW and textile, creating loopholes in waste management. Addressing these issues

with high priority is crucial, especially for supporting SMEs in implementing circular standards through close collaboration and effective monitoring.

- Low level of enforcement and proper monitoring of Romanian policies and legislation: while Romania has developed numerous environmental strategies and legislation in recent years, concerns remain regarding their effectiveness. Enforcement and monitoring often fall short, hindering progress towards sustainability goals. Additionally, resource allocation may not always match ambitions, and action plans may lack long-term vision and coordinated efforts across government institutions.
- The proper implementation of legislation is hampered by the weak institutional capacity of central and local government: for example, despite being mandatory for over a decade, separate waste collection remains elusive, existing only in pilot areas. This exemplifies a broader challenge: Romania's public administration lacks dedicated human resources for circular economy, sustainable development, and climate change. Instead of proactive leadership, the government often adopts a reactive stance towards waste management. Legislation struggles to reach the local level, hindering effective implementation. Furthermore, waste prevention languishes as a non-priority, evidenced by the unimplemented laws on anti-food waste, composting, and Green Public Procurement (GPP). The absence of supporting regulations for their application and enforcement further exacerbates the issue.
- Low absorption capacity of EU funds: While Romania boasts a 70% absorption rate for EU structural funds in the 2014–2020 period, significant challenges remain. Delays in implementation and a lack of qualified staff to manage projects are major hurdles. This is particularly true for local public institutions, which often struggle with weak budgets, complex administrative processes, and unclear regulations. Adding to the burden are opaque co-financing requirements, limited ability to secure matching funds, and few opportunities for project collaboration and regional coordination. These issues are further magnified by vast regional disparities: counties like Bihor, Bucharest, Constanta, and Cluj demonstrate high absorption rates, while others like Giurgiu, Ialomita, and Teleorman lag behind, widening economic gaps within the country.
- Lack of technical capacity and low level of institutional efficiency: the 2021–2027 EU funding for Romania risks suffering from the same administrative and technical limitations as the previous period. Local authorities' capacity to design and implement new projects remains restricted, potentially hindering the efficient utilization of available resources.
- The development of circular businesses is limited by a lack of government vision in recent years, current legislation and fiscal policy on circular economy: Industrial symbiosis and sustainable partnerships with private actors receive little attention from most Romanian municipalities. Non-mandatory GPP further hinders progress towards more eco-friendly local procurement.
- Poor or missing data: Concerns about the accuracy of waste management data in Romania have been voiced by the EU, urging improvements in both quality and

transparency. This data deficiency presents a significant obstacle to measuring progress and developing effective strategies.
- The demand for products that have a low impact on the environment is still low, especially as these products tend to be more expensive than their conventional counterparts: current Romanian consumer behavior doesn't prioritize circular options. Initial steps should focus on shifting attitudes away from a "throw-away" mentality through strategic interventions such as national and local policies, targeted communication campaigns, comprehensive media coverage, and consistent, clear messaging from political leaders [364].

To accelerate Romania's transition towards a circular economy, a multifaceted approach is needed. This includes enacting comprehensive circular economy legislation, fostering technical and institutional capacity development, and driving behavioral change. World Bank outlined specific actions within each of these key areas in the Diagnostic Analysis for Circular Economy Interventions in Romania:

1. Consolidate and simplify the regulatory landscape:
   - Harmonize and streamline existing waste legislation to eliminate inconsistencies and ensure clarity for all stakeholders.
   - Orient legislation towards long-term circular economy goals, aligning with EU directives and focusing on prevention, reuse, and resource recovery.
   - Enforce existing legislation vigorously and consistently to deter non-compliance and promote responsible waste management.
2. Prioritize waste prevention and circular practices:
   - Establish a GPP Action Plan with mandatory targets for public institutions, focusing on circular procurement and resource efficiency.
   - Develop a comprehensive food waste prevention strategy as part of the broader circular economy package.
3. Empower Local Action and Collaboration:
   - Allocate resources to local authorities based on their commitment to circular practices and industrial symbiosis initiatives.
   - Establish financial incentives for circular businesses to promote innovation and investment in sustainable solutions.
   - Create a national compost policy that empowers local authorities while ensuring strong central oversight and monitoring.
4. Empowering Institutions for Effective Implementation:
   - Conduct a comprehensive assessment of the MoE and its regional/local branches, evaluating resource needs, training gaps, and implementation challenges related to circular economy.
   - Address lags in EU law transposition, insufficient legislation, and weak enforcement through targeted capacity building and reorganization.
5. Upskilling the Workforce:

- Deliver targeted training programs on circular economy, sustainable development, and climate change for civil servants at all levels.
- Offer specialized training for key personnel in Parliament, the Prime Minister's office, and ministries to guide national leadership.
- Foster stronger collaboration between relevant ministries and agencies to ensure coordinated action.

6. Strengthening Data Management:

   - Implement an open-source, reliable centralized waste reporting system with robust verification mechanisms involving authorities, research bodies, and producers.
   - Improve data availability and transparency to inform decision-making and track progress towards circular goals.

7. Fostering Innovation and Knowledge Sharing:

   - Establish partnerships with universities to promote research on circular solutions, product design, and closed-loop practices.
   - Develop advanced circular economy studies to create a pool of national experts and foster innovation clusters.
   - Create a national database highlighting best practices and successful circular economy initiatives to inspire broader adoption.

8. Setting Standards and Incentives:

   - Establish national circular economy standards for both public institutions and businesses, addressing resource use reduction and promoting circular practices.
   - Link these standards to financial incentives to motivate investment and adoption by public and private actors.

9. Empowering Consumers:

   - Promote informed choices: educate consumers about sustainable products, cost savings, and their role in a circular economy.
   - Facilitate cost-effective sustainability: encourage eco-friendly choices through incentives, subsidies, and accessible green alternatives.

10. Educating and Engaging:

    - Raise awareness: implement broad-based education campaigns to foster environmental consciousness and responsible consumption.
    - Empower communities: support civil society initiatives and encourage citizen participation in sustainability efforts.
    - Plan for the future: integrate long-term obsolescence management strategies into product design and waste management plans.

11. Boosting SME Resource Efficiency:

- Invest in knowledge: expand training and education programs for SMEs on resource efficiency, leveraging EU best practices.
- Unlock export potential: enhance resource efficiency to improve product competitiveness and access new markets.

12. Fostering Innovation and Collaboration:

- Strengthen research infrastructure: develop regional research hubs within universities and research centers focused on circular economy solutions.
- Engage with the EU: Actively participate in the EU Stakeholders Platform for circular economy to share and learn from best practices.

13. Designing for Sustainability:

- Invest in future-proof products: upskill designers and manufacturers to create products for reuse and extended lifespans.
- Minimize waste: implement obsolescence management strategies to reduce product waste and promote repair and refurbishment.

14. Sustainable Business Models:

- Incentivize sustainable practices: promote and reward businesses that adopt circular economy models.
- Drive innovation: encourage the development and adoption of innovative, sustainable business models.

15. Enforcing Extended Producer Responsibility (EPR) Schemes:

- Strengthen enforcement: ensure effective implementation and enforcement of EPR schemes [364].

Following specific strategies and actions should be implemented in the Romanian construction sector in order to encourage the transition towards a circular economy in Romania:

- Procurement: accelerate market uptake of circular construction solutions through innovative procurement approaches that prioritize resource efficiency and closed-loop material management.
- Competence: enhance the human capital of the construction sector by fostering the development of knowledge, skills, and competencies relevant to circular economy practices.
- Recovery: develop a comprehensive legal framework and supporting infrastructure to enable efficient recovery of construction materials.
- Accountability: establish a comprehensive CDW register to track and manage waste materials, coupled with a digital marketplace to facilitate efficient trading and reuse.
- Reinforcement: strengthen enforcement mechanisms and implement stricter penalties to deter illegal dumping of construction waste, promoting compliance with environmental regulations (IFC 2023).

5.1.16.5 Examples of Successful Implementation

Romania's construction sector witnesses a growing embrace of sustainability and circular economy principles, evidenced by the rising number of BREEAM and LEED certified projects. More than 730 buildings in Romania have obtained BREEAM or LEED certifications by the end of 2023, including buildings from educational sector, healthcare, industrial, offices, residential and retail. From these, 32 buildings have an "Outstanding" rating score in the BREEAM certification and 65 buildings have a "Platinum" award in LEED certification.

Public Policy Initiatives

EFdeN Signature House. The EFdeN Signature House, a prototype solar house designed by Romanian students, proudly represented their country at the prestigious Solar Decathlon Middle East 2018 competition in Dubai. This remarkable journey involved constructing the house in Romania, meticulously dismantling it for transport, then reassembling and testing it in the scorching Dubai climate.

The house's success was undeniable, achieving an impressive 4th place finish globally and securing 4 podium positions: 1st in communication, 2nd in engineering and construction, 2nd in comfort conditions, and 3rd in sustainability. This remarkable performance solidified its reputation as a leader in sustainable design and circular economy. Upon returning from Dubai, securing LEED for Homes v4.1 certification became a top priority. The certification process ran alongside the final reconstruction of the house on the Faculty of Building Services Engineering campus in Bucharest, taking two years to complete. The EFdeN Signature House rose to the challenge, scoring a remarkable 105 points, the highest ever achieved by a LEED project in Europe [105].

Buzau City. Buzau city has emerged as a pioneer in Romania's transition towards a circular economy, developing a strategy toward circular economy with seven key directions for circularity for 2030:

1. Materials: Buzau is already leading the charge with zero waste and a 60% circular materials flow, demonstrating its commitment to resource efficiency and responsible consumption. The city is the proud host of Green Group, the largest private recycling conglomerate in Romania. This European leader operates the continent's largest integrated recycling park, specializing in recyclable waste management, collection, and diverse waste recovery. Green Group's mission is to transform waste into valuable resources, closing the loop and conserving resources and energy. Green Group actively collaborates with local authorities. This partnership also yielded a revised County Plan for Waste Management, solidifying their joint efforts towards a greener future.
2. Energy: Transitioning towards a renewable energy future, Buzau prioritizes local production, ensuring energy security and reducing carbon footprint.

3. Biodiversity: Recognizing the value of its natural resources, Buzau prioritizes regenerating ecosystems and protecting its natural capital through strategic actions.
4. Health: the city of Buzau promotes healthy living through flexible and efficient infrastructure, prioritizing sustainable mobility with near-zero emissions.
5. Society and Culture: Building a vibrant and inclusive community, Buzau fosters a healthy, safe, and attractive environment with recreational spaces for all residents.
6. Generation of Value: Buzau cultivates a strong local economy that empowers entrepreneurs and encourages the development of circular businesses, driving sustainable economic growth.
7. Resilience: Buzau emerges as a leader in CE implementation, showcasing its commitment to adaptation and long-term sustainability.
8. The strategy offers valuable insights into the current economic landscape and explores potential pathways towards circular development, though detailed action plans are pending.

Private Policy Initiatives

MEX DAY hall. The building, originally designed in 2008 for flexibility in location and use, was initially erected 60 km from Timisoara, in 2009. The structure remained unclad until 2012, when plans for a "Pasta fabrication" plant emerged. However, these plans were ultimately shelved. In 2017, under new ownership, the structure was planned to be repurposed as a Cereal Storage Unit, utilising the entire hall and incorporating a partial mezzanine for office and laboratory space. The new plan involved relocating the entire structure to a new site, demonstrating its adaptability and potential for reuse. Despite its initial design in 2008, this steel-structure required to be evaluated and strengthened. This was due to the stricter building codes in place in 2017, which mandated higher climatic (snow and wind) and seismic load requirements compared to the standards in place when the building was first designed. The structure underwent a resourceful transformation. While relocating the original structure, the layout was cleverly adapted to incorporate new office spaces. This required the addition of a complementary steel structure, ensuring seamless integration with the existing framework. Notably, both the main and secondary structure were entirely reused, minimizing waste and maximizing resource efficiency [56, 57].

HIDROTIM offices building. Constructed in the 1960s in Timisoara, Romania, this existing steel structure was originally designed to house a hydraulic testing laboratory for hydraulic power steel equipment. Comprising a single-story industrial hall, the building was characterized by its steel structural elements, integrated crane, and thermally insulated roofing and wall cladding. In 2004, the investor, Siemens Ltd, through its subsidiary HIDROTIM Ltd Timisoara, requested the transformation of the existing single-story industrial hall into a five-story office building (ground floor + four additional stories). The plan also included a partial basement for additional space. Due to the restrictions imposed by the 2004 construction permit for the central Timisoara site, which primarily consists of multi-story concrete dwellings,

complete demolition of the former hydraulic laboratory building was not authorized. Therefore, the deconstruction/demolition process was divided into several phases, adhering to the permit stipulations. This necessitated the reuse of the existing steel structure, requiring additional structural measures to ensure its suitability for the new five-story office building function. More than 50% from the steel needed for the new building was provided by reusing the existing elements of the industrial hall. The project leveraged existing structural elements, carefully integrating them with newly designed components to achieve the desired functionality. The successfully revitalized building is now fully operational, standing as a testament to the project's innovative approach and commitment to sustainable urban development. The successfully revitalized building is in function at present time, standing as a testament to the project's innovative approach and commitment to sustainable urban development [56, 57].

ALUM. ALUM, a Romanian alumina producer belonging to the Alro Group, joined forces with LafargeHolcim and other partners in the innovative ReActiv project. Funded by the European Commission's Horizon 2020 program with €8.8 million, the project aimed to create low-carbon circular industries by transforming waste into valuable resources [94].

TenarisSilcotub. TenarisSilcotub, a Romanian a pipes manufacturer belonging to the Tenaris Group, achieved a remarkable 100% recovery rate for iron waste generated in its production processes. This commitment to sustainability is further underscored by their reliance on scrap metal, which constitutes 96% of their raw materials at the Calarasi facility. Calarasi facility processes 500,000 tonnes of scrap per year, demonstrating their dedication to closed-loop manufacturing and circular economy principles.

CONCORDIA Employers' Confederation. CONCORDIA is a Romanian organization that brings together 15 industries essential for the Romanian economy, representing almost 2200 companies and a total contribution of 26% to Romania's GDP. Concordia holds a unique position as the sole Romanian representative within influential organizations such as Business Europe, Business at the OECD (BIAC), and the International Organization of Employers (IOE). This distinction grants CONCORDIA a legitimate voice in public discussions at both government and parliamentary levels, as well as the authority to participate in decision-making processes within Romania. Unveiling innovative practices in Romania, [Organization name] published a guide showcasing over 20 member companies' circular economy initiatives across numerous sectors, from hospitality to energy. This insightful resource, "Circular Economy in Romanian Business", identifies common practices for sustainable progress.

5.1.17 Serbia Factsheet

5.1.17.1 Policy and Regulatory Framework

Governance

As stipulated by the first strategic planning document related to circular economy [130] and adopted by the government in December 01, 2022, the Ministry of Environmental Protection (MEP) of the Republic of Serbia (Serbia, RS) is the government agency in charge of overseeing and controlling the implementation of the circular economy in Serbia. The MEP and its administration body, the Serbian Agency for Environmental Protection (SEPA), also have main regulatory authority regarding waste management, with the exception of radioactive waste [244]. The national policies and rules established by the MEP are implemented by local authorities which are in charge of planning and carrying out services for waste collection, transport, and disposal within their respective territories.

Along with MEP, the Ministry for Construction, Transport, and Infrastructure (MCTI) is in charge of overall policy, laws, regulations, and strategic research pertaining to construction, construction land, urban and spatial planning, housing and architectural policy, communal activities, and energy efficiency, as well as road, rail, water, and air transport, and infrastructure. As such, it plays a significant role in the application of circular economy principles in the built environment in Serbia.

Legislation

Currently, aside from the aforementioned strategic document and the closely related waste management programme [131] and Waste Management Act [132] and Planning and Building Act [129], there is no specific act related to circular economy in Serbia. Instead there are two acts with a certain degree of circular economy principles incorporated in them. When it comes to waste management, one of the main objectives of the Waste Management Act (Article 2) is to provide and secure conditions for the prevention of waste generation through rational use of natural resources and conditions for recovery and recycling of waste and the use of secondary raw resources. One of the guiding principles for providing such conditions is the hierarchy of waste treatment, which means that the least desirable option is disposal and the most ideal options are prevention, reuse, recycling, and other forms of recovery.

Similarly to the Waste Management Act the circular economy related provisions in the Planing and Building Act in its Article 3 stipulated that the activities of planning, development and the use of space, should be guided by sustainable development and rational and sustainable use of non-renewable resources and optimal use of renewable resources. In addition the Planning and Building Act's by-law, the Rulebook on the content, method and procedure of technical documentation preparation and control according to the class and purpose of the objects [202], stipulates that the rational

use of energy and sustainable use of natural resources shoul be one of the basic requirements of each object.

Circular Economy Strategy, Roadmap or Action Plan

The implementation of the "Circular Economy Platform for Sustainable Development in Serbia" project, initiated by United Nations Development Programme (UNDP) in partnership with the Government of Republic of Serbia (RS), marked the start of the circular economy's ascent in Serbia in 2018. One of the main result of the project was the creation of a "Roadmap for Circular Economy in Serbia" [218]. The roadmap aimed to gather, promote and connect stakeholders which can contribute to a faster transition to circular economy. Additionaly it identified several priority sectors, construction has been selected as one of the priority sectors in Serbia's transition to a circular economy by the working group for the circular economy, which includes representatives of various stakeholders.

Analysis of the ex-ante effects of the circular economy initiated by the Ministry of European Integration and supported by the European Union was the first step in Serbia's strategic planning in this area [355]. The analysis highlighted the need for harmonization with the EU regulatory framework, a special circular economy agency, institutional coordination, fiscal incentives, national media campaign for circular economy; payment system for waste disposal; easier institutional and infrastructural use of RES; a mandatory share of recycled materials in the final product; a mandatory minimum of green public procurement in public procurements.

According to these findings, the MEP developed and adopted the Circular Economy Development Programme in the Republic of Serbia for the period from 2022 to 2024 (CE Programme) with the overarching goal of fostering the growth of the circular economy and the green transition in Serbia economy [130]. The most crucial areas for a circular economy are covered in this document, including waste management, water management, chemical management, renewable energy sources and energy efficiency, green public procurement, innovation, and awareness-building. The document also contains a three-year action plan with general and more specific objectives as well as key performance indicators.

For the built environment and the construction sector, the CE Programme envisioned improvements to the waste management system to enable efficient use of non-hazardous construction and demolition waste (CDW). The program's initiatives, however, are raising awareness oriented, and focused only on the analysis of the current situation and the creation of a construction and demolition waste management guideline. In contrast to the CE Programme, Waste Management Programme for the period 2022–2031 includes more specific objectives for the construction and demolition waste. These include a specific share of 40% of construction and demolition waste prepared for re-use by the end of 2029 and 70% of CDW pretreated CDW by the end of 2034 (soil excluded). The programme even highlights the need for the determination of legal frameworks which would enable the mandatory use of recycled aggregates (with the share of 10%, for example) in green public procurement.

Construction and Demolition Waste Management Regulatory Framework

Aside from several designated section in the waste management programe and the waste management act, currently there is no CDW specific legislation in Serbia. Only the definition of CDW is included in the act when it comes to CDW; while all other waste management provisions such as mandatory separation at source, reporting on generation and treatment, may be interpreted to apply to CDW as well. However, both the circular economy and waste management program highlight the need for the CDW specific by-law. Additionally, the draft of the Planning and Building Act Amendments, which is awaiting National Assembly adoption, contains various provisions focused on improved monitoring and reporting on the amounts of CDW generted and treated.

5.1.17.2 Platforms and Networks Facilitating the Transition to a Circular Economy

Circular Economy Platforms

There is no official platform, run by government or any of its administration bodies, for circular economy in Serbia. However there are two informal platforms created to promote circular economy prinicples in the national and local context. The first is Digital Platform for Circular Economy (CE HUB) created by the Chamber of Commerce and Industry of Serbia and the second "Circular Communities" is created in partnership of MEP and UNDP with the support of Global Environmental Fund (GEF). By displaying circular economyrelated information on best practices, potential grant opportunities, financial assistance, and business models, CE HUB strives to advance knowledge, enhance practice, and connect stakeholders from many sectors at the national level. On the other hand "Circular Communities" platform was created within the five year project "Reducing the carbon footprint of local communities by applying the principles of the circular economy in the Republic of Serbia" which has been implementing since March 2022. So far it has provided financial assistance for 19 local projects in the total amount of about USD 1.5 million.

In addition to these, two other circular economy related initiatives are identified: "Circular Economy Balkans Beacons" project and Centre for the promotion of Circular Economy. They are formed up of interested individuals and experts who primarily gather other individual experts in the field of circular economy and utilise their knowledge to advance new business models and raise awareness of the concept.

Circular Buildings Platform

No circular buildings platform has been established to date in Serbia. However, Serbia Green Budiling Council member of World Green Building Council and Serbian Demolition Association (SDA) member of European Demolition Association (EDA),

which promote selective deconstruction, primary separation, re-use and recycling of CDW and use of secondary raw materials in new buildings.

Building Materials Passport Platform

No building materials platform has been established to date in Serbia.

Public Procurement Platform

The public procurement in Serbia is governed by the Public Procurement Office and regulated by the Public Procurement Act [128]. In this act there are no specific provisions regarding the green public procurement criteria and procedures. However, Article 132 provides the posibility that the contract awarding criteria include cost-effectiveness approach such as life cycle costing or the price-quality ratio which shall be assessed on the basis of criteria, including qualitative, environmental and/or social aspects.

5.1.17.3 Funding Opportunities

Some potential funding sources that may support circular economy projects in Serbia include EU funds, international organisations and programmes such as UNDP, WB and GEF, as well as China Export and Credit Insurance Coorporation, etc.

European Union (EU). Serbia has been a candidate country for EU membership, and as such, there are various EU funding programs that may support circular economy projects. EU with its grants and favourable loans for 17 economy sectors is the biggest donor in Serbia**.** In cooperation with the RS Government, the EU donated and invested EUR 892 million in the environment sector in since 2007. Over EUR 192 million was invested to improve the waste management sector which directly supports the transition to circular economy. The current investment portfolio is based on the European Green Deal and the Economic and Investment Plan for the Western Balkans. The "EU for Green Agenda in Serbia" initiative was launched in 2021 by the EU Delegation and MEP and is implemented by UNDP, in cooperation with the Embassy of Sweden and the European Investment Bank (EIB) with additional funding from the Governments of Sweden, Switzerland and Serbia. Its objective is to contribute to the efficient, inclusive and sustainable implementation of the Green Agenda for the Western Balkans and its Action Plan.

European Bank for Reconstruction and Development (EBRD). In 2021, EBRD with the support of GEF and Austrian Fedreal Ministry of Finance have launched the program "Circular Economy Regional Initiative" in Turkey and Western Balkans. A USD 154.76 million will be used to support investments in the private sector particulary SMEs to implement resource-efficient technologies and adopt circular

business model. In addition to this programme EBRD provides credit lines to partner banks in Serbia under the Western Balkans Sustainable Energy Financing Facility (WeBSEFF) is a financing facility under which the EBRD provides credit lines to partner banks to lend to businesses and municipalities wanting to invest in energy efficiency and small-scale renewable energy projects.

The Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ). Since 2021, Germany and Serbia cooperates on sustainable climate policy in line with the climate objectives and the Green Agenda. In this partnership, GIZ helps to improve the legal, institutional and technical conditions for the use of renewable energies, improve energy efficiency, and supports the transition towards a green economy.

Global Environmental Fund (GEF). GEF endorse environmental related projects in Serbia either alone or in partnership with the United Nations (UN) or the World Bank (WB) since 2007. So far it has supported 26 projects which focused on climate change, land degradation, biodiversity, chemicals and waste.

World Bank. First Serbia Green Transition Programmatic Development Policy Loan providing EUR 149.9 million was developed in cooperation of the World Bank with French Development Agency (Agence Française de Développement, AFD) and the German Development Bank (Kreditanstalt für Wiederaufbau, KfW). The loan was approved in March 2023 for the acceleration of the clean energy transition and align harmonisation of domestic legislation with European Union standards on climate and environment action, with emphasis on waste and air quality management.

International Cooperation and Support from International Organizations

Aside from the aforementioned initiatives by the international financing institutions and organisations there are no other types of wider cooperation on this matter in Serbia.

5.1.17.4 Challenges, Barriers and Potential Improvements

So far challenges and barriers for the implementation of circular economy prinicples in Serbia were only identified in the Roadmap for Circular Economy in Serbia. The document included challenges from the regulatory, institutional and financial aspects one one side and lack of infrastructure and poor knowledge on possible implementation on another. More particular, the current legislation calls for harmonisation of national documents like strategic documents, laws and bylaws, technical regulations, etc. as well as documents in connection to the EU framework. While certain aspects of the regulations, such as the strategic documents for waste management, have been updated, the implementation of the existing regulations has remained a significant problem. This is particularly relted to the required primary sorting and high rates of illegal dumping, is also one of Serbia's main regulatory obstacles. Even if these issues

had not existed, the absence of a waste management infrastructure, however, would still hinder the circularity of CDW in Serbia as there are no other recycling facilities and organised recycling of CDW in Serbia save one central plant in Belgrade. This is something that the aforementioned waste management programme, which calls for the establishment of 26 mobile recycling facilities (one in each region), is acutely aware of. However, the finance for these facilities has been allocated to the private sector, which still lacks both financial incentives and knowledge of the circular economy implementation advantages.

5.1.17.5 Examples of Successful Implementation

Public Policy Initiatives

As part of a new development project funded by the Republic of Serbia, the abandoned industrial historic site "Ložionica" (Furnace Room) will be revitalised and readapted into a multifunctional centre for creativity and innovation. The 3600 m^2 Ložonica building complex has been standing for almost a century. It includes a water tower, a railroad roundabout and the furnace chamber, which is made of reinforced concrete. The project's fundamental principle is the preservation of the cultural and historical heritage in the present with reconstructed furnance room and water tower, with a clear emphasis on new elements and structures such as public open space around the roundabout and new office building.

Private Initiatives

FEPLO is a Serbian company manufacturing waterproof eco-panels that are used as construction material for rooftops and floor construction. To manufacture the waterproof panels, they use the carton packaging from communal and packaging waste, while instead of glue they add 10% of mouldable polymers. These panels have a wide range of use, as they're employed for rooftops, floors, walls and flooring. They are used as an alternative to wooden products.

The cement factories in the Republic of Serbia: Lafarge Serbia, Beocin;, CRH Serbia, Popovac, Paracin; Titan Cement Factory use dangerous and hazardous waste as an alternative fuel. In addition, this industry in the Republic of Serbia, uses more than 300,000 tons of non-hazardous and hazardous waste per year (mostly fly ash and granulated blast furnace slag) as an alternative raw material.

5.1.18 Slovakia Factsheet

The construction industry is one of the key sectors of the Slovak economy and the largest producer of industrial waste in the country. All industrial construction

activities combined account for 16% of total industrial waste generation. Meanwhile, the recovery rate of construction and demolition waste was only 51% in 2018. The demand for living space is increasing that projects a growing trend of demolishing and reconstruction of old building stock. The renovation of apartment buildings in Slovakia reaches 3% per year, which is an above-average rate in Europe-wide comparison. The renovation of buildings is a top priority of Slovakia's National Recovery Plan. Planned investments are around EUR 500 million for family houses and EUR 200 million for historical buildings. The environmental policy goals of the Slovakia and the current trends of the construction market create a need for new waste disposal sites with advanced recycling solutions [151].

5.1.18.1 Policy and Regulatory Framework

Governance

Slovakia does not have specific government institutions solely dedicated to implementing the circular economy. However, various government bodies and ministries are involved in promoting and implementing policies related to sustainability and resource efficiency. Key institutions and ministries in Slovakia that play a role in promoting the principles of the circular economy include:

- Ministry of Environment of the Slovak Republic (Ministerstvo životného prostredia Slovenskej republiky). The Circular Economy Section of the Ministry of the Environment—Department of Waste Management is looking more closely at this topic. The Slovak Environmental Agency (SAŽP), under the competence of the Ministry of the Environment, evaluates and monitors the indicators of the circular economy at national level (revised framework for monitoring the circular economy).
- Ministry of Economy of the Slovak Republic (Ministerstvo hospodárstva Slovenskej republiky). It is partly possible to identify efforts to implement elements of circularity in selected documents and activities of the Ministry of Economy of the Slovak Republic (e.g. in the energy policy and renewable resources areas).
- Ministry of the Transport of the Slovak Republic (Ministerstvo dopravy Slovenskej republiky). In Slovakia, the Ministry of Transport of the Slovak Republic is the body responsible for building administration, housing policy and construction. Its strategic documents do not explicitly include an elaborated strategy for the transition to circularity in the construction sector.

Legislation

In the Slovak Republic, the Construction Act (Act No. 201/2022 Coll.) primarily addresses construction-related matters. While the Act does not explicitly focus on circularity in the construction industry, it does regulate specific methods for handling

construction waste and outlines the responsibilities of various stakeholders involved in the construction process. For instance, according to §23, one of the obligations of the construction contractor is the "placement of construction products on the construction site and removal of waste from the construction site." Similarly, §26 mandates that the construction manager coordinate, receive, control, and document the delivery of construction products to the site, as well as the removal of waste, while maintaining records of such deliveries and removals.

The Act No. 133/2013 Coll. on Construction Products and on Amendments and Additions to Certain Acts, as amended by Act No. 91/2016 Coll., establishes the requirements governing the placement and availability of construction products in the market of the Slovak Republic. The legislation covers various aspects such as the authorization process for legal entities to perform technical assessments and assess and verify the consistency of the manufacturer's declared parameters regarding the essential characteristics of the products. Additionally, it outlines the rights and obligations of authorized individuals, manufacturers, and the responsibilities of state administrative bodies in this regard.

Many of the existing policy interventions and plans at the other life cycle stages introduce approaches with indirect circularity impacts. These include, for instance, policies related to the objectives of energy efficiency and renovation that are relevant for the use phase (i.e. Energy Efficiency Act, the Energy Performance of Buildings Act, and the Long-Term Building Renovation Strategy).

Circular Economy Strategy, Roadmap or Action Plan

The Slovak Republic has developed several cross-cutting strategies and regulations, which aim to set out a vision towards climate neutrality and sustainable development. The six policies directly or indirectly related to the circular economy in the construction sector include:

- the Sustainable Development Strategy to 2030 [223],
- the 2030 Environmental Strategy [216],
- the Recovery and Resilience Plan (RRP) [219],
- the Economic Policy Strategy until 2030 [208],
- the Low-Carbon Development Strategy [217],
- the National Energy and Climate Plan [328].

Besides the Recovery and Resilience Plan, which demonstrates the country's national commitment to steer the construction sector towards a circular economy around waste management, the policy targets and goals of the other cross-cutting strategies (related to the circular economy) remain rather limited and defined at a relatively high level. Moreover, many of the circular economy objectives are being addressed by targets and policies indirectly related to the circular economy, such as those concerning energy efficiency and renewable energy.

The Slovak Ministry of the Environment, in cooperation with the European Commission and the OECD, has worked on the technical basis for the preparation

of a roadmap for a circular economy in Slovakia since 2020. "A Roadmap Towards Circularity For Competitiveness, Eco-Innovation And Sustainability. Closing The Loop In The Slovak Republic. OECD Environment Policy Paper No. 30" (2022) provides a thorough overview of the business opportunities of the circular economy in Slovakia. The main objectives of the Roadmap are to improve waste management, decrease the environmental footprint, use natural resources effectively, support innovation progress, and increase the country's competitiveness [151]. A Roadmap Towards Circularity For Competitiveness, Eco-Innovation And Sustainability (2022) also includes the role of the construction sector in transitioning to a circular economy, giving an overview of the current situation and policy framework. The gap analysis informs policy recommendations to shift away from the focus on energy efficiency or construction and demolition waste (CDW) towards the integration of circular economy principles along the entire construction value chain. Key recommendations on how to transition to a circular construction sector in the Slovak Republic by 2040 are complemented with some concluding reflections.

The Waste Management Programme of the Slovak Republic (WMP SR) is a significant strategic document that guides waste management efforts in the Slovak Republic (SR) from 2021 to 2025. It has been developed in alignment with the principles of sustainable growth, as presented in the EU Action Plan for Circular Economy, the European Green Deal, and the New EU Action Plan for Circular Economy. The Programme also specifically addresses the management of construction and demolition waste, with the aim of increasing the preparation for re-use and recycling of such waste, including backfilling, to a target of 70%.

To achieve this target, the Programme establishes measurable indicators and outlines the following measures:

- Conduct analysis of construction waste, considering both organic carbon content and recycling and recovery possibilities.
- Incorporate obligations into decision-making authorizations of competent authorities (via legislation, guidelines, or methodological guides), including:
  a. Sorting requirements for expanded polystyrene used for building insulation.
  b. Implementation of selective demolition practices during building removal, along with the submission of photo documentation of the demolition process.
  c. Submission of evidence demonstrating the recovery of waste to the authorizing authority.
- Encourage research and development activities focused on new technologies for construction waste management.
- Promote the financing of technologies and projects aimed at recycling construction waste into higher value-added output products, utilizing recyclates as feedstock. However, funding for technologies primarily focused on shredding construction and demolition waste should not be supported.
- Consider the implementation of standards for wood waste management activities in line with the waste hierarchy principles.

- These measures reflect the commitment of the WMP SR to enhancing the circularity of the construction and demolition waste sector while promoting sustainable waste management practices.

The New Waste prevention program of the Slovak Republic for the years 2019–2025 was established in 2018. The new waste prevention measures include environmental education; application of the principles of green public procurement; implementation of voluntary instruments in the field of environmental policy (e.g., Eco-design, EMAS); adequate organizational, personnel, and financial coverage via increase landfill fees (2022); linking the activity with the 2030 Agenda for Sustainable Development and the preparation of the National Investment Plan of the Slovak Republic for the years 2018–2030 [151].

Construction and Demolition Waste Management Regulatory Framework

Waste management, including construction waste, is explicitly addressed in the Waste Act No. 79/2015, as amended, with subsequent acts such as Act 230/2022. Article 77 of this legislation governs the "Management of construction and demolition waste." The law provides a definition for construction waste and outlines the obligations of waste producers. It also introduces the concept of "selective demolition," which involves planning demolition activities to enable the separation and sorting of removed construction materials and waste. This provision can be considered a legislative framework aimed at enhancing the efficient sorting and management of construction waste, as well as incorporating elements of the circular economy into the construction industry.

The Waste Act No. 79/2015 sets the basis for a circular economy in the end-use-phase by introducing the principles of waste management hierarchy, applicable to all sectors. It also includes a construction-specific target that demands to recover 70% of non-hazardous Construction and Demolition Waste (CDW) by 2020 (derived from the corresponding EU obligation for 2020). The Waste Act also imposes a general obligation for responsible entities to reuse the produced CDW in constructions, renovations or infrastructure maintenance. At the same time, a large part of the recovered CDW still ends up as backfilling material rather than being recycled. The Waste Prevention Programme (WPP) [216] (https://www.minzp.sk/files/sekcia-enviromentalneho-hodnotenia-riadenia/odpady-a-obaly/registre-a-zoznamy/ppvo-sr-19-25.pdf) sets high-level targets and goals for nine waste streams, including for CDW, among others. The most recent Waste Management Plan for 2021–2025 singles out "circular economy" as one of its key priorities and extends the 70% CDW material recovery target to 2025. Further policy reform ambitions have recently been announced for the end-of-life stage as a part of the Slovak RRP, with a primary focus on CDW management reform. However, other priority objectives, related to the use of buildings in the RRP, remain at the level of improving building energy efficiency and decarbonisation.

Construction waste in Slovakia has traditionally been an untapped resource of valuable raw materials that can be reused and fully utilized within the construction industry. Regrettably, in 2018, almost half of the treated mineral waste from construction and demolition activities ended up in landfills in Slovakia. Only 37% of mineral waste underwent recycling, with approximately 13% utilized for backfill purposes. These statistics indicate one of the lowest performances within the European Union. Recognizing the urgency to address this issue, the Ministry of the Environment (MoE) has taken proactive measures. They have proposed an amendment to the Waste Act (Law 230/2022) for legislative consideration. The amendment specifically aims to promote the recovery and recycling of construction waste, aligning with the objectives outlined in the Recovery and Resilience Plan of the Slovak Republic, specifically COMPONENT 2: Building Renewal 1.1 Policy Area—Green Economy—Reform 3: Reform of construction waste management. The primary goal of this amendment to the Act is to enhance the potential of the circular economy within the construction waste and construction sectors. By doing so, it is expected to raise recycling rates significantly and prevent the generation of excessive construction waste. As an example, the amendment introduces modifications to waste management requirements for construction sites larger than 300 m^2. It mandates that a minimum of 70% of non-hazardous construction and demolition waste must be recycled, emphasizing the importance of sustainable waste management practices.

5.1.18.2 Platforms and Networks Facilitating the Transition to a Circular Economy

Circular Economy Platforms

The country's environmental policies consider waste management and recycling key tools to stimulate Slovakia's transition towards a circular economy. The current state of the country's waste management sector is desperate, more than half of the waste ends up in landfills, making Slovakia one of the most backward countries in the field of waste management. The utilization of secondary raw materials shows an emerging trend in the country. The platforms, associations of processors, recyclers, and manufacturers providing virtual space for trading are becoming significant players in the market. However, there is no uniform database in Slovakia comparing processing capacities across all classes of materials. Companies are seeking such databases to find a suitable technology for processing or suppliers for their material [151].

In Slovakia, there are currently several active platforms supporting and promoting the circular economy and its principles:

The Slovak Green Building Council (SKGBC) is the main ambassador of sustainable constructions in Slovakia. SKGBC brings together companies from different sectors of the economy and promotes quality construction and building renovation by organising meetings focused on sustainable solutions in the construction or renovation of buildings.

Circular Slovakia is a public–private platform for the promotion of a circular economy that brings together business companies, government and knowledge institutions, associations and NGOs with the ambition to accelerate the transition to a greener and circular Slovakia. Actually the platform brings together 66 entities.

The Institute of Circular Economy (INCIEN) is a non-profit organization that focuses on innovative environmental solutions in the field of waste prevention, environmental management. INCIEN collaborates with its partners on projects that represent the transition from a linear to a circular economic system. Within the framework of its projects, it introduces and implements circular economy in practice in the conditions of the Slovak Republic. INCIEN is composed of a team of experts who focus on waste management and circular economy issues. The basic effort is to create cooperation with research, but also governmental institutions, non-profit sector and experts in various fields. INCIEN is looking for a sustainable path from an environmental but especially economic perspective.

In Slovakia, the Green Economy Information Platform has been established as a hub for sharing and publishing solutions related to the circular economy, sustainable resource usage, energy efficiency, green buildings, and housing, among other topics. This platform serves as a valuable resource for information dissemination.

The Ministry of Economy of the Slovak Republic actively supports initiatives geared towards transitioning to a circular economy. One notable initiative is their participation in the MOVECO project (Mobilising Institutional Learning for Better Exploitation of Research and Innovation for the Circular Economy). This project aims to facilitate the transition to a circular economy within the countries of the Danube Region, while also promoting awareness of this important issue. In Slovakia, the Slovak Business Agency oversees the implementation of the MOVECO project, working in collaboration with various stakeholders to drive the circular economy agenda forward. The Ministry of Economy's involvement in this project demonstrates their commitment to fostering a sustainable and circular economy within the country.

Public Procurement Platform

Based on legislative changes, technological advancements, and the development of green public procurement practices in both the European Union and the Slovak Republic, the National Action Plan for Green Public Procurement in the Slovak Republic for 2016–2020 (NAP GPP III) was formulated. This action plan received approval from the Government of the Slovak Republic on 14th December 2016 through Resolution No. 590. At the national level, the **NAP GPP III** represents the third consecutive action plan focusing on concrete commitments by the State to promote the integration of environmentally friendly practices in public procurement. It serves as a guiding document for the implementation of green public procurement in the Slovak Republic.

The primary objective of the NAP GPP III is to establish a clear path for green public procurement within the context of the Slovak Republic. This is achieved by

outlining specific measures and activities that, when implemented through a proactive approach by relevant institutions, aim to achieve more ambitious targets for green public procurement from 2016 to 2020. The NAP GPP III demonstrates the commitment of the Slovak Republic to enhance sustainability and environmental considerations in public procurement processes, aligning with the broader goals of promoting a greener and more sustainable economy.

5.1.18.3 Funding Opportunities

National Recovery and Resilience Plan

The greening of the Slovak economy, including the construction sector, is primarily facilitated through funding allocated under the National Recovery and Resilience Plan. This funding is then directed towards national initiatives, such as the Household Greening and Climate Change Adaptation Programme (Green for Households, Renew the House, Renewal of Public Historic and Listed Buildings). Approximately €2.17 million has been designated through the Plan to support the development of the green economy.

Environmental Fund

The Environmental Fund was established to implement state-supported initiatives for environmental care and the creation of a sustainable environment. Its core mission is to provide financial resources, in the form of grants or loans, to applicants aiming to achieve the objectives of national environmental policies at various levels: national, regional, and local. Currently, subsidies can also be obtained from the Environmental Fund (administered by the Ministry of the Environment of the Slovak Republic) for circular activities and more efficient waste management. The fund supports various activities, including the construction of collection yards that facilitate preparation for re-use and re-use of products or product components that are not considered waste for the same purpose for which they were originally intended. It also supports the establishment and operation of re-use centers for collection, sorting, and re-use of materials.

Operational Programme Quality of the Environment (OP EQE)

Another funding opportunity for initiatives promoting the circular economy is the Operational Programme on Environmental Quality (OP EQE). It offers support in the area of Waste, specifically Investment Priority 1, which focuses on investing in the waste management sector to meet the requirements of the Union's environmental regulations and to address additional needs identified by Member States that go beyond these requirements. Within the context of waste management, the OP EQE

prioritizes activities related to the preparation for re-use and recycling of waste materials.

International Cooperation and Support from International Organizations

The Slovak Ministry of the Environment has established collaborative partnerships with the European Commission and the OECD in the pursuit of a circular economy. Since 2020, they have been actively engaged in developing the technical framework for a circular economy roadmap in Slovakia. You can find more information on this topic in the following document:

Furthermore, Slovakia has engaged in cooperation with the **World Bank** to advance circularity efforts.

One noteworthy example of international cooperation is the collaboration between the Dutch organization Circle Economy and the capital city of Bratislava. They are currently working together to conduct a scan of the city's material flow, with the aim of providing recommendations to enhance circularity within the city.

5.1.18.4 Challenges, Barriers and Potential Improvements

The Slovak construction sector faces notable obstacles and unexplored possibilities when it comes to reducing the reliance on virgin raw materials and encouraging the utilization of recycled building materials. Not only is construction a vital economic sector in the Slovak Republic, but it also accounts for over half of the country's domestic raw material consumption and generates a substantial amount of waste. Until recently, efforts to promote circularity within this sector have been limited, with most of the emphasis placed on enhancing the energy efficiency of buildings.

However, both new construction projects and renovations present significant opportunities for applying principles of the circular economy. Currently, there is a lack of incentives in Slovakia that actively promote circular design and the adoption of secondary building materials, which possess immense potential in reducing material consumption and mitigating associated environmental impacts.

The transition to a circular economy in the Slovak Republic holds significant potential for reducing greenhouse gas (GHG) emissions. The construction sector, in particular, presents the greatest opportunity for GHG emissions reduction through the application of circular economy principles in steel and cement production. Slovakia could consider several key activities to contribute to its climate targets, such as increasing the use of alternative materials to steel, promoting space-sharing practices in non-residential buildings, and improving the recycling, recovery, reuse, and upcycling of construction and demolition waste.

By reducing the use of concrete, cement, and steel throughout the life cycle of buildings, emissions from buildings in the EU could potentially be reduced by 61% in 2050 compared to 2015 levels (Ramboll, Fraunhofer ISI, and Ecologic Institute

2020). These activities align with the goal of closing the loop and achieving a more circular construction sector in Slovakia [252].

To further support the implementation of circular economy principles, the establishment of material banks becomes crucial across different sectors of the national economy, including construction. In environmentally friendly demolition practices within the construction sector, materials can be separated for reuse or used as inputs for producing new products. Building materials should be viewed as valuable resources that can be stored and utilized throughout their life cycle. An excellent example of such practices in Slovakia is Cyrkl, an organization that operates a free digital marketplace. Cyrkl enables the selling and buying of industrial waste, by-products, secondary raw materials, and used materials. The marketplace also provides circular solutions and optimization of material flows and management, utilizing tools such as the Circular Waste Scan. Cyrkl also conducts projects focused on material recovery from the demolition process and optimizing material flows for the production of construction materials.

Key policy recommendations to help the country transition to a circular construction sector are:

- Strengthening evidence-based policy making and multi-stakeholder collaboration
  - Improve the measurement and monitoring of CDW flows from producers to final waste processors.
  - Develop a comprehensive overview of the national building stock and its renovation needs.
  - Strengthen the collaboration and partnerships between stakeholders from across the value chain.
- Policy recommendations related to extraction, design and construction phases
  - Consider introducing an aggregates tax to discourage the extraction of construction minerals.
  - Introduce a quality standard for recycled construction materials.
  - Introduce minimum recycled content requirements for specific construction products.
  - Increase the use of GPP criteria in the construction sector to stimulate the market for the construction and renovation of sustainable buildings, possibly including minimum recycled content requirements as a GPP criterion.
  - Encourage business model innovation for accessing secondary materials and for developing new recovery processes and technologies.
  - Use future construction projects as pilots to test and apply circular economy principles and innovations.
- Overview of buildings use and renovation-related policy recommendations
  - Investigate the potential of using fiscal instruments (tax benefits or subsidies) to stimulate the use of secondary and renewable materials in renovations.
  - Examine the potential of revising some of the zoning codes to include more flexibility in space distribution and utilisation.

- Overview of policy recommendations related to end-of-life, reuse and recycling
- Gradually increase the landfill taxes (in place from July 2022), and reform the redistribution of proceeds from the landfill tax in combination with greater waste management enforcement.
- Remove legal obstacles to the use of recycled materials by implementing EoW criteria for some additional construction and building materials (in place from June 2022).
- Introduce mandatory selective demolition, including a system of inspection/audit before and after demolitions take place (in place from June 2022).
- Consider expanding EPR to construction products or specific renovation waste.

5.1.19 Spain Factsheet

5.1.19.1 Policy and Regulatory Framework

Governance

The Spanish Circular Economy Strategy (*España Circular 2030*) [192] was approved in June 2020 by the Ministry for Ecological Transition and Demographic Challenge (known as MITERD, previously MITECO). The Strategy, aligned with the European Green Deal (among other international regulations, strategies and plans) has the main purpose of promoting a new production and consumption model in a country, Spain, with a GDP of EUR 1 122.0 billion (which represents the 8.4% of EU27 total in 2020, according the aforementioned Strategy), in order to contribute to achieve a sustainable and decarbonised economy. The Strategy identifies **six priority sectors**, including the construction sector, which is a very significant sector within the Spanish economy (the sector contributed 6.5% of Spanish GPD in 2018, according the Strategy), with a substantial impact in the environment. Therefore, the fulfilment of the circular target set by the Plan for the construction sector "which involves both environmental and financial benefits".

The Spanish Government, again through the MITERD, is also in charge of developing and approving triennial action plans to implement this Strategy, whose progress will be assessed through a group of indicators include on the basis of those introduced in the EU CE Monitoring Framework. Moreover, sectoral action plans are pointed out as another tool to implement the Spanish Strategy, being also aligned with the climate goals set by the Paris Agreement and the objectives of the European Commission's circular economy strategy.

The first of these plans, already adopted, is the Circular Economy Action Plan I (2021–2023) [195]. This plan was approved on 25 May 2021 and is divided into five axes and three lines of action. By the successive action plans a series of quantifiable goals are expected to be met by 2030. Among them, it could be highlighted the goal of "reducing greenhouse gas emissions to less than 10 million tons of carbon dioxide equivalent", with the construction sector playing a key role in achieving that goal.

The Spanish governance model outlined to assess the progress of the Strategy implementation includes three difffent bodies that introduce the perspective of the different administrations involved (at national, regional, and municipal levels). In fact, the regional governments (known in Spain as autonomous communities) are empowered to develop their own Circular Economy strategies, plans and regulations, aligned with the national ones; indeed, some of these autonomous communities have already done it (for example, the Basque Country Region).

Legislation

Apart from the above, no other specific national Circular Economy legislation has been established to date. However, several Circular Economy policy elements are included in different national policies already in place. In fact, the Law 7/2022, of April 8th, on waste and contaminated soils for a circular economy (in Spanish), Ley 7/2022, de 8 de abril, de residuos y suelos contaminados para una economía circular [159] can be considered as an important instrument to support the Spanish Circular Economy Strategy since it includes some fiscal measures to promote the circular economy (among other measures aligned with the Strategy).

Another policy element to highlight is the Spanish Urban Agenda [188], aligned with the Urban Agenda for the EU, which included measures to promote circularity within materials cycle, for example. It should be highlithed another legal document, the Orden PCI/86/2019 [190], by which was approved the Green Public Procurement Plan (2018–2025), including legal criteria for sustainable production and waste management (for example, the use of sustainable construction materials, taking into account their lifespan). Moreover, the long-term decarbonisation strategy [193], published in November 2020, also includes measures linked to circularity, such as the adaptation of infrastructure to efficient and circular consumption systems in order to support decarbonisation goals.

Regarding the activities in the field of building work, within the document known as Just Transition Strategy [203], the need of a Circular Economuy thinking in building refurbishment plans was noted. The Law 7/2021, of May 20th, on climate change and energy transition (in Spanish, Ley 7/2021, de 20 de mayo, de cambio climático y transición energética, [158]) includes an article (Article 8) focused on the energy efficiency and building rehabilitation that introduce Circular Economy measures to be applied in construction materials (for example, the usage of “materials with the smallest carbon footprint”) or building services (for example, “the management of demand and the use of energy from renewable sources in the field of building”).

Construction and Demolition Waste Management Regulatory Framework

The conditions for the construction waste management were specifically addressed by the Royal Decree 105/2008, of February 1st, regulating the production and management of construction and demolition waste—CDW—(in Spanish, Real Decreto 105/2008, de 1 de febrero, por el que se regula la producción y gestión de los residuos de construcción y demolición [189]). Coming into force in 2008, it was developed to establish the legal framework for CDW, to promote "their prevention, reuse, recycling, and other forms of valorization, ensuring that those destined for disposal operations receive appropriate treatment, contributing to a sustainable development of the construction activity". This regulation has been complemented by the aforementioned Law 7/2022. The Law 7/2022 set as an objetive that reaching a minimum of 70% by weight of the total waste generated of non-hazardous CDW being prepared for reuse, recycling, and other material recovery. Moreover, this Law has an article (Article 30) focused on the CDW which, apart from regulating its management, includes some circular measures as is the case of the obligation (on 2024) for the demolition to be preferably carried out selectively.

5.1.19.2 Platforms and Networks Facilitating the Transition to a Circular Economy

Circular Economy Platforms

The organizational model of the Spanish Circular Economy Strategy establishes the creation of Council for Circular Economy. The main purpose of this Council is "to promote collaboration between public and private sectors so as to speed up the transition towards a circular economy both in the public and private spheres" [194]. To achieve that goal, the Council must develop, implement, monitor, and review annual proposals in the framework of the Spanish Strategy.

Circular Buildings Platform

No circular buildings platform has been established to date. Nevertheless, the Green Building Council of Spain (GBCe) is taking a lead role in the promotion of Circular Economy in the building environment. It can be mentioned the report "Circular Economy in Construction" [356], developed with the objective of diffusion, mobilization of the sector, and raising awareness among professionals to promote a transition of the sector toward a Circular Economy.

Building Materials Passport Platform

No building materials platform has been established to date at national level.

Public Procurement Platform

The aforementioned Green Public Procurement Plan [190], approved in 2019, includes some legal criteria for green public procurement of products and services considered as priorities by the EU. Under this Plan, the official public procurement platform will have a section dedicated to helping develop specifications with the criteria approved to promote a sustainable production and waste management in the construction sector.

To the best of our knowledge, this section is not yet fully operational.

5.1.19.3 Funding Opportunities

Although European funds have supported various projects and initiatives in Spain related to energy-efficient buildings and improving waste management in the construction environment during the last few years (for example, through the European Regional Development Fund), nowadays, the most relevant ones are supported via the Recovery and Resilience Mechanism funds, the European funds mobilized to help rebuild a post-COVID-19 Europe.

National Recovery and Resilience Plan

The Spanish **Recovery, Transformation and Resilience Plan** (PRTR) [107] is the instrument that allocates the European funds linked with the Next Generation EU Instrument. This plan set up some measures aimed at facilitating the economic recovery needed after the coronavirus pandemic by speeding up the transition to a more digital and greener economic model. Among the 30 components included in the Plan, the number 12 adresses the objective of promoting the Circular Economy in various industrial sectors, for instance, by supporting the implementation of the Spanish Circular Economy Strategy and waste regulations (addressed in Investment 3 of the Component 12) [90].

In addition, the Circular Economy has been introduced as a cross-section in several components of the plan; the Component 2 directly addresses this topic in the construction sector by including CE requirements in the building refurbishment programmes. The Royal Decree 853/2021, of October 5th, regulating assistance programs for residential rehabilitation and social housing as part for the Component 2 of the PRTR (in Spanish, Real Decreto 853/2021, de 5 de octubre, por el que se regulan los programas de ayuda en materia de rehabilitación residencial y vivienda social del Plan de Recuperación, Transformación y Resiliencia, [191]) sets some circular measures as a requirement for receipt of the aid.

Finally, it is worth noting that the PRTR contemplates the implementation of various Strategic Projects for Recovery and Economic Transformation (PERTEs) to bring together all levels of government and the private sector. Among these PERTEs there is one on Circular Economy with a budget of EUR 492 million seeking to

increase the competitiveness of industrial sectors and companies in general in this area [108].

International Cooperation and Support from International Organizations

As already noted, the Green Building Council of Spain (GBCe) is providing technical support, taking a lead role in the promotion of Circular Economy in the building environment. We lack awareness of any official organization offering direct financial assistance in this particular domain.

5.1.19.4 Challenges, Barriers and Potential Improvements

As already mentioned, there are several challenges and barriers related to different areas of implementation of circular economy in the built environment. In the case of Spain, two Catalogues of Best Practice in Circular Economy has been developed by the MITERD [204, 205], where the companies participating in them laid down the main difficulties encountered to carry out circular economy activities. These companies assessed a list of non-country specific circular economy barriers as they perceived, obtaining the ranking of those barriers shown below (Table 5.5). As a result of the analysis carried out, various policy initiatives have been developed to address the main obstacles and challenges have been encountered.

5.1.19.5 Examples of Successful Implementation

Although the Spanish data are still below the most advanced European countries in this particular area, they show a positive trend in the last few years [90]. This is mainly because of the policy initiatives already implemented at different levels.

The already mentioned Catalogues of Best Practice in Circular Economy [204] also collect relevant initiatives coming from the private sector. The General Sub-Directorate for the Circular Economy of the Ministry in charge of developing these cataloghes is working on the implementation of a database with the examples of CE activities already mapped.

Public Policy Initiatives

Apart from the legislation already in place before mentioned, work is now being carried out on new legislation in the Circular Economy area. These new legislation initiatives aim to introduce the new European regulations, including the 2035 targets [90].

Table 5.5 Ranking of circular economy barriers after the companies assessment

Ranking (Rk.n)	Circular economy barriers
Rk.1	Lack of circular regulation
Rk.2	Behavioral change/lack of awareness or cooperation
Rk.3	Recognition of by-products/secondary raw materials
Rk.4	Lack of circular infrastructure/technical or logistical…
Rk.5	Absence of legal standards and definitions
Rk.6	Administrative burden
Rk.7	Complex process to make it circular
Rk.8	High initial investments
Rk.9	Quality problems
Rk.10	Cooperation with authorities
Rk.11	Useful applications of recycled materials
Rk.12	Insufficient demand
Rk.13	Access to relevant information and applicable assessments
Rk.14	Low return on investment
Rk.15	Lack of incentives
Rk.16	Time-consuming processes
Rk.17	Organizational structures
Rk.18	Other
Rk.19	Quantity problems
Rk.20	Access to financing
Rk.21	Transboundary waste shipments
Rk.22	Price volatility
Rk.23	Lack of implementation

Source MITERD [204, 205]

There are also regional and local public initiatives to be highlighted, such as the Circular Thinking Initiative [154] developed by the Basque Department of Environment of Basque Country region or the initiatives in this area implemented by the cities of Valladolid or Gijón.

Private Policy Initiatives

The Spanish Association for Standardisation (UNE) lead a study on standards techniques capable of supporting different aspects of the Circular Economy [340], in order to highlight the availability of reliable tools for reducing the use of raw materials and promoting a better waste management [90].

5.1.20 Türkiye Factsheet

5.1.20.1 Policy and Regulatory Framework

Governance

With the spread of the circular economy concept in recent years, important studies have been carried out by the Ministry of Environment, Urbanization and Climate Change (MoEUCC), especially on effective resource and waste management. In this context, the concept of "circular economy" serves as a guide for many of the MoEUCC's studies in the field of legislation and implementation. Within the scope of the "Green Deal Action Plan" published by the Ministry of Commerce, an action has been defined for "Determining Priority Sectors in the Field of Circular Economy" and "Conducting Detailed Impact and Needs Analyzes" and MoEUCC has been assigned as the responsible institution for this action. The main output of the action; "Preparation of Needs and Impact Assessment Reports" for sectors. While studies on prioritization of sectors are carried out; Areas such as textile, plastic, construction and manufacturing will be examined in detail. Another action that is under the responsibility of MoEUCC is "Second Phase of 2023". "Preparation of the Circular Economy National Action Plan by the 2nd Quarter" [175]. The main output of the action, there will be a "Circular Economy National Action Plan" and "determination of technical criteria for the use of recycled secondary materials". With the amendment made to the Environmental Law in December 2020; General principles regarding the dissemination of "zero waste" and "circular economy" practices and the protection, improvement and prevention of pollution of the environment are also included in the Law. Another important step taken with this change is; It is a regulation regarding the "compulsory use of waste or recycled materials obtained from waste", which will contribute greatly to our country's circular economy vision in the coming period. To ensure that all these studies are carried out systematically, to determine our country's road map for the circular economy and to strengthen Türkiye's institutional and technical capacity in the transition to the circular economy in line with the EU Circular Economy Model, the "Technical Assistance Project for the Assessment of Türkiye's Transition to the Circular Economy Potential" 07.02.2022. It was officially implemented on the project is carried out by the Department of Circular Economy and Waste Management, where the Department of European Union Investments of the General Directorate of European Union and Foreign Relations of the Ministry of Environment, Urbanization and Climate Change is the Contracting Authority, and is carried out by the European Union Pre-Accession Assistance Instrument (IPA) II. It is supported under the Environment and Climate Action Sector Operational Program within its period.

Legislation

"Law No. 7261 on the establishment of National Environmental Agency and related amendments:" This Law lays down rules for the establishment of Turkish Environmental Agency for the prevention of environmental pollution; the contribution to the protection, improvement and development of green areas; the increase in resource efficiency in line with the circular economy and zero waste approach; and the establishment, operation, monitoring and control of deposit management system on a national scale. This Law sets forth provisions on the activities, structure and budget of the Agency. This Law makes amendments in the Environment Law No. 2872 in the fields of strengthened waste management, recycling, and clean technologies. Furthermore, Article 20 is amended regarding the activities without environmental permit or environmental permits and licenses and related penalties. Provisional Clause 14 is added regarding the establishment of eco-labelling system.

Circular Economy Strategy, Roadmap or Action Plan

National. According to the "Republic of Türkiye Updated First Nationally Determined Contribution" document published in April 2023, the national circular economy action plan and circular economy strategy and action plan was stated as being drafted.

In order to reach the net zero target by 2053, protect the natural environment and improve competitiveness, a resource efficient and sustainable circular economy is important. In this sense, The "Green Deal Action Plan" (GDAP) of Türkiye was published on 16th of July 2021 with the Presidential Circular numbered 2021/15. The Action Plan, including a total of 32 objectives and 81 actions under nine main headings, dwells on the green transformation of Türkiye's industries and the adoption of measures especially in areas related to trade and industry. The GDAP includes actions to be taken in a wide range of areas, such as Combating Climate Change, a Green and Circular Economy, Green Finance, Carbon Border Adjustments, Clean, Affordable and Secure Energy Supply, Sustainable Agriculture, Sustainable Smart Transportation and Diplomacy in order to facilitate the green transformation towards a lowcarbon, resource-efficient and circular economic structure. As a country that understands the value of adaptation policies, Türkiye has acted decisively in this area and is dedicated to the pursuit of its goals across a wide range of initiatives, including impact, vulnerability, and risk assessments, information systems, legal and political instruments at the national and local levels, capacity building, financing, monitoring, and implementation. Some important adaptation efforts are National Climate Change Adaptation Strategy and Action Plan (NASAP), National Drought Management Strategy Paper and Action Plan (2017–2023), National Report on Land Degradation Neutrality for Türkiye (2016–2019), National Basin Management Strategy and Action Plans (2014–2023) In accordance with international standards, Türkiye is enhancing its green financial ecosystem to foster investment opportunities for more ambitious climate action. Financial institutions are key for greening the

financial system. There have been number of developments to improve the green financial ecosystem in Türkiye. One of the most important of these developments is "Sustainable Banking Strategic Plan 2022–2025".

According to the The National Action Plan for Waste Management (NWMAP) 2016–2023 in Türkiye, the key targets are included [174]:

- Recycling rate to be increased by 35% by 2023. The recycling rate for glass, plastic, metal and paper are to increase to 60% by 2023;
- Collect 4.6 million tonnes of packaging waste at the point of origin by 2023; and
- Construction of three new incinerators for hazardous waste.

Regional. Türkiye, one of the parties to the Barcelona Agreement, has submitted its commitments to the "Sustainable Consumption and Production Regional Action Plan for the Mediterranean," which is built around: "By 2027 a prosperous Mediterranean region is established, with nonpollutant, circular, socially inclusive economies based on sustainable consumption and production patterns, preserving natural resources and energy, ensuring the well-being of societies and contributing to clean environment and healthy ecosystems that provide goods and services for present and future generations." [339]. The SCP Regional Action Plan has been implemented under regional programs like the EU-funded SwitchMed Programme, however, Türkiye could not participate in such regional programs and only be integrated as an observer. In addition, although Türkiye has a variety of policy instruments, including strategies and measures to reduce the adverse influences of high-impact sectors resulting from carbon-, energy-, waste-intensive current consumption and production techniques, indicator 12.1.1 of SDGs, "Countries with sustainable consumption and production (SCP) national action plans or SCP mainstreamed as a priority or a target into national policies" still has not reached a satisfactory level.

Construction and Demolition Waste Management Regulatory Framework

"Regulation on Demolition of Buildings" was published in the Official Gazette on 13 October 2021 by the Ministry of Environment and Urbanization (Official Gazette Directive 31627). This regulation mandates selective demolition in buildings to facilitate the implementation of the circular economy. It involves the separation of materials that can be reused during selective demolition, thus preventing waste generation. Throughout the demolition process, waste is segregated and stored separately, ensuring their recycling. Waste that cannot be recycled is disposed of in compliance with applicable regulations.

Regulation of the "Control of Excavation Soil and Construction and Demolition Waste" number 25406 enacted by the Ministry of the Environment and Forestry which came into force on March 18th, 2004 (Official Gazette Directive 25406). The purpose of this Regulation is; to regulate the technical and administrative issues and the general rules to be followed regarding the reduction, collection, temporary accumulation, transportation, recovery, evaluation and disposal of excavation soil

and construction and demolition wastes at the source in a way that does not harm the environment.

5.1.20.2 Platforms and Networks Facilitating the Transition to a Circular Economy

Circular Economy Platforms

Since 2016, BCSD Türkiye and EBRD have joined forces to create awareness and accelerate the transition to circular economy in Türkiye by providing tools and technical support that enable businesses to move away from the traditional ineffective way/concept to a more powerful way of doing business. The journey started with Türkiye Materials Marketplace that was instrumental in creating an ecosystem around circular economy. Through the course of the past 4 years BCSD Türkiye felt the need to create a space where anything and everything on circular economy is explained in detail. With the establishment of Türkiye Circular Economy Platform, BCSD Türkiye aim to provide practical solutions, incentives, news and opportunities in the field of circular economy. The platform at hand includes a knowledge hub, an e-commerce platform (Türkiye Materials Marketplace), measurement tools, and offers training, financial opportunities, and consultancy services for companies that are truly looking to accelerate their transition to circular. BCSD Türkiye believes this joint effort will support businesses to identify opportunities and provide solutions to turn them into reality.

Circular Buildings Platform

No circular buildings platform has been established to date.

Building Materials Passport Platform

No building materials platform has been established to date.

Public Procurement Platform

No public procurement platform has been established to date.

5.1.20.3 Funding Opportunities

TÜBİTAK (The Scientific and Technological Research Council of Türkiye): is a prominent government agency in Türkiye that supports research and innovation

projects across various sectors, including construction and sustainability. TÜBİTAK often offers research grants and funding opportunities for projects that promote environmental sustainability, resource efficiency, and circular economy practices. Researchers, universities, and businesses in Türkiye can apply for TÜBİTAK grants and programs related to sustainable construction and circular economy research and development.

International Cooperation and Support from International Organizations

Horizon 2020 (European Union Program): While Horizon 2020 is an EU program, Turkish researchers and organizations can participate in Horizon 2020 projects and access funding opportunities through collaboration with European partners. Horizon 2020 has funded research projects focused on sustainable construction, circular economy, and resource efficiency. Turkish entities can join these consortia to benefit from funding and expertise. COSME Program (EU Program for Small and Medium-sized Enterprises): COSME is another EU program that supports small and medium-sized enterprises (SMEs). Turkish SMEs involved in construction or related industries can explore funding and support opportunities under COSME, particularly in projects related to sustainability and circular economy. European Structural and Investment Funds (ESIF): Türkiye, as a candidate country for EU membership, can access European Structural and Investment Funds (ESIF) to promote regional development and sustainable growth. ESIF funds may be allocated to projects aimed at improving environmental sustainability, including circular economy practices in construction, within eligible regions in Türkiye. National Development Agencies: In addition to TÜBİTAK, Türkiye has several regional development agencies that offer funding and support programs for projects contributing to regional economic development and sustainability. These agencies may support circular economy initiatives in construction on a regional level.

5.1.20.4 Challenges, Barriers and Potential Improvements

The main challenges and barriers to the implementation of circular economy in the built environment in Türkiye can be defined as follows:

- Lack of financial and economic aid;
- Deficiencies in the legislation and standards on waste;
- Lack of awareness regarding the environment;
- Lack of cooperation between stakeholders;
- Insufficient effective areas for waste collection and separation;
- Lack of innovation in recycling and low efficiency in recycling systems;
- Uncertainty about circular economy targets and strategies;
- Lack of temporary holding sites;
- Insufficient methods for sorting, transporting and recycling waste;

- Weaknesses in environmental regulations and insufficient monetary sanctions;
- Insufficiency in awareness regarding environmental protection;
- Insufficient advertising and media coverage for waste management.

The particularly important areas for improving the implementation of the circular economy in the built environment in Türkiye can be defined as follows:

- Governmental measures, landfill bans, taxes, green public procurement supporting recycling;
- Development of new standards;
- Develop further life cycle analysis indicators for the saving of natural resources;
- Adopting a secondary raw materials policy;
- New technological development/new business models.

5.1.20.5 Examples of Successful Implementation

Public Policy Initiatives

The UK-Türkiye GreenLegOuse project has created a flexible, Lego-like construction system that can be quickly built to provide affordable accommodation for low income communities, including the homeless, slum dwellers and refugees, not only in Newton Fund partner countries but countries all around the world [247]. The system can also be disassembled and reassembled, increasing its reusability and recyclability with easy-to-implement, low-cost and energy-efficient techniques, and removing the need for heavy demolition processes and the pollution this creates. Within the scope of project, the first-ever real-time demonstration of a fully demountable 1-story building constructed in 2021 with construction and demolition waste (CDW)-based geopolymer concrete has been constructed and completed. After the successful construction of the green building, it is believed that real-time demonstration of the study's outcomes in the field will help the impact of this study to last for years to come and will be used as a viable tool and advertisement element for anybody who is interested in making collaborations/learning more about CO_2 capture/storage, innovative CDW recycling and design-for-demountability for future reuse.

Private Policy Initiatives

No data to this point.

5.1.21 United Kingdom Factsheet

5.1.21.1 Policy and Regulatory Framework

Governance

The United Kingdom (UK) Government has committed to the circular economy. It has been horizon scanning to identify best practice internationally, for example, the EU's Circular Economy Package (CEP). Under its transition out of the EU, the UK is required to transpose the CEP into UK law. It also recognises the trade benefits of alignment with the EU bloc. Governance is spread across various departments and through the devolved institutions in Scotland, Wales and Northern Ireland, see below [135]. Details can be found on the UK Government portal.

At national and English level, the Department for Environment, Food and Rural Affairs (Defra) is taking the lead. In 2018 A Green Future: Our 25 Year Plan to Improve Environment [139] for England was published, with a sub-section of which is the Resources and Waste Strategy (RWS). Within the devolved administratons, the Department of Agriculture, Environmental and Rural Affairs (DAERA) is overseeing this and the Climate Change Act in Northern Ireland. The Scottish Government was the first of the UK nations to publish its circular economy strategy [12]. Zero Waste Scotland (ZWS) is the lead body, funded by the Scottish Government, responsible for promoting and advising on all circular economy issues. ZWS is a not-for-profit environmental organisation that works alongside government, local councils and other bodies to jointly deliver a more circular economy [351]. The Welsh Government has expressed its commitment to accelerating the transition to a circular and low carbon economy in the circular economy strategy. The Department for the Economy launched a public consultation on the draft Circular Economy Strategy for Northern Ireland in January 2023 [51].

Legislation

The Environmental Act [140], introduces legislation around waste and resource efficiency within England and Wales. The CEP Directive was transposed into UK law through *The Waste (Circular Economy) (Amendment) Regulations 2020* [136]. In 2023 the Scottish Government published the Circular Economy Bill [10].

Measures have been implemented by each UK nation:

- Technical guidance WM3 has applied in the UK from 1st July 2015. This was updated in 2021. This document provides guidance on waste classification. It is a comprehensive reference manual for anyone involved in producing, managing and regulating waste [137].
- The Welsh Government has created a portal outlining planning policy and guidance on waste [357].

- Scotland waste legislation may be accessed from their Waste Legislation portal [321].
- In North Ireland waste is overseen by the Department of Agriculture, Environment and Rural Affairs, who along with the Northern Ireland Environment Agency oversee the provinces waste legislation, which may be accessed through their portal [48].

In addition, the British Standards Institution launched a guide for organisations in adopting a circular economy approach to their business model—BS 8001:2017 [16]. It outlines what the circular economy is and how to implement its principles in the delivery of both products and services.

Circular Economy Strategy, Roadmap or Action Plan

The Scottish Government published *Making Things Last*, their CE strategy, in 2016 [12], which sets out a vision to move Scotland from a linear to a circular economy. In this strategy four areas are prioritised:

1. Food and drink, and the broader bio-economy
2. Remanufacture
3. Construction and the built environment
4. Energy infrastructure.

Construction and demolition waste accounts for about 50% of all waste in Scotland and influencing the built environment has an impact on wider resource efficiency. The construction sector is the biggest user of materials responsible for over half of total carbon emissions when the operation of buildings is included. The strategy sets the following priorities related to the construction sector:

- ensure building designs consider waste reduction in both new build and refurbishment, while also enabling more reuse and recycling at end of life
- supporting SMEs to deliver building projects with the potential to deliver significant impact that can be scaled up and repeated
- build capacity to deliver change in the construction sector in collaboration with the Construction Scotland Innovation Centre and other partners
- avoid depletion of primary aggregates and timber resources through enhanced recycling of demolition materials.

In Wales, *Beyond Recycling* has been launched in 2021 [358] to make Wales a circular, low carbon economy with zero waste by 2050. They commit to prioritising the use of sustainable and low carbon materials in construction in Wales to support progress towards whole life net zero carbon for construction projects. These metarials are intended to be used first for public sector construction, the refurbishment of the social housing stock, and the construction of new schools.

In 2022, the UK's Competition and Markets Authority (CMA) gave advice to the UK Government [27]. This advice included changes to consumer law so that consumers can make more sustainable choices, effective enforcement where breaches of consumer law lead to environmental harm and identifying other ways of promoting more sustainable consumption.

The Northern Ireland Executive has been developing a Circular Economy Strategy. This started with a construction demolition/waste policy in 2017, that was updated in 2024 [47]. Their vision is to have an innovative, inclusive and competitive economy by 2050 where business, people and planet flourish, with responsible production and consumption at its core. They acknowledge the need to increase the provision, quality and accessibility of secondary and regenerative comnstruction materials. They highlight the role of stakeholder engagement to make the secondary building materials market competitive and the need for collaboration across the entire value chain from architects, manufacturers, designers and regulators to contractors. It had a consultation which concluded in March 2023, led by the Department of the Economy [51]. This was based upon *The Circularity Gap Report* [9] which provided a snapshot by applying circularity metrics to the Northern Ireland economy. One significant finding was that the Northern Ireland economy was less than 8% circular, meaning that over 92% of the economy consumes virgin material to maintain itself. The construction and agriculture sectors were highlighted for focus for change.

5.1.21.2 Platforms and Networks Facilitating the Transition to a Circular Economy

5.1.21.3 Circular Economy Platforms

The Climate Change Committee and the UK's Green Building Council (UKGBC) have been pro-active in promoting the Circular Econony. The London Mayor's office have launched a Good Design Guide for the Circular Economy [104]. The UKRI have established a hub for five national centres for research on the circular economy [338].

Circular Buildings Platform

The UKGBC has established a platform to promote CE [336]. This contains significant guidance on the transition required.

Building Materials Passport Platform

A materials passport for buildings is being trialled in London [161]. The New Civil Engineer reports that this could form the basis of a UK wide materials database. They are working in conjunction with Circuland to produce the Circuland Platform.

Public Procurement Platform

The Scottish Government has launched a platform to inform and support circular procurement [322].

5.1.21.4 Funding Opportunities

UK Government has issued a roadmap on Sustainable Investing [138].

International Cooperation and Support from International Organizations

No data to this point.

5.1.21.5 Challenges, Barriers and Potential Improvements

Stakeholders in the construction industry cite a number of challenges and barriers to the implmentation of a circular economy in the UK. The UK Government and the devolved insitutions have set out clear strategies that point towards the adoption of a circular economy, but there is little legislative leverage to help. The UK Government is primarily focused on a market driven adoption using levers of government to promote CE, with one stakeholder saying that there was a '… reliance on manufacturers to do the *right thing* with no enforcement, and a lack of meaningful choices'.

Challenges raised include cost of recycled material, in-built supply chains, a lack of knowledge of the circular economy, or the need to become sustainable. Some cite a lack of government funding to develop products and a lack of meaningful regulation. A lack of clear quantifiable performance metrics was raised. This shows a lack of dissemination of material developed by Royal Institution of Chartered Surveyors (RICS) [284] and the UKGBC—however, it does point out a lack of knowledge of how recycled or reused materials will perform when used a second time. In terms of reusing buildings, UK tax legislation, primarily VAT on building products, makes retrofit expensive to deliver compared to new build. There are also concerns as to who undertakes quality assessment, verification and validation of secondary use products.

A full report on overcoming the barriers to the implementation of CE in the built environment has been published by the UK GBC [337]. These have also beein addressed by the Ellen MacArthur Foundation and Arup report—*First steps towards a circular built environment* [3].

In Northern Ireland, the recent consultation [51] into barriers to circularity highlighted the following:

- Lack of data collection and measurement to understand material flows and management of waste.
- Material possession of new products is perceived as a sign of wealth and wellbeing.

- The current perception of growth and approach to capital investment is to build new.
- Lack of CE awareness and understanding of the opportunities CE can present for businesses
- Inadequate research and innovation to identify circular solutions to current linear practices.
- Public procurement currently supports linear business models.
- Lack of leadership, vision and funding from government
- Lack of incentives to source regenerative materials
- Connections are lost between the demand for raw materials and the impact it has on climate change, biodiversity loss and inequality.
- Inadequate provision of networks to foster collaboration across sectors.
- Lack of the knowledge and appropriate skills to enable circularity across industries
- The existing waste regulatory framework and waste classifications impede the circularity of materials and valorisation opportunities.

From this report eight scenarios for action were identified, those which are relevant in this report include:

- Create a circular built environment.
- Champion circular manufacturing
- Power clean mobility
- Leverage public sector procurement
- Welcome a circular lifestyle.

5.1.21.6 Examples of Successful Implementation

Public Policy Initiatives

Local Government in London has tended to lead in establishing initiatives, demonstrated by the Merton Rule, which required developers to go beyond published building regulations in embedding renewable energy technologies in buildings. As a result of initiatives by the London Mayor, ReLondon was established [285] with a wide-ranging brief to make London circular. It is a partner in a number of research projects. It has deployed several pilot projects to promote circularity. In the built environment it has established a Materials Reuse Portal (MRP) for surplus materials, with the aim of promoting what materials are in circulation [55]. Initiatives by Re-London have included matchmaking events, which introduced clients and contractors to each other who would not have otherwise met. They also undertook a retrofit feasibility study in Hounslow, interviewing stakeholders, and undertaking market assessments as to how circular principles could be adopted in retrofit projects to minimise embodied carbon, extend material/product lifespans and reduce waste.

Private Policy Initiatives

Construction materials supplier Amey worked with Staffordshire County Council to recycle 7250 tonnes of tar-bound planings and combined it with fly ash material. The tar was classified as a hazardous waste, costing around £140 per tonne to dispose of. The recycled material also saved £100,000 on materials.

Arup erected temporary 'circular' buildings for the London Design Festival. All the elements used had to be able of being reused after the festival closed. Conversations were required across the wider supply chains with consideration of new asset ownership models. It required a significant change in the design thinking to achieve the resultant building especially regarding how the components were assembled.

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