Reconmatic

Automated Solutions for Sustainable and Circular Construction and Demolition Waste Management

University of Salford

D1.1 Evaluation of Current Practices and Policies in the EU and the UK

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List of acronyms

Abbreviation / acronym	Description
BIM	Building Information Modelling (or Management)
CDW	Construction and Demolition Waste
CE	Circular Economy
EC	European Commission
EPR	Extended Producer Responsibility
EU	European Union
Dx.y	Deliverable number y belonging to WP x
GPP	Green Public Procurement
H&S	Health and Safety
IT	Information Technology
KPI	Key Performance Indicator
UK	United Kingdom
WP	Work Package

Executive Summary

Construction and demolition waste (CDW) is a major burden for industry, bringing considerable economic, social and environmental impacts that needs to be addressed. RECONMATIC proposes the development and implementation of automated solutions to enhance CDW recovery rates, promote higher value uses and minimise waste. The approach involves a holistic analysis of circular solutions throughout the life cycle of construction assets, integrating digital and robotic technologies.

The impact of these technologies implementation can only be assessed if any measurement method is established for circular economy that can help understand their performance from a holistic perspective and will support the assessment of future improvements. The aim of this report is to make an assessment about current practices and circular economy implementation in the construction industry for six countries in the EU and the UK, to be used as baselines for improvement with the later implementation of the RECONMATIC demonstrators. These baselines are shown as country profiles.

Based on circular economy assessment methods and recommendations by main national and international organisations, 50 indicators are selected and classified in 6 sections: governance, managerial, technological, economic, environmental, and social. They are designed qualitatively, presenting 5 levels of performance for ease of presentation and comparison. These indicators are calculated for 6 countries (Cyprus, Czech Republic, Greece, Italy, Spain and the UK) creating, this way, six country profiles. The calculation of these indicators is made with the information gathered from literature review and surveys to different stakeholders involved (clients, designers, manufacturers, contractors and waste managers).

In addition to challenges such as difficulties in data comparison between countries, the report identifies other areas of improvement, including the need for improvement of waste recovery statistics and data transparency, as well as standardised circular economy assessment methods. On the other hand, the procedure followed suggests some improvements, such as a ponderation system applied to the country profiles based on relevance/impact of each indicator.

The anticipated outcome for this report is to be a valuable framework for RECONMATIC project and to establish the references for improvement in the different demonstrators to develop. Additionally, it is expected to support the assessment tool in work package 6.

1. Introduction

Within the EU, the industry that is primarily responsible for consuming minerals and additional non-renewable resources is construction, which produced approximately 35.75% of all waste in the region in 2018 (this figure was even higher in the UK at 48.8% [1]), the majority of which was generated as part of construction and demolition activities. The implementation of various measures aimed at addressing the problems caused by construction and demolition waste (CDW) has brought to high recovery rates, but the analysis of these practices more in depth reveals that this CDW recovery is largely based on backfilling and downcycling [2]. In general, end-users have reduced confidence that recycled CDW is of the necessary quality as a result of substandard sorting and contamination in addition to insufficient control over the quality and homogeneity of materials. Firstly, it is necessary to minimise amount of the materials that enter CDW streams, and secondly, the treatment and control of CDW must be improved to ensure that materials can be provided for re-use of high value products, such that they can be traced, and quality is assured. It is important that stakeholders who play a role in CDW generation and management processes can easily adopt the proposed solutions for accomplishing these objectives to ensure that the future targets of the EU to reach higher CDW recovery levels can be met, and most significantly, the complete elimination of CDW in order to comply with the EU growth policy to become the first climate-neutral continent by 2050 [3].

Efforts to reach zero CDW are confronted by significant obstacles: (i) the construction industry is fragmented with stakeholders engaged in insufficient cooperation [4], (ii) efforts aimed at minimising CDW throughout the lifecycle of buildings and infrastructure are lacking [5], (iii) aversion to advanced technologies within the industry and dependence on human workers to operate machinery or perform manual tasks, together with a lack of training and resources (iv), digital solutions are not implemented fast enough as a result of the conservative approach of both local authorities/investors and construction contractors [6], and lastly. (v) incompatibility between legislation requirements and the extent to which the sector's technology is prepared causing uncertainty, and the tendency not to take action towards eliminating waste [7].

According to the Brundtland Commission of the United Nations, there is urgent need for the establishment of new ways to assess progress toward sustainable development. This have resulted in the emergence of a wide variety of sustainable development indicators advanced by practitioners, academics, and governmental and environmental agencies [8]. On this basis, it is widely acknowledged that the introduction of evaluation and monitoring tools like indicators becomes essential to promote circular economy by measuring and quantifying the progress on it [9] [10] [11]. Supporting this, the European Commission also emphasised the need for circularity indicators through its action plan for the circular economy in 2015 [12]. Consequently, increased attempts at developing indicators for the circular economy concept are found in the literature.

Various advantages were found in the relevant literature concerning the use of indicators in regard to the measurement of the circular economy performance. The concept of indicators can function as a springboard for a transition toward more circular economy practices considering their different potential use: as a benchmark and compare practices; as product labels to inform stakeholder choices; and as a basis for regulatory change [13]. Such concept has the ability to summarise, focus and condense the complexity of the dynamic environment to a manageable amount of meaningful knowledge [14]. This is in addition to the capability to communicate, raise public awareness on important issues such as potential environmental impacts, as well as to indicate whether targets will be met or not. Indicators can also be used as policy-making and managerial instruments to define goals and targets, report activities, track progress, and support and guide policymaking [15].

1.1 Purpose of the document

This report aims to evaluate current practices and policies in CDW management in different EU countries (Cyprus, Czech Republic, Greece, Italy and Spain) and the UK. These countries are main beneficiaries of RECONMATIC project, with the development of six demonstrators to validate in their territories. It was expected to include China as largest Asian market and partner of RECONMATIC project in this deliverable, nevertheless, funding for the Chinese partners led by China Association of Circular Economy (CACE) was not available until the end of 2023. This did not allow their participation in this deliverable. Further discussions are currently held to integrate the Chinese partners in the dynamics of RECONMATIC project and their participation in the different work packages and deliverables, including this one.

This aim is achieved through the execution of a work plan which involves the following tasks/objectives:

1. Development of basic nomenclature for CDW to enable communication and understanding of circular economy practices in construction, which subsequently facilitates the summarisation and comparison of the existing situation within the EU and the UK. This nomenclature will be further developed in a Glossary of Terms about Construction Circular Economy and submitted as a separate document (additional outcome of the project). The reason for that is to have the possibility to update it periodically as a live document during the implementation of the RECONMATIC project.

2. Initial review and evaluation about current practices, challenges and solutions for CDW management in the construction industry, with special focus on digitised and automated improvements as well as links with BIM. Existing practices are assessed throughout the entire lifecycle of the construction asset. This preliminary examination incorporates survey questionnaires targeted at various groups of stakeholders in the CDW lifecycle to obtain an extensive overview of practices and trends within the industry.

3. Analysis of existing standards, regulations and policies. Targets, policies, regulations and standards established at the national, regional and country level for managing CDW in the countries previously specified are analysed. This task helps to identify

commonalities and distinctions that generate obstacles for common markets, and examine how the European Green Deal environmental, social and governance (ESG) regulations influences initiatives implemented nationally and regionally. The degree to which EU standards and directives are implemented within the construction sector is identified, as well as guidance regarding to circular economy and the management of CDW.

4. Development of country profiles as benchmarks of reference about current implementation of circular solutions in the construction industry. These country profiles are built between country specific findings against a range of KPIs classified in different categories (governance, managerial, economic, technological, environmental and social).

5. Identification of the relationship with other RECONMATIC project work packages.

1.2 Introduction to RECONMATIC project

RECONMATIC will address the development of circular solutions grounded on digitisation and automation, facilitating decision-making processes based on minimisation, reduction and recovery of CDW throughout the entire lifecycle.

The proposed tools and methods will ensure that the various demands on cost, technology, health and safety, legislation, sustainability and the business needs of all relevant stakeholders are reconciled. After their development, knowledge and best practices will be proactively disseminated by RECONMATIC to assist various stakeholders in different EU nations, the Popular Republic of China and the UK to promote the adoption of the solutions developed in this project and increase their impact.

This is the ambition of the RECONMATIC project, which fully aligns with both the EU Waste Framework Directives [16] and the Circular Economy Action Plan [17]. RECONMATIC constitutes a fundamental change in the management of CDW, shifting from the long-established conservative methods adopted by the construction sector that is experiencing difficulties with achieving the ambitious waste recovery targets, to adopting readily accessible technologies and optimally exploiting the opportunities of the New European Green Deal [3]. Consequently, the structure of RECONMATIC consists of eight interconnected work packages as shown in Figure 1-1, concentrating on the entire lifecycle of construction and addressing automation and digitisation solutions to increase the effectiveness of CDW management and material valorisation.

Work Package 1 (WP1), which constitutes the focal point of the current report, is designed to provide an automated CDW framework for RECONMATIC. This will support other work packages as shown in Figure 1-2, providing an evaluation of current practices and benchmarks for countries, providing initial data and information to the work packages and giving an initial reference to RECONMATIC for the implementation and evaluation of the demo cases during the project development. These deliverable covers task 1.1 (T1.1).

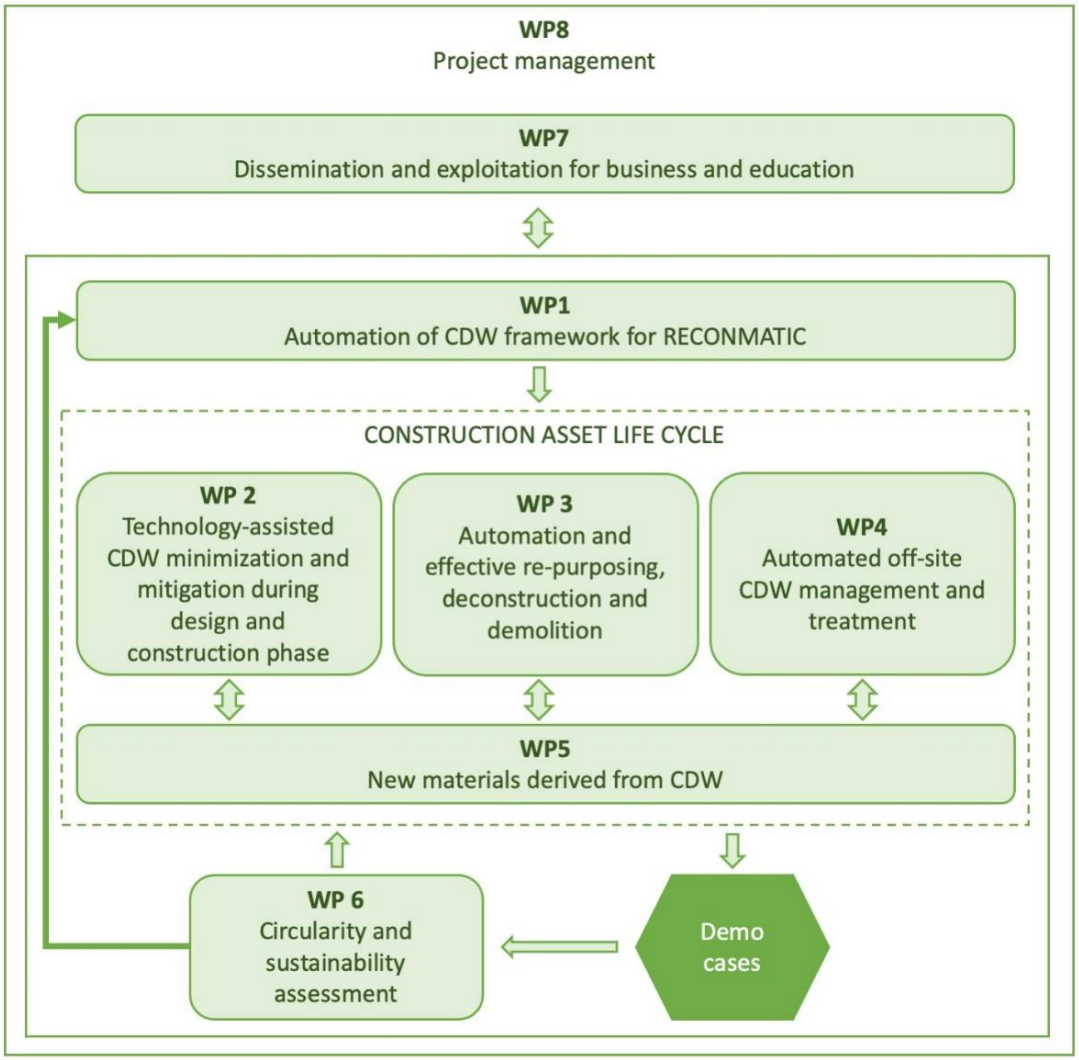

Figure 1-1. Relationship between work packages in RECONMATIC.

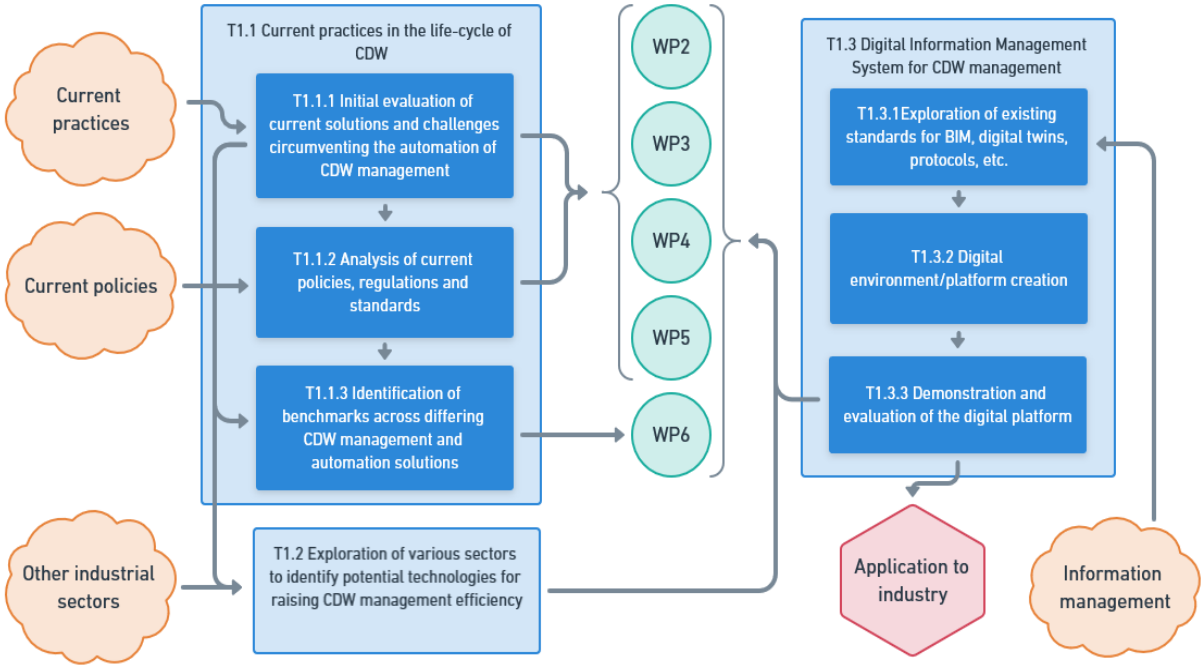

Figure 1-2. Interaction of work package 1 (WP1) with the rest of work packages and project activities.

1.3 Structure of the report

This document is structured in 4 major chapters as follows:

Chapter 1 makes an introduction of RECONMATIC and the problem that this report aims to address.

Chapter 2 explains the methodology used in this research, which consists of three interlinked steps: review, questionnaires and key performance indicators (KPIs). These KPIs were calculated using information obtained from the review and questionnaires, and further utilised to shape the profiles for the assessed countries.

Chapter 3 presents the results obtained for these country profiles, serving as baselines for the countries under study. Additionally, an analysis of participants in the questionnaires was developed, showcasing their characteristics.

Chapter 4 presents the conclusions drawn from this study, mainly focused on the development of these country profiles and future steps or recommendations.

Additionally, in the annexes, all tables, data and other documents developed during this research are included. These additional data sources provide supporting information for the main chapters.

2. Methodology

This chapter explains the adopted methodological framework to achieve the objectives of this report, primarily based on an evaluation of current practices and policies about CDW management. The range activities for this deliverable were completed from September 2022 to September 2023.

This evaluation is made through an array of KPIs, which is designed and applied to the assessment of the six European countries involved in RECONMATIC, so that the country profiles can be obtained. Therefore, this KPI's array is the core of this evaluation. A review on CDW practices and regulatory framework and the use of questionnaires complement and support the KPIs results, which are summarised in Figure 2-1.

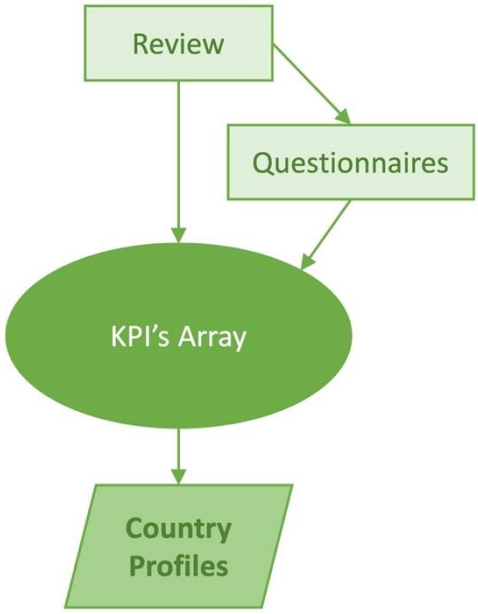

Figure 2-1. Relationship between stages in the methodological framework.

2.1 Definition of KPIs array

The evaluation of current practices and policies for CDW management is developed through an array of key performance indicators. In this context, the obtained results define country profiles about circular economy solutions implementation which provides a reference of country performance. This can be later used as baselines for the identification of strengths, weaknesses, trends and gaps for future development, and support in the assessment of application and validation of the RECONMATIC demonstration case studies. To define this list of indicators, a previous literature review is performed, which is shown in 2.1.1.

2.1.1 Literature review

The classification and selection of KPIs is made based on literature review, identifying international and national policies, guidance, projects and partners' experience such as the following:

- Literature review, such as [10] [14] [15].
- The 6 priorities from the European Commission for 2019-2024 [18].
- The European Circular Economy Monitoring Framework (2018) [19].
- Indicators suggested by the European Environment Agency, Circular Economy in Europe (2016) [20].
- The OECD Inventory of Circular Economy indicators (2020) [21].
- Examples of National Monitoring Frameworks of different countries provided by OECD [21].
- ISO/DIS 59020 about measuring and assessing circularity (under development) [22].

In this literature, there are strong observations of the incipient development and implementation of existing circular economy monitoring frameworks and challenges associated, to highlight the following:

- Lack of an agreed definition of circular economy, for which reason it is difficult to identify what should be measured. Different definitions bring to different interpretations and ways of measuring. There is no harmonisation of indicators [23].
- The broad variety of indicators and methodologies for monitoring and evaluation does not facilitate robustness and reliability of the results [21].
- Circular economy indicators are not present in statistical databases in many occasions, therefore there are data gaps and inconsistencies when reporting [24].
- There is a risk of conflict with strategies at macro, micro and meso levels due to the lack of integration between them [24].
- The main focus is on waste management, but little on closing loops. The analysis of waste management does not necessarily reflect on primary materials consumption reduction [15] [25].
- Indicators used are mainly data-driven, creating a great dependency on data availability. On the other hand, objective-driven indicators are low represented.
- Generally, indicators focus on design, production and waste management, but not in the use of products.
- The approach to circular economy assessment is reduced to technical or economic aspects and not from a true holistic approach analysing systemic effects [21].

These observations helped the design of the KPIS array.

2.1.2 Definition of KPIs array

Taking into consideration this literature and observations, our KPIs are identified and classified under six main performance categories namely: Governance, Managerial, Technological, Economic, Environmental, and Social. Each of these categories includes

several subcategories, reflecting particular performance criteria for their related indicators as follows:

- **Governance**

  - *Mission / Vision / Values*: Commitment towards circular economy in construction sector. This includes national strategies, plans, programmes, schemes and targets about CDW management including prevention, collecting, sorting, reuse, recycling and disposal. Further, it includes involvement of public organisations and industry hubs in circular economy such as R&D, promotion of new laws/regulations on circular economy, controlling/certification activities, consultation, etc.

  - *Corporate environmental responsibility:* Environmental responsibility of suppliers and manufacturers to improve circular economy performance of construction products and material flows along the life cycle including types of construction products/materials targeted for circular economy, use of recycled materials in product design and manufacturing, measurable recycling and reuse targets, etc. With regards to public procurement, it accounts for a large share of consumption and can drive the circular economy including, specifying processes which generate less waste, encouraging reuse and recycling of materials, reducing using products containing critical/virgin raw materials, reducing using products containing hazardous substances, etc.

  - *Assessment and certification processes:* Conformity standards, certification and assessment methods that support circular economy of construction products and materials.

  - *Green finance/investment businesses (taxonomy):* Engage with businesses for greening their investments which can make a substantial contribution to the environment and circular economy.

- **Managerial**

  - Circular economy *management*: On site processes opportunities, processes and/or requirements targeting waste generation and circular economy of construction products and materials including those that have reached the end-of-life status. Aspects such as site waste management plans and waste audits are included, as well as waste traceability and best practices.

- **Technological**

  - *IT and digital systems:* Digital transformation and Innovative technologies related to the circular economy boost of construction products and materials. Levels of BIM implementation and the integration of CDW management in BIM are assessed, as well as the use of other digital tools and technologies.

- *Data management:* Methods and tools used for CDW data collection including generated, recycled, reused, and landfilled waste. This is in addition to information provided about the construction product/material in relation to the recycled content, durability, hazardous substances, critical raw materials, CO_2 emissions, etc.

- *Infrastructures:* The existence of physical and virtual facilities and services (and their different types) that are concerned with waste management of CDW.

- **Economic**

  - *Circular business:* Type and degree of involvement of businesses in construction circular economy. This is in addition to the creation of services provision around a construction product creating other opportunities for business without consuming resources (e.g., maintenance, repair services, etc.)

  - *Economic incentives:* Taxes, fines, and/or awards for boosting CDW prevention, reuse, and recycling.

- **Environmental**

  - *CDW statistics:* Statistics collection about CDW management (including hazardous and excavation waste) and waste recovery to explore the current situation.

  - *Circular Design:* Consideration of sustainable and green solutions within design that promotes circular economy of construction products and materials such as disassembly, building adaptation, maintenance and repair, use of durable materials, secondary materials, etc.

- **Social**

  - *Knowledge, skills, and awareness:* Knowledge about construction circular economy aspects including information as to the extent to which the product is reusable and recyclable, skills in reuse and recycling techniques and awareness about recovery alternatives.

  - *Health and safety:* Knowledge and training about safety aspects on construction sites in addition to the application of H&S measures.

With this classification, a total of 50 KPIs are finally identified, which are presented as indicated in Table 2-1.

Table 2-1. Array of KPIs identified for country profiles.

Category	Sub-category	Code	Indicators
Governance	Mission / Vision / Values	GM1	Strategies for circular economy in construction sector
		GM2	Programmes and schemes for circular economy in construction sector
		GM3	Public and industry organizations working towards circular economy in construction sector
	Corporate environmental responsibility	GC1	Defining/Implementation of measurable waste recovery targets (% of targeted recovery)
		GC2	Implementation of Extended Producer Responsibility schemes in construction
		GC3	Aspects of implementation of EPR scheme. (Refer to question 8 to view the aspects of EPR that are included in this indicator - the first 6 points)
		GC4	Implementation of measures towards reduction of plastic packaging
		GC5	Implementation of Green Public Procurement in construction
		GC6	Defining/Implementation of measurable GPP targets
	Assessment and certification processes	GA1	Use of circular economy assessment tools/ certification schemes
		GA2	Use of sustainable/green construction schemes (e.g. LEED, BREEAM) that include circular economy aspects
	Green finance businesses (taxonomy)	GG1	Implementation of EU Taxonomy (or similar scheme) in the country
Managerial	CE management	MM1	Implementation of site waste management plans on site
		MM2	Implementation of waste audits
		MM3	Monitoring of waste traceability
		MM4	Implementation of best practices (Refer to question 14 to view the aspects of best practices that are included in this indicator)
Technological	IT and digital systems	TT1	Level of BIM implementation
		TT2	Integration of circular economy/waste management in BIM
		TT3	Implementation of digital tools for CE (Refer to question 16 to view the types of digital tools that are included in this indicator)
	Data management	TD1	Availability of product environmental data (Refer to question 17 to view the types of product data that are included in this indicator)
		TD2	CDW data collection methods (project and national)
		TD3	Digital reporting of CDW data
	Infrastructures	TI1	Available recycling facilities for CDW (Refer to question 22 to view the types of waste for recycling that are included in this indicator)

(Continuation of Table 2-1. Array of KPIs identified for country profiles.)

Category	Sub-category	Code	Indicators
Technological	Infrastructures	TI2	Available markets for reused and recycled construction products and materials
		TI3	Available communication/collaboration platforms for the development/ implementation of CE value chains
Economic	Circular business	EC1	Use of secondary materials
		EC2	Servitisation
		EC3	Implementation of waste up-cycling
	Economic incentives	EI1	Landfill tax
		EI2	Illegal dumping fines
Environmental	CDW statistics	NS1	CDW generation per capita
		NS2	CDW generation per construction gross domestic product
		NS3	Hazardous waste generation
		NS4	CDW recovery rate
			· Reuse
			· Recycling
			· Backfilling
		NS5	Incineration (waste-to-energy)
		NS6	CDW landfilling rate
		NS7	Illegal dumping percentage
	Circular Design	ND1	Consideration of disassembly in design
		ND2	Consideration of maintenance and repair in design
		ND3	Consideration of the use of durable materials in design
		ND4	Consideration of non-hazardous materials in design
		ND5	Consideration of the use of secondary materials in design
		ND6	Consideration of modular (off-site) construction in design
		ND7	Consideration of adaptable building design
Social	Knowledge, skills and awareness	SK1	Awareness of available recovery solutions for CDW
		SK2	Knowledge and skills in effective/ innovative solutions and methods for CDW reuse and recycling
	Health and safety	SH1	Training for waste handling
		SH2	Adequate waste transport measures
		SH3	Adequate waste storage
		SH4	Reduction measures of H&S risks onsite

2.2 Review

The review consists of two differentiated parts: current practices and regulatory framework of CDW management.

Current practices for CDW management

The first part of the review is to identify current practices circumventing the automation of CDW management within the different lifecycle stages of a construction asset in different EU countries (i.e., Spain, Italy, Czech Republic, Greece, and Cyprus) and the UK. This review involves gathering information on a number of aspects as follows:

1. Waste generation, management and recovery: This involves gathering data on the generation of each CDW stream as well as the recovery statistics of CDW including reuse, recycle and landfill/backfilling. The information is gathered from the most recent year with available data about the aforementioned aspects (see Annex 1).

2. Waste treatment and end of life: Treatment processes and final destiny at the end of life are identified for each of the CDW streams. Information gathered refers to each of the participating countries. Hazardous waste is not considered in this table since it is very difficult to recycle or reuse such type of waste. Percentage for each final destiny is also identified based on its availability (see Annex 3).

3. Examples of new recycled construction products and circular services: A list with examples of new construction products in the market from reused/recycled materials is provided. Various types of products are identified according to different waste streams used. Furthermore, it involves adding examples of services provided (by companies or institutions) to the construction industry that support circular economy and/or develops circular business (specific construction works, waste collection practices, reuse and repurpose, etc.). The list is just showing the variety of already existing options in the market for construction materials, but it does not mean to be exhaustive. The reality is changing rapidly, and new innovative products are being permanently introduced. The list, although mainly referred to the participating countries, also includes other examples from other European countries (see Annexes 4 and 5).

4. Examples of digital and automated solutions: Similarly, a list of examples of currently implemented digital and automated solutions for CDW management is created. The same purpose as before is followed, showing the variety of digital solutions available for CDW management and circular economy in construction in the way of software applications, such as BIM for example. This aspect is very relevant for RECONMATIC considering the focus of this project is the development of automated solutions for CDW management. This list is useful to obtain other examples as a reference for the different RECONMATIC demonstration case studies (see Annex 6).

5. Industry databases, institutions and hubs linked to CDW management and circular economy: This involves a number of aspects; firstly, is to add databases (national

databases or similar) that can be useful for RECONMATIC, for example: environmental information, list of companies for questionnaire distribution, etc. Secondly, is to add different industry hubs and platforms from the assessed countries, of which their work could be linked to RECONMATIC. Finally, similarly adding any governmental/public institutions as well as nongovernmental/public institutions from the assessed countries, of which their work could be linked to RECONMATIC. These lists are later used to select participants in the questionnaires for the different groups of stakeholders and contacts for potential collaboration in the RECONMATIC demonstration case studies and beyond (see Annexes 7 and 8).

6. Listing of examples of projects linked to circular economy in construction that could match some of the aspects to develop in RECONMATIC. This can allow the exploration of synergies between projects and potential collaborations for further development in the field of automated solutions for CDW management (see Annex 9).

Regulatory framework for CDW management

This second part of the review is to analyse national targets, policies, regulations and standards for CDW management in the assessed countries. CDW is a priority for many regulations within the concept of circular economy in the European Union (EU), focusing on the efficient use of resources and reuse and recycle of waste, aiming to reduce the environmental impacts of construction product cycles. In this context, regulatory aspects have been gathered from EU directives, communications, protocols, and guidelines, for the purpose of identifying the scope of circular economy and CDW regulations. Subsequently, a set of questions have been formulated against each stage of a construction product lifecycle to comprehensively review and examine the current regulatory framework for each country of the RECONMATIC partners, including national rules, laws, policies, initiatives, targets, plans and visions.

Five stages are identified in this analysis, covering the whole life cycle of a construction asset. Each stage includes various regulatory aspects:

1. Design and Manufacturing. It involves gathering information on Extended Producer Responsibility Schemes (EPR), use of BIM in designing, and Harmonised Standards.
2. Construction. This stage is concerned in information related to Green Public Procurement (GPP), EU Taxonomy, and Site Waste Management Plans.
3. Maintenance, Renovation and Demolition. This is mainly focused on Waste Audits regulations.
4. Recovery. This stage involves reviewing regulatory information on CDW recovery aspects.
5. Residual Waste. This is the fifth stage which describes the end-of-life regulations concerning CDW.

This regulatory framework will provide guidance for the partners to fully explore the current uptake of circular economy and the application of the waste hierarchy in their countries, in order to identify strengths, weaknesses and gaps for future development. In Annex 2 of this

document, in-depth information and guidelines have been provided to support a full understanding of the questions' aim and domain.

2.3 Questionnaires

Much of the research in the social sciences and management fields involves asking and obtaining answers to questions by conducting surveys of targeted participants using questionnaires [26]. The previous review was supported by the evaluation of questionnaires conducted across the assessed EU countries and the UK to obtain information for the development of baselines about implementation of circular economy in construction and automated solutions. The development of the questions in the survey was based on the investigation of the current practices and regulatory framework in section 2.2 and the information required for the identified KPIs in section 2.1.12 A full list of these questions is presented in Annex 10.

Different stakeholders were considered for this survey: clients/developers, designers, manufacturers/suppliers, contractors and waste managers. A total of 31 questions were designed in the questionnaire. Some of these questions were directed to all stakeholders and others were specific to selected ones. The questionnaires were split into three differentiated parts:

- Part 1: Participant information. The main purpose of this part was to gather statistical information of participants, so that it could provide a good understanding of their characteristics: organization size, main business activity, and role in the organisation (capacity to take decisions). Manufacturers/suppliers were also asked to identify the type of material/product they manufacture/supply. This part included 5 questions.
- Part 2: Questionnaire. It included a total of 25 questions about the topics that were subject for this research and KPIs calculation.
- Part 3 Contact details. Participants had the option to give their contact details if they were interested in being added to the RECONMATIC distribution list and participate in future activities within the project. This was voluntary and confidential, explicitly only for that purpose.

Due to the characteristics of the required information of the KPIs (explained in section 2.1.2), many of the questions in part 2 were adapted to a Likert scale, establishing 5 options ranging from 'never' to 'always'. There was an additional option for 'unsure' or 'non applicable', which provided further knowledge about the characteristics and opinion of the participants.

The questionnaires were translated into five languages according to the countries where they were distributed: English, Spanish, Italian, Czech and Greek. A different list of questions was selected for each stakeholder according to their speciality and information to obtain. Consequently, different questionnaires were created for each of these participants groups.

The questionnaires were carried out online using JISC surveys, and commenced with an introductory note to the respondents, introducing the project's aim and rationale along with

a consent form including issues associated with ethical performance and confidentiality (see Appendix 10).

2.3.1 Distribution of questionnaires and participation

The survey was open for two months, from 30th May to 31st July 2023. The identification of potential participants in each of the countries was obtained through the current practices review (section 2.2), where in each country a list of industry hubs and governmental/non-governmental institutions were identified. These institutions and hubs were initially contacted by the corresponding national partners, describing the project scope and aim of the surveys, and asking them to help in distributing the surveys in their networks. From that sample, some of these hubs/institutions accepted to participate. The distribution of questionnaires was made through links to the corresponding stakeholders and countries. Some of the RECONMATIC partners acted as industry hubs for the distribution in their supply chain as well. The RECONMATIC website was also used for advertising and distribution among registered members. A list of hubs and institutions participating in this distribution per country is provided below:

Table 2-2. Hubs and institutions participating in the distribution of questionnaires

Country	Hubs and institutions
Cyprus	Union of Cyprus Communities/Municipalities Public Works Department of Cyprus Ministry of Transport, Communications and Works) Cyprus Employers and Industrialists Federation Cyprus Scientific and Technical Chamber Cyprus Recycling organisation Cyprus Quarries Association Cyprus Architects Association Cyprus Association of Civil Engineers
Czech Republic	Czech Green Building Council (CZGBC) Czech Association for Circular Economy (ČAObH) Czech Road Contractors Association (SVS) Association for the Development of Recycling of building materials (ARSM) Czech Chamber of Authorized Engineers and Technicians active in construction (ČKAIT) Association for Infrastructure Development (ARI) South Bohemian Innovation Support Agency (JAIP) Ministry of Industry and Trade Czech chamber of architects (ČKA) Concrete Producers Association of Czech Republic (ČSVB)
Greece	Technical Chamber of Greece Technical Board of Aristotle University of Thessaloniki Greek Association of Civil Engineers Thessaloniki water supply & sewerage Co S.A. (EYTAH) Municipality of Thessaloniki

(Continuation of Table 2-2. Hubs and institutions participating in the distribution of questionnaires)

Country	Hubs and institutions
Italy	National Council of Engineers (CNI) Board of Engineers of Como Province Sustainable Infrastructure Association (AIS) Ferrovie dello Stato Italiano Group (FS Group) Geotechnical and Environmental Engineering Group S.r.l. Rete Sand
Spain	Andalucia, Ceuta & Melilla CDW management companies Association (AGRECA) Ferrovial (FER) Vasc Govern Environmental Management Public Society (IHOBE) Euskadi CDW recycling fixed plants Association (Aprr) Castilla & Leon CDW management companies Association (Agerdcyl) Civil Infrastructures Research and Studies Centre (Cedex) Ministry of Ecological transition and Demographic Challenge (Miteco) Institute for Ceramic Technology (ITC-AICE)
UK	The Royal Institution of Chartered Surveyors (RICS) UK Green Building Council (UKGBC) Innovate UK Knowledge Transfer Network (Innovate UK KTN) Transforming Foundation Industries Network+ University of Salford Morgan Sindall Group Oseng-Rees Reflection
European level	European Asphalt Pavements Association (EAPA) RECONMATIC website

Prior to the distribution of the surveys, a pilot questionnaire was distributed within the RECONMATIC consortium including academics, researchers and industry partners to check its comprehensiveness, validity, and creditability. Additionally, other industry professionals participated in this pilot questionnaire to ensure that the statements are understandable and clear. The feedback received from 37 participants helped to make some minor corrections.

A total of 339 responses were received from these 6 participating countries. Participation per country and different stakeholders is identified as shown in Table 2-3.

Additionally, 2 responses were obtained from Germany (1 from waste managers and 1 from designers) through the website, but they were not considered in the country profiles and analysis due to the low number of responses.

Table 2-3. Number of participants per country and different stakeholders.

Czech Republic	Num. participants	Cyprus	Num. participants
Clients/developers	10	Clients/developers	8
Designers	12	Designers	12
Manufacturers/suppliers	11	Manufacturers/suppliers	5
Contractors	22	Contractors	18
Waste managers	8	Waste managers	6
Total	**63**	**Total**	**49**
Greece	**Num. participants**	**Italy**	**Num. participants**
Clients/developers	6	Clients/developers	6
Designers	16	Designers	77
Manufacturers/suppliers	5	Manufacturers/suppliers	14
Contractors	7	Contractors	5
Waste managers	6	Waste managers	6
Total	**40**	**Total**	**108**
Spain	**Num. participants**	**UK**	**Num. participants**
Clients/developers	5	Clients/developers	2
Designers	15	Designers	14
Manufacturers/suppliers	15	Manufacturers/suppliers	11
Contractors	6	Contractors	4
Waste managers	6	Waste managers	1
Total	**47**	**Total**	**32**

2.4 Calculation of KPIs

Following the recommendations identified in the literature review, the calculation of KPIs is developed from a qualitative approach, avoiding a quantitative representation of final results and facilitating the analysis of a wider range of indicators. Additionally, the creation of ranges allows identifying 5 levels where the results can be classified and represented for each KPI, establishing a common framework for metrics to all KPIs for later comparison. The higher number of a level means that it has qualitatively a better value.

Information and data used are obtained from the literature review and questionnaires. Literature review provides objective facts, data and information about statistics and regulatory framework applicable to CDW management, which is evaluated in different KPIs. On the other hand, questionnaires cover industry current practices and perceptions that cannot be obtained from the literature. They were distributed to different stakeholders and types of organisations as indicated in section 2.3, obtaining a good range of realities and opinions. Both sources are complimentary and support evidence for the KPIs calculation.

KPIs calculation method is different according to the type of information and data to manage. A group of indicators (GM1, GM2, GM3, GC6, TI3, EI1, and NS8) is based on qualitative data from the review through an objective evaluation of the aspects to consider in each indicator. The rest of the indicators are based on data categorisation by the use of Likert scales and yes/no questions. A summary of calculation criteria and levels is presented below for all KPIs. Further information about KPIs classification and calculation method is provided in Annex 6.

- GM1, GM2, GM3, GC6, TI3 and EI1. Levels are defined based on a qualitative analysis of the reviews. For example, GM1 levels are divided according to the type of strategy (national, local or both) aimed at circular economy in the country, and whether if these strategies are general targeting circular economy in all/most industries or specific for the construction industry (CDW management).

- GC1, TT1 and TD2. Levels are defined based on quantifying the number of responses for each of the answer's options listed in the survey questions. For example, the levels for TT1 were defined according to the highest frequency of response for the answer's options of question 15 (see Annex 10).

- MM1, MM2, MM3, TT2, TT3, and TD3. Levels are defined based on quantifying the number of YES responses to the overall responses (including YES, NO, and UNSURE) listed in the survey questions. Accordingly, the levels are split into 5 intervals referring to percentages. For example, the levels for MM1 are defined according to the percentage of YES response in question 11 (see Annex 10).

- GC2, GC3, GC4, GC5, GA1, GG1, MM4, TD1, TI1, TI2, EC1, EC2, EC3, ND1, ND2, ND3, ND4, ND5, ND6, ND7, SK1, SK2, SH1, SH2, SH3, and SH4. Levels are defined based on an average calculation of frequencies and ponderation for each option of the Likert scale. Accordingly, the levels are split into 5 intervals i.e., 1.0-1.9, 2.0-2.9, 3.0-3.9, 4.0-4.7, and 4.8-5.0. If more than one calculation is required with a Likert scale option in the same indicator, they are calculated separately, and an average is later obtained. Calculations are made according to the formula shown below:

$$X = \frac{\sum_{i=1}^{n}(x_n \times a_n)}{n} \qquad (1)$$

Where:
X: Result of this indicator
x_n: Frequency of each option in the Likert scale
a_n: Ponderation factor (Never - 1; rarely - 2; sometimes - 3; very often - 4; always - 5; unsure - 0, 'unsure' is not considered in the calculations)
n: Number of options in the Likert scale

If more than one calculation is required with a Likert scale option in the same indicator, they are calculated separately, and an average is later obtained.

- GA2. Levels are defined based on an average calculation of frequencies and ponderation for each option of the Likert scale, similarly as previous group of indicators. The difference is that the total number of participants in question 10 (see annex 10) is considered, independently of their response. The certification schemes which do not consider circular economy are excluded. The levels are split in the following ranges: [0-0.9]; [1.0-1.9]; [2.0-2.9]; [3.0-3.9]; [4.0-5.0].

- NS1, NS2, NS3, NS4 and NS5. Levels are defined based on national statistical data, operating as specified in each indicator. Data availability is a challenge because: not all CDW data refers to the same waste streams (e.g. soil waste is considered sometimes, others not); there is not availability for the same periods of time (calculations are referred to 2018 or 2020 data); there is no available data in some cases (e.g. hazardous waste, landfilling, etc.).

With these calculations, the country profiles are obtained, which are shown in section 3.

3. Presentation of results

This chapter offers a comprehensive view of each country's performance to circular economy in the construction sector, based on the calculated KPIs. The results are presented for each country creating the country profiles and making them easily understandable and allowing for comparison. This information is essential to draw baselines for countries, and a starting point for monitoring and impact assessment of circular solutions in future.

Additionally, a descriptive analysis is conducted to provide insights into the characteristics of the participants in the questionnaire.

3.1 Questionnaire participants

In this section, the results of the statistical analysis regarding the characteristics of participants in the questionnaires are presented. Aspects such as organisations size, main activities, and participants' roles within their companies or institutions are described in the figures below.

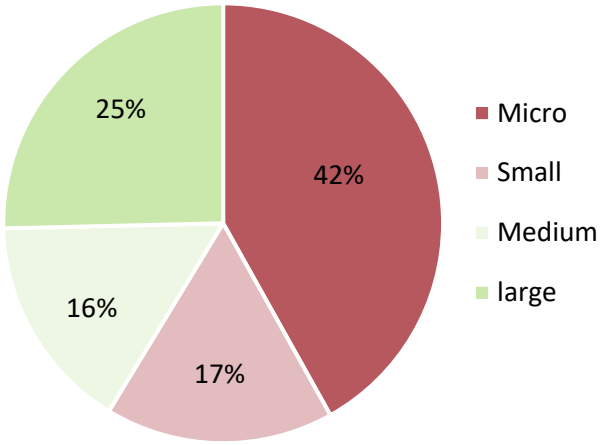

Figure 3-1. Distribution of participants' organisation size.

The size of organisations participating in the questionnaire is shown in Figure 3-1. The results are as follows:

- micro-businesses: 42%
- small-medium size organizations (combined): 33%
- Large organizations: 25%

As it can be observed, the majority of participants are working in micro-businesses, followed by small to medium-sized organizations, and lastly, participants integrated into large organisations.

In Figure 3-2, the organization size of participants is compared across the different assessed countries. This comparison highlights variations in the size of participants' organizations across regions, indicating potential regional differences in the study.

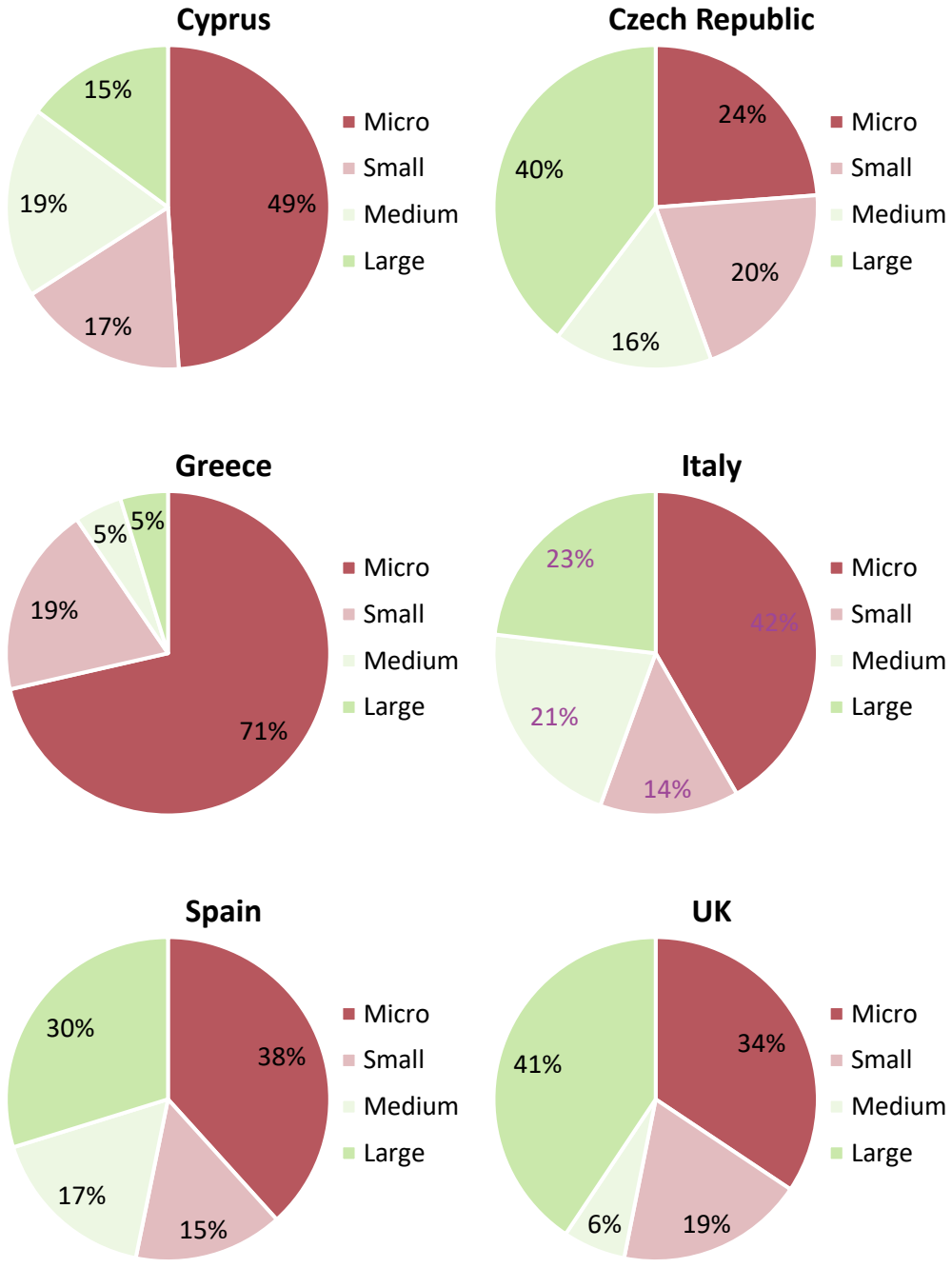

Figure 3-2. Distribution of participants' organisation size per country.

Figure 3-3 illustrates the primary construction activities identified by the participants. The main results are as follows:

- Renovation/refurbishment: being the most common construction activity, identified by the majority of participants.
- New building construction: showing a significant activity as well, close to the previous one with 35% of participants involved.
- Infrastructure: approximately 25% of participants linked to infrastructure projects.
- Demolition: a smaller portion, 7% of participants indicated involvement in demolition projects.
- No specific construction activity: Finally, approximately 16% of participants do not have a specific construction activity. Although their main activity is not directly linked to construction, their involvement may be linked to public or private developers acting as clients and participating as another stakeholder involved in the construction process. This is the case of areas such as administration, healthcare, education or other private owners (it is to highlight that domestic clients were not considered in the study).

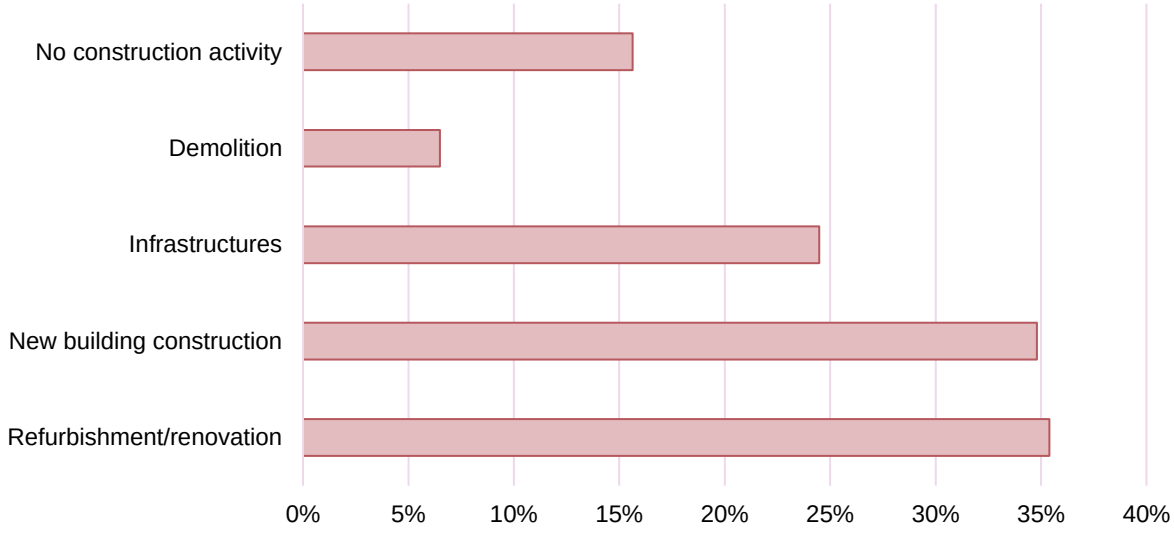

Figure 3-3. Main construction activities of participants' organizations.

Figure 3-4 presents the roles that participants hold within their organizations, which is relevant for understanding their decision-making and change capacity. The key results are as follows:

- Managers: A significant portion, representing 35% of participants that hold managerial roles in their organizations.
- Employees: 28% of participants.
- Directors: making up a total of 22% of participants.
- Administration: a small portion are involved in administrative roles (4%).
- Others: 11% of participants have roles classified under 'others', including consultancy and other unique positions.

It is worth noting that there is a notable representation of participants with high-level decision-making capacity, including directors and managers. This diversity in roles provides

valuable insights into the realities of their organizations and potential avenues for change and improvement.

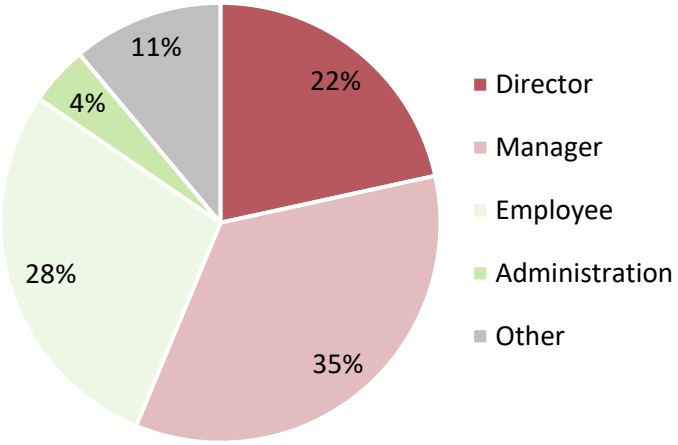

Figure 3-4. Participants' role in the organization.

Finally, Figure 3-5 provides the results about the materials used by the 61 participating manufacturers in their production processes. The key findings are as follows:

- **Ceramics:** Nearly 30% of manufacturers specified ceramics as a primary material in their production.
- **Concrete:** Approximately 18% of manufacturers reported using concrete as a key material.
- **Metals:** 13% of manufacturers identified metals as a significant component in their production.
- **Gypsum:** Gypsum accounted for 11% of the materials used by manufacturers.
- **Cement:** Approximately 10% of manufacturers mentioned cement.
- **Plastics:** Plastic materials were used by 10% of manufacturers in their production.
- **Glass:** 8% of manufacturers indicated the use of glass.
- **Timber:** The lowest representation was with timber, which was mentioned by only 2% of manufacturers.

On the other hand, the group of 'others' was very heterogeneous, identifying from different types of coating to precast (with a varied range of materials in one product). In other cases, these materials were not identified and, therefore, it is not possible to make an analysis of them.

This information provides valuable insights into the material use among participating manufacturers, helping to understand the material landscape in the survey.

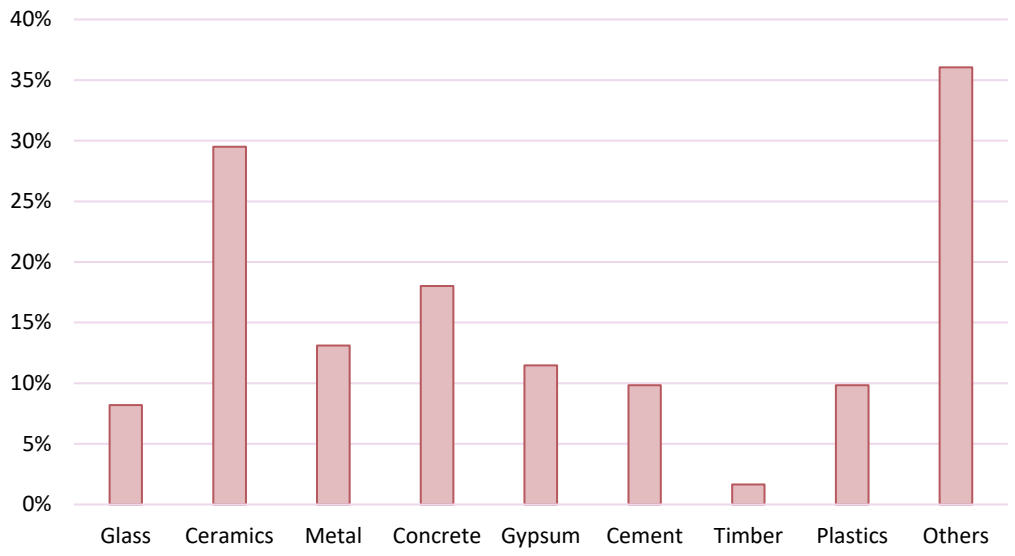

Figure 3-5. Materials identified by manufacturers in their main production.

3.2 Country profiles

The calculation of country profiles was conducted by applying the criteria defined in section 2.4 to the assessed countries (i.e., Cyprus, Czech Republic, Greece, Italy, Spain and UK). The results were 6 country profiles where all KPI's were classified in 5 levels, which were presented in a simplified format with the purpose to facilitate understanding and comparison between them and also between countries.

The calculation process showed a number of issues, to highlight the following:

- Some questions were linked to specific stakeholders. In some cases, the number of responses was not considered to be sufficient to obtain any reliable output (less than 20 participants in the corresponding country). The affected KPIs were calculated but identified in light pink so that they can be perfectly distinguished from the rest.
  Due to the low number of participants for some stakeholder groups or areas, the RECONMATIC consortium is planning to use the extending number of followers, as well as organizations approaching gradually to the project team members, and collect additional data to the questionnaires run in 2023. Added to that, further discussions are being held by the RECONMATIC coordinator with academia representatives in other EU countries (e.g. Poland) about possibilities of getting data from their countries and study the possibility to make the same benchmark analysis. The Project Steering Committee is at the same time discussing the option about a second run of questionnaires at the end of the project for some of the countries assessed within task 1.1. This would provide different information related to the identification of potential improvements between the first and last year of RECONMATIC project development.

- In some countries, information and statistical data were not available for some specific KPIs. In those cases, they were not calculated and left in blank in their corresponding profiles.
- Statistical data was referred to different years and waste streams, and it was difficult (sometimes impossible) to homogenise between countries. The reference for each country was taken according to the most recent data available (see appendix 1).

The 6 country profiles are presented below.

Table 3-1. Cyprus country profile.

Category	Sub-category	KPI Code	Level 1	Level 2	Level 3	Level 4	Level 5
Governance	Mission / Vision / Values	GM1					
		GM2					
		GM3					
	Corporate environmental responsibility	GC1					
		GC2					
		GC3					
		GC4					
		GC5					
		GC6					
	Assessment and certification processes	GA1					
		GA2					
	Green finance businesses (taxonomy)	GG1					
Managerial	CE management	MM1					
		MM2					
		MM3					
		MM4					
Technological	IT and digital systems	TT1					
		TT2					
		TT3					
	Data management	TD1					
		TD2					
		TD3					
	Infrastructures	TI1					
		TI2					
		TI3					

(Continuation of Table 3-1. Cyprus country profile.)

Category	Sub-category	KPI Code	Level 1	Level 2	Level 3	Level 4	Level 5
Economic	Circular business	EC1					
		EC2					
		EC3					
	Economic incentives	EI1					
		EI2					
Environmental	CDW statistics	NS1					
		NS2					
		NS3					
		NS4					
		NS5					
		NS6					
		NS7					
	Circular Design	ND1					
		ND2					
		ND3					
		ND4					
		ND5					
		ND6					
		ND7					
Social	Knowledge, skills and awareness	SK1					
		SK2					
	Health and safety	SH1					
		SH2					
		SH3					
		SH4					

Table 3-2. Czech Republic country profile.

Category	Sub-category	KPI Code	Level 1	Level 2	Level 3	Level 4	Level 5
Governance	Mission / Vision / Values	GM1					
		GM2					
		GM3					
	Corporate environmental responsibility	GC1					
		GC2					
		GC3					
		GC4					
		GC5					
		GC6					
	Assessment and certification processes	GA1					
		GA2					
	Green finance businesses (taxonomy)	GG1					
Managerial	CE management	MM1					
		MM2					
		MM3					
		MM4					
Technological	IT and digital systems	TT1					
		TT2					
		TT3					
	Data management	TD1					
		TD2					
		TD3					
	Infrastructures	TI1					
		TI2					
		TI3					

(Continuation of Table 3-2. Czech Republic country profile.)

Category	Sub-category	KPI Code	Level 1	Level 2	Level 3	Level 4	Level 5
Economic	Circular business	EC1					
		EC2					
		EC3					
	Economic incentives	EI1					
		EI2					
Environmental	CDW statistics	NS1					
		NS2					
		NS3					
		NS4					
		NS5					
		NS6					
		NS7					
	Circular Design	ND1					
		ND2					
		ND3					
		ND4					
		ND5					
		ND6					
		ND7					
Social	Knowledge, skills and awareness	SK1					
		SK2					
	Health and safety	SH1					
		SH2					
		SH3					
		SH4					

Table 3-3. Greece country profile.

Category	Sub-category	KPI Code	Level 1	Level 2	Level 3	Level 4	Level 5
Governance	Mission / Vision / Values	GM1					
		GM2					
		GM3					
	Corporate environmental responsibility	GC1					
		GC2					
		GC3					
		GC4					
		GC5					
		GC6					
	Assessment and certification processes	GA1					
		GA2					
	Green finance businesses (taxonomy)	GG1					
Managerial	CE management	MM1					
		MM2					
		MM3					
		MM4					
Technological	IT and digital systems	TT1					
		TT2					
		TT3					
	Data management	TD1					
		TD2					
		TD3					
	Infrastructures	TI1					
		TI2					
		TI3					

(Continuation of Table 3-3. Greece country profile.)

Category	Sub-category	KPI Code	Level 1	Level 2	Level 3	Level 4	Level 5
Economic	Circular business	EC1					
		EC2					
		EC3					
	Economic incentives	EI1					
		EI2					
Environmental	CDW statistics	NS1					
		NS2					
		NS3					
		NS4					
		NS5					
		NS6					
		NS7					
	Circular Design	ND1					
		ND2					
		ND3					
		ND4					
		ND5					
		ND6					
		ND7					
Social	Knowledge, skills and awareness	SK1					
		SK2					
	Health and safety	SH1					
		SH2					
		SH3					
		SH4					

Table 3-4. Italy country profile.

Category	Sub-category	KPI Code	Level 1	Level 2	Level 3	Level 4	Level 5
Governance	Mission / Vision / Values	GM1					
		GM2					
		GM3					
	Corporate environmental responsibility	GC1					
		GC2					
		GC3					
		GC4					
		GC5					
		GC6					
	Assessment and certification processes	GA1					
		GA2					
	Green finance businesses (taxonomy)	GG1					
Managerial	CE management	MM1					
		MM2					
		MM3					
		MM4					
Technological	IT and digital systems	TT1					
		TT2					
		TT3					
	Data management	TD1					
		TD2					
		TD3					
	Infrastructures	TI1					
		TI2					
		TI3					

(Continuation of Table 3-4. Italy country profile.)

Category	Sub-category	KPI Code	Level 1	Level 2	Level 3	Level 4	Level 5
Economic	Circular business	EC1					
		EC2					
		EC3					
	Economic incentives	EI1					
		EI2					
Environmental	CDW statistics	NS1					
		NS2					
		NS3					
		NS4					
		NS5					
		NS6					
		NS7					
	Circular Design	ND1					
		ND2					
		ND3					
		ND4					
		ND5					
		ND6					
		ND7					
Social	Knowledge, skills and awareness	SK1					
		SK2					
	Health and safety	SH1					
		SH2					
		SH3					
		SH4					

Table 3-5. Spain country profile.

Category	Sub-category	KPI Code	Level 1	Level 2	Level 3	Level 4	Level 5
Governance	Mission / Vision / Values	GM1					
		GM2					
		GM3					
	Corporate environmental responsibility	GC1					
		GC2					
		GC3					
		GC4					
		GC5					
		GC6					
	Assessment and certification processes	GA1					
		GA2					
	Green finance businesses (taxonomy)	GG1					
Managerial	CE management	MM1					
		MM2					
		MM3					
		MM4					
Technological	IT and digital systems	TT1					
		TT2					
		TT3					
	Data management	TD1					
		TD2					
		TD3					
	Infrastructures	TI1					
		TI2					
		TI3					

(Continuation of Table 3-5. Spain country profile.)

Category	Sub-category	KPI Code	Level 1	Level 2	Level 3	Level 4	Level 5
Economic	Circular business	EC1					
		EC2					
		EC3					
	Economic incentives	EI1					
		EI2					
Environmental	CDW statistics	NS1					
		NS2					
		NS3					
		NS4					
		NS5					
		NS6					
		NS7					
	Circular Design	ND1					
		ND2					
		ND3					
		ND4					
		ND5					
		ND6					
		ND7					
Social	Knowledge, skills and awareness	SK1					
		SK2					
	Health and safety	SH1					
		SH2					
		SH3					
		SH4					

Table 3-6. UK country profile.

Category	Sub-category	KPI Code	Level 1	Level 2	Level 3	Level 4	Level 5
Governance	Mission / Vision / Values	GM1					
		GM2					
		GM3					
	Corporate environmental responsibility	GC1					
		GC2					
		GC3					
		GC4					
		GC5					
		GC6					
	Assessment and certification processes	GA1					
		GA2					
	Green finance businesses (taxonomy)	GG1					
Managerial	CE management	MM1					
		MM2					
		MM3					
		MM4					
Technological	IT and digital systems	TT1					
		TT2					
		TT3					
	Data management	TD1					
		TD2					
		TD3					
	Infrastructures	TI1					
		TI2					
		TI3					

(Continuation of Table 3-6. UK country profile.)

Category	Sub-category		KPI Code	Level 1	Level 2	Level 3	Level 4	Level 5
Economic	Circular business		EC1					
			EC2					
			EC3					
	Economic incentives		EI1					
			EI2					
Environmental	CDW statistics		NS1					
			NS2					
			NS3					
			NS4					
			NS5					
			NS6					
			NS7					
	Circular Design		ND1					
			ND2					
			ND3					
			ND4					
			ND5					
			ND6					
			ND7					
Social	Knowledge, skills and awareness		SK1					
			SK2					
	Health and safety		SH1					
			SH2					
			SH3					
			SH4					

4. Conclusions

The main purpose of this deliverable was to develop baselines about circular economy implementation in the construction industry for the countries directly involved in RECONMATIC: Cyprus, Czech Republic, Greece, Italy, Spain and the UK. These baselines for the assessed countries were developed and presented as country profiles, based on the calculation of a range of KPIs classified in different categories and sub-categories. The categories identified were: governance, management, technological, economic, environmental and social. This approach allowed a more integrated and holistic assessment for circular economy in construction, also including IT and digital solutions for CDW management, including BIM implementation.

These country profiles included 50 KPIs, which were selected according to existing guidance, standards and experience. They were categorized in 5 levels defining ranges of application and avoiding a quantitative representation of the indicators. This allowed ease of representation, understanding and comparison, with the possibility to combine numerical and non-numerical indicators. The calculation was developed with the information and data obtained from the review and questionnaires to different stakeholders in the corresponding countries. Once presented in a summary table, it drew a good picture of the current situation of the assessed countries.

The results of this report will be used to support the development of the Guidance Tool for circular economy assessment in the construction industry. This Guidance tool will create a methodology for the performance evaluation of automated solutions for CDW management implemented in the construction industry, and it will be used and validated with the RECONMATIC demonstrator cases. Additionally, the information gathered will be useful to support the review and evidence to develop in the different work packages and case studies in this Horizon Europe project.

The calculation of the presented country profiles has shown several challenges, though, to summarise as follows:

- There is a lack of environmental data in national statistics. Several KPIs were not possible to be calculated and, therefore, it reduced the possibility to develop results in some specific areas of the assessment, especially with statistical data of countries. This were the following:
    - Quantities of hazardous waste in the sector were difficult to identify, in some cases it was not possible, to highlight Greece and UK. The main reason is that hazardous waste types are very often of small quantities and normally they are not estimated, although considered in the waste management plans. We assume that waste managers do collect and consider the overall quantities of hazardous waste, but they do not differentiate if it is coming from construction or from other activity not necessarily directly linked to the construction process. Hazardous waste cannot be ignored, on the other hand

it needs to be clarified to what extent it is presently critical for new structures on construction or rehabilitation works. Without any doubt it is clearly linked to demolition and deconstruction works where additional legal rules are forcing us to identify existence of such materials and products and include procedures in deconstruction plans. This most probably needs specific attention in the actual activities related to updates of European pre-demolition and pre-rehabilitation audit protocol. RECONMATIC might in further tasks and activities create additional supportive solutions by integrating automation in pre-demolition process and providing recommendations about use and generation of simplified digital twins and their linking to non-destructive testing and structured data collection.

- Final destiny of waste is unknown. It was not possible to know what final solution was given to waste, and even more opaque information exists about incineration and landfilling. On the other hand, recycling is mixed with the concept of backfilling, considering many end-of-pipe solutions as recycling (e.g. CDW downgrading as recycled aggregates for pipe bedding, hardcore or road subbase). This seems to be a problem found in all interviewed and analysed countries and as recommendation shall result probably in a more unambiguous definition and legal boundaries. Backfilling shall remain as a specific case of using waste.

- Information about illegal dumping is completely unknown. Therefore, it demonstrates that it is not under control in many countries. In fact, another gap in information is about illegal dumping fines, which is much heterogeneous in the European framework, causing great indefinition in that field.

- The data sources and structure are different in each country. In some cases, the available data are calculated differently, or there are different criteria for data disaggregation, for example in the case of statistical data for waste streams or recovery strategies. Therefore, it is necessary to make adjustments, which are not possible always due to the lack of disaggregated data.

- Similarly, the period of reference is difficult to identify. Access to most recent data can be delayed up to five years before, which is not representative of what is happening currently. Furthermore, comparability between countries is challenging considering there is a big disparity in availability.

- Regarding the questionnaires, it was difficult to make sampling for participant identification as access to national stakeholders' databases was not possible, in many cases because they do not exist. The use of hubs and institutions for the questionnaire distribution helped to identify the targeted population, but despite that, it is doubtfully able to correlate it to a national representation.

- The number of questionnaires completed was low considering the targeted audience for this research. This presents a big uncertainty and low representativity of the

results in the study. As stated in chapter 3.2, RECONMATIC is identifying additional actions to increase the number of responses related to questionnaires, especially for some stakeholder groups where the response was very low. In general RECONMATIC team does not have the power to force corresponding experts or stakeholders to provide answers and views, the team can just extend the hub of potential respondents by cooperating with existing associations or similar collective bodies. This could be combined with other options to identify, like for example, re-opening the questionnaires and keeping them active for a longer period of e.g. 6-12 months. Possibly extended period might result in higher rate of completed questionnaires and more data.

- The KPIs selected were dependent on data availability. Some KPIs were discarded from the list or adapted during the calculation process for that reason.

- All KPIs were considered equally, there was no differentiation according to the relevance or impact they can cause in the implementation of circular economy. This way, for example, more relevance was given to CDW statistics with 7 KPIs than to assessment and certification processes with only 2 KPIs.

Recommendations:

- The work presented in this deliverable should be considered as a first step for the assessment of circular economy evaluation in the construction industry for countries, but improvements are still needed. The results presented can be taken as an initial reference, but a significant uncertainty is expected in the results obtained for questionnaires due to the lack of data and the relatively low representativity of the number of participants. In any case, the circular assessment procedure presented for countries will be further considered and developed in work package 6, for application to products, services and companies.

- Improvements can be made in different aspects, for example, an increased number of KPIs used, more accurate calculation methods, or introducing a ponderation system in the array of indicators. Regarding this last aspect, it could introduce a more sensitive approach to these country profiles by bringing to the front the most relevant considerations for construction assets circularity.

- Currently, information available about CDW is reduced and not always helpful. If circular economy assessments are required to be developed within the industry – which presently if following the requirements and targets of EU taxonomy is a need and not an option, further development of national and regional CDW generation and waste recovery statistics should be carried out. This information should develop databases about waste generation and waste types, treatments and final destiny, as well as producers and waste managers, providing accurate traceability information and acknowledgement of their proper management. On the other hand, this will create increased pressure for necessary modifications and extensions to existing technical standards, but this has a much broader interdependence on both the revised and newly issued Construction Product Regulation (CPR) text and the not

always sufficient range of technical scientific data that can competently enable more fundamental changes to the standards, especially in cases where higher limits of usable recycled raw materials need to be allowed for product groups (a typical example here would be structural concrete and the difficulty of increasing the existing limits of the maximum recycled concrete in new concrete mixes due to technical uncertainty).

- Access to data and information should be more transparent and easier to get. Further development of national databases and references is a growing demand, for public and private organisations, not only in this case about circular economy, but regarding environmental information in general. Waste producers should be identified, as well as the measures they take to minimize waste or initiate to recycle waste.

- The development of clear circular economy assessment methods is essential to be able to measure performance of countries, but also organizations and implementation of solutions. A clear definition of concepts and standardisation process should be in place as a reference, in this case to be able to apply to the construction industry.

Acknowledgements

Cyprus

Union of Cyprus Communities (www.ekk.org.cy),
Public Works Department of Cyprus Ministry of Transport, Communications and Works (www.mcw.gov.cy/mtcw/pwd/pwd.nsf/home/home?openform)
Cyprus Employers and Industrialists Federation (www.oeb.org.cy/)
Cyprus Scientific and Technical Chamber (etek.org.cy/en/home)
Cyprus Recycling organisation (www.oak.org.cy/)
Cyprus Quarries Association (https://cyprusquarries.pro.cy/gr/)
Cyprus Architects Association (https://architecture.org.cy/)
Cyprus Association of Civil Engineers (https://www.spolmik.org/)

Czech Republic

Czech Green Building Council (CZGBC) (www.czgbc.org)
Czech Association for Circular Economy (ČAObH) (obehove-hospodarstvi.cz)
Czech Road Contractors Association (SVS) (www.sdruzeni-silnice.cz)
Association for the Development of Recycling of building materials (ARSM) (www.arsm.cz)
Czech Chamber of Authorized Engineers and Technicians active in construction (ČKAIT) (www.ckait.cz)
Association for Infrastructure Development (ARI) (www.ceskainfrastruktura.cz)
South Bohemian Innovation Support Agency (JAIP) (www.jaip.cz)
Ministry of Industry and Trade (www.mpo.cz)
Czech chamber of architects (ČKA) (www.cka.cz)
Concrete Producers Association of Czech Republic (SVB) (www.svb.cz)

Greece

Technical Chamber of Greece (web.tee.gr/en)
Technical Board of Aristotle University of Thessaloniki (www.auth.gr/committee/3243/)
Greek Association of Civil Engineers (www.spme.gr/)
Thessaloniki water supply & sewerage Co S.A. (EYTAH) (https://www.eyath.gr/)
Municipality of Thessaloniki (thessaloniki.gr/?lang=en)

Italy

National Council of Engineers (CNI) (www.cni.it)
Board of Engineers of Como Province (como.ordingegneri.it)
Sustainable Infrastructure Association (AIS) (infrastructuresostenibili.org)
Ferrovie dello Stato Italiane Group (FS Group)
(www.fsitaliane.it/content/fsitaliane/en.html)
Geotechnical and Environmental Engineering Group S.r.l. (GEEG) (www.geeg.it)
Rete Sand (retesand.it)

Spain

Andalucia, Ceuta & Melilla CDW management companies Association (AGRECA) (agreca.es)
Ferrovial (FER) (www.ferrovial.com)
Vasc Govern Environmental Management Public Society (IHOBE) (www.ihobe.eus)
Euskadi CDW recycling fixed plants Association (Aprr) (www.aprr.eus)
Castilla & Leon CDW management companies Association (Agerdcyl) (agerdcyl.org)
Civil Infrastructures Research and Studies Centre (Cedex) (www.cedex.es)
Ministry of Ecological transition and Demographic Challenge (Miteco) (www.miteco.gob.es)
Institute for Ceramic Technology (ITC-AICE) (www.itc.uji.es)

UK

The Royal Institution of Chartered Surveyors (RICS) (www.rics.org)
UK Green Building Council (UKGBC) (ukgbc.org)
Innovate UK Knowledge Transfer Network (Innovate UK KTN) (iuk.ktn-uk.org)
Transforming Foundation Industries Network+ (tfinetworkplus.org)
University of Salford (www.salford.ac.uk)
Morgan Sindall Group (morgansindall.com)
Oseng-Rees Reflection (www.osengreesreflection.com)

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Annex 1. CDW generation and recovery statistics

Annex 1. Table 1. CDW generation and recovery statistics for Cyprus.

Waste streams	2018		2020		Reused (%)	Recycled (%)	Landfill (%)	Comments
	Ton	%	Ton	%				
Concrete	N/A	N/A	N/A	N/A	N/A	N/A	N/A	No specific data available. Data regarding waste streams are contained in the sum of "Mineral Waste"
Ceramics	N/A	N/A	N/A	N/A	N/A	N/A	N/A	No specific data available. Data regarding waste streams are contained in the sum of "Mineral Waste"
Gypsum	N/A	N/A	N/A	N/A	N/A	N/A	N/A	No specific data available. Data regarding waste streams are contained in the sum of "Mineral Waste"
Mineral Waste	318,171	30.2%	421,192	37.8%	0.0%	48.9% (79.27)	12.8% (20.73)	For 2020 259,629 tonnes of Mineral Waste from construction and demolition were processed, leaving 161,563 tonnes (38.36% of total waste) of C&D mineral waste untreated. Percentages are calculated for the total waste production for year 2020 and while in parentheses, there are shown the percentages of the treated wastes for each category.
Glass	37	0.0%	1,283	0.1%	0.0%	100%	0.0%	Reuse/Recycle/Landfill data refer to the total produced waste of this category, not exclusively for C&D Waste streams. Data represent latest values (2020).
Wood	2,252	0.2%	2,380	0.2%	15.1%	84.9%	0.0%	Reuse/Recycle/Landfill data refer to the total produced waste of this category, not exclusively for C&D Waste streams. Data represent latest values (2020).
Metals	4,142	0.4%	4,432	0.4%	N/A	N/A	N/A	2018 Ferrous metal wastes: 3070 Non-ferrous metal wastes: 351 Mixed metal wastes: 721 2020 Ferrous metal wastes: 3285 Non-ferrous metal wastes: 376 Mixed metal wastes: 771
Plastics	264	0.0%	273	0.0%	36.3%	63.7%	0.0%	Reuse/Recycle/Landfill data refer to the total produced waste of this category, not exclusively for C&D Waste streams. Data represent latest values (2020).
Mixed	5,919	0.6%	4,025	0.4%	N/A	N/A	N/A	
Soils	715,039	67.9%	644,412	57.8%	N/A	N/A	N/A	
Hazardous	1,351	0.1%	1,789	0.2%	1.4%	93.8%	4.8%	Reuse/Recycle/Landfill data refer to the total produced waste of this category, not exclusively for C&D Waste streams. Data represent latest values (2020).

(Continuation of Annex 1. Table 1)

Waste streams	2018		2020		Reused (%)	Recycled (%)	Landfill (%)	Comments	
	Ton	%	Ton	%					
Others (please specify)	23,525	2.2%	80,010	7.2%	N/A	N/A	N/A	2018 Paper and cardboard: 613 Rubber wastes: 589 Discarded equipment: 4 Vegetal wastes: 79 Household and similar: 3,476 Other mineral wastes: 1,389 Other except mineral: 17,375	2020 Paper and cardboard: 569 Rubber wastes: 106 Discarded equipment: 4 Vegetal wastes: 89 Household and similar: 32,225 Other mineral wastes: 1,632 Other except mineral: 45,385
TOTAL tonnes	1,053,325	100%	1,114,411	100%	N/A	N/A	N/A	Total	
Please, specify documents, statistics and any other evidence for reference about this information									
Eurostat: https://ec.europa.eu/eurostat/databrowser/bookmark/69806c00-a018-4d3c-bbdf-5761df0d18e2?lang=en https://ec.europa.eu/eurostat/databrowser/view/ENV_WASTRT__custom_3912361/default/table?lang=en									

Annex 1. Table 2. CDW generation and recovery statistics for Czech Republic.

Waste streams	2019		2020		2021		Reused (%)	Recycled (%)	Landfill (%)	Comments
	kT	%	kT	%	kT	%				
Concrete	1,988	8.4%	1,789	7,2%	1,882	7.4%	0	**	**	2,121 kT in 2018; waste code 170101
Ceramics	808	3.4%	711	2.8%	734	2.9%	0	**	**	796 kT in 2018; waste code 170102 and 170103
Gypsum	11	<0.1%	10	<0.1%	11	<0.1%	0	5	95	14 kT in 2018; waste code 170802
Glass	11	<0.1%	9	<0.1%	9	<0.1%	0	80	20	11 kT in 2018; waste code 170202
Wood	50	0.2%	47	0.2%	47	0.2%	n.a.	n.a.	n.a.	53 kT in 2018; waste code 170201
Metals	2,669	11.3%	2,475	9.9%	2,715	10.6%	0	100	0	2,811 kT in 2018; waste codes 170401-170407
Plastics	12	0.1%	10	0.0%	13	0.1%	n.a.	n.a.	n.a.	13 kT in 2018; waste code 170203
Mixed	2,168	9.2%	2,092	8.4%	2,296	9.0%	0	**	**	2,220 kT in 2018; waste code 170107
Hazardous	542	2.3%	569	2.3%	422	1.7%	0	0	100	453 kT in 2018; waste codes: 170106, 170204, 170301, 170303, 170409, 170503, 170505, 170507, 170601, 170605, 170801,170901, 170903
Asphalt mixtures	807	3.4%	703	2.8%	761	3.0%	15	57	28	902 kT in 2018; waste code 170302
Insulation materials	41	0.2%	40	0.2%	41	0.2%	0	**	**	43 kT in 2018; waste code 170604
Soils and gravel	13,404	56.9%	15,431	61.8%	15,614	61.1%	**	**	**	13,105 kT in 2018; waste code 170504
Excavated igneous rock	69	0.3%	62	0.2%	98	0.4%	**	**	**	40 kT in 20218; waste code 170506
Gravel from railway superstructure	231	1.0%	314	1.3%	231	0.9%	**	**	**	308 kT in 2018; waste code 170508
Cables	22	0.1%	19	0.1%	21	0.1%	0	**	**	18 kT in 2018; waste code 170411
Mixed CDW	717	3.0%	674	2.7%	673	2.6%	0	**	**	709 kT in 2018; waste code 170904
TOTAL tonnes	23,550	100%	24,955	100%	25,568	100%				

(Continuation of Annex 1. Table 2)

Please, specify documents, statistics and any other evidence for reference about this information
Presented statistics includes the whole waste categorychapter 17 according to the EWC. Metals contain different types of metallic waste, which is collected and reported from different areas, i.e. it is by far not metallic waste just related to demolitions or deconstructions but includes the whole construction sector. Presented data are based on the official statistics, as provided by the National Statistical Office. These data are base for the reporting to EUROSTAT (https://www.czso.cz/). n.a. means that this information is not available ** means that the waste material is either reused, recycled, backfilled or landfilled but exact information and monitoring about the ratios does not exist and in the country is not in detail inquired.

Annex 1. Table 3. CDW generation and recovery statistics for Greece.

Waste streams	2018		2020		Reused (%)	Recycled (%)	Landfill (%)	Comments
	Ton	%	Ton	%				
Concrete					No data	No data	No data	
Ceramics					No data	No data	No data	
Gypsum					No data	No data	No data	
Mineral Waste	444,210	19%	2,987,684	55%	No data	No data	No data	
Glass	12		21		No data	No data	No data	
Wood	1899		2181		No data	No data	No data	
Metals ferrous	140,064	6%	140,064	2,50%	No data	No data	No data	
Metals	54,595	2%	8,441		No data	No data	No data	
Plastics	400		56		No data	No data	No data	
Mixed	500,536	21%	1,000,331	18%	No data	No data	No data	
Soils	1,480,135	64%	1,642,919	30%	No data	No data	No data	

(Continuation of Annex 1. Table 3)

Waste streams	2018		2020		Reused (%)	Recycled (%)	Landfill (%)	Comments
	Ton	%	Ton	%				
Hazardous	618,924	27%	552,386	10%	No data	No data	No data	
Other	754.049	32%	524,288	9%	No data	No data	No data	
TOTAL tonnes	2,312,710		5,476,397					
Please, specify documents, statistics and any other evidence for reference about this information								
https://ec.europa.eu/eurostat/databrowser/view/ENV_WASGEN__custom_4940841/settings_1/table?lang=en								

Annex 1. Table 4. CDW generation and recovery statistics for Italy.

Waste streams	2017 (1)		2018 (1)		2019		2020		Reused (%)	Recycled (%)	Landfill (%)	Comments
	Ton	%	Ton	%	Ton	%	Ton	%				
Concrete (2)	N/A	-	N/A	-	N/A	-	N/A	-	-	-	-	
Ceramics (3)	N/A	-	N/A	-	N/A	-	N/A	-	-	-	-	
Gypsum (4)	N/A	-	N/A	-	N/A	-	N/A	-	-	-	-	
Glass	80.344	0,19%	88.209	0,19%	87.833	0,17%	82.287	0,16%		82%	18%	
Wood	175.413	0,41%	195.569		219.550		207.086			84%	16%	
Metals	4.856.920 (6.1 a 6.3)	11,49%	4.892.823	10,68%	4.852.067	9,32%	4.342.273	8,65%		86%	14%	5
Plastics	40.965	0,10%	25.075	0,05%	43.252	0,08%	43.736	0,09%		53%	47%	
Mixed	-	-	-	-	-	-	-	-				

(Continuation of Annex 1. Table 4)

Waste streams	2017		2018		2019		2020		Reused (%)	Recycled (%)	Landfill (%)	Comments
	Ton	%	Ton	%	Ton	%	Ton	%				
Others (Mineral waste from C&D) (7)	37.128.551	87,81%	40.632.686	88,65%	46.880.379	90,01%	45.506.917	90,68%		76%	24%	
TOTAL tonnes	**42.282.193**	*138.896.207* (8) 30% (9)	**45.834.362**	*143.497.702* 32% (9)	**52.083.081**	*153.397.324* 34% (9)	**50.182.299**	146.983.736 34% (9)		75,1% (2017) 77,4% (2018) 78,1% (2019) 77,9% (2020)		
Others (excavated soil and rocks 170504 – dredging sludge 170506) (10)	13.830.112		13.978.465		16.251.690		14.610.901					

Please, specify documents, statistics and any other evidence for reference about this information

(1) ISPRA (Istituto Superiore per la protezione e la ricerca Ambientale) publishes annually the special waste report. The 2021 edition also contains data for 2017 and 2018. It may be useful to include these data in the table as well.
(2) According to ISPRA partition of C&D waste – according to Regulation (CE) n. 2150/2002 - there is not a single data on concrete. The data is included in mineral waste from construction and demolition.
(3) According to ISPRA partition of C&D waste – according to Regulation (CE) n. 2150/2002 - there is not a single data on ceramic. The data is included in mineral waste from construction and demolition
(4) According to ISPRA partition of C&D waste – according to Regulation (CE) n. 2150/2002 - there is not a single data on gypsum. The data is included in mineral waste from construction and demolition
(5) Metals tons are the sum of: - ferrous metal waste - non-ferrous metal waste- mixed metal waste, ferrous and non-ferrous (according to Regulation (CE) n. 2150/2002)
(6) 2021 data deriving from national simulation on C&D flows from WREP project (PVC Forum)
(7) Mineral waste: construction and demolition - concrete, brick, tile and ceramic, stones)
(8) Total tons of national production of C&D waste
(9) The percentage of the total is calculated on the national production of special waste
(10) Regulation (CE) n. 2150/2002 excludes EER codes 170504 and 170506. The data is calculated:"C&D total ton waste – Regulation (CE) n. 2150/2002 total tons"

N.B. the latest ISPRA 2022 publication collects data up to 2020. there will be forecasts for the years 2021 and 2022
ISPRA, "Special waste report", Edition 2020 for 2017 tons of waste (https://www.isprambiente.gov.it/it/pubblicazioni/rapporti/rapporto-rifiuti-speciali-edizione-2020)
ISPRA, "Special waste report", Edition 2021 for 2018 – 2020 tons of waste (https://www.isprambiente.gov.it/it/pubblicazioni/rapporti/rapporto-rifiuti-speciali-edizione-2022)
Regulation (CE) n. 2150/2002 → Aggregation of waste categories referred to in Annex 1, section 2: ferrous metal waste - non-ferrous metal waste - mixed metal waste, ferrous and non-ferrous – glass waste – plastic waste – wood waste - Mineral waste from construction and demolition
WREP Project from PVC Forum

Annex 1. Table 5. CDW generation and recovery statistics for Spain.

Waste streams	2018		2020		Reused (%)		Recycled (%)		Landfill (%)		Comments
	Ton	%	Ton	%	2018	2020	2018	2020	2018	2020	
Concrete	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	No specific data available
Ceramics	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	No specific data available
Gypsum	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	No specific data available
Glass	8,835	0.02	5,572	0.017	0	0	99.59	99.30	0.41	0.70	
Wood	144,110	0.38	65,758	0.20	0	0	86.70	94.98	3.17	1.34	In 2018, 10.13% of wood wastes was treated by energy recovery. In 2020, 3.68 % of wood wastes was treated by energy recovery.
Metals	74,668	0.20	86,733	0.26	0	0	99.96 (ferrous) 99.64 (non-ferrous) 99.99 (mixed)	99.96 (ferrous) 95.66 (non-ferrous) 99.97 (mixed)	0.038 (ferrous) 0.36 (non-ferrous) 0.0051 (mixed)	0.034 (ferrous) 4.34 (non-ferrous) 0.027 (mixed)	For 2018: - Metal wastes, ferrous: 41,831 tones (0.11%) - Metal wastes, non-ferrous: 13,205 tones (0.034%) - Metal wastes, mixed ferrous and non ferrous: 19,632 tones (0.052%) For 2020: - Metal wastes, ferrous: 49,960 tones (0.15%) - Metal wastes, non-ferrous: 9,420 tones (0.029%) - Metal wastes, mixed ferrous and non-ferrous: 27,353 tones (0.084%) In 2020, 0.71% of ferrous metal waste was treated by energy recovery.

(Continuation of Annex 1. Table 5)

Waste streams	2018		2020		Reused (%)		Recycled (%)		Landfill (%)		Comments	
	Ton	%	Ton	%	2018	2020	2018	2020	2018	2020		
Plastics	22,680	0.06	22,788	0.07	N/A	N/A	N/A	N/A	N/A	N/A		
Mixed	3,365	0.0088	8,135	0.025	N/A	N/A	N/A	N/A	N/A	N/A		
Hazardous	56,325	0.15	84,730	0.26	N/A	N/A	N/A	N/A	N/A	N/A		
Others (please specify)	37,643,744	84.60	32,214,371	98.99	0	0	74.86	85.13	25.14	14.85	2018 (tones): Mineral CDW: 13,061,329 Other mineral wastes: 60,926 Soils: 24,521,489	2020 (tones): Mineral CDW: 13,434,566 Other mineral wastes: 124,490 Soils: 18,655,315
											Waste treatment data are for mineral waste from construction and demolition. In 2020, 0.017% of waste was treated by energy recovery, and 0.98% was used for backfilling operations.	
TOTAL tonnes	38,075,987	100	32,542,554 24,970,527		N/A	N/A					Source: Informe producción RCD de la Asociación Española de Reciclaje de Residuos de Construcción y Demolición (2021). (CDW production report of the Spanish Construction and Demolition Waste Recycling Association (2021))	

Please, specify documents, statistics and any other evidence for reference about this information

2019 source: Cantidad de residuos generados por actividad económica CNAE-2009, clase de residuo y tipo de peligrosidad. (ine.es) (Amount of waste generated by economic activity CNAE-2009, type of waste and type of danger (ine.es))
2020 source: Statistics | Eurostat (europa.eu)
Generation of waste: Statistics | Eurostat (europa.eu)
Treatment of waste: Statistics | Eurostat (europa.eu)
Construction and demolition mineral waste final waste treatment: Tratamiento final de residuos por tipos de residuos, peligrosidad y tipo de tratamiento. (ine.es) (Final treatment of waste by type of waste, dangerousness and type of treatment)

Annex 1. Table 6. CDW generation and recovery statistics for the UK.

Waste streams		2018			Comments	Reference
		Generated Tonnes	Recovered%	Landfill %		
C&D waste - 67.8 Millon Tonnes (2018)	Concrete, bricks & blocks	N/A	>90%	<1%	Concrete is 100 per cent recyclable. Almost none goes to landfill and 90% of hard construction and demolition waste is recycled as aggregates.	7
	Ceramics	>35 M	N/A	N/A	Approximately 55% of C&D waste is represented by ceramic materials (blocks, tiles, electrical insulation, bathroom fixtures). Ceramics are the single largest contributor to construction and demolition waste.	8 & 9
	Plasterboard	1.3 M	N/A	N/A	Up to 1.3 million tonnes of plasterboard waste is generated within the new-build construction and refurbishment sectors each year.	10
	Glass	N/A	N/A	N/A	In 2018, almost 200,000 tonnes of glass from construction sites in the UK was sent to landfill which is around 8% of total waste glass.	5 & 6
	Wood	2 M	N/A	N/A	2 M tonnes is the approximate average rate of wood waste from construction and demolition activities between 2011-2020.	2
	Metals	N/A	97%	3%	Around 97% of construction steel waste is yearly recovered of which 87% is recycled and 10% is reused.	1
	Plastics	N/A	33%	33%	A third of construction plastics are recycled, a third are landfilled, and a third are incinerated. The UK construction industry accounts for 19% of all plastic waste.	3 & 4
	Floor & Wall Coverings	0.6 M	<2%	>90%	Almost 600,000 tonnes of flooring are disposed of each year, of which less than 2% is recycled. A small quantity is incinerated but the vast majority, over 90%, goes to landfill.	11
	Others	N/A	N/A	N/A	No data is identified. Other types of waste such as cable, Copper, Aluminium, Roofing, Insulation, furnishings, etc).	15
	Hazardous	0.116 M & .04 M	N/A	N/A	An estimated figures of hazardous waste generated by construction and demolition sectors in Wales and Scotland respectively.	12 & 13
	Excavation (inc dredging spoil)	70 M	44%	44%	Excavation and dredging waste accounts for almost 32% of total waste generated (all sectors) in UK. 44% of excavation waste is recovered and 98% of dredging spoil is recovered.	14
	General remarks	In 2018, total CD&E wate in UK (excluding Hazardous waste) was 137.8 M tonnes which accounts for 62% of the total waste generated (all sectors) C&D waste accounts for almost 30% of total waste generated (all sectors) in UK- of which 92.3% was recovered and around 7% was sent to landfill In 2019, C&D waste generated in England & Wales (respectively) was 62.3 & 3.43 M tonnes- of which 93.6% & 93% was recovered and 6% was landfilled In 2020, C&D waste generated in England was 53.6 M tonnes of which 93.2% was recovered and 6% was sent to landfill. Recovery includes reuse, recycling and backfilling (15,16)					15 & 16

(Continuation of Annex 1. Table 6. CDW generation and recovery statistics for the UK.)

Please, specify documents, statistics and any other evidence for reference about this information
1. Steel recycling https://www.galvanizing.org.uk/sustainable-construction/steel-is-sustainable/steel-recycling/ 2. Recycling wood in the UK https://communitywoodrecycling.org.uk/what-we-do/recycling-wood-in-the-uk/ 3. How can construction overcome its dependence on plastic? https://ww3.rics.org/uk/en/modus/natural-environment/renewables/how-can-construction-overcome-its-dependence-on-plastic-.html 4. PLASTIC WASTE FROM UK CONSTRUCTION INDUSTRY RISES 46% IN 2 YEARS, REVEALS GOVERNMENT DATA https://developer-update.co.uk/2021/11/15/plastic-waste-from-uk-construction-industry-rises-46-in-2-years-reveals-government-data/ and SiteStak Study Lays Bare The Construction Industry's Plastic Waste Problem https://www.sitestak.co.uk/news/sitestak-study-lays-bare-the-construction-industrys-plastic-waste-problem 5. Glass: the importance of recycling in construction https://optimasystems.com/glass-the-importance-of-recycling-in-construction/ 6. Re-using Waste Glass in the Construction Industry https://ukdiss.com/examples/construction-industry-recycling-glass.php 7. UK Concrete and Cement Industry Roadmap to Beyond Net Zero https://thisisukconcrete.co.uk/TIC/media/root/Perspectives/MPA-UKC-Roadmap-to-Beyond-Net-Zero_October-2020.pdf 8. Recycling ceramic waste powder https://pureadmin.qub.ac.uk/ws/portalfiles/portal/165108549/Recycling_ceramic_waste_powder_into_cement_based_composites_4th_final_revision.pdf 9. Recycling Ceramic Waste to Produce Green Concrete https://www.research.ed.ac.uk/en/publications/recycling-ceramic-waste-to-produce-green-concrete 10. Is Plasterboard Hazardous Waste https://cartwrightswastedisposal.co.uk/2021/02/11/is-plasterboard-hazardous-waste/ 11. Recycling Buildings: 10 Building Materials That Can Be Reused After Demolition http://rubberbond.co.uk/blog/recycling-buildings-10-building-materials-that-can-be-reused-after-demolition/ 12. Construction and demolition waste survey for 2019 https://naturalresources.wales/evidence-and-data/research-and-reports/waste-reports/construction-and-demolition-waste-survey-2019/?lang=en 13. Waste from all sources – summary data 2018 https://www.sepa.org.uk/media/500273/waste-from-all-sources-summary-document-and-commentary-text-2018.pdf 14. HOW MUCH WASTE IS PRODUCED BY THE CONSTRUCTION SECTOR? https://www.constructionproducts.org.uk/media/557062/how-much-construction-waste-is-there.pdf 15. Official Statistics (DEFRA) - UK statistics on waste - Updated 11 May 2022 https://www.gov.uk/government/statistics/uk-waste-data/uk-statistics-on-waste#recovery-rate-from-non-hazardous-construction-and-demolition-cd-waste 16. 2019 Wales Construction & Demolition Waste Arisings Survey https://naturalresources.wales/evidence-and-data/research-and-reports/waste-reports/construction-and-demolition-waste-survey-2019/?lang=en

Annex 2. Regulatory framework for CDW management

Annex 2. Table 1: Regulatory framework for CDW management in Cyprus.

Stage	Measuring Item		Comments	References
Design and Manufacturing	*Extended Producer Responsibility Schemes (EPR)*	Is EPR scheme applied in your country? [i] If not, please describe if there is any similar scheme applied	Directive 94/62/EC on packaging and packaging waste (paper/cardboard, plastic, glass, metal), which was adopted in Cyprus with the Packaging and Packaging Waste Law (L.32(I)/2002, 133(I)/2003) 159(I)/2005, 48(I)/2006, 58(I)/2012, 59(I)/2012 and 125(I)/2012)	http://www.moa.gov.cy/moa/environment/environmentnew.nsf/page21_en/page21_en?OpenDocument
		What construction product categories are regulated by the EPR scheme in your country? [ii]	The only Legislation in Cyprus governed by the principle of Producer Responsibility is Packaging Waste Management which can include construction products packaging).	
		Are there waste management quantitative targets set by your country, relevant for the EPR scheme? (e.g., recycling rate of products, setting a minimum percentage of reusable/recyclable products placed on the market) If so, please provide further information	Directive 94/62/EC on packaging and packaging waste posed 25-45% recycling rates (15% recycling by weight for any material) and 50-65% recovery rates for total packaging waste by December 2005 and by related amendments (L.48(I)/2006) stricter recycling rates at 55-80% (60% for paper /cardboard, 60% for glass, 50% for metal, 22.5% for plastic and 15% for wood, by weight) and 60% recovery rates for all packaging waste for December 2012. There are not any more recent quantitative targets.	
	BIM	Does your country have a national level driven Digital Transformation/BIM agenda/mandate/roadmap? If so, please provide further information.	Cyprus Organization of Standardization (CYS) (https://www.cys.org.cy/en/) is responsible for adopting and distributing the ISO 19650 standard for Cyprus.	https://etek.org.cy/el/news-details/%CE%BF-%CF%81%CF%8C%CE%BB%CE%BF%CF%82-%CF%84%CF%89%CE%BD-%CF%80%CF%81%CE%BF%CF%84%CF%8D%CF%80%CF%89%CE%BD-%CF%83%CF%84%CE%B7%CE%BD-%CF%88%CE%B7%CF%86%CE%B9%CE%B1%CE%BA%CE%AE-%CE%B5%CF%80%CE%B1%CE%BD%CE%AC%CF%83%CF%84%CE%B1%CF%83%CE%B7-%CF%84%CE%BF%CF%85-%CF%84%CE%BF%CE%BC%CE%AD%CE%B1-%CF%84%CF%89%CE%BD-%CE%BA%CE%B1%CF%84%CE%B1%CF%83%CE%BA%CE%B5%CF%85%CF%8E%CE%BD
		What is the main driver for BIM adoption/Digital Transformation in your national sector? (Government/Industry/both/neither) Please provide explanation	BIM adoption/Digital Transformation is promoted by the Cyprus Scientific and Technical Chamber (ETEK) is the statutory Technical Advisor to the State and is the umbrella organisation for all Cypriot Engineers.	
		What BIM/Information Management standards, protocols, etc. are predominantly being adopted in your national sector to facilitate the digital transformation/BIM adoption? (e.g. ISO 19650 series).	ISO 19650 series	
		What is the level of BIM adoption within your national sector? Provide references to supporting government, industry, academic reports	There are not any relevant statistics available.	
		Is the Digital Twin a key concern to the digital transformation of your national sector? If so, please provide further information	There is some activity around Digital Twin in Cyprus, but there is no official statement at a national level towards Digital Twin.	
		How (and to what extent) is the circular economy/waste management being integrated into your sector's digital transformation?	There are not any relevant statistics available.	

(Continuation of Annex 2. Table 1: Regulatory framework for CDW management in Cyprus.)

Stage	Measuring Item		Comments	References
Design and Manufacturing	*Harmonised Standards*	Is CE marking conformity implemented in your country?	The legislation that regulates the free movement of certain categories of products, for which the CE marking is required, is the Essential Requirements to be fulfilled by Specific Categories of Products Law of 2002, as amended, as well a series of specific Regulations for each of the 21 categories of products. These Regulations are issued in accordance with article 59 of the above Law. The Essential Requirements to be fulfilled by Specific Categories of Products Law of 2002, was amended with Law 29(I)/2003, Law 258(I)/2004, Law 89(I)/2005, Law 71(I)/2009, Law 7(I)/2011, Law 90(I)/2011 and Law 54(I)/2013. The Law is considered the «Framework Law» and contains the fundamental principles of the CE mark and market surveillance, the procedure for the approval of Notified Bodies, the powers of the competent authorities, the penalties imposed on the violations of the legislation, etc.	https://www.mlsi.gov.cy/mlsi/dli/dliup.nsf/pagem7_en/pagem7_en?OpenDocument
		What other conformity standards and certification are implemented in your country that affect reuse/recycling and recyclability of construction products?	Cyprus complies with EU-level standards and Cyprus Organization of Standardization (CYS) (https://www.cys.org.cy/en/) is assigned all standardization activities according to the Standardization, Accreditation and Technical Information Law (N.156 (I)/2002).	
		Are there any national sustainable-building or construction schemes in your country? (e.g. LEED, BREEAM, etc) If so, please provide further information and if they include any requirements about waste and circular economy	There is no officially established scheme.	
		Is it a legal requirement for buildings (or some type of buildings) to be designed for disassembly? [iii] (reflect ISO 20887 or any other standards) If so, please provide further information	There is no legal requirement.	

(Continuation of Annex 2. Table 1: Regulatory framework for CDW management in Cyprus.)

Stage	Measuring Item		Comments	References
Construction	*Green Public Procurement (GPP)*	Is GPP policy applied in your country? [iv] If not, please describe if there is any similar scheme applied	In order to participate in the effort of the E.U. to promote the Green Public Procurements, Cyprus first prepared its own National Action Plan with a period of implementation in the years 2007-2009. With the completion of this first Action Plan, the Department of Environment proceeded with its Review, preparing the new Action Plan for the GPP. This Revised Plan, after being submitted to public consultation, was approved by the Council of Ministers on January 31st, 2012 and is still in force today.	http://www.moa.gov.cy/moa/environment/environmentnew.nsf/All/9B99E4EB2CA7A90DC2257F64003CF378?OpenDocument# http://www.moa.gov.cy/moa/environment/environmentnew.nsf/All/24D7718D0776D2A8C225837600447F7F?OpenDocument
		Is there a target set by your country? If so, has it been fulfilled? (a target in which a percentage of all public procurement should be green).	The latest goal was the adoption of GPP criteria and requirements in each public contract is expected and framework contracts are expected to contribute significantly to the EU's goal of overtaking the 20% reduction in CO2 emissions to 2020.	
		Is GPP policy applied in construction related aspects? [v] [vi] [vii]	There is no GPP policy applied in construction related aspects.	
		What aspects in construction waste management the GPP is targeting in your country? (e.g., specifying processes or packaging which generate less waste; encouraging reuse and recycling of materials; reducing using products containing critical raw materials, reducing using products containing hazardous substances, etc.) [viii] [ix] [x]	In accordance with the Waste Law, L.185(I)/2011, and its respective amendments, any holder of waste from Excavation, Construction and Demolition (W.E.C.D.), must deliver the waste to a licensed operator for collection, transport, recovery or disposal, or the same holder must ensure the above administrative processes in the manner specified in the Waste Management Permits granted by the Competent Authority after consultation with the Advisory Committee on Waste Management (S.E.D.A.), under the provisions of article 25 of the Law, as amended.	
	EU Taxonomy for New Construction	Is there a familiarity of EU taxonomy system in your country? [xi] [xii] [xiii] If so, please provide further information on the level of its adoption	Both new and existing building in Cyprus are characterized based on their Energy Efficiency. Usually, some incentives are given to owners to upgrade their low efficiency buildings.	https://www.cea.org.cy/en/energiaki-apodosi/
		Are there a technical screening criteria established by your country, for defining economic activities that counts as green? [xiv] If so, please provide references to supporting reports/documents	There is no legal obligation for building, but the Energy Performance Certificates can be a general directive, evaluating current building's efficiency and the relevant guides can be used to take improving actions.	
		Are there any similar system/scheme to EU taxonomy applied in your country? If so, please provide further information	There is no direct connection with the EU taxonomy.	

(Continuation of Annex 2. Table 1: Regulatory framework for CDW management in Cyprus.)

Stage	Measuring Item		Comments	References
Construction	*Site Waste Management Plans*	Are site waste management plans applied in your country? If so, please describe if it Is a mandatory or voluntary requirement for construction activities	In accordance with Regulation 5, of the W.E.C.D. Management Regulations (R.A.A.159/2011), the project owner [unless he has transferred under contract to the operator of Management of Waste from Excavation, Construction and Demolition (W.E.C.D.) the possession of the produced WECD, as well as the responsibility that derives from the provisions of Regulation 5 (Regulation 6)] is fully responsible for the management of the produced WECD.	http://www.moa.gov.cy/moa/environment/environmentnew.nsf/All/24D7718D0776D2A8C225837600447F7F?OpenDocument http://www.moa.gov.cy/moa/environment/environmentnew.nsf/All/D82F379F28D41417C2257F620027FBC8/$file/%CE%91%CF%80%CF%8C%CE%B2%CE%BB%CE%B7%CF%84%CE%B1%20%CE%95%CE%BA%CF%83%CE%BA%CE%B1%CF%86%CF%8E%CE%BD%20%CE%9A%CE%B1%CF%84%CE%B1%CF%83%CE%BA%CE%B5%CF%85%CF%8E%CE%BD%20%CE%BA%CE%B1%CE%B9%20%CE%9A%CE%B1%CF%84%CE%B5%CE%B4%CE%B1%CF%86%CE%AE%CF%83%CE%B5%CF%89%CE%BD%20%CF%87%CF%89%CF%81%CE%AF%CF%82%20%CE%95%CF%80%CE%B9%CE%BA%CE%AF%CE%BD%CE%B4%CF%85%CE%BD%CE%B5%CF%82%20%CE%9F%CF%85%CF%83%CE%AF%CE%B5%CF%82%20-%20%CE%91%CE%95%CE%9A%CE%9A.pdf
		What are the requirements for site waste management plans in your country?	The owner needs to perform the following before the start of any project: (a) to prepare an Integrated WECD Management Plan, for which he is fully responsible to see its implementation; (b) to submit to the Competent Authority, with the exception of public bodies, before the beginning of the project, a bank guarantee to ensure the fulfilment of his obligations based on the Integrated WECD Management Plan, the amount of which is specified in Annex I. The bank guarantee has the same period of validity as the project execution timetable and is refunded to the owner only after the expiry date of the authorization and when confirmed by the Competent Authority that he has met all conditions of the Management Plan. For the fulfilment of the obligations of paragraph (1) the WECD producer is obliged to maintain and operate a Licensed Individual Management System for WECD or participate in a Licensed Collective Management System for WECD, which is issued under the R.A.A. 159/2011 regulations and any amendments thereto.	
		If SWMP is not applied in your country, are there any legal/voluntary requirements for managing waste on construction sites? (e.g., waste identification of expected waste types and amounts, source separation and collection, documentation, storing, transportation, etc.,) [xv] [xvi] [xvii] If so, please provide further information	The requirements per type of waste are defined for the licensed operator receiving the waste. According to the Waste (Amending) Law 3(I)/2016 permit granting / renewal for operators for waste collection, transport and disposal and permit granting or renewal for the operation of establishment of processing/recycling of Waste from Excavation, Construction and Demolition (W.E.C.D.) as well as licensing collective or individual WECD management systems shall be done by the Department of Environment of the Ministry of Agriculture, Rural Development & Environment.	

(Continuation of Annex 2. Table 1: Regulatory framework for CDW management in Cyprus.)

Stage	Measuring Item		Comments	References
Maintenance, Renovation and Demolition	*Waste Audits*	Are waste audits and/or inventories applied in your country? If so, please describe if it Is a mandatory or voluntary requirement for renovation and demolition activities	Waste audits are not applied for each project, but in the facilities of licensed operators.	http://www.moa.gov.cy/moa/environment/environmentnew.nsf/page54_en/page54_en?OpenDocument https://www.oak.org.cy/index.php/partners/licensed-units http://www.moa.gov.cy/moa/environment/environmentnew.nsf/All/FBDCBA0166BEB201C225802F003AD23F/$file/KDP77_2016.pdf (See also references in the next section) http://www.moa.gov.cy/moa/environment/environmentnew.nsf/All/92262E94077FEEF4C2258053003F04B5/$file/%CE%A3%CF%87%CE%AD%CE%B4%CE%B9%CE%BF%20%CE%94%CE%B9%CE%B1%CF%87%CE%B5%CE%AF%CF%81%CE%B9%CF%83%CE%B7%20%CE%91%CF%80%CE%BF%CE%B2%CE%BB%CE%AE%CF%84%CF%89%CE%BD.pdf
		What are the regulatory requirements/checklist for the waste audits in your country? [xviii] Generally describe the scope of requirements and guidelines that regulate the waste audits process,	i. The manager/technician must inspect the unit for any degradation (damage) or malfunctions (breakdowns), for technician errors, and for leaks that may lead to: release of hazardous waste substances into the environment; threat to human health. The operator/technician must conduct these inspections frequently enough to identify problems early enough to correct them before they harm human health or the environment. ii. - The manager/technician must develop and maintain a written Inspection Program of monitoring equipment, safety and emergency equipment, safety devices, operating equipment and structures that are important for the prevention, detection, or response to hazards for the environment/ human health. - This Program must be kept on premises - The Program must specify the types of problems (e.g. malfunctions or degradations), which are to be examined during the inspection (e.g. inoperative well pump, leakage, trench erosion, etc.) iii. The person in charge/technician must repair any wear or damage to the equipment or structures, which has been identified in a scheduled inspection. This ensures that the problem will not lead to a risk to the environment and human health. When a hazard is imminent or already exists, immediate corrective action should be taken. iv. The supervisor/technician must record the results of the inspections in a log- book/file. It must keep this record for at least 3 years from the date of the inspection. At a minimum, these records must include the date and time of inspection, the name of the inspector, a note of observations made, and the date and nature of any repairs or other corrective actions. The Competent Authority may, by notification published in the Official Gazette of the Republic, designate an official of the ministry he heads as Chief Inspector and other officials of the same ministry as Inspectors. Inspectors carry out regular and extraordinary inspections of every person who carries out waste treatment operations, every person who collects or transports waste on a professional basis, brokers and traders, every person who produces waste as well as product producers and their facilities, to ascertain against how much the work, including the restoration work of the premises after the shutdown of the facilities, is carried out in accordance with the terms of the waste management license and the provisions of the Waste Laws of 2011-2016.	

(Continuation of Annex 2. Table 1: Regulatory framework for CDW management in Cyprus.)

Stage	Measuring Item		Comments	References
Maintenance, Renovation and Demolition	*Waste Audits*	Are waste audits requirements regulated in each region or is it generalised for the entire country?	Every regulation applies to national-wide level.	
		Are there regular inspections/monitoring of the process and the output of the waste audits, in your country? [xix] If so, please provide further information	The frequency of inspections may differ for the various items in the Program. However, the frequency should be based on the degree of equipment degradation (wear and tear) and potential environmental or human health event if the degradation, malfunction, or technician error goes unnoticed between two inspections. Areas where leaks may occur, such as waste loading and unloading areas, should be inspected daily when in use. As a minimum, the Inspection Program must include the items and frequencies for the following, where applicable: 1. Storage areas: Storage areas should be inspected at least once a week. Checks should focus on any leakage of containers/containers and any deterioration of both containers/containers and leak containment systems caused by corrosion or other factors. 2. Storage or treatment tanks: • The manager/technician must develop and adhere to a schedule and procedure for tank fullness checks. • The supervisor/technician shall inspect at least once a day the data obtained from the monitoring and leak detection equipment (e.g. pressure or temperature gauges, monitoring wells) to ensure that the tank system is operating in accordance with its design. • The manager/technician must inspect at least once a day the above-ground parts of the tank system, if any, for corrosion or leakage, and the construction materials and the externally accessible part of the tank system, including the secondary storage system (e.g. dams), to detect corrosion or signs of leakage (e.g. wet spots, dead vegetation). • Tank system managers/technicians who use leak detection systems to alert personnel to leaks or implement established field practices to confirm a leak is immediately detected must inspect the areas listed in the above paragraph at least once a week. The use of an alternative inspection program must be documented in the facility's records. This record must include a description of the practices established on site at the facility. • Auxiliary equipment not equipped with a secondary leak containment system must be inspected at least once a day. • The person in charge/technician must inspect the cathodic protection system and the forced current sources	

(Continuation of Annex 2. Table 1: Regulatory framework for CDW management in Cyprus.)

Stage	Measuring Item		Comments	References
Maintenance, Renovation and Demolition	*Waste Audits*		Secondary Storage Tank Inspection Requirements 1 Tank fullness control development of schedule and procedures each day of tank operation (interim status). 2 Visual inspection of the above-ground parts of the tank for corrosion or leaks. -Analysis of monitoring and leak detection data (e.g. pressure and temperature gauges, monitoring wells, leak detection devices) each day of tank operation. 3 - Materials of construction and externally accessible parts of the tank and secondary storage system to detect corrosion or signs of leaks (e.g. wet spots, dead vegetation) each day the tank is in operation. 4 - Proper operation of the cathodic protection system within 6 months of initial installation and once a year thereafter. 5 - Impressed current sources every 2 months 2 For accessible underground tanks: a procedure to carry out a leak test or general inspection of the tank/s system by an independent, qualified, approved, professional engineer. Program to be approved by implementing body for tanks 1 time per year for tanks in intermediate condition. 3 - For auxiliary equipment: leak tests or other approved method once a year. 4 Recording of all checks and record keeping at the institution's facilities. 5 - Leaking or inadequate tank systems	
		Other than waste audits, are there any schemes, plans, policies, permits or guidelines, etc., for renovation and demolition activities, in your country? (that control and regulate waste aspects in demolition sites) [xx] If so, state them describing their scope and provide references to supporting reports/documents	N/A	
Recovery	*Multiple Felds*	What is the current recovery rate of CDW in your country? [xxi] [xxii]	77% Estimated for 2020	https://ec.europa.eu/eurostat/databrowser/view/ENV_WASTRT__custom_5550408/default/table?lang=en http://www.moa.gov.cy/moa/environment/environmentnew.nsf/All/FBDCBA0166BEB201C225802F003AD23F/$file/N3(I)-2016.pdf
		Are there economic incentives implemented in your country for promoting CDW prevention, collection, reuse, and recycling? [xxiii] If so, please describe the types of such incentives	No	
		How is CDW defined in your country, and what are the types of CDW according to that definition? (i.e., What can be counted as CDW) [xxiv] [xxv] [xxvi]	Cyprus defines the CDW as per EU regulation. An excessive list can be found in the references.	

(Continuation of Annex 2. Table 1: Regulatory framework for CDW management in Cyprus.)

Stage	Measuring Item		Comments	References
Recovery	*Multiple Felds*	Are there national strategies (plans, programmes, schemes, targets) about CDW management including prevention, collecting, sorting, reuse, recycling and disposal established in your country? [xxvii] [xxviii] [xxix] [xxx] [xxxi] [xxxii] [xxxiii] [xxxiv] If so, please state them, and provide references to supporting reports/documents	The latest national strategy was established in 2016, in the Waste Management law amendment.	http://www.moa.gov.cy/moa/environment/environmentnew.nsf/All/FBDCBA0166BEB201C225802F003AD23F/$file/%CE%95%CF%85%CF%81%CF%89%CF%80%CE%B1%CE%B9%CE%BA%CF%8C%CF%82%20%CE%9A%CE%B1%CF%84%CE%AC%CE%BB%CE%BF%CE%B3%CE%BF%CF%82%20%CE%91%CF%80%CE%BF%CE%B2%CE%BB%CE%AE%CF%84%CF%89%CE%BD%20-%20%CE%91%CF%80%CF%8C%CF%86%CE%B1%CF%83%CE%B7%20%CE%95%CF%85%CF%81%CF%89%CF%80%CE%B1%CE%B9%CE%BA%CE%AE%CF%82%20%CE%95%CF%80%CE%B9%CF%84%CF%81%CE%BF%CF%80%CE%AE%CF%82.pdf (Pages 35,36) http://www.moa.gov.cy/moa/environment/environmentnew.nsf/page20_gr/C2CAECE079E9931DC2257EF200356E7A/$file/%CE%A3%CF%87%CE%AD%CE%B4%CE%B9%CE%BF%20%CE%94%CE%B9%CE%B1%CF%87%CE%B5%CE%AF%CF%81%CE%B9%CF%83%CE%B7%CF%82%20%CE%91%CF%80%CE%BF%CE%B2%CE%BB%CE%AE%CF%84%CF%89%CE%BD%20(%CE%B3%CE%B9%CE%B1%20%CF%84%CE%B1%20%CE%BB%CE%BF%CE%B9%CF%80%CE%AC%20%CF%81%CE%B5%CF%8D%CE%BC%CE%B1%CF%84%CE%B1%20%CE%B1%CF%80%CE%BF%CE%B2%CE%BB%CE%AE%CF%84%CF%89%CE%BD)%202016-%202022.pdf
	Recycle	How is CDW recycling defined in your country, and what are the types of processes that can be counted as acceptable recycling processes (of which the resultant materials are considered recycled)? [xxxvii]	Cyprus follows EU definitions for CDW recycling.	
		Is there a classification of CDW types that are applicable for recycling, in your country? [xxxviii] If so, please provide further information	CDW are classified as hazardous, non-hazardous and mixed. They are further separated to the subcategories described above. Each operator/facility can apply different treatments as per their capabilities. Waste that cannot be treated are either exported or end up in landfills.	
		Are there markets for secondary raw materials (recycled CDW materials) established in your country? If so, please provide further information on the types of these markets	Secondary raw materials are mainly exported. There is not specific established market in the country. There may be some reuse at national level, but there are not significant information available in this aspect.	
	Reuse	How is CDW reuse defined in your country?	Cyprus follows EU definitions for CDW reuse.	
		Are there networks and sharing platforms for reuse and repair in your country? [xxxix] If so, please provide examples with references/links	No	

(Continuation of Annex 2. Table 1: Regulatory framework for CDW management in Cyprus.)

Stage	Measuring Item		Comments	References
Recovery	*Treatment*	Is there a definition of ownership and responsibility for the actors involved in waste handling and treatment, set by your country? (e.g., waste producers, holders, and managers, etc.) [xl] [xli] [xlii] If so, please provide further information	As described above, the project owner is fully responsible for the management of the produced WECD and they can transfer the responsibility under contract to a licensed operator of Management of Waste from Excavation, Construction and Demolition.	http://www.moa.gov.cy/moa/environment/environmentnew.nsf/All/92262E94077FEEF4C2258053003F04B5/$file/%CE%A3%CF%87%CE%AD%CE%B4%CE%B9%CE%BF%20%CE%94%CE%B9%CE%B1%CF%87%CE%B5%CE%AF%CF%81%CE%B9%CF%83%CE%B7%20%CE%91%CF%80%CE%BF%CE%B2%CE%BB%CE%AE%CF%84%CF%89%CE%BD.pdf
		Issuing of permits for CDW treatment (either for establishment or undertaking) applied by your country? [xliii] If so, please provide further information	Yes, they are issued by the Ministry of Agriculture, Rural Development and Environment (https://eia.moa.gov.cy/public/pollution/)	
Residual Waste	*Multiple Felds*	Are there landfilling and incineration charges, and restrictions adopted by your country? If so, please state them and describe their criteria	N/A	https://cypruscircular.org.cy/wp-content/uploads/2021/07/state-of-CDW-management-in-Cyprus.pdf
		What is the most common disposal method for CDW in your country? [xliv]	There are limited available data in this aspect, using 2016 data, the most common disposal method for CDW was recycling, followed closely by landfilling.	

Annex 2. Table 2: Regulatory framework for CDW management in Czech Republic.

Stage	Measuring Item		Comments	References
Design and Manufacturing	*Extended Producer Responsibility Schemes (EPR)*	Is EPR scheme applied in your country? [i] If not, please describe if there is any similar scheme applied	Yes, CZ applies similarly to Spain, Belgium, France, Ireland, Finland, the Netherlands Cyprus, Italy and Luxemburg the principle of single-operator.	EKOKOM (https://www.ekokom.cz/en/other/about-us/
		What construction product categories are regulated by the EPR scheme in your country? [ii]	Plastic, paper, glass – this is for packaging materials, not for products in buildings or built structures.	
		Are there waste management quantitative targets set by your country, relevant for the EPR scheme? (e.g., recycling rate of products, setting a minimum percentage of reusable/recyclable products placed on the market) If so, please provide further information	Information not available so far.	
	BIM	Does your country have a national level driven Digital Transformation/BIM agenda/mandate/roadmap? If so, please provide further information.	Yes, there exists the so called "Concept of implementation of the BIM method in the Czech Republic" which was prepared by the Ministry of Industry and Trade in 2017. This was at the same year approved by the government. The status of progress was reported in 2020 and in 2023 it is planned to have an extended revision. Methodological responsibility is given to the Czech Standardization Agency.	https://www.koncepcebim.cz/koncepce
		What is the main driver for BIM adoption/Digital Transformation in your national sector? (Government/Industry/both/neither) Please provide explanation	Both. Government based on the concept and integration in the legal framework including the mandatory requirement for above-limit public contracts (public works) as defined by the procurement law to use BIM since mid of 2023. Industry (developers or private investors) who have identified several benefits in information modelling and digitalization of construction processes and facility management. In the latter case it is dependent on the readiness of the investor to require BIM in his projects.	
		What BIM/Information Management standards, protocols, etc. are predominantly being adopted in your national sector to facilitate the digital transformation/BIM adoption? (e.g. ISO 19650 series).	ČSN EN ISO 19650 as the key standard. Additionally, there are two national data standards for nongraphic information. Contract documents like BEP, BIM Protocol, EIR, CDE, DiMS requirements are further ruled by guidance documents provided either by the Czech Standardization Agency or by the State Fund for Transport Infrastructure.	
		What is the level of BIM adoption within your national sector? Provide references to supporting government, industry, academic reports	2D combined with 3D, higher dimensions of BIM so far rather rare and if used then mainly by private developers/investors. The mandatory use, see in one of previous answers. Designers and architects are by more than 30 % able to use and generate 3D models. In the construction sector (sites) the models are used by some large companies for coordination, work handover, detection of collisions. Facility managers are starting to use is as integral part of CAFM where the digital twin of as-built shall provide the only truth of the built structure.	

(Continuation of Annex 2. Table 2: Regulatory framework for CDW management in Czech Republic.)

Stage	Measuring Item		Comments	References
Design and Manufacturing	*BIM*	Is the Digital Twin a key concern to the digital transformation of your national sector? If so, please provide further information	Based on the national data standard for graphical and non-graphical (attributes) information detail (LoIN).	
		How (and to what extent) is the circular economy/waste management being integrated into your sector's digital transformation?	Not yet.	
	Harmonised Standards	Is CE marking conformity implemented in your country?	Yes, on the basis of Act No. 22/1997 Coll., construction products for which there are harmonised European standards are placed on the market strictly in accordance with EU Regulation No. 305/2011 (CPR) (these products receive the CE marking). The properties of these products can be defined (on the basis of EN standards) in Czech technical standards.	
		What other conformity standards and certification are implemented in your country that affect reuse/recycling and recyclability of construction products?	Construction products for which we do not have European harmonised standards are marketed according to Act No. 22/1997 Coll. and Government Regulation No. 163/2002 Coll. Construction products are then divided into the category of specified and non-specified products. These products are compared with national specifications, standards or company standards. For these products, a production management system certificate must be issued to the manufacturer (or a so called construction technical certificate) and a national declaration of conformity must be drawn up by the manufacturer. For example, some products, like reclaimed asphalt, have a national product standard (CSN) since the EN 13108-8 which is dedicated to reclaimed asphalt on European level is not harmonized. Furthermore, in road sector (as the only one) there are technical specifications TP 210 (Ministry of Transport) which provide rules for use and declaration of recycled or reused granular materials derived from CDW.	
		Are there any national sustainable-building or construction schemes in your country? (e.g. LEED, BREEAM, etc.) If so, please provide further information and if they include any requirements about waste and circular economy	LEED, BREEAM as international certification systems for buildings. SBToolCZ as a national certification system. There is no certification so far in transport infrastructure.	https://www.sbtool.cz/
		Is it a legal requirement for buildings (or some type of buildings) to be designed for disassembly? [iii] (reflect ISO 20887 or any other standards) If so, please provide further information	No.	

(Continuation of Annex 2. Table 2: Regulatory framework for CDW management in Czech Republic.)

Stage	Measuring Item		Comments	References
Construction	*Green Public Procurement (GPP)*	Is GPP policy applied in your country? [iv] If not, please describe if there is any similar scheme applied	The recommendation for GPP known as EU GPP criteria are translated to the Czech language and provided by the Ministry of Regional Development for volunteer use. They are not mandatory and are not strictly requested to be part of public procurement.	
		Is there a target set by your country? If so, has it been fulfilled? (a target in which a percentage of all public procurement should be green).	Since the use of GPP is on volunteer basis and public investors or sponsors are not forced to use these criteria, there are also no targets. There are since 2021 new clauses in the national procurement law which follows the requirements of public procurement directive and waste framework directive of the EU which requests to perform public tenders with environmental and social responsibility aspects. Therefore, the procurement law introduced this duty in two paragraphs, but in a very general way not providing any measures or guidance.	
		Is GPP policy applied in construction related aspects? [v] [vi] [vii]	No, it is just regulated by the waste law, that contractors have to separate waste materials on site during the construction process, i.e. mixed waste shall be avoided.	
		What aspects in construction waste management the GPP is targeting in your country? (e.g., specifying processes or packaging which generate less waste; encouraging reuse and recycling of materials; reducing using products containing critical raw materials, reducing using products containing hazardous substances, etc.) [viii] [ix] [x]	So far there are no aspects and targets related to waste management and GPP. Regarding packing the industry is following the actually discussed requirements in the European packing directive. Regarding recycling and reuse of materials no specific requests or targets are defined by the law. Critical raw materials are embedded in the policies of the Ministry of Industry and Trade, but none of the critical raw materials is linked to the typical CDW. This means that construction sector in CZ is not affected by this.	
	EU Taxonomy for New Construction	Is there a familiarity of EU taxonomy system in your country? [xi] [xii] [xiii] If so, please provide further information on the level of its adoption	Very limited so far. Due to the requirements in the European legislation and mandatory non-financial reporting of large companies since 2024 the understanding of EU taxonomy and ESG reporting raise more awareness and companies train own staff.	
		Are there technical screening criteria established by your country, for defining economic activities that counts as green? [xiv] If so, please provide references to supporting reports/documents	So far large companies – as defined by the EU regulation No. 2020/852 – have to report about fulfilling ESG criteria and assess their projects for eligibility and alignment according to the criteria provided by corresponding delegated acts of the European Commission. Nationally there are no specific criteria.	
		Are there any similar system/scheme to EU taxonomy applied in your country? If so, please provide further information	No.	

(Continuation of Annex 2. Table 2: Regulatory framework for CDW management in Czech Republic.)

Stage	Measuring Item		Comments	References
Construction	*Site Waste Management Plans*	Are site waste management plans applied in your country? If so, please describe if it Is a mandatory or voluntary requirement for construction activities	Yes, but only as part of the documentation (integral part for approval by the public authorities – usually Construction Office) of demolition works. SWMP in accordance with the "EU CDW waste management protocol" is voluntary. There are actually expert discussions between several stakeholders how to integrate these protocols as a mandatory part of demolition or deconstruction works.	Act No. 183/2006 Coll Annex No. 15 Degree No. 499/2006 Coll https://www.mzp.cz/cz/metodika_stavebni_odpady
		What are the requirements for site waste management plans in your country?	Relevant requirements for CDW and documentation related to demolition works are: i.presence of asbestos in the building. ii.the maximum quantities and types of waste and emissions produced during the removal (demolition) of the building or infrastructure, the handling of waste, especially hazardous waste, the method of transport and their disposal or further use or disposal.	
		If SWMP is not applied in your country, are there any legal/voluntary requirements for managing waste on construction sites? (e.g., waste identification of expected waste types and amounts, source separation and collection, documentation, storing, transportation, etc.,) [xv] [xvi] [xvii] If so, please provide further information	During demolition, construction or maintenance of the works, the following CDW shall be separately collected. CD materials that can be reused or CDW that can be recycled. CDW containing hazardous components (List of recyclable, reusable and hazardous waste and materials in Annex 24 Decree No. 273/2021 Coll.) CDW containing hazardous substances shall be handled in such a way as to avoid contamination of other demolished construction materials, by-products or construction and demolition waste intended for recycling or reuse. CDW containing asbestos must be wrapped in leak-proof packaging or placed in sealed receptacles or containers immediately after generation, labelled and delivered to a waste management facility for collection or disposal.	

(Continuation of Annex 2. Table 2: Regulatory framework for CDW management in Czech Republic.)

Stage	Measuring Item		Comments	References
Maintenance, Renovation and Demolition	*Waste Audits*	Are waste audits and/or inventories applied in your country? If so, please describe if it Is a mandatory or voluntary requirement for renovation and demolition activities	Since this refers to pre-demolition audits which are not mandatory European-wide on country level there are presently running some innovation projects with the target to identify how this shall be in the near future integrated in the construction processes and overall life-cycle of buildings and infrastructure.	
		What are the regulatory requirements/checklist for the waste audits in your country? [xviii] Generally describe the scope of requirements and guidelines that regulate the waste audits process,	Not existing yet.	
		Are waste audits requirements regulated in each region or is it generalised for the entire country?	Not existing yet.	
		Are there regular inspections/monitoring of the process and the output of the waste audits, in your country? [xix] If so, please provide further information	No, since pre-demolition audits do not exist yet.	
		Other than waste audits, are there any schemes, plans, policies, permits or guidelines, etc., for renovation and demolition activities, in your country? (that control and regulate waste aspects in demolition sites) [xx] If so, state them describing their scope and provide references to supporting reports/documents	This refers mainly to pre-demolition audits. There are several actions at this moment ongoing in the Czech Repulbic which target to introduce and adapt these audits as a regular part of deconstruction and demolition, mainly as a national technical standard.	

(Continuation of Annex 2. Table 2: Regulatory framework for CDW management in Czech Republic.)

Stage	Measuring Item		Comments	References
Recovery	*Multiple Felds*	What is the current recovery rate of CDW in your country? [xxi] [xxii]	Most countries include in their recovery overviews backfilling as well. According to this approach more than 70% of CDW is recovered, which provides no information about the true recovery in terms of recycling and reuse.	
		Are there economic incentives implemented in your country for promoting CDW prevention, collection, reuse, and recycling? [xxiii] If so, please describe the types of such incentives	There does not exist any system or motivation scheme which would support companies, investors or waste originators to prevent waste or favour recycling/reuse. The industry as several options to apply for public financial support (various funding schemes) to co-finance investments in technologies or new solutions for recycling, reuse or more sustainable production. In construction sector the country so far does not have some system of environmental/sustainability/circularity criteria which would be applicable especially in public tenders. On the other hand there is of course a system on landfilling charges, but we do not consider this as a kind of economic incentive promoting better use of CDW.	Ministry of Environment: https://opzp.cz/dotace/62-vyzva/ Ministry of Industry and Trade: https://www.mpo.cz/cz/podnikani/dotace-a-podpora-podnikani/optak-2021-2027/aktivity/obehove-hospodarstvi/obehove-hospodarstvi-_-vyzva-i--op-tak--276677/
		How is CDW defined in your country, and what are the types of CDW according to that definition? (i.e., What can be counted as CDW) [xxiv] [xxv] [xxvi]	CZ follows the European Waste Catalogue and definitions + waste category codes provided there. The waste codes are then integrated in the national waste catalogue and the originators/holders or later the waste managers are classifying the generated or received waste according to these codes. General definition: Construction and demolition waste is the waste produced during construction and demolition activities. It is defined as demolished construction materials, products and soils that can be reprocessed by recycling or construction and demolition waste that can be recycled into inert material. Additionally, it is understood as collection of constituents which do not have hazardous properties and which, under normal climatic conditions, do not undergo any significant physical, chemical or biological changes. CDW categories are listed in the document “Review of current practices – Czech Republic”.	https://www.mzp.cz/cz/plan_odpadoveho_hospodarstvi_aj
		Are there national strategies (plans, programmes, schemes, targets) about CDW management including prevention, collecting, sorting, reuse, recycling and disposal established in your country? [xxvii] [xxviii] [xxix] [xxx] [xxxi] [xxxii] [xxxiii] [xxxiv] If so, please state them, and provide references to supporting reports/documents	Generally, for waste management the Ministry of Environment adopted in the past “Waste Management Plan of the Czech Republic for 2015-2024”. Additionally. there is another strategic document called “The basis for the area of support for waste and recycling management as part of the Programme Document in the Operational Programme Environment 2021-2027". Ministry of Industry and Trade implemented in the strategies for construction sector the “EU protocol on the management of construction and demolition waste”. The same ministry is responsible for following and adopting the “Secondary Raw Materials Policy of the Czech Republic for the period 2019 – 2022”.	https://www.mpo.cz/cz/prumysl/politika-druhotnych-surovin-cr/ceska-republika-se-priblizuje-k-cirkularni-ekonomice--vlada-cr-schvalila-politiku-druhotnych-surovin-ceske-republiky-pro-obdobi-2019-_-2022--248121/
		How is the national CDW data collected/measured in your country? (i.e., volumes/amounts of generated, recycled, reused, and landfilled waste) Are there electronic reporting measures taken by your country [xxxv] [xxxvi] (volume, amounts, types, etc.) If so, please provide further information	Companies are requested to report data to the National Statistical Office. Furthermore, Ministry for Environment has a specific Information Agency for Environmental Data, which is maintaining information system for waste management (ISOH). This system is a comprehensive, detailed, regional, heterogeneous, modular and fully computerized information system built according to the principles of SOA architecture. It serves the decision-making, control and statistical needs of the waste management of the Czech Republic. The data are available in detailed form to state administration authorities and in aggregated form to the public.	

(Continuation of Annex 2. Table 2: Regulatory framework for CDW management in Czech Republic.)

Stage	Measuring Item		Comments	References
Recovery	*Recycle*	How is CDW recycling defined in your country, and what are the types of processes that can be counted as acceptable recycling processes (of which the resultant materials are considered recycled)? [xxxvii]	Recycling: the transformation of waste, within a production process, for its initial purpose or for other purposes, including composting and similar bio-based processed, but not incineration with energy recovery. During recycling it is not expected that same performance and same characteristics of the final product will be achieved like for reuse. Recycled materials have to fulfil technical standards and specifications, but it is not expected that e.g. recycled concrete aggregates will result in new concrete without the need for new binder (virgin cement to be added).	
		Is there a classification of CDW types that are applicable for recycling, in your country? [xxxviii] If so, please provide further information	CDW is classified according to the Catalogue of wastes which follows the coding of European catalogue. Recycling centers or authorised companies who are allowed to manipulate with waste are then either landfilling the waste or using it for backfilling or turning it to recycled materials. These materials are then as non-waste or by-products used as products (granular materials) following existing standards or can be used as substitute to soils and are classified as particular type of soil material and then applied for intended use.	
		Are there markets for secondary raw materials (recycled CDW materials) established in your country? If so, please provide further information on the types of these markets	CYRKL: Europe's largest platform for industrial waste management and green sourcing (*it is how their present themselves*). See the document "Review of current practices – Czech Republic".	
	Reuse	How is CDW reuse defined in your country?	Reuse: the use of a used product for the same purpose for which it was originally designed.	
		Are there networks and sharing platforms for reuse and repair in your country? [xxxix] If so, please provide examples with references/links	No, partly CYRKL is dealing with reuse as well.	

(Continuation of Annex 2. Table 2: Regulatory framework for CDW management in Czech Republic.)

Stage	Measuring Item		Comments	References
Recovery	*Treatment*	Is there a definition of ownership and responsibility for the actors involved in waste handling and treatment, set by your country? (e.g., waste producers, holders, and managers, etc.) [xl] [xli] [xlii] If so, please provide further information	In CZ we have national Waste Act (541/2020 Coll.) which reflects the requirements and common EU rules given mainly in the directive 2008/98/EC. Other European directives are reflected by this act as well. This act defines originator – subject who generates the waste. Then the act defines and lists subjects who are allowed to retrieve the waste and further manipulate with waste materials – these are operators of facilities which are approved for waste treatment, waste dealers or municipalities (for them additionally requirements are given in §59 of the waste act). In detail obligations and responsibilities for waste originators and waste managers are given including requirements for the facilities which are used for receiving and further treatment of waste.	
		Issuing of permits for CDW treatment (either for establishment or undertaking) applied by your country? [xliii] If so, please provide further information	A facility for the storage, collection, **treatment**, recovery or disposal of waste may be operated only on the basis of a permit for the operation of the facility issued by the regional public authority (CZ has 13 regions following the NUTS structure as given for EU). The requirements are in detail given in the national waste act (541/2020 Col.)	
Residual Waste	*Multiple Felds*	Are there landfilling and incineration charges, and restrictions adopted by your country? If so, please state them and describe their criteria	Sub-fees for landfilling are set out in Act No. 541/2020 Coll., Annex 9. This is a fee that is shared between the respective municipality and the State Environmental Fund. The rate increases every year until 2030. Minimum landfill charges for 2023 (per tonne): - recoverable waste 1000 CZK (calorific value > 6,5 MJ/kg; respiration activity (AT(4) > 10 mg O2/g; or waste that can be recycled in a meaningful way in the current state of scientific and technical progress (according to Decree No 273/2021 Coll); - hazardous waste 2000 CZK; - selected technological waste 45 CZK; - remediation waste 1000 CZK; residual waste 500 CZK (including asbestos waste)	
		What is the most common disposal method for CDW in your country? [xliv]	Backfilling and similar use on the terrain (land reclamation etc.). For non-hazardous mineral wastes especially in transport infrastructure sector use as substitute to soil and gravel is also commonly used.	

Annex 2. Table 3: Regulatory framework for CDW management in Greece.

Stage	Measuring Item		Comments	References
Design and Manufacturing	*Extended Producer Responsibility Schemes (EPR)*	Is EPR scheme applied in your country? [i] If not, please describe if there is any similar scheme applied	Yes, through Law 4819/2021 that incorporates Directives (EU) 2018/851 and 852 [1]. Minimum requirements are established for the following components of the EPR scheme: • EPR programs (stakeholder role definition, waste management targets, report system establishment, proprietary rights and industrial/commercial confidentiality and competition protection, information campaign and incentive provision to product users, alternative waste treatment directives requirements) • Personal Alternative waste management systems (AWMS) (permit approval, geographical coverage, product specialization, waste collection methods/systems, economic and organizational capabilities/structure, financial management and data recording self and regular independent auditing, financial/methods and processes/collaboration/objective fulfilment transparency, confidentiality requirements) • Collective Alternative waste management systems (AWMS bodies) (organizational structure/composition, legal incompatibilities, financial and waste management report obligations/structure, auditing, target setting and fulfilment requirements) • Supervising institution (Hellenic Recycling Agency) (monitoring, supervision, auditing and enforcement framework) • Waste producers (form or collaborate and financially contribute to alternative waste management systems)	[1] (Government Gazette A' 129/23.7.2021), Law 4819/2021 "Integrated framework for waste management – Transposition of Directives 2018/851 and 2018/852 of the European Parliament and of the Council of 30 May 2018 amending Directive 2008/98/EC on waste and Directive 94/62/EC on packaging and packaging waste, framework for the organization of the Hellenic Recycling Organization, provisions for plastic products, urgent provisions for the protection of the natural environment, spatial-urban planning and energy regulations'' [2] EUR-Lex - 32001D0118 - EN - EUR-Lex, 2001/118/EC: Commission Decision of 16 January 2001 amending Decision 2000/532/EC as regards the list of wastes. [3] (Government Gazette Issue 1312/B/24-08-2010), Joint Ministerial Decision 36259/1757/E.103/2010.
		What construction product categories are regulated by the EPR scheme in your country? [ii]	Excavation, construction and demolition waste (ECDW) products, as described in the European List of Waste [2], are regulated by EPR-resembling schemes that are based on the obligation of the waste producer (construction project manager/contractor/owner) to direct waste to Collective Alternative Waste Management Systems and pay for their management, or form themselves Personal such systems and upload relevant required information to the Digital Waste Registry [1], [3].	
		Are there waste management quantitative targets set by your country, relevant for the EPR scheme? (e.g., recycling rate of products, setting a minimum percentage of reusable/recyclable products placed on the market) If so, please provide further information	For excavation, construction and demolition waste (ECDW), future alternative waste management programs are provided for in the legislation that should resemble EPR schemes and should include that a minimum 70% w/w of ECDW are prepared for reuse, recycling or recovery. It should be noted that the target was initially set to be achieved by 2020. Since however this was not the case, it has been renewed in Law 4819/2021 [1].	

(Continuation of Annex 2. Table 3: Regulatory framework for CDW management in Greece.

Stage	Measuring Item		Comments	References
Design and Manufacturing	*BIM*	Does your country have a national level driven Digital Transformation/BIM agenda/mandate/roadmap? If so, please provide further information.	The "Deployment of a Strategic Plan and Roadmap for the Implementation of Building Information Modelling (BIM) in Greece, for the delivery and management of Infrastructure Projects", funded by DG REFORM, was commissioned in 12/2021. Its results are expected to be publicized by 4/2023 [4].	[4] 'Deployment of a Strategic Plan and Roadmap for the Implementation of Building Information Modelling (BIM) in Greece, for the delivery and management of Infrastructure Projects' - Ministry of Infrastructure and Transportations (Press release - In Greek). [5] "Greece - European construction sector observatory (ECSO) country fact sheet." [6] "Athens Twin | digital urban european twins." [7] "Home | Iliad - Digital Twin of the Ocean." [8] "Homepage - DT4GS Digital Twin for Green Shipping." [9] "About National Producers' Register (In Greek)." [10] "Obligations of companies producing packaging and other products." [11] "Digital Waste Registry (in Greek)."
		What is the main driver for BIM adoption/Digital Transformation in your national sector? (Government/Industry/both/neither) Please provide explanation	According to the European Construction Sector Observatory's (ECSO) country profile for Greece for 2020 [5], domestic construction firms are lacking in innovation and only 5 % of them implement augmented or virtual reality (EU average 11%). BIM involvement was found to be limited to participation in the EUBIM Task Group and to one major project BIM application on a national level.	
		What BIM/Information Management standards, protocols, etc. are predominantly being adopted in your national sector to facilitate the digital transformation/BIM adoption? (e.g. ISO 19650 series).	Currently none.	
		What is the level of BIM adoption within your national sector? Provide references to supporting government, industry, academic reports	As mentioned in the ECSO report [5], domestic legislation permits the use of BIM in public construction projects, without however providing any further guidance or requirements.	
		Is the Digital Twin a key concern to the digital transformation of your national sector? If so, please provide further information	There are currently no policies on adopting Digital Twin technologies on a national level. The city of Athens is currently however developing its digital twin as part of the DUET project [6], and domestic research institutions are active on the broader field (projects Iliad, DT4GS) [7], [8].	
		How (and to what extent) is the circular economy/waste management being integrated into your sector's digital transformation?	Both a National Producers' Registry (for packaging, vehicles, tyres, mineral oils, batteries and accumulators, electrical and electronic equipment) [1], [9], [10]and a Digital Waste Registry (CDW included) are established [1], [11]. The former's function is to record all domestically produced or imported quantities of the aforementioned products. It should be mentioned though that this does not apply to ECDW producers. This is one of the differences between EPR schemes concerning other products and the EPR-resembling scheme applied to ECDW. The latter's is 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. No direct links with BIM technology are however in place.	

(Continuation of Annex 2. Table 3: Regulatory framework for CDW management in Greece.)

Stage	Measuring Item		Comments	References
Design and Manufacturing	*Harmonised Standards*	Is CE marking conformity implemented in your country?	Yes.	[12] "Environmental Labeling - Hellenic Recycling Agency (in Greek)."
		What other conformity standards and certification are implemented in your country that affect reuse/recycling and recyclability of construction products?	Eco-labels marking (Green Dot, Möbius with or without recycled material percentage) [12].	
		Are there any national sustainable-building or construction schemes in your country? (e.g. LEED, BREEAM, etc) If so, please provide further information and if they include any requirements about waste and circular economy	No.	
		Is it a legal requirement for buildings (or some type of buildings) to be designed for disassembly? [iii] (reflect ISO 20887 or any other standards) If so, please provide further information	No.	
Construction	*Green Public Procurement (GPP)*	Is GPP policy applied in your country? [iv] If not, please describe if there is any similar scheme applied	Yes. The GPP National Action Plan (2021-2023) [13] 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) and also voluntary for some further categories (furniture, textiles, public space maintenance, waste water infrastructure, electrical and electronic equipment used in the health care sector, road design, construction and maintenance, office building design, construction and management). Relevant obligatory ordinances are also applied through sector-specific regulations (for single-use plastics and building energy efficiency). Environmental licensing for major public (or private) construction projects is also required [14], [15] .	[13] "About GPP National Action Plan, Ministry of Development and Investment." [14] "Projects and activities subject to environmental licensing." [15] "Environmental licensing categories."
		Is there a target set by your country? If so, has it been fulfilled? (a target in which a percentage of all public procurement should be green).	The GPP National Action Plan (2021-2023) [13]has not set a target for all public procurement. It has rather set individual targets for the abovementioned service/product categories. These targets, for each category, vary for each year of the plan's duration and are also expected to be fulfilled by different public organizations (ranging from central government the first year to more decentralised public bodies the following two years).	

(Continuation of Annex 2. Table 3: Regulatory framework for CDW management in Greece.)

Stage	Measuring Item		Comments	References
Construction	*Green Public Procurement (GPP)*	Is GPP policy applied in construction related aspects? [v] [vi] [vii]	As mentioned, yes, on a voluntary basis (with a strong recommendation) on public procurement concerning: Road Design, Construction and Maintenance and Office Building Design, Construction and Management, adopting common EC GPP criteria. In addition, through other sector specific regulations, obligatory standards with regards to the buildings' energy design and efficiency are applied [13].	
		What aspects in construction waste management the GPP is targeting in your country? (e.g., specifying processes or packaging which generate less waste; encouraging reuse and recycling of materials; reducing using products containing critical raw materials, reducing using products containing hazardous substances, etc.) [viii] [ix] [x]	It targets the following aspects for Road Design, Construction and Maintenance: • Minimizing the use of natural resources embodied impact. • Extending the service life of the road's surface layers in order to minimize replacement needs • Site waste management planning, in order to achieve maximum on-site reuse of excavation waste and recycling/reuse of construction and demolition waste • Maximum use of materials with a high recycled content, including by-products. For Office Building Design, Construction and Management: • Minimizing the use of natural resources embodied impact • Site waste management planning, in order to minimize construction and demolition waste • Maximum use of materials with a high recycled content [13].	
	EU Taxonomy for New Construction	Is there a familiarity of EU taxonomy system in your country? [xi] [xii] [xiii] If so, please provide further information on the level of its adoption	The level of adoption of the EU taxonomy system consists on the provisions of the Regulation (EU) 2020/852 for large companies with over 500 employees with Non-Financial Reporting Directive (NFRD) obligations, financial market participants and the State when policies regarding green bonds or financial products are concerned [16].	[16] "EUR-Lex - 32020R0852 - EN - EUR-Lex Regulation (EU) 2020/852 of the European Parliament and of the Council of 18 June 2020 on the establishment of a framework to facilitate sustainable investment, and amending Regulation (EU) 2019/2088." [17] "Greek Sustainability Code." [18] "Hellenic Corporate Governance Code - HCGC."
		Are there any technical screening criteria established by your country, for defining economic activities that counts as green? [xiv] If so, please provide references to supporting reports/documents	No further technical screening criteria are established on a domestic basis. The Greek Sustainability Code has however been developed as an official reference framework for non-financial data reporting but is of a more general/organizational nature and does not have specific provisions for new construction [17]. The Hellenic Corporate Governance Code also includes (organizational) recommendations and best practices regarding corporate sustainability policies [18].	

(Continuation of Annex 2. Table 3: Regulatory framework for CDW management in Greece.)

Stage	Measuring Item		Comments	References
Construction	*EU Taxonomy for New Constructio*	Are there any similar system/scheme to EU taxonomy applied in your country? If so, please provide further information	No.	[19] (Government Gazette 92/A` 7.5.2020), Law 4685/2020 "Modernising of Environmental Legislation - Transposition of Directives 2018/844 and 2019/692 of the European Parliament and Council" (In Greek). [20] "IMPROVED MANAGEMENT OF CONSTRUCTION & DEMOLITION WASTE IN GREECE FINAL REPORT 24/07/2020 Athens, Greece [21] (Government Gazzette 135/B` 27.1.2014), Ministerial Decision 170225/2014 "Specification of the contents of the files submitted for the environmental permitting of projects and activities of category A, according to the Decision of the Minister of Environment and Energy 1958/2012 (GG B'21), as it applies, in accordance with art 11 of Law No. 4014/2011 (GG A'209), and every other detail" (In Greek).
	Site Waste Management Plans	Are site waste management plans applied in your country? If so, please describe if it Is a mandatory or voluntary requirement for construction activities	No.	
		What are the requirements for site waste management plans in your country?	N/A.	
		If SWMP is not applied in your country, are there any legal/voluntary requirements for managing waste on construction sites? (e.g., waste identification of expected waste types and amounts, source separation and collection, documentation, storing, transportation, etc.,) [xv] [xvi] [xvii] If so, please provide further information	ECDW managers (contractors, project owners or managers) are obligated to submit ECD Waste Management Data reports to Urban Planning Agencies, concerning the waste expected to be produced by their activity, in order to get a construction, renovation or demolition permit. These include total waste quantity estimation (v/v or w/w), waste quantity estimation by European Waste Catalogue material, waste quantity estimation for reuse, recycling or landfilling. The reports are accompanied by copies of contracts for the management of ECDW by Alternative Waste Management Systems [3], [19]. This scheme, although resembling the process of a waste audit, does not fully comply to the guidelines established by the EC and improvements are required, as was found in a recent report conducted for the Greek government [20]. Apart from expanding the framework to match EC guidelines, corresponding control bodies must be developed and executives trained, since current control of these procedures is lacking. In major construction projects (category A) that require environmental licensing [14], waste management is conducted in accordance with the requirements to get an Environmental Terms Approval Decision (ETAD). These include a disclosure of expected liquid and solid waste production during the construction, operation and end-of-life stage, along with a thorough description of their management and disposal methods, to ensure legal conformity based on waste type [21]. 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 is established in Law 4819/2021. Consideration of these measures should be reflected in corresponding Waste Management Data reports for ECDW. Hazardous ECDW is managed according to the legislation for hazardous materials [1]. From 1/1/2023 onwards, all ECDW transporting vehicles are obligated to have GPS tracking systems [1].	

(Continuation of Annex 2. Table 3: Regulatory framework for CDW management in Greece.)

Stage	Measuring Item		Comments	References
Maintenance, Renovation and Demolition	*Waste Audits*	Are waste audits and/or inventories applied in your country? If so, please describe if it Is a mandatory or voluntary requirement for renovation and demolition activities	No.	[22] (Government Gazzette 167/A` 3.11.2017), Law 4495/2017 "Control and Protection of the Built Environment" (In Greek).  [23] (Government Gazzette 209/A` 21.9.2011), Law 4014/2011 "Environmental Licensing of Works and Activities, Regulation of Illegal Constructions in Connection with Environmental Stability and other Provisions falling under the competence of the Ministry of Environment" (In Greek).
		What are the regulatory requirements/checklist for the waste audits in your country? [xviii] Generally describe the scope of requirements and guidelines that regulate the waste audits process,	N/A.	
		Are waste audits requirements regulated in each region or is it generalised for the entire country?	N/A. However, the abovementioned process resembling waste audits is generalised nationwide.	
		Are there regular inspections/monitoring of the process and the output of the waste audits, in your country? [xix] If so, please provide further information	N/A. Inspections however are conducted for construction/renovation/demolition works by Urban Planning Agencies, focused on ensuring urban planning permit requirements are met [22]. In addition, central, regional or municipal environmental agencies, depending on project scale, are responsible for inspections concerning Environmental Terms Approval Decision (ETAD) or Standard Environmental Commitments (ETS) requirements (which in many cases concern waste management practices) [23].	
		Other than waste audits, are there any schemes, plans, policies, permits or guidelines, etc., for renovation and demolition activities, in your country? (that control and regulate waste aspects in demolition sites) [xx] If so, state them describing their scope and provide references to supporting reports/documents	Please check question 23 regarding SWMP alternatives.	

(Continuation of Annex 2. Table 3: Regulatory framework for CDW management in Greece.)

Stage	Measuring Item		Comments	References
Recovery	*Multiple Felds*	What is the current recovery rate of CDW in your country? [xxi] [xxii]	In 2018 2854191tn of CDW were collected and managed by the Alternative Waste Management Systems according to their annual reports. From this amount 599755tn were recycled and 1564712tn were used for backfilling. In total 2164467tn were recovered, which is 75.83% [24]. The relevant amount in 2019 was 4627590tn [20], out of which 75% was recovered, with 54% in backfilling and 46% in other processes [25]. However, it must be noted that these amounts refer only to the CDW managed by the Alternative Waste Management Systems, while there is great uncertainty regarding the real CDW production, since the Alternative Waste Management Systems do not cover the whole Greek domain. This uncertainty is obvious by the discrepancy between the annual data collected by the Alternative Waste Management Systems and the ones collected by the Digital Waste Registry [20]	[24] H. R. Agency, "Recycling in Greece according to data of the year 2018," 2018. [25] "Hellenic Recycling Agency." [26] (Government Gazzette 2706/B` 15.12.2015), Ministerial Decision 51373/4684/2015 "Ratification of the National Waste Management Plan and National Strategic Plan for Waste Prevention" (In Greek).
		Are there economic incentives implemented in your country for promoting CDW prevention, collection, reuse, and recycling? [xxiii] If so, please describe the types of such incentives	The cost of waste management, including infrastructure and operation costs, are attributed to the waste producer or their current or previous owners, according to "the polluter pays" principle. Waste producers or waste owners are responsible for waste processing either directly or through contracting appropriate public or private organizations/companies. According to the "pay as I throw" principle, municipalities are to establish a compensatory charging system based on waste weight, along with waste weight measuring capabilities, starting from 1/2023 and onwards, according to their size and their local material flows. Since 1/2022, municipalities are obligated through Law 4819/2021 to pay increased landfilling charges to correspondent Solid Waste Management Agencies based on waste weight (20 €/tn currently, to reach 55 €/tn by 2027). Collected charges are directed to the Hellenic Recycling Agency and re-invested into waste management programs. The application of this measure however has been so far put on hold. In addition, these increased charges do not apply to ECDW [1]. They are directed to AWMS and according to the National Strategic Plan for Waste Prevention, their management prioritizes reuse, reclamation or recycling, backfilling, and afterwards energy reclamation or disposal as a last resort [26]. Disposal (landfilling) fees for CDW according to a recent report are very low [20].	
		How is CDW defined in your country, and what are the types of CDW according to that definition? (i.e., What can be counted as CDW) [xxiv] [xxv] [xxvi]	Every material or object produced by excavation, construction and demolition procedures considered as waste relevant to the European List of Wastes (2001/118/EC) with code 17. [2]	

(Continuation of Annex 2. Table 3: Regulatory framework for CDW management in Greece.)

Stage	Measuring Item		Comments	References
Recovery	*Multiple Felds*	Are there national strategies (plans, programmes, schemes, targets) about CDW management including prevention, collecting, sorting, reuse, recycling and disposal established in your country? [xxvii] [xxviii] [xxix] [xxx] [xxxi] [xxxii] [xxxiii] [xxxiv] If so, please state them, and provide references to supporting reports/documents	The National Program for Waste Prevention (2021-2030) [27] is in effect since 5/2022. It presents and evaluates the current situation in waste prevention and 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) The National Waste Management Plan (2020-2030) [28] has also set targets concerning ECDW management: • 70% w/w preparation for reuse/recycling or reclamation (excluding however natural aggregates EWC 17 05 04) • Increased geographic coverage of the country by Alternative Waste Management Systems (was at 63% in 2018) • Legislate for the obligatory management of ECDW of public and private projects through AWMS (done through Law 4819/2021) • Streamlining WAMS functions and fees • Establish separate collection of excavation waste, which are excluded from ECDW targets, and also for concrete residue • Develop the secondary ECDW materials market	[27] Ministry of Environment and Energy, “National Program for Waste Prevention (In Greek).” [28] Ministry of Environment and Energy, Modified National Waste Management Plan 2020-2030 (In Greek). [29] “Excavation, Construction and Demolition Waste - Hellenic Recycling Agency (In Greek).” [30] “Waste Framework Directive.”

(Continuation of Annex 2. Table 3: Regulatory framework for CDW management in Greece.)

Stage	Measuring Item		Comments	References
Recovery	*Multiple Felds*	How is the national CDW data collected/measured in your country? (i.e., volumes/amounts of generated, recycled, reused, and landfilled waste) Are there electronic reporting measures taken by your country [xxxv] [xxxvi] (volume, amounts, types, etc.) If so, please provide further information	Waste producers/managers have to submit as mentioned, preliminary ECD Waste Management Data reports to Urban Planning Agencies [3]. They are also obligated to direct their waste to Collective Alternative Waste Management Systems or to form Personal such systems. In the first case, they receive a Final Confirmation of Waste Reception by the receiving AWMS. Large scale projects that are expected to have major environmental impacts (category A1) are exempted from this obligation, and on-site ECDW management, according to the Environmental Terms Approval Decision (ETAD), is prioritized. Data about waste used on-site must be however uploaded to the Digital Waste Registry (except those regarding 17 05 04) by the project manager, and in case there are ECDW not able to be managed on-site, they must be directed to AWMS [1]. Both ECDW Management Data reports and Final Confirmations of Waste Reception are uploaded in digital form in online public platforms, however no data aggregation is conducted using them [19]. Every organization/enterprise producing waste or conducting waste processing and that has the potential to cause environmental impacts (categories A, B), or that collects and transports waste on a professional basis has to upload yearly relevant data to the Digital Waste Registry. Solid Waste Management Agencies (SWMA) have to upload yearly reports concerning the residential waste streams under their responsibility, and Municipalities complement these data with yearly reports for residential waste not managed by AWMS or SWMA. Collective or Personal Alternative WMS of certain EPR products have to record and upload yearly data for the waste they receive and process to the Digital Waste Registry. This does not, however, apply to ECDW AWMS. Data uploaded to the Digital Waste Registry may include (varying by case): producer data, waste type by EWC classification and quantities, waste processing unit data, information about disposal or reclaiming/recovery processes. Collective AWMS (including in this case ECDW AWMS) have to submit yearly reports containing information about the quantities of waste collected and reclaimed and information concerning alternative waste management methods, infrastructure and efficiency, as well as financial and organizational data, to a supervising body (the Hellenic Recycling Agency) [1]. Two streams for ECDW data collection are thus in place, through AWMS reports to the Hellenic Recycling Agency and through the Digital Waste Registry. According to a recent report conducted on behalf of the Greek government [20], they have not yet been able to provide a complete picture of domestic ECDW management and certain data gaps/discrepancies were spotted for the following reasons: AWMS geographical coverage is not yet complete for the entire country, especially in the island regions (although it has risen from 57.7% in 2018 to 90.54% in 2021) [29]. Data from the Digital Waste Registry cannot be examined on a local/regional scale but only on total terms. ECDW AWMS do not use a common recording/reporting code for ECDW streams [20].	

(Continuation of Annex 2. Table 3: Regulatory framework for CDW management in Greece.)

Stage	Measuring Item		Comments	References
Recovery	*Recycle*	How is CDW recycling defined in your country, and what are the types of processes that can be counted as acceptable recycling processes (of which the resultant materials are considered recycled)? [xxxvii]	The reprocessing in a production process of the recyclable materials contained in the waste materials in order to be used for their original purpose or for purposes other than energy recovery. [3]	
		Is there a classification of CDW types that are applicable for recycling, in your country? [xxxviii] If so, please provide further information	Waste, hazardous and non-hazardous waste definitions follow those of Directive 2008/98/EC as amended by Directive (EU) 2018/851 of the European Parliament and by the Council of 30 May 2018. C&D waste too, with the addition of a separate definition for Excavation, Construction and Demolition Waste. Based on these definitions, the following categories are excluded from alternative waste management processes (not just recycling) [1]: • Provisions of Art.2 of Directive 2008/98/EC, among them: "land (in situ) including unexcavated contaminated soil and buildings permanently connected with land; 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; radioactive waste". In addition, according to the Joint Ministerial Decision 36259/1757/E103/2010 (concerning ECDW alternative management) also excluded are [3]: • Hazardous waste or waste mixed with them (their treatment is based on correspondent legislation). • Excavation and demolition materials, originating from industrial or other regions, contaminated in previous use by hazardous substances or materials. • Waste resulting from prospecting, extraction, treatment and storage of mineral resources and the working of quarries. Furthermore, by-product and end-of-waste status criteria again follow the provisions of Directives 2008/98/EC (Art. 5 and 6 respectively) and of any implementing acts adopted by the European Commission to establish detailed criteria for specific substances/objects [1] (e.g. as those set for iron, steel and aluminium scrap, glass cullet, copper scrap end-of-waste status criteria) [30]. Further provisions are made for procedures to establish such criteria on a national basis or through private documentation and public validation in Law 4819/21 [1], however no such criteria have been found.	

(Continuation of Annex 2. Table 3: Regulatory framework for CDW management in Greece.)

Stage	Measuring Item		Comments	References
Recovery	*Recycle*	Are there markets for secondary raw materials (recycled CDW materials) established in your country? If so, please provide further information on the types of these markets	Not in an organized matter. Waste management/processing/recycling plants sell secondary materials on their own. The National Waste Management Plan (2020-2030) [28]however aims to support the development of this market, through encouraging the use of secondary ECDW materials by public organizations and the establishment of a minimum percentage of recycled aggregates use in major public civil engineering projects as part of GPP.	
	Reuse	How is CDW reuse defined in your country?	Any action through which the materials coming from demolitions, constructions, natural or other disasters are used for the purposes that were designed, with or without the support of auxiliary products available on the market. [3]	
		Are there networks and sharing platforms for reuse and repair in your country? [xxxix] If so, please provide examples with references/links	As mentioned, the National Program for Waste Prevention (2021-2030) [27]provides for the creation of CDW reuse centers or spaces inside CDW processing units.	
	Treatment	Is there a definition of ownership and responsibility for the actors involved in waste handling and treatment, set by your country? (e.g., waste producers, holders, and managers, etc.) [xl] [xli] [xlii] If so, please provide further information	Ownership and responsibility of the actors involved in waste handling and treatment is defined similarly to Article 15 of Directive 2008/98/EC. In particular: • Waste producers or others possessing waste individually manage the waste treatment or assign it to a trader or an organization or a company which realize waste management treatment or via an arrangement with a national or a private waste collection organization. When waste is moved from the initial producer or owner to one or more legal entity for a preliminary treatment, this is not translated to an exemption from the responsibility of the prosecution of a full recovery or disposal treatment. [1]	
		Issuing of permits for CDW treatment (either for establishment or undertaking) applied by your country? [xliii] If so, please provide further information	In accordance with Article 23 of Directive 2008/98/EC, the Greek legislation states that every organization or company aiming at providing waste management treatment must firstly receive an Environmental Terms Approval Decision (ETAD) or Standard Environmental Commitments (ETS). The environmental terms concerning waste management define at least the amounts and types of waste able to be treated, every possible operation, the adopted safety measures, the method used for each operation type, the necessary monitoring and auditing procedures, and the legislation regarding the suspension periods of the relevant plant. Special permits need to be released for the collection and transportation of hazardous waste. [1]	

(Continuation of Annex 2. Table 3: Regulatory framework for CDW management in Greece.)

Stage	Measuring Item		Comments	References
Residual Waste	*Multiple Felds*	Are there landfilling and incineration charges, and restrictions adopted by your country? If so, please state them and describe their criteria	As mentioned, landfilling charges (gate fees) are in place, that are provided by Law 4819/2021 to be gradually increased from 1/1/2022 up to 2027 [1]. This measure has not however been applied in practice so far. In addition, these increased charges do not apply to ECDW. They are directed to AWMS and according to the National Strategic Plan for Waste Prevention [26], their management prioritizes reuse, reclamation or recycling, backfilling, and afterwards energy reclamation or disposal as a last resort. Disposal (landfilling) fees according to a recent report are however very low [20]. Incineration charges also do not generally apply to ECDW, except perhaps for wood/timber residue that are directed to energy recovery processes (incineration). No set charges are in place in this case, prices are instead negotiated between businesses.	
		What is the most common disposal method for CDW in your country? [xliv]	Backfilling [24], [25].	

Annex 2. Table 4: Regulatory framework for CDW management in Italy.

Stage	Measuring Item		Comments	References
Design and Manufacturing	*Extended Producer Responsibility Schemes (EPR)*	Is EPR scheme applied in your country? [i] If not, please describe if there is any similar scheme applied	YES. It is adopted in Italy by the legislative decree 116/2020, which modified art. 178-bis of the Environmental Consolidated Act - legislative decree 152/2006.	Environmental Consolidated Act - Decree 152/2006 https://reopenspl.invitalia.it/archivio-news/notizie/reopen-spl---recepimento-pacchetto-economia-circolare
		What construction product categories are regulated by the EPR scheme in your country? [ii]	No specification regarding construction product categories is made by the EPR scheme in Italy. However, the EPR scheme in Italy includes packaging, packaging waste and WEEE (in particular, the product macro-categories included are: plastics, wood, metal, glass, multi-material, paint, ink, resins, adhesive, paper, cardboard, batteries, photovoltaics, conditioning systems, etc.).	
		Are there waste management quantitative targets set by your country, relevant for the EPR scheme? (e.g., recycling rate of products, setting a minimum percentage of reusable/recyclable products placed on the market) If so, please provide further information	In compliance with the EU Directives 2018/851 and 852, Italy has established to achieve (ReOpen SPL and InvItalia "The implementation of the EU Circular Economy Package", 2021): • By 2020, at least 50% (by weight) of paper, metal, plastic and glass waste deriving from municipal waste and similar (e.g., CDW not managed by accredited firms) should be reused and/or recycled; • By 2020, at least 70% (by weight) of non-hazardous CDW should be reused, recycled or recovered, exception made for waste code 17.05.04; • By 2025, at least 55% (by weight) of municipal waste should be reused and/or recycled; • By 2030, at least 60% (by weight) of municipal waste should be reused and/or recycled; • By 2035, at least 65% (by weight) of municipal waste should be reused and/or recycled.	
	BIM	Does your country have a national level driven Digital Transformation/BIM agenda/mandate/roadmap? If so, please provide further information.	YES, in compliance with the D.M. (Ministerial Decree) 560/2017 "Methods and times for the progressive introduction of electronic modelling methods and tools for construction and infrastructure" and with the updates in the D.M. 312/2021, in Italy it has been established that (for the times of introduction of BIM): • from 2021 complex works above EUR 15 million • from 2023 all works above EUR 5 million (except for maintenance) • from 2025 all works above EUR 1 million (except for maintenance) will be done by using BIM Method and Digital Transformation.	Ministerial Decree 560/2017: https://www.mit.gov.it/nfsmitgov/files/media/normativa/2018-01/Decreto%20Ministro%20MIT%20n.%20560%20del%201.12.2017.pdf Ministerial Decree312/2021: https://www.mit.gov.it/nfsmitgov/files/media/normativa/2021-08/DM_2021-08-02_BIM.pdf
		What is the main driver for BIM adoption/Digital Transformation in your national sector? (Government/Industry/both/neither) Please provide explanation	The main drivers in Italy for the construction sector are mainly the Government (by using the D.M. in the previous answer) and the contracting authorities.	

(Continuation of Annex 2. Table 4: Regulatory framework for CDW management in Italy.)

Stage	Measuring Item		• Comments	References
Design and Manufacturing	*BIM*	What BIM/Information Management standards, protocols, etc. are predominantly being adopted in your national sector to facilitate the digital transformation/BIM adoption? (e.g. ISO 19650 series).	• Ministerial Decree 312/2021 "Ways and timescales for the progressive introduction of digital modelling methods and tools for construction and infrastructure" • UNI 11337 (1-2-4-5-6-7) "Digital Management of BIM Construction Information Processes" • Ministerial Decree 560/2017 (amended by Ministerial Decree 312/2021) • Ministerial Decree 50/2016 (art.23) "public procurement code" UNI 11337 in Italy implements the updates from ISO 19650 (UNI stands for "Italian National Unification Agency")	Legislative Decree 50/2016 (art.23, comma 13): https://www.codicecontrattipubblici.com/parte-i/art-23-livelli-della-progettazione-per-gli-appalti-per-le-concessioni-di-lavori-nonche-per-i-servizi/
		What is the level of BIM adoption within your national sector? Provide references to supporting government, industry, academic reports	The level of adoption of BIM in Italy was assessed by ASSOBIM (the Italian BIM Association) through a study conducted in 2021. The sample surveyed in the study was composed by several hundred professionals in Italy mainly appertaining to design firms (60% of the sample) and engineering companies (16.4%). Most of the companies had less than 10 employees (70% of cases compared to 68% in 2020) and a turnover below one million euros (70% of cases). The results of the survey reflect a faithful picture of the Italian professional realities: more than 60% of the sample (+6 percent compared to 2020) know and use the BIM methodology, while a further 30% know it but do not use it or make partial use of it, and only a marginal number of operators (7% compared to 10% in 2020) are not aware of it.	Level of BIM adoption: https://www.01building.it/bim/il-bim-in-italia-lo-stato-dellarte/
		Is the Digital Twin a key concern to the digital transformation of your national sector? If so, please provide further information	The Digital Twin is fundamental for digital transformation of the construction sector because it allows the creation of a virtual representation of physical assets and processes (existing or to be designed). By having a digital twin, construction stakeholders can simulate, analyse, and optimize the performance of their systems in a virtual environment before making changes in the real world. The benefits of Digital Twin are multiple: • It allows for the prediction and prevention of maintenance issues, reducing the need for costly repairs and downtime. • It enables better and faster decision-making by providing real-time data and insights. • It can improve safety by simulating different scenarios and identifying potential hazards before they occur. • It also allows for better collaboration and communication among stakeholders, including engineers, operators, and regulators.	

(Continuation of Annex 2. Table 4: Regulatory framework for CDW management in Italy.)

Stage	Measuring Item		Comments	References
Design and Manufacturing	*BIM*	How (and to what extent) is the circular economy/waste management being integrated into your sector's digital transformation?	The integration of Circular Economy/Waste Management criteria in the digital transformation of the construction sector is still ongoing; in particular, in the infrastructural sector it isn't still well integrated. Today the experimentation in the infrastructural sector concerns punctual works and it is limited by the availability of suitable digital tools.	
	Harmonised Standards	Is CE marking conformity implemented in your country?	YES, since Italy is part of the extended single market of the European Economic Area (EEA), where the CE conformity is mandatory for various product categories, including construction products.	
		What other conformity standards and certification are implemented in your country that affect reuse/recycling and recyclability of construction products?	Other conformity standards and certifications: • Minimum Environmental Criteria (CAM) for GPP and procurement contracts in general; • ReMade in Italy is a certification regarding a material/product recyclability content and by-products. It is a traceability scheme consistent with the procurement code (Codice Appalti – legislative decree 50/2016 and further modifications); • ISO 14021, self-declaration of a product recyclability and compostability; • Concrete Sustainability Council (CSC) for the sustainable production of concrete • Forest Stewardship Council (FSC) and Chain of Custody (CoC) for forest management and product traceability • Made Green in Italy is a national scheme on a voluntary basis for evaluation and communication of environmental performance of products based on the Product Environmental Footprint methodology.	Procurement Code (Codice degli Appalti - ministerial decree 256/2022) https://www.mase.gov.it/pagina/lo-schema-nazionale-made-green-italy https://www.remadeinitaly.it/
		Are there any national sustainable-building or construction schemes in your country? (e.g. LEED, BREEAM, etc) If so, please provide further information and if they include any requirements about waste and circular economy	YES, there is CasaClima Nature (certified by an independent public agency), ITACA Protocol (developed by an independent public agency), ARchitettura Comfort Ambiente (ARCA), Deutsche Gesellschaft für Nachhaltiges Bauen (DGNB), Haute Qualité Environmentale (HQE), Sustainable Building (SB) Tool, Green Building Council Italia (GBC) Protocol, LEED, WELL, BREEAM, FITWEL, ENVISION. However, these schemes are adopted on a voluntary basis, so they have more binding requirements compared to what is required by law. These schemes include, but are not limited to, storage and collection of recyclables, CDW management plans, durability of materials and design, sourcing of raw materials and materials ingredients.	https://www.agenziacasaclima.it/it/certificazione-edifici-1405.html https://www.itaca.org/certificazione_ed_sost.asp https://portale.assimpredilance.it/articoli/uni-e-la-demolizione-selettiva-prassi-di-riferimento-uni-pdr-75-2020

(Continuation of Annex 2. Table 4: Regulatory framework for CDW management in Italy.)

Stage	Measuring Item		Comments	References
Design and Manufacturing	*Harmonised Standards*	Is it a legal requirement for buildings (or some type of buildings) to be designed for disassembly? [iii] (reflect ISO 20887 or any other standards) If so, please provide further information	No, there is no binding law regarding the design of buildings for disassembly in Italy. However, the technical screening criteria for the principle DNSH to "the transition to a circular economy" of the EU taxonomy (mandatory for large companies with more than 500 employees) refer to the standards and criteria provided by ISO 20887.	
Construction	*Green Public Procurement (GPP)*	Is GPP policy applied in your country? [iv] If not, please describe if there is any similar scheme applied	YES. GPP is mandatory in Italy since 2016, adopted by the Nuovo Codice degli Appalti (New Procurement Code - legislative decree 50/2016), subsequently modified by the legislative decree 56/2017 and by the ministerial decree 256/2022.	https://gpp.mite.gov.it/Home/Cam
		Is there a target set by your country? If so, has it been fulfilled? (a target in which a percentage of all public procurement should be green).	YES, 100% of all public investments since GPP is mandatory by law.	
		Is GPP policy applied in construction related aspects? [v] [vi] [vii]	YES, there are specific Minimum Environmental Criteria for construction sector (CAM Edilizia) with some exceptions concerning renovation activities, such as installation and maintenance of water systems, renovation of buildings (including demolition and new construction) in historic and consolidated urban fabric, etc. In general, exceptions are made anytime there is a conflict between CAM Edilizia and other sectors' technical norms.	
		What aspects in construction waste management the GPP is targeting in your country? (e.g., specifying processes or packaging which generate less waste; encouraging reuse and recycling of materials; reducing using products containing critical raw materials, reducing using products containing hazardous substances, etc.) [viii] [ix] [x]	The Minimum Environmental Criteria (CAM; i.e., the screening criteria for GPP) address aspects such as sourcing of non-renewable raw materials, land use and degradation, energy and water consumption, waste production and management and workers safety and security.	

(Continuation of Annex 2. Table 4: Regulatory framework for CDW management in Italy.)

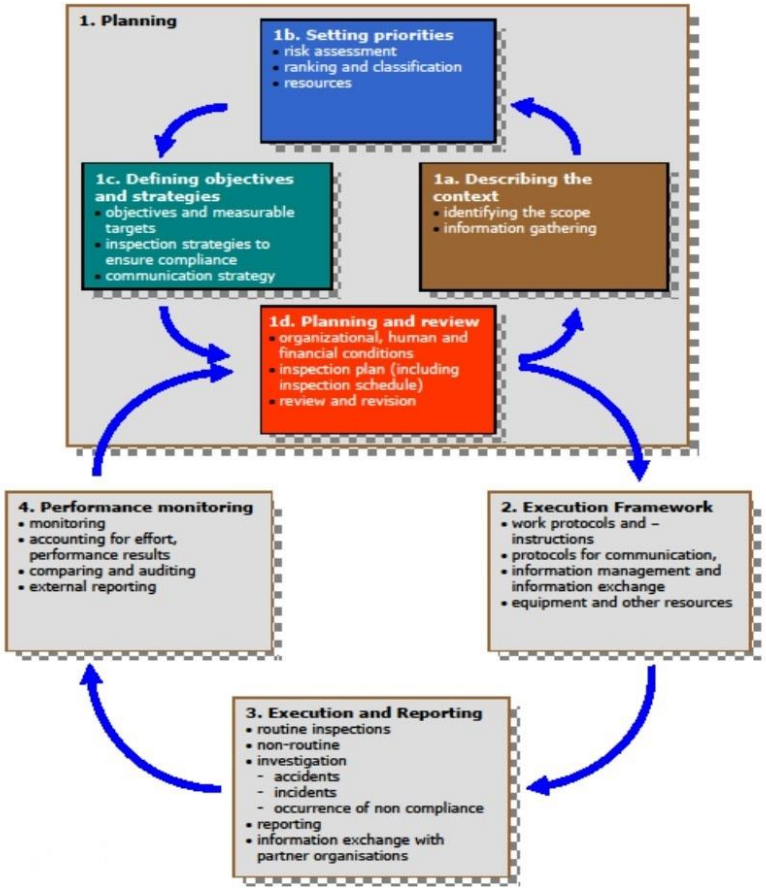
Stage	Measuring Item		Comments	References
Construction	*EU Taxonomy for New Construction*	Is there a familiarity of EU taxonomy system in your country? [xi] [xii] [xiii] If so, please provide further information on the level of its adoption	YES. Italy has adopted the Regulation (EU) 2020/852 (i.e., EU taxonomy) and it is applied to all economic activities of large firms (with more than 500 employees). Moreover, the conformity to the principle "do not significant harm" is mandatory for all projects funded by the National Plan for Resilience and Recovery (PNRR).	https://www.anit.it/wp-content/uploads/2017/11/DM-11-ottobre-2017.pdf
		Is there a technical screening criteria established by your country, for defining economic activities that counts as green? [xiv] If so, please provide references to supporting reports/documents	Technical screening criteria included in the Delegated Acts of the EU taxonomy are applied in Italy. In addition to the technical screening criteria introduced by the Delegated Acts of the EU taxonomy, Italy has established: • Minimum Environmental Criteria (CAM - Criteri Ambientali MInimi) for GPP adopted by the legislative decree 50/2016 modified by the legislative decree 56/2017 and further modified by the ministerial decree 256/2022; • Environmental Consolidated Act (legislative decree 152/2006) that refers to UNI EN ISO 14020/21/24/25 regarding the recycled material content.	
		Are there any similar system/scheme to EU taxonomy applied in your country? If so, please provide further information	In addition to the EU taxonomy, Italy has adopted the legislative decree 254/2016, as an implementation of the EU Directive 2014/95, concerning the disclosure of non-financial and diversity information by certain large undertakings and groups.	
	Site Waste Management Plans	Are site waste management plans applied in your country? If so, please describe if it Is a mandatory or voluntary requirement for construction activities	There is no binding law regarding a consolidated form for editing a SWMP, but there are technical specifications for site waste management defined by law (legislative decree 152/2006 and further modifications, and decree 256/2022). Therefore, the so-called SWMP (it can be called differently for different projects and in different areas) can be edited as a separate document or as part of other documents within the project documentation and can depend on the type/size of the building site and/or on local regulation.	
		What are the requirements for site waste management plans in your country?	The information concerning a site waste management plan should include the demolition modality/process, typologies of waste produced according to EWC codes, estimated waste quantities, transportation responsibilities and waste treatment plants foreseen to use, or, if this is the case, modality of waste treatment on site. All these requirements should consider possible site risks and impacts and observe the restrictions of CAM (for the construction sector) that require to recycle, reuse or recover at least 70% of non-hazardous waste by wight (in compliance with the EU Directive 2008/98).	
		If SWMP is not applied in your country, are there any legal/voluntary requirements for managing waste on construction sites? (e.g., waste identification of expected waste types and amounts, source separation and collection, documentation, storing, transportation, etc.,) [xv] [xvi] [xvii] If so, please provide further information	See the answers to the questions above.	

(Continuation of Annex 2. Table 4: Regulatory framework for CDW management in Italy.)

Stage	Measuring Item		Comments	References
Maintenance, Renovation and Demolition	*Waste Audits*	Are waste audits and/or inventories applied in your country? If so, please describe if it Is a mandatory or voluntary requirement for renovation and demolition activities	Audits regarding compliance with national and local regulation/laws on emissions, pollution and the overall sustainability of industrial activities are conducted annually by local agencies (i.e., ARPA/APPA) on a sample basis. In particular, waste audits are conducted either on a regular annual basis, or in case there is a serious environmental accident or a complaint by the regulatory agency. Moreover, audits are less frequent for companies that have an Environmental Management System certification (ISO 14001).	
		What are the regulatory requirements/checklist for the waste audits in your country? [xviii] Generally describe the scope of requirements and guidelines that regulate the waste audits process,	The principles that regulate the waste audit process conducted by local agencies (i.e., ARPA/APPA) are the following: • proportionality to the risks faced by the audited activity • prevention and effective protection from environmental risks • protection of public interests • collaboration with firms in order to prevent risks. The main objectives of waste audits include: • improvement of environmental performance by assessing the overall environmental impacts, as well as management and facilities aspects, of audited activities, • promotion of knowledge and understanding for the site manager of environmental laws and prescriptions, and main environmental issues related to site activities, • check the compliance of audited facilities to established environmental requirements, • examination and check of self-monitoring and self-audit activities conducted directly by the site manager (or on his/her behalf) • check of the site and related equipment (including eligibility of maintenance), and of the suitability of site environmental management, • collection and elaboration of data and information relevant to the audited facilities and related to their environmental impacts. Together with the check of management procedures and compliance to the local/national/European regulatory framework, the aim of waste audits is to increase awareness and culture on environmental issues. The documents considered for the audit include: • self-audits conducted by the site manager, • reports compiled by the site manager, • programmed audits, samples, and analyses conducted, • check of compliance of the site • extraordinary audits	

(Continuation of Annex 2. Table 4: Regulatory framework for CDW management in Italy.)

Stage	Measuring Item		Comments	References
Maintenance, Renovation and Demolition	*Waste Audits*	Are waste audits requirements regulated in each region or is it generalised for the entire country?	There are technical criteria defined at national level by SNPA (Sistema Nazionale per la Protezione Ambientale/National System for Environmental Protection) in the Guideline regarding Minimum Criteria for Environmental Audits; however, waste issues (e.g., collection/check/audits/data/fees etc.) are managed at local level.	https://www.snpambiente.it/wp-content/uploads/2020/08/CF-2014-06-30-Del.-40-Criteri-minimi-ispezioni-ambientali-CMIA-doc-e-allegati-.pdf
		Are there regular inspections/monitoring of the process and the output of the waste audits, in your country? [xix] If so, please provide further information	Audits follow the process defined in the Guideline regarding Minimum Criteria for Environmental Audits (CMIA – Criteri Minimi per le Ispezioni Ambientali) edited by SNPA in 2014. In the following picture are described all the steps of the process:	


1. Planning
1b. Setting priorities
• risk assessment
• ranking and classification
• resources
1c. Defining objectives and strategies
• objectives and measurable targets
• inspection strategies to ensure compliance
• communication strategy
1a. Describing the context
• identifying the scope
• information gathering
1d. Planning and review
• organizational, human and financial conditions
• inspection plan (including inspection schedule)
• review and revision
4. Performance monitoring
• monitoring
• accounting for effort, performance results
• comparing and auditing
• external reporting
2. Execution Framework
• work protocols and – instructions
• protocols for communication,
• information management and information exchange
• equipment and other resources
3. Execution and Reporting
• routine inspections
• non-routine
• investigation
- accidents
- incidents
- occurrence of non compliance
• reporting
• information exchange with partner organisations

(Continuation of Annex 2. Table 4: Regulatory framework for CDW management in Italy.)

Stage	Measuring Item		Comments	References
Maintenance, Renovation and Demolition	*Waste Audits*	Other than waste audits, are there any schemes, plans, policies, permits or guidelines, etc., for renovation and demolition activities, in your country? (that control and regulate waste aspects in demolition sites) [xx] If so, state them describing their scope and provide references to supporting reports/documents	• Environmental Consolidated Act (Testo Unico Ambiente - Decree 152/2006) regulates general aspects concerning waste management (e.g., EPR scheme); • Procurement Code (Codice Appalti – decree 256/2022) with respective CAM (Minimum Environmental Criteria) for construction sector regulate technical screening criteria for recycle/reuse/recover and recyclability, as well as aspects concerning end-of-waste; • Strategia Nazionale per l'Economia Circolare/National Strategy for Circular Economy (approved with Decree of Ministry of Ecological Transition 259 24.06.2022) provides national guidelines for implementation of circular economy in Italy; • Piano d'Azione Nazionale sul GPP/National Action Plan on GPP (adopted with the inter-ministerial decree 107/2008, further modified with the decree 102/2013) provides guidelines/action plan for GPP • SNPA (Sistema Nazionale Protezione Ambiente/National Sistem for Environment Protection) Guidelines n. 23/2020 defines a shared system for planning and cerification of treatment plants, in particular concerning end-of-waste.	
Recovery	*Multiple Fields*	What is the current recovery rate of CDW in your country? [xxi] [xxii]	In particular, in 2019, 78.1% of CDW in Italy are recovered or reused (ISPRA, 2022b).	- ISPRA, Rapporto rifiuti speciali (Special Waste report), 2022a - ISPRA, Indicatori, indici e scenari per l'analisi dei principali trend ambientali (Indicators, indices and scenarios for the analysis of the main environmental trends), 2022b -Environmental Consolidated Act. Decree 152/2006 -Decree 152, 27.09.2022, Regulation governing the end-of-waste for inert waste from construction and demolition and other inert waste of mineral origin, pursuant to article 184-ter, paragraph 2, of legislative decree 3 April 2006, n. 152.
		Are there economic incentives implemented in your country for promoting CDW prevention, collection, reuse, and recycling? [xxiii] If so, please describe the types of such incentives	Yes. The General goal is present in the Italian National Strategy for Circular Economy and Italian Government has launched several measures: 1. The Decree Ministry of Ecological Transition, 6 October 2021 stated that "Companies that use materials and products deriving, for at least 75% of their composition, from the recycling of waste or scrap, could apply for the costs incurred in 2020 and could receive a reimbursement of 25% of the costs as a tax credit". https://www.gazzettaufficiale.it/eli/id/2021/12/15/21A07272/sg 2. The national Fund for reconstruction after the Earthquake of 2009 called "Fondo complementare Aree Sisma 2009-2016" (in the line "B3.3 Ciclo delle Materie") has funded a facilitating measure for the management of the rubble and materials resulting from the reconstruction activity. It relates to the financing investments for the transformation of rubble into raw and secondary materials for the building industry, for the construction of building and road works and environmental restoration, reducing the volume to be disposed of and activating new local production processes and new production chains, through the reuse and recycling of construction and demolition materials. https://nextappennino.gov.it/incentivi/investimenti-di-media-dimensione/ciclo-delle-macerie	

(Continuation of Annex 2. Table 4: Regulatory framework for CDW management in Italy.)

Stage	Measuring Item		Comments	References
Recovery	*Multiple Fields*	How is CDW defined in your country, and what are the types of CDW according to that definition? (i.e., What can be counted as CDW) [xxiv] [xxv] [xxvi]	(Environmental Consolidated Act - Legislative Decree No. 152/2006) According to Art. 184 (Classification), co. 3 Special wastes include: "b) waste produced by construction and demolition activities, as well as waste deriving from excavation activities, without prejudice to the provisions of article 184-bis" (by-product); Article 184-ter, paragraph 3 letter b defines inert waste as waste produced by construction and demolition activities, as well as waste deriving from excavation activities.	
		Are there national strategies (plans, programmes, schemes, targets) about CDW management including prevention, collecting, sorting, reuse, recycling and disposal established in your country? [xxvii] [xxviii] [xxix] [xxx] [xxxi] [xxxii] [xxxiii] [xxxiv] If so, please state them, and provide references to supporting reports/documents	Yes. • Strategia Nazionale per l'Economia Circolare/National Strategy for Circular Economy (approved with Decree of Ministry of Ecological Transition 259 24.06.2022) • Programma Nazionale per la Gestione dei Rifiuti/National Programme for Waste Management 2022-2028 (approved with Decree of Ministry of Ecological Transition n. 257 24.06.2022) • Programma Nazionale di Prevenzione dei rifiuti/National Programme for Waste Prevention (approved with Decree Ministry of Environment, Territorial and Marine Protection 7.10.2013) • Piano d'Azione Nazionale sul GPP/National Action Plan on GPP (adopted with the inter-ministerial decree 107/2008, further modified with the decree 102/2013)	
		How is the national CDW data collected/measured in your country? (i.e., volumes/amounts of generated, recycled, reused, and landfilled waste) Are there electronic reporting measures taken by your country [xxxv] [xxxvi] (volume, amounts, types, etc.) If so, please provide further information	Data on CDW are collected by ISPRA that publishes annually the Special Waste Report (Rapporto Rifiuti Speciali, 2022a). Moreover, ISPRA, together with local agencies for environmental protection (i.e., ARPA/APPA) are required by law (art. 184-ter of the Environmental Consolidate Act - legislative decree 152/2006) to control and certify the end-of-waste in treatment plants, and to report the information annually to the Ministry of Ecological Transition. The calculation methods for verifying the achievement of the objective of the waste recovery have been identified by decision 2011/753/EC; 50.2 million tons of CDW in 2020, of which 39.1 have been prepared for reuse/recycle in Italy.	

(Continuation of Annex 2. Table 4: Regulatory framework for CDW management in Italy.)

Stage	Measuring Item		Comments	References
Recovery	*Multiple Fields*		Other tools used for collecting data on CDW include: • The register of waste loaded and unloaded (Registro di carico e scarico) where the entire life of waste is annotated, from production to disposal, including intermediate storage. This register is not mandatory for non-hazardous CDW and for companies which adhered to the electronic waste traceability system – SisTRI (see below for details on SisTRI) • Consolidated Model for Environmental Declaration (Modello Unico di Dichiarazione Ambientale - MUD) is an annual declaration made by companies regarding quantities and typologies of waste produced and/or treated. MUD is not mandatory for all waste typologies and for companies with less than 10 employees. • Waste Identification Form (Formulario di Identificazione del Rifiuto – FIR) is an accompanying document used for transportation of waste that includes all information regarding the typology of waste, as well as the producer, the carrier and the recipient of waste. • The national waste cadastre (Catasto Rifiuti – legislative decree 152/2006, art. 189), where are registered the data regarding municipal waste and special waste (which include CDW). The cadastre is managed by ISPRA together with local agencies for environmental protection (i.e., ARPA/APPA). Until 2018, the electronic system for waste traceability was called SisTRI (Sistema di Controllo della Tracciabilità dei Rifiuti/Control System for Waste Traceability), which was mandatory for companies and institutions with more than 10 employees. However, SisTRI has never been very successful (due to its inability to communicate with other local waste systems and its system bugs), therefore it was abolished in 2018 and in 2019 the Ministry of Ecological Transition launched RenTRi (Registro Elettronico Nazionale sulla Tracciabilità dei Rifiuti/National Electronic Register for Waste Traceability) that is still in an experimental phase (https://www.rentri.it/). Once RenTRI will become operational, it is meant to substitute FIR, MUD and the register of waste loaded and unloaded.	
	Recycle	How is CDW recycling defined in your country, and what are the types of processes that can be counted as acceptable recycling processes (of which the resultant materials are considered recycled)? [xxxvii]	Environmental Consolidate Act (Legislative Decree No. 152/2006 and mod.): Art. 143 Definitions c. 1. Letter u) "recycling" *(riciclaggio)*: any recovery operation through which waste is treated to obtain products, materials or substances to be used for their original function or for other purposes. Include the processing of organic material but not energy recovery or reprocessing into materials for use as fuel or in backfilling operations; In particular, the decree 152/2022 allows a list of *Waste admitted for the production of recovered aggregate.*	Environmental Consolidate Act (Legislative Decree No. 152/2006 and mod.)

(Continuation of Annex 2. Table 4: Regulatory framework for CDW management in Italy.)

Stage	Measuring Item		Comments	References
Recovery	*Recycle*	Is there a classification of CDW types that are applicable for recycling, in your country? [xxxviii] If so, please provide further information	Art. 2 Decree MITE 152/2022 defines «inert waste from construction and demolition activities»: waste deriving from construction and demolition operations identified in chapter 17 of the European List of Waste (LoW - Commission Decision 2000/532/EC of 3 May 2000) and indicated in point 1 of table 1 of Annex 1 the Decree: "Table 1 - Waste admitted for the production of recovered aggregate (End of Waste) 1. Inert waste from construction and demolition activities (Chapter 17 European List of Waste) •170101 Concrete •170102 Bricks •170103 Tiles and ceramics •170107 Mixtures of concrete, bricks, tiles and ceramics other than those mentioned in 17 01 06 •170302 Bituminous mixtures other than those mentioned in 17 03 01 •170504 Soil and stones other than those mentioned in 170503 •170508 Track ballast other than those mentioned in 170507 •170904 Mixed construction and demolition wastes other than those mentioned in 170901, 170902 and 170903" "Abandoned or buried waste from construction and demolition activities is not eligible for the production of recovered aggregate." National regulation for recovered aggregates are specified in the Decree (Tables 2, 3, 4 and 5) Table 4 Regulation for the CE Certification UNI EN 13242 Aggregati per materiali non legati e legati con leganti idraulici per l'impiego in opere di ingegneria civile e nella costruzione di strade UNI EN 12620 Aggregati per calcestruzzo UNI EN 13139 Aggregati per malta UNI EN 13043 Aggregati per miscele bituminose e trattamenti superficiali per strade, aeroporti e altre aree soggette a traffico UNI EN 13055 Aggregati leggeri UNI EN 13450 Aggregati per massicciate per ferrovie UNI EN 13383-1 Aggregati per opere di protezione (armourstone) "For the purpose of proving the existence of the criteria referred to in in Article 3, the producer of recovered aggregate should keep for five years, at the production facility or at its registered office, a sample of the aggregate recovered withdrawn, at the end of the production process of each batch of recovered aggregate, in compliance to the standard UNI 10802:2013 Waste - Manual sampling, sample preparation and eluate analysis"	Decree 152, 27.09.2022, Regulation governing the cessation of the status of waste for inert waste from construction and demolition and other inert waste of mineral origin, pursuant to article 184-ter, paragraph 2, of legislative decree 3 April 2006, n. 152. Laboratorio REF, "Riciclare i rifiuti da costruzione e demolizione. L'economia circolare alla prova dei fatti", 2022

(Continuation of Annex 2. Table 4: Regulatory framework for CDW management in Italy.)

Stage	Measuring Item		Comments	References
Recovery	*Recycle*	Are there markets for secondary raw materials (recycled CDW materials) established in your country? If so, please provide further information on the types of these markets	Yes There is a growing demand and trend of circular use of materials: "The circular material use rate measures the share of material resources that an economy reuses. In the period 2004-2019, the rate of circular use of Italian materials went from 5.8% to 19.3%" (Eurostat). In order to meet the demand and offer of secondary raw materials, there are specific projects: i.e. Lombardy Region https://marketinerti.arpalombardia.it/home However, some reports point out that "The recycling rate of waste from C&D effective recycling is still discouraged by the low cost and greater regulatory "safety" of virgin quarry materials. Essentially, up to now, C&D waste has been subject to an excessively cumbersome regulatory framework and an exemplary case of market failure (…). Since CDW are heavy materials (in terms of specific weight), heterogeneous and bulky, mainly transport costs and therefore treatment costs (to make them compliant with the technical standards of the sector) make them still not affordable and not able to compete with the virgin material. The latter is still today extracted near the shipyards at negligible costs, due to very low royalties requested by the municipal administrations. These low costs make the use of virgin materials more profitable and easier compared to the production and marketing of recycled aggregates, which are strictly regulated due to their status of waste" (Laboratorio REF, 2022).	
	Reuse	How is CDW reuse defined in your country?	Environmental Consolidate Act (Legislative Decree No. 152/2006 and mod.): Art. 143 Definitions Co. 1 Letter r) Reuse (*Riutilizzo*): any operation through which products or components that are not waste are reused for the same purpose for which they were conceived. Art. 180 bis. Reuse of products and preparation for reuse of waste "Public administrations promote, in the exercise of their respective competences, initiatives aimed at promoting the reuse of products and the preparation for reuse of waste. These initiatives may also consist of: a) use of economic instruments; b) logistical measures, such as the establishment and support of accredited repair/reuse centers and networks; c) adoption, within the context of the procedures for awarding public contracts, of suitable criteria, pursuant to article 83, paragraph 1, letter e), of legislative decree no. 163, and provision of the conditions referred to in articles 68, paragraph 3, letter b), and 69 of the same decree (…)" In addition, the presidential decree (DPR 120/2017) regarding "Regulation containing the simplified discipline of the management of excavated soils and rocks" regulates the reuse of excavated soils and rocks as a by-product.	

(Continuation of Annex 2. Table 4: Regulatory framework for CDW management in Italy.)

Stage	Measuring Item		Comments	References
Recovery	*Reuse*	Are there networks and sharing platforms for reuse and repair in your country? [xxxix] If so, please provide examples with references/links	Yes. Italferr, with the start-up Circularity, has developed a Proof of Concept called Terre Circolari (Circular soils). It is a digital platform that allows the connection between the producer of excavated soils and rocks, users of by-products (companies that can reuse the materials in their industrial cycle) and recovery plants. This process also makes it possible to evaluate the most sustainable alternatives, by quantifying the CO2eq emitted and classifying the best scenarios. https://circularity.com/en/casehistory/italferr-circular-by-product-management/ At European/National Level: ICESP - Italian Circular Economy Stakeholder Platform https://circulareconomy.europa.eu/platform/en/dialogue/names-contacts/icesp-italian-circular-economy-stakeholder-platform Circularity https://circularity.com/piattaforma-circolare/ Examples at Local Level: Re-sign: https://re-sign.it/ Taranto Circolare https://tarantocircolare.tech/it	
	Treatment	Is there a definition of ownership and responsibility for the actors involved in waste handling and treatment, set by your country? (e.g., waste producers, holders, and managers, etc.) [xl] [xli] [xlii] If so, please provide further information	Environmental Consolidate Act (Legislative Decree No. 152/2006 and mod.): Art. 188. Responsibility in waste management The initial producer, or other holder, of waste provides for their treatment directly or by entrusting them to an intermediary, or to a trader or for their delivery to an institution or company that carries out waste treatment operations, or to a person in charge the collection or transport of waste, public or private, in compliance with Part IV of this decree.	Environmental Consolidate Act (Legislative Decree No. 152/2006 and mod.)
		Issuing of permits for CDW treatment (either for establishment or undertaking) applied by your country? [xliii] If so, please provide further information	Art. 208 Unique authorization for new waste disposal and recovery plants Persons intending to build and manage new waste disposal or recovery plants, including hazardous waste, must submit a specific application to the region responsible for the territory, attaching the final plant project and the technical documentation required for the implementation of the project itself by the provisions in force in urban planning, environmental protection, occupational health and safety and public hygiene.	

(Continuation of Annex 2. Table 4: Regulatory framework for CDW management in Italy.)

Stage	Measuring Item		Comments	References
Recovery	*Treatment*		Art. 208 (Unique Authorization) relates to the ordinary procedure. The Legislative Decree 152/2006 also regulate simplified/specific procedures that allow waste recovery activities identified by specific technical standards issued by the Ministry of the Environment. The choice between the ordinary procedure and the other procedures (AIA - Integrated Environmental Authorization; AUA - Unique Environmental Authorization) is up to the company, depending on the type of activity he intends to carry out. Art. 212. National register of environmental managers Enrolment in the Register is a requirement for carrying out waste collection and transport, site remediation, asbestos-containing assets reclamation, waste trade and intermediation without custody of the waste itself.	
Residual Waste	*Multiple Felds*	Are there landfilling and incineration charges, and restrictions adopted by your country? If so, please state them and describe their criteria	Yes. Landfilling charges are defined at regional level. The example of Emilia-Romagna Region is a range between EUR 9 per tonne for inert wastes and EUR 25 per tonne for dangerous wastes. The charge is reduced by 20% for disposal in Incinerators or some treated wastes.	
		What is the most common disposal method for CDW in your country? [xliv]	The data is not available for CDW waste. Anyway, CDW are considered special waste; in fact, in 2020, about 45% of special waste are CDW (as defined by ISPRA in compliance to the Chapter 17 of the European LoW). The report on special wastes declares: Within special wastes: • 70.6% of the managed special waste are recovered • 11% are put in reserve and deposit - R13/D15, • 10.3 % are interested by disposal D3, D8, D9, D13, D14; • around 6% are disposed in landfills D1 • around 1% are incinerated (D10,R1) and 1.1% co-incinerated (R1)	ISPRA, Special Waste Report, 2022 (for 2020)

Annex 2. Table 5: Regulatory framework for CDW management in Spain.

Stage	Measuring Item		Comments	References
Design and Manufacturing	*Extended Producer Responsibility Schemes (EPR)*	Is EPR scheme applied in your country? [i] If not, please describe if there is any similar scheme applied	Yes	Responsabilidad ampliada del productor (miteco.gob.es) Plastic recycling in Spain – RepetCo Innovations
		What construction product categories are regulated by the EPR scheme in your country? [ii]	Paper and cardboard, glass, packaging of agricultural products, containers of phytosanitary products and fertilizers, expired medication and medication containers, batteries, tires, used industrial oils, waste electrical and electronic equipment	
		Are there waste management quantitative targets set by your country, relevant for the EPR scheme? (e.g., recycling rate of products, setting a minimum percentage of reusable/recyclable products placed on the market) If so, please provide further information	Spain has already exceeded the 50% recycling rate set by the European Union for packaging by 2025. However, the Ministry of Ecological Transition and the Demographic Challenge has raised this commitment to 60%, which is also very close to being achieved.	
	BIM	Does your country have a national level driven Digital Transformation/BIM agenda/mandate/roadmap? If so, please provide further information.	Yes, there is a strategy for implementation in public procurement, led by the Ministry of Transport, Mobility and Urban Agenda, since 2015 (es.BIM).	https://cbim.mitma.es/bim-en-el-mundo/espana
		What is the main driver for BIM adoption/Digital Transformation in your national sector? (Government/Industry/both/neither) Please provide explanation	Both: The Ministry of Transport, Mobility and Urban Agenda of the Spanish Government has an inter-ministerial working group for the implementation of BIM methodology in public tenders. In parallel, groups such as the Spanish Chapter of the international association Building Smart, set up in 2014 by public and private agents, are also contributing to the implementation.	https://www.miteco.gob.es/es/calidad-y-evaluacion-ambiental/temas/economia-circular/espanacircular2030_def1_tcm30-509532_mod_tcm30-509532.pdf
		What BIM/Information Management standards, protocols, etc. are predominantly being adopted in your national sector to facilitate the digital transformation/BIM adoption? (e.g. ISO 19650 series).	UNE-EN ISO 19650-2019 Organization and digitization of information about buildings and civil engineering works, including building information modelling (BIM)	

(Continuation of Annex 2. Table 5: Regulatory framework for CDW management in Spain.)

Stage	Measuring Item		Comments	References
Design and Manufacturing	*BIM*	What is the level of BIM adoption within your national sector? Provide references to supporting government, industry, academic reports	Regarding the type of work: Mature level of BIM adoption in building and public works (From 2018: the use of BIM is mandatory for building works over €2M with public funding; from 2019: mandatory for infrastructure works with public funding. From 2019: mandatory for all public building and civil works over €5.5M in Catalonia). Regarding type of entity: According to CIC construcción (data for 2021), BIM implementation is around 31% in architectural firms, 23% in engineering and construction companies, and 11% in other companies in the same field.	https://www.cicconstruccion.com/texto-diario/mostrar/3069210/implantacion-bim-espana-ronda-31-estudios-arquitectura
		Is the Digital Twin a key concern to the digital transformation of your national sector? If so, please provide further information	According to data from the survey developed by Fundación Laboral de la Construcción on digitisation in the construction sector in Spain in 2021, almost 75% of respondents attach high importance to BIM and digital twins for the integration of the value chain. Nevertheless, there are no policies regarding Digital Twin technologies at the national level	https://blog.fundacionlaboral.org/wp-content/uploads/2021/04/1-Informe-Consulta-Trans-Digital-def-1.pdf
		How (and to what extent) is the circular economy/waste management being integrated into your sector's digital transformation?	Although without a precise definition, relationships are drawn in some national documents linked, directly or indirectly, to the lines of digital transformation of the construction industry. E.g.: the Spain Circular 2030 Strategy (España Circular 2030) refers to the promotion of the use of BIM in the life cycle analysis of buildings to contribute to sustainability and climate action.	
	Harmonised Standards	Is CE marking conformity implemented in your country?	Yes	Normas para los productos de construcción: obtención del marcado CE | SGS España Edificación Sostenible | Ministerio de Transportes, Movilidad y Agenda Urbana (mitma.gob.es) Certificaciones LEED®, BREEAM® y VERDE® (isover.es) Certificación Passivhaus - Plataforma PEP (plataforma-pep.org) (Standards for construction products: obtaining the CE marking | SGS Spain Sustainable Building | Ministry of Transport, Mobility and Urban Agenda (mitma.gob.es) LEED®, BREEAM® and VERDE® certifications (isover.es) Passivhaus Certification - PEP Platform (plataforma-pep.org))
		What other conformity standards and certification are implemented in your country that affect reuse/recycling and recyclability of construction products?	An important document for many CE-marked products is the so-called Factory Production Control (FPC) certificate. We can provide FPC certification, which covers quality control procedures and inspections of a product. After passing the audit of a Notified organism, the manufacturer will receive the FPC certificate, which indicates compliance with the European standard for procedures and inspections. The standard for construction products distinguishes four different levels of control regarding the CE marking. The level of control is indicated by standard. An FPC certificate is only needed for the two highest levels. In many standards, a control level is recommended. In others, the manufacturer may select a level, or it may depend on a specific use.	

(Continuation of Annex 2. Table 5: Regulatory framework for CDW management in Spain.)

Stage	Measuring Item		Comments	References
Design and Manufacturing	*Harmonised Standards*	Are there any national sustainable-building or construction schemes in your country? (e.g. LEED, BREEAM, etc) If so, please provide further information and if they include any requirements about waste and circular economy	LEED, BREEAM, WELL, VERDE, PASSIVHAUS • LEED is characterized by providing an evaluation of the sustainability of the building, assessing its impact in 5 main areas: sustainable location, water protection and efficiency, energy efficiency and renewable energy, conservation of materials and natural resources, and quality of the indoor environment. • BREEAM is a system for evaluating sustainability in construction projects developed by the BRE (Building Research Establishment) in the early 1990s in the United Kingdom based on 9 categories as follows: management, health and well-being, energy, transport, materials, waste, water, land use and ecology, and pollution. • WELL is a performance-based standard that combines best practices in design and construction with evidence-based health and wellness interventions. That is, it searches the built environment for a vehicle to support human health, well-being, and comfort. • VERDE is a methodology for the environmental assessment and certification of buildings developed by the GBC Spain Association. Being aware that it is not enough to introduce a single element of improvement to be able to affirm that a building is sustainable, the GBCEspaña Technical Committee has formulated a series of criteria and accepted rules to define the limits and requirements necessary for a building to obtain GBCEspaña –VERDE® Certification. The evaluation system is based on a performance method in accordance with the philosophy of the Technical Building Code and the European Directives. At the base are the principles of bio-architecture and the construction of the building respecting the environment, compatible with the environment and with high levels of comfort and quality of life for users. The evaluation criteria are grouped into different thematic areas: site selection, siting and planning project, interior space quality, energy and atmosphere, service quality, natural resources and socio-economic impact • Passivhaus focuses on energetic efficiency of the building While the LEED, BREEAM and VERDE certifications focus on compliance with sustainability and energy efficiency standards, the WELL Building Standard guarantees that the certified space works for the health and well-being of the occupants.	

(Continuation of Annex 2. Table 5: Regulatory framework for CDW management in Spain.)

Stage	Measuring Item		Comments	References
Design and Manufacturing	*Harmonised Standards*	Is it a legal requirement for buildings (or some type of buildings) to be designed for disassembly? [iii] (reflect ISO 20887 or any other standards) If so, please provide further information	No	
Construction	*Green Public Procurement (GPP)*	Is GPP policy applied in your country? [iv] If not, please describe if there is any similar scheme applied	Yes	Microsoft Word - Las compras verdes y socialmente responsables en el marco de la empresa (ecoembes.com) - Publicaciones - La compra y contratación pública Verde en Euskadi 2005-2020. Una historia de éxito (ihobe.eus) gpp2020 :: Inicio (Microsoft Word - Green and socially responsible purchases within the company (ecoembes.com) - Publications - Green public procurement and contracting in Euskadi 2005-2020. A success story (ihobe.eus))
		Is there a target set by your country? If so, has it been fulfilled? (a target in which a percentage of all public procurement should be green).	40% It has not been fulfilled since this % was set not long ago. The Basque Country's commitment to sustainability is solid and stable. Euskadi has committed to transferring international and European commitments to its context and reality, becoming a pioneer region in the transition towards more sustainable development models. Already in 2002, the Basque Country visualized the relevance of public procurement as a strategic tool and instrument of transformation towards models' responsible production and consumption, environmentally sustainable, competitive and innovative. And he internalized the tractor and exemplary role of public sector in the market. A reflection of this, the Basque Environmental Strategy for Sustainable Development (2002-2020) established "Promote a public procurement policy that introduces ecological criteria" as an objective for Euskadi. A goal that has been materialized, step by step, in a long-term process, promoted and provided by Ihobe – the Government's public environmental management company Basque-, in coordination and from a shared leadership between the Basque administrations and the business sector.	

(Continuation of Annex 2. Table 5: Regulatory framework for CDW management in Spain.)

Stage	Measuring Item		Comments	References
Construction	*Green Public Procurement (GPP)*	Is GPP policy applied in construction related aspects? [v] [vi] [vii]	Yes, it is. In construction of roads, buildings	
		What aspects in construction waste management the GPP is targeting in your country? (e.g., specifying processes or packaging which generate less waste; encouraging reuse and recycling of materials; reducing using products containing critical raw materials, reducing using products containing hazardous substances, etc.) [viii] [ix] [x]	Basque Country: The different aspects in construction waste management are specified in different documents that need to be available prior to the building phase. The company has to take charge of this. The companies Bidders will attach a preview of the Environmental Management Plan, detailing the measures that the bidder will implement to minimize the impacts derived from the execution of the works. The plan will include: - The prevention and correct management of waste according to its dangerousness (inert, non-hazardous and dangerous) and their final management strategy (prevention, reuse, recycling) - Control and rational consumption of water, energy and fuels - The minimization of emissions into the atmosphere (in the form of dust, CO2 and other combustion gases from vehicles and machinery, odours, pollution light, etc.) The Waste Management Study will include an objective for the generation of CDWs and a minimum valuation objective of 80% with respect to the total forecast of residues carried out in said study	
	EU Taxonomy for New Construction	Is there a familiarity of EU taxonomy system in your country? [xi] [xii] [xiii] If so, please provide further information on the level of its adoption		
		Are there a technical screening criteria established by your country, for defining economic activities that counts as green? [xiv] If so, please provide references to supporting reports/documents	For the building sector, World GBCe has tested the *proposed Circular Economy EU-Taxonomy technical Screening criteria* for buildings. Based on this work, GBCe is developing a portal for the validation of the European Taxonomy on Buildings.	https://gbce.es/verificacion-esg-para-la-taxonomia-de-la-ue/#verificacion
		Are there any similar system/scheme to EU taxonomy applied in your country? If so, please provide further information		

(Continuation of Annex 2. Table 5: Regulatory framework for CDW management in Spain.)

Stage	Measuring Item		Comments	References
Construction	*Site Waste Management Plans*	Are site waste management plans applied in your country? If so, please describe if it Is a mandatory or voluntary requirement for construction activities	Yes. It is mandatory and regulated by the government	Microsoft Word - 1.4 Memoria-Anexo Gestión Residuos (contratacióndelestado.es) Real Decreto 105/2008, de 1 de febrero, por el que se regula la producción y gestión de los residuos de construcción y demolición. (boe.es)
		What are the requirements for site waste management plans in your country?	Obligations of the producer of construction and demolition waste. 1. In addition to the requirements demanded by the legislation on waste, the producer of construction and demolition waste must comply with the following obligations: a) Include in the work execution project a waste management study construction and demolition, which will contain at least: 1. An estimate of the quantity, expressed in tons and in cubic meters, of the construction and demolition waste that will be generated on site, coded according to to the European list of waste published by Order MAM/304/2002, of February 8, by the waste recovery and disposal operations and the European list are published waste, or standard that replaces it. 2. The measures for the prevention of waste in the work object of the project. 3. The reuse, recovery, or elimination operations to which the waste that will be generated on site. 4. The measures for the separation of waste on site for the compliance by the holder of the waste, of the obligation established in the paragraph 5 of article 5. 5. The plans of the facilities provided for the storage, handling, separation and, where appropriate, other construction waste management operations and demolition within the work. Subsequently, these plans may be subject to adaptation to the characteristics of the work and its execution systems, prior agreement of the optional direction of the work 6. The requirements of the specific technical specifications of the project, in relation to the storage, handling, separation and, where appropriate, other operations of management of construction and demolition waste within the work. 7. An assessment of the expected cost of construction waste management and demolition that will form part of the budget of the project in an independent chapter. b) In demolition, rehabilitation, repair, or reform works, make an inventory of the hazardous waste that will be generated, which must be included in the management study to referred to in letter a) of section 1, as well as providing for its selective withdrawal, to avoid mixing with each other or with other non-hazardous waste, and ensure its shipment to authorized managers of hazardous waste.	

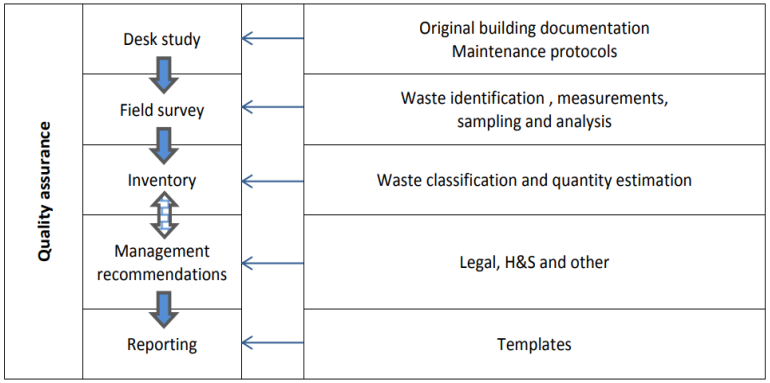
(Continuation of Annex 2. Table 5: Regulatory framework for CDW management in Spain.)

Stage	Measuring Item		Comments	References
Construction	*Site Waste Management Plans*		c) Have the documentation that proves that construction waste and demolition actually produced in their works have been managed, where appropriate, on site or delivered to a recovery or disposal facility for treatment by manager of authorized waste, in the terms included in this royal decree and, in particular, in the waste management study of the work or its modifications. The documentation corresponding to each calendar year must be maintained for the following five years. d) In the case of works subject to planning permission, constitute, when appropriate, in the terms provided in the legislation of the autonomous communities, the bond or guarantee financial equivalent that ensures compliance with the requirements established in said license in relation to construction and demolition waste from the work. In the case of building works, when a basic project is presented for the obtaining the planning license, said project will contain, at least, the documents referred to in numbers 1, 2, 3, 4 and 7 of letter a) and letter b) of section 1. Obligations of the holder of construction and demolition waste: 1. In addition to the obligations provided for in the applicable regulations, the natural person or legal entity that executes the work will be obliged to present to the owner of the same a plan that reflects how you will carry out the obligation's incumbent on you in relation to the construction and demolition waste that will be produced in the work, collected in article 4.1. and in this article. The plan, once approved by management optional and accepted by the property, it will become part of the document's contractual works. 2. The holder of construction and demolition waste, when not appropriate to manage them by itself, and without prejudice to the requirements of the approved project, will be obliged to deliver them to a waste manager or to participate in a voluntary agreement or collaboration agreement for its management. Construction and demolition waste is will preferably be used, and in this order, for reuse, recycling or other forms of valuation. 3. The delivery of construction and demolition waste to a manager by the possessor must be recorded in a reliable document, which includes, at least, the identification of the holder and the producer, the work of origin and, where appropriate, the number license for the work, the quantity, expressed in tons or cubic meters, or both units where possible, the type of waste delivered, coded according to the European list of waste published by Order MAM/304/2002, of February 8, or norm that replaces it, and the identification of the manager of the destination operations. When the manager to whom the holder delivers the construction and demolition waste carry out only collection, storage, transfer, or transport operations, the delivery document must also include the recovery or disposal manager after which the waste will be allocated.	

(Continuation of Annex 2. Table 5: Regulatory framework for CDW management in Spain.)

Stage	Measuring Item		Comments	References
Construction	*Site Waste Management Plans*		In any case, the administrative responsibility in relation to the transfer of waste of construction and demolition by the holders to the managers will be governed by the established in article 33 of Law 10/1998, of April 21. 4. The holder of the waste will be obliged, while they are in his possession, to keep them in adequate hygiene and safety conditions, as well as to avoid mixing fractions already selected that prevents or hinders their subsequent recovery or disposal. 5. Construction and demolition waste must be separated into the following fractions, when, individually for each of said fractions, the quantity. Expected generation for the total work exceeds the following amounts: Concrete: 80 t. Bricks, tiles, ceramics: 40 t. Metal: 2 t. Wood: 1 t. Glass: 1 t. Plastic: 0.5 t. Paper and cardboard: 0.5 t. The separation into fractions will be carried out preferably by the holder of the construction and demolition waste within the work in which it is produced. Due to the lack of physical space in the work, it is not technically feasible to carry out said separation in origin, the holder may entrust the separation of fractions to a waste manager in an off-site construction and demolition waste treatment facility. In the latter case, the owner must obtain documentation from the facility manager certifying that the latter has complied, on his behalf, with the obligation contained in this pulled apart. 6. The competent body in environmental matters of the autonomous community in which the work is located, exceptionally, and provided that the separation of waste does not has been specified and budgeted in the work project, may exempt the holder of construction and demolition waste from the obligation to separate one or more all the above fractions. 7. The holder of construction and demolition waste will be obliged to pay the corresponding management costs and to deliver to the producer the certificates and other Documentation accrediting the management of the waste referred to in the section 3, as well as to maintain the documentation corresponding to each calendar year for the next five years.	

(Continuation of Annex 2. Table 5: Regulatory framework for CDW management in Spain.)

Stage	Measuring Item		Comments	References
Maintenance, Renovation and Demolition	*Waste Audits*	Are waste audits and/or inventories applied in your country? If so, please describe if it Is a mandatory or voluntary requirement for renovation and demolition activities	Yes. Waste treatment in Spain is applied to the construction of infrastructures and new buildings, although you must also present the plan in cases of demolition of real estate and, even, if you want to carry out a small demolition, as part of a renovation work premises and houses. The construction and demolition waste management plan are required by law and applies to all types of work, including renovations and urbanization works. Likewise, there is also a hospital waste management plan, which refers to sanitary waste generated in health centers. Therefore, health centers cannot function without having the corresponding waste management plan approved.	Guidelines for the waste audits before demolition and renovation works of buildings EU Construction and Demolition Waste Management May 2018 Plan_Residuos_CAPV_2020.pdf (euskadi.eus)
		What are the regulatory requirements/checklist for the waste audits in your country? [xviii] Generally describe the scope of requirements and guidelines that regulate the waste audits process,		
		Are waste audits requirements regulated in each region or is it generalised for the entire country?	Generalized for the entire country but the Basque country also has its own waste prevention and management plan	
		Are there regular inspections/monitoring of the process and the output of the waste audits, in your country? [xix] If so, please provide further information	Not identified.	

(Continuation of Annex 2. Table 5: Regulatory framework for CDW management in Spain.)

Stage	Measuring Item		Comments	References
Maintenance, Renovation and	*Waste Audits*	Other than waste audits, are there any schemes, plans, policies, permits or guidelines, etc., for renovation and demolition activities, in your country? (that control and regulate waste aspects in demolition sites) [xx] If so, state them describing their scope and provide references to supporting reports/documents	Not identified.	
Recovery	*Multiple Felds*	What is the current recovery rate of CDW in your country? [xxi xxii]	2020 (tones): Mineral CDW: 13,434,566	Statistics | Eurostat (europa.eu) Real Decreto 105/2008, de 1 de febrero, por el que se regula la producción y gestión de los residuos de construcción y demolición. (boe.es) BOE.es - BOE-A-1998-9478 Ley 10/1998, de 21 de abril, de Residuos. Statistics | Eurostat (europa.eu) INE. Instituto Nacional de Estadística gestionresiduos2.pdf (fundacionlaboral.org)
		Are there economic incentives implemented in your country for promoting CDW prevention, collection, reuse, and recycling? [xxiii] If so, please describe the types of such incentives	No. The incentive is not having to pay taking the residues to landfill. And the use of recycled product is also cheaper.	
		How is CDW defined in your country, and what are the types of CDW according to that definition? (i.e., What can be counted as CDW) [xxiv xxv xxvi]	Construction and demolition waste: any substance or object that, complying with the definition of «Waste» included in article 3.a) of Law 10/1998, of April 21, is generated at a construction or demolition site "Waste": any substance or object belonging to any of the categories that appear in the annex to this Law, from which its holder disposes or from which he has the intention or obligation to dispose. In any case, those listed in the European Waste Catalog (CER), approved by the Community Institutions, will have this consideration. Annex: waste categories Q1 Waste from production or consumption not specified below. Q2 Products that do not meet the standards. Q3 Expired products. Q4 Materials that have been accidentally released, lost or otherwise subjected to, including material, equipment, etc., that have become contaminated as a result of the incident in question. Q5 Contaminating or soiled materials due to voluntary activities (for example, residues from cleaning operations, packaging materials, containers, etc.). Q6 Unused items (for example, dead batteries, exhausted catalytic converters, etc.). Q7 Substances that have become unusable (eg contaminated acids, contaminated solvents, exhausted tempering salts, etc.).	(Statistics | Eurostat (europa.eu) Royal Decree 105/2008, of February 1, which regulates the production and management of construction and demolition waste. (boe.es) BOE.es - BOE-A-1998-9478 Law 10/1998, of April 21, on Waste. Statistics | Eurostat (europa.eu) INE. Statistics National Institute gestionresiduos2.pdf (fundacionlaboral.org))

(Continuation of Annex 2. Table 5: Regulatory framework for CDW management in Spain.)

Stage	Measuring Item		Comments	References
Recovery	*Multiple Felds*		Q8 Residues from industrial processes (for example, slag, distillation grounds, etc.). Q9 Waste from anti-pollution processes (for example, gas washing sludge, dust from air filters, spent filters, etc.). Q10 Machining/finishing waste (for example, turning or milling chips, etc.). Q11 Waste from the extraction and preparation of raw materials (for example, waste from mining or oil exploitation, etc.). Q12 Contaminated matter (for example, oil contaminated with PCBs, etc.). Q13 Any matter, substance, or product whose use is prohibited by law. Q14 Products that are not useful or that no longer have utility for the holder (for example, articles discarded by agriculture, homes, offices, warehouses, workshops, etc.). Q15 Contaminated materials, substances, or products from soil regeneration activities. Q16 Any substance, matter or product that is not included in the previous categories.	
		Are there national strategies (plans, programmes, schemes, targets) about CDW management including prevention, collecting, sorting, reuse, recycling and disposal established in your country? [xxvii] [xxviii] [xxix] [xxx] [xxxi] [xxxii] [xxxiii] [xxxiv] If so, please state them, and provide references to supporting reports/documents	Not identified.	
		How is the national CDW data collected/measured in your country? (i.e., volumes/amounts of generated, recycled, reused, and landfilled waste) Are there electronic reporting measures taken by your country [xxxv] [xxxvi] (volume, amounts, types, etc.) If so, please provide further information	Amount of waste generated by economic activity (CNAE-2009), class of waste and type of hazard.	

(Continuation of Annex 2. Table 5: Regulatory framework for CDW management in Spain.)

Stage	Measuring Item		Comments	References
Recovery	*Recycle*	How is CDW recycling defined in your country, and what are the types of processes that can be counted as acceptable recycling processes (of which the resultant materials are considered recycled)? [xxxvii]	"Recycling": the transformation of waste, within a production process, for its initial purpose or for other purposes, including composting and biomethanization, but not incineration with energy recovery.	BOE.es - BOE-A-1998-9478 Ley 10/1998, de 21 de abril, de Residuos. gestionresiduos2.pdf (fundacionlaboral.org) Mercados secundarios incentivan el crecimiento del reciclaje| Ecoembes (thecircularlab.com) (BOE.es - BOE-A-1998-9478 Law 10/1998, of April 21, on Waste. gestionresiduos2.pdf (fundacionlaboral.org) Secondary markets encourage the growth of recycling | Ecoembes (thecircularlab.com))
		Is there a classification of CDW types that are applicable for recycling, in your country? [xxxviii] If so, please provide further information	There are several ways to classify RCDs. In the first place, the waste will be classified according to its origin, which generally gives an idea of its features. Secondly, a classification is made according to the nature of the waste, listing its main characteristics and problems management a. Classification of waste according to its origin RCDs, according to their origin, are classified as: – Waste from aggregate extraction points or points of the work where pure earthworks are carried out, without no other type of construction activity is involved. – Waste from construction works. – Waste from demolition works. Each of these types has different characteristics: • Waste from extraction points or pure earthworks. They are waste composed entirely of original materials. Stone, of a variable nature and granulometry. are clean waste of any contamination by other construction substances. • Construction waste. They are waste mainly of stone and ceramic origin (approximately 75%) with a significant presence of other materials. In the stone fraction (the rubble) there are mainly remains of concrete and ceramics from scraps or torn materials. The remaining 25% is made up of a heterogeneous mix of waste ranging from glass, wood, and paper to garbage. Most dangerous, composed of toxic or polluting substances, as thinner and paints or some metals (such as lead). Among these heterogeneous residues there is an important fraction of plastics and papers from the packaging of the construction materials. • Demolition waste It is waste like construction waste in its proportions between rubble (concrete and ceramic waste) and other waste type.	

(Continuation of Annex 2. Table 5: Regulatory framework for CDW management in Spain.)

Stage	Measuring Item		Comments	References
Recovery	*Recycle*		However, the fundamental difference lies in how mixed they meet each other. While in waste from a construction site it is relatively easy to separate the remains paper ceramics when a shipment of bricks breaks or separate the cuts of the reinforcements of the concrete surpluses, in a demolition is not possible. When a building is demolished, the separation of the reinforcements from the concrete cannot be carried out in the work. Nor is it easy to separate the materials present in a room: metals and plastics from service pipes, ceramics for partitions, plasters and plasters for ceilings, fibers, synthetic insulation, etc. A demolition must be resorted to selective for an adequate separation and, even so, there will always be a fraction that will not be possible to separate to reuse in some way. Thus, the waste from a demolition work they are more contaminated than those coming from a construction site. b. Classification of waste according to its nature In addition to classification by origin, waste is classified by its nature, closely related to its origin. According to its nature, waste is: – Inert waste. - Non-hazardous waste. – Toxic and dangerous waste. • Inert waste They are considered as non-hazardous waste those which do not undergo significant physical, chemical or biological transformations. Among these residues, it is not found soluble, combustible, biodegradable materials or that react physically or chemically with other substances; They do not harm human health or pollute the environment. These residues are commonly called as “debris”. Relating it with the previous classification, according to the origin, the residues coming from points of extraction of aggregates or movements of pure earth and the fraction of debris from construction and demolition works can be classified as inert. It is immediate to deduce that most of the RCDs belong to this category • Non-hazardous waste They do not present toxicity problems in themselves but can be undergone or produced in other substances with physical, chemical modifications, or biological that give rise to harmful substances for the human being or environmental pollutants.	

(Continuation of Annex 2. Table 5: Regulatory framework for CDW management in Spain.)

Stage	Measuring Item		Comments	References
Recovery	*Recycle*		Toxic and dangerous waste contains dangerous or toxic substances for humans or pollutants for the environment. They are collected and classified in the legislation and its transfer and handling is carried out by authorized managers. Even though its volume is not very high in the global RCD, its toxicity or polluting potential should not be underestimated. The main problem with this type of waste lies in its ability to contaminate other residues, especially inert ones. The mixture of toxic and dangerous waste with the inert produces the contamination of the latter, which multiplies the amount of waste that must be delivered to authorized managers. The mixing and contamination of waste is a serious problem both for health human as for the environment. In addition, it considerably increases management costs. Source separation and classification (as seen below) is the best strategy to minimize toxic and hazardous waste	
		Are there markets for secondary raw materials (recycled CDW materials) established in your country? If so, please provide further information on the types of these markets	The Spanish market appears in the trading market as an importer of textile waste and non-ferrous metals and paper and cardboard. CDW is not mentioned.	
	Reuse	How is CDW reuse defined in your country?	Reuse: the use of a used product for the same purpose for which it was originally designed.	BOE.es - BOE-A-1998-9478 Ley 10/1998, de 21 de abril, de Residuos. gestionresiduos2.pdf (fundacionlaboral.org) Telefónica launches MAIA, a platform to promote the reuse of its network equipment - Telefónica (telefonica.com)
		Are there networks and sharing platforms for reuse and repair in your country? [xxxix] If so, please provide examples with references/links	MAIA: a platform to promote the reuse of its network equipment. It allows each operator in the Group to publish and display available equipment and to connect with others to encourage reuse.	
	Treatment	Is there a definition of ownership and responsibility for the actors involved in waste handling and treatment, set by your country? (e.g., waste producers, holders, and managers, etc.) [xl] [xli] [xlii] If so, please provide further information	The holder of construction and demolition waste is the physical or legal person who have in their possession the construction and demolition waste and that they do not have the status waste manager. In any case, the natural person or legal entity that executes the construction or demolition work, such as the builder, the subcontractors or self-employed workers. In any case, they will not be considered as holder of construction and demolition waste workers employed by others.	Real Decreto 105/2008, de 1 de febrero, por el que se regula la producción y gestión de los residuos de construcción y demolición. (boe.es) (Royal Decree 105/2008, of February 1, which regulates the production and management of construction and demolition waste. (boe.es))

(Continuation of Annex 2. Table 5: Regulatory framework for CDW management in Spain.)

Stage	Measuring Item		Comments	References
Recovery	*Treatment*		Obligations of the holder of construction and demolition waste. 1. In addition to the obligations provided for in the applicable regulations, the natural person or legal entity that executes the work will be obliged to present to the owner of the same a plan that reflects how you will carry out the obligations incumbent on you in relation to the construction and demolition waste that will be produced in the work, in particular collected in article 4.1. and in this article. The plan, once approved by management optional and accepted by the property, it will become part of the document's contractual works. 2. The holder of construction and demolition waste, when not appropriate to manage them by itself, and without prejudice to the requirements of the approved project, will be obliged to deliver them to a waste manager or to participate in a voluntary agreement or collaboration agreement for its management. Construction and demolition waste is will preferably be used, and in this order, for reuse, recycling or other forms of valuation. 3. The delivery of construction and demolition waste to a manager by the possessor must be recorded in a reliable document, which includes, at least, the identification of the holder and the producer, the work of origin and, where appropriate, the number license for the work, the quantity, expressed in tons or cubic meters, or both units where possible, the type of waste delivered, coded according to the European list of waste published by Order MAM/304/2002, of February 8, or norm that replaces it, and the identification of the manager of the destination operations. When the manager to whom the holder delivers the construction and demolition waste carry out only collection, storage, transfer or transport operations, the delivery document must also include the recovery or disposal manager subsequent to which the waste will be allocated. In any case, the administrative responsibility in relation to the transfer of waste of construction and demolition by the holders to the managers will be governed by the established in article 33 of Law 10/1998, of April 21. 4. The holder of the waste will be obliged, while they are in his possession, to keep them in adequate hygiene and safety conditions, as well as to avoid mixing fractions already selected that prevents or hinders their subsequent recovery or disposal.	

(Continuation of Annex 2. Table 5: Regulatory framework for CDW management in Spain.)

Stage	Measuring Item		Comments	References
Recovery	*Treatment*		5. Construction and demolition waste must be separated into the following fractions, when, individually for each of said fractions, the quantity expected generation for the total work exceeds the following amounts: Concrete: 80 t. Bricks, tiles, ceramics: 40 t. Metal: 2 t. Wood: 1 t. Glass: 1 t. Plastic: 0.5 t. Paper and cardboard: 0.5 t. The separation into fractions will be carried out preferably by the holder of the construction and demolition waste within the work in which it is produced. When it is not technically feasible to carry out this separation in origin due to the lack of physical space in the work, the holder may entrust the separation of fractions to a waste manager in an off-site construction and demolition waste treatment facility. In the latter case, the owner must obtain documentation from the facility manager certifying that the latter has complied, on his behalf, with the obligation contained in this pulled apart. 6. The competent body in environmental matters of the autonomous community in which the work is located, exceptionally, and provided that the separation of waste does not has been specified and budgeted in the work project, may exempt the holder of construction and demolition waste from the obligation to separate one or more all of the above fractions. 7. The holder of construction and demolition waste will be obliged to pay the corresponding management costs and to deliver to the producer the certificates and other documentation accrediting the management of the waste referred to in the section 3, as well as to maintain the documentation corresponding to each calendar year for the next five years.	
		Issuing of permits for CDW treatment (either for establishment or undertaking) applied by your country? [xliii] If so, please provide further information		

(Continuation of Annex 2. Table 5: Regulatory framework for CDW management in Spain.)

Stage	Measuring Item		Comments	References
Residual Waste	*Multiple Felds*	Are there landfilling and incineration charges, and restrictions adopted by your country? If so, please state them and describe their criteria	The Tax on the deposit of waste in landfills, incineration and waste co-incineration is an indirect tax that falls on the delivery of waste in landfills, incineration or co-incineration facilities for disposal or energy recovery. The purpose of the tax is to promote prevention, preparation for the reuse and recycling of waste, with the organic fraction as the preferred fraction and environmental education, in order to discourage the deposit of waste in landfills, the incineration and its co-incineration. This tax will tax the delivery of waste to landfills and incinerators for disposal and energy recovery. Different rates will be applied to the tax base, constituted by the weight of the waste expressed in metric tons, to obtain the full amount or invoice. For example, in the case of waste deposited in non-hazardous landfills, a rate of 40 euros will be applied per ton of municipal waste. In incineration facilities, rates will be applied that range between 5 and 20 euros depending on the type of recovery.	Ley 7/2022, de 8 de abril, de residuos y suelos contaminados para una economía circular. (boe.es) Real Decreto 105/2008, de 1 de febrero, por el que se regula la producción y gestión de los residuos de construcción y demolición. (boe.es) (Law 7/2022, of April 8, on waste and contaminated soils for a circular economy. (boe.es) Royal Decree 105/2008, of February 1, which regulates the production and management of construction and demolition waste. (boe.es))
		What is the most common disposal method for CDW in your country? [xliv]	Recycling plants and after landfilling but by the law construction and demolition waste should preferably be used, and in this order, for reuse, recycling or other forms of recovery.	

Annex 2. Table 6: Regulatory framework for CDW management in the UK.

Stage	Measuring Item		Comments	References
Design and Manufacturing	*Extended Producer Responsibility Schemes (EPR)*	Is EPR scheme applied in your country? [i] If not, please describe if there is any similar scheme applied	The new EPR system will replace the current Packaging Waste Regulations and will apply to all UK organisations that handle and supply packaging to consumers and to businesses with a phased implementation from 2023/4. (1) Organisations will need to start collecting the correct packaging data from 1 January 2023 (1) Other similar schemes to EPR in UK is 'Polluter Pays Principle' introduced within the environmental principles policy in the Environment Act 2021. However, it is still a draft policy. It states that, where possible, the costs of pollution should be borne by those causing it. (2) (3)	1.https://www.gov.uk/guidance/packaging-waste-prepare-for-extended-producer-responsibility 2.https://www.gov.uk/government/publications/environmental-principles-policy-statement/draft-environmental-principles-policy-statement 3.https://www.gov.uk/government/publications/environmental-principles-policy-statement 4.https://consult.defra.gov.uk/extended-producer-responsibility/extended-producer-responsibility-for-packaging/supporting_documents/23.03.21%20EPR%20Consultation.pdf
		What construction product categories are regulated by the EPR scheme in your country? [ii]	The only product category that EPR is targeting in UK is *PACKAGING* (which can include construction products packaging).	
		Are there waste management quantitative targets set by your country, relevant for the EPR scheme? (e.g., recycling rate of products, setting a minimum percentage of reusable/recyclable products placed on the market) If so, please provide further information	In UK EPR for packaging, it is proposed that by 2024, 63% of all packaging placed on the UK market and in scope of packaging Extended Producer Responsibility will be recycled – by 2030, it is 73% (4) Recycling targets for six packaging materials (plastic, card, steel, aluminium, glass, wood) will be set initially to 2030. (4)	
	BIM	Does your country have a national level driven Digital Transformation/BIM agenda/mandate/roadmap? If so, please provide further information.	In April 2016, BIM Level 2 (which was later replaced by UK BIM Framework) became mandatory for public projects in UK. (5) The UK BIM Framework was launched in 2019 by Business Innovation and Skills (BIS), The Centre for Digital Built Britain (CDBB), and the UK BIM Alliance. It is an overarching approach to implementing BIM in the UK, supporting digital transformation. The strategies targeting BIM and UK digital transformation are explained below. (6)	5.https://www.gov.uk/government/publications/government-construction-strategy 6.https://www.ukbimframework.org/ 7.https://www.gov.uk/government/publications/construction-2025-strategy 8.https://www.gov.uk/guidance/creating-a-digital-built-britain-what-you-need-to-know
		What is the main driver for BIM adoption/Digital Transformation in your national sector? (Government/Industry/both/neither) Please provide explanation	The government and the construction industry in UK are collaborating to promote the success of the UK construction sector – focusing on smart technologies. Governmental departments and agencies such as Minister for the Cabinet Office, Department for Business Innovation and Skills, Department of Business, Energy & Industrial Strategy (BEIS), Innovate UK, Infrastructure and Projects Authority (IPA), have set out the rout map of UK digital transformation working with the industry and academia (e.g., Cambridge University, UK BIM Alliance). (5)(6)(7)(8)(9)(10)(11)(12)	

(Continuation of Annex 2. Table 6: Regulatory framework for CDW management in the UK.)

Stage	Measuring Item		Comments	References
Design and Manufacturing	*BIM*	What BIM/Information Management standards, protocols, etc. are predominantly being adopted in your national sector to facilitate the digital transformation/BIM adoption? (e.g. ISO 19650 series).	UK has established BS1192: 2007 standard, which forms the basis of today's ISO 19650 series. BS 1192:2014, PAS 1192-6:2018, BS 8536-1:2015, BS 8536-2:2016, BIM Protocol (2nd edition), Digital Plan of Work (DPoW), Government Soft Landings (GSL), and Classification System are also used in UK. All these standards, protocols, and guidelines form the main pillars of BIM adoption. (8)	9.https://www.cdbb.cam.ac.uk/system/files/documents/bis15155digitalbuiltbritainlevel3strategy.pdf 10.https://www.gov.uk/government/publications/government-construction-strategy-2016-2020 11.https://www.cdbb.cam.ac.uk/news/2017NovPressRelease 12.https://www.gov.uk/government/publications/transforming-infrastructure-performance-roadmap-to-2030/transforming-infrastructure-performance-roadmap-to-2030#annex-b-information-management-mandate 13.https://www.cdbb.cam.ac.uk/what-we-did/national-digital-twin-programme 14.https://www.great.gov.uk/international/content/investment/sectors/ar-and-vr/ 15.https://www.sciencedirect.com/science/article/abs/pii/S221067071630021X
		What is the level of BIM adoption within your national sector? Provide references to supporting government, industry, academic reports	The UK is recognised by its peers as one of the leading nations in the exploitation of BIM technology and processes with an internationally respected centrally led programme. The UK has the highest number of construction companies using BIM at level 2 and beyond. It remains the leader in the earliest use and implementation of BIM in construction projects. BIM is the target for many strategies in the UK that set out the rout map of digital transformation in the UK construction industry and BIM adoption. These include Government Construction Strategy (2011-2015 & 2016-2020), Construction 2025 Strategy, Digital Built Britain programme (DBB), and Centre for Digital Built Britain (CDBB, 2017 - 2022), and Transforming Infrastructure Performance (TIP): Roadmap to 2030. The main aim of these strategies is to support the digital transformation of the construction by promoting the use of BIM and modern digital approaches and technologies. (5)(6)(7)(8)(9)(10)(11)(12)	
		Is the Digital Twin a key concern to the digital transformation of your national sector? If so, please provide further information	The National Digital Twin programme (NDTp) was run by the Centre for Digital Built Britain and launched by HM Treasury 2018. It is a key step in the digital transformation of the UK infrastructure and construction sectors. The NDTp has set up the Digital Framework Task Group (DFTG) as an advisory group and runs the Digital Twin Hub, a collaborative and supportive web-enabled community. (13)	
		How (and to what extent) is the circular economy/waste management being integrated into your sector's digital transformation?	According to the findings of governmental report such as Latham, Egan, Farmer report, the construction industry in UK is slow to change in relation to digitalisation. However, changes in train are happening including the advancement in BIM adoption, which provides sustainable design and construction and support the efficient use of resources. This is in addition to establishment of The National Digital Twin programme which promotes more reuse and greater resource efficiency – a key enabler of the circular economy in the built environment. Further, Augmented reality and virtual reality in which UK is a pioneer with the fastest growing market in Europe. (14) Other measures in the digital transformation targeting waste services and management include sharing platforms and mandatory digital waste tracking, Material passport, off-site manufacturing, although the UK has been slow in its adoption. This is in addition to several digital & automated solutions for CDW management – refer to current practices document. (15)	

(Continuation of Annex 2. Table 6: Regulatory framework for CDW management in the UK.)

Stage	Measuring Item		Comments	References
Design and Manufacturing	*Harmonised Standards*	Is CE marking conformity implemented in your country?	Usage of CE marking on the UK market will continue until 31 December 2024. The UK requires a UKCA mark to replace the CE Mark effective December 31, 2022. (16) (17)	16.https://www.gov.uk/guidance/ce-marking#:~:text=The%20letters%20'%20CE%20'%20appear%20on,safety%2C%20health%20or%20environmental%20requirements 17.https://www.gov.uk/guidance/using-the-ukca-marking 18.https://bregroup.com/products/breeam/
		What other conformity standards and certification are implemented in your country that affect reuse/recycling and recyclability of construction products?	UKCA …	
		Are there any national sustainable-building or construction schemes in your country? (e.g. LEED, BREEAM, etc) If so, please provide further information and if they include any requirements about waste and circular economy	BREEAM was first launched in the UK in 1990. As part of the government's Construction Strategy, it is now a requirement for all public projects to undergo an environmental assessment, achieving an Excellent BREEAM rating. (18) Other sustainable scheme applied in UK includes (Home Quality Mark (HQM)- established by BRE), SKA Rating (established by RICS).	
		Is it a legal requirement for buildings (or some type of buildings) to be designed for disassembly? [iii] (reflect ISO 20887 or any other standards) If so, please provide further information	It is not a legal requirement	
Construction	*Green Public Procurement (GPP)*	Is GPP policy applied in your country? [iv] If not, please describe if there is any similar scheme applied	Sustainable Procurement regulations are set out in 'National procurement strategy for local government in England' and been reinforced in the UK Government Green Paper 'Transforming public procurement' and the subsequent 'National procurement policy statement'. (19)	19.https://www.local.gov.uk/publications/sustainable-procurement-delivering-local-economic-social-and-environmental-priorities 20.https://ec.europa.eu/environment/gpp/pdf/statistical_information.pdf 21.https://www.gov.uk/government/publications/procurement-policy-note-0620-taking-account-of-social-value-in-the-award-of-central-government-contracts 22.https://www.local.gov.uk/sites/default/files/documents/Sustainable%20Procurement%20Toolkit_1.pdf
		Is there a target set by your country? If so, has it been fulfilled? (a target in which a percentage of all public procurement should be green).	The UK is the best performing country, scoring a percentage of 75% on GPP. The total green purchases in construction product group score from as high as 77%. (20) From 1 January 2021, a minimum weighting of 10% must be given to environmental, social and governance (ESG) objectives in each procurement by all UK central government procurement. (21)	
		Is GPP policy applied in construction related aspects? [v] [vi] [vii]	The UK government buying standards cover many priority procurement categories including construction. (22)	
		What aspects in construction waste management the GPP is targeting in your country? (e.g., specifying processes or packaging which generate less waste; encouraging reuse and recycling of materials; reducing using products containing critical raw materials, reducing using products containing hazardous substances, etc.) [viii] [ix] [x]	Involves aspects including climate change adaptation, the use of materials derived from vulnerable ecosystems, opportunities to reduce scarce and virgin material/resource use, minimising hazardous products procured or used within services, extend useful life of products and assets, enhance high-quality recycling, and finally, recover value through design, reuse, refurbishment or remanufacturing including through innovation. (22)	

(Continuation of Annex 2. Table 6: Regulatory framework for CDW management in the UK.)

Stage	Measuring Item		Comments	References
Construction	*EU Taxonomy for New Construction*	Is there a familiarity of EU taxonomy system in your country? [xi] [xii] [xiii] If so, please provide further information on the level of its adoption	In July 2019 the UK Government published Green Finance Strategy that supports the UK's economic policy for a greener, more sustainable and prosperous future. (23) In June 2021, new independent expert group (The Green Technical Advisory Group [GTAG]) established to advise on standards for green investment. (24) In October 2021 the UK Government published its 'roadmap' – Greening Finance: A Roadmap to Sustainable Investing in which it set out its plans to develop a new Sustainability Disclosures Regime (SDR) and a Green Taxonomy. (25)	23.https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/820284/190716_BEIS_Green_Finance_Strategy_Accessible_Final.pdf 24.https://www.gov.uk/government/news/new-independent-group-to-help-tackle-greenwashing 25.https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/1031805/CCS0821102722-006_Green_Finance_Paper_2021_v6_Web_Accessible.pdf 26.https://www.gov.uk/government/news/uk-to-enshrine-mandatory-climate-disclosures-for-largest-companies-in-law 27.https://www.gov.uk/government/publications/climate-related-financial-disclosures-for-companies-and-limited-liability-partnerships-llps
		Are there a technical screening criteria established by your country, for defining economic activities that counts as green? [xiv] If so, please provide references to supporting reports/documents	The UK Taxonomy has six environmental objectives, outlined in the 'roadmap' document, and each of the environmental objectives will be underpinned by a set of detailed standards, known as Technical Screening Criteria (TSC) which identifies how each economic activity included in the Taxonomy can make a substantial contribution to the environmental objective. (25) The 'roadmap' also determines the precise scope and timing of UK taxonomy requirements, and the reporting detail, subject to relevant consultation processes and other statutory requirements. (25)	
		Are there any similar system/scheme to EU taxonomy applied in your country? If so, please provide further information	From April 2022, The UK became the first G20 country to make it mandatory for Britain's largest businesses to collect, act and report on climate and sustainability-related financial information, in line with Taskforce on Climate-related Financial Disclosures (TCFD) recommendations. (26) The TCFD is an industry-led group that developed a framework which helps investors understand their financial exposure to climate risk and works with companies to disclose this information in a clear and consistent way. (26) Further, from April 2022, all large UK companies and large limited liability partnerships (LLPs) are required to disclose climate-related financial information, in line with the BEIS Climate-related Financial Disclosures regulations. (27) The BEIS Climate-related Financial Disclosures regulations support investment decisions by comparing companies' exposures to climate-related risks and opportunities, allowing investors to be better equipped to incorporate these risks into their investment and business decisions. (27)	

(Continuation of Annex 2. Table 6: Regulatory framework for CDW management in the UK.)

Stage	Measuring Item		Comments	References
Construction	*Site Waste Management Plans*	Are site waste management plans applied in your country? If so, please describe if it Is a mandatory or voluntary requirement for construction activities	SWMPs was a legal requirement in England for all construction projects that cost of over £300,000. In December 2013, the regulation was revoked and became a voluntary requirement. As for Northern Ireland, Scotland and Wales, it is not legally required to have a SWMPs. (28) (29)	28.https://www.legislation.gov.uk/uksi/2008/314/contents/made 29.https://www.netregs.org.uk/media/1114/swmp_simple_guide.pdf 30. https://www.gov.uk/how-to-classify-different-types-of-waste/construction-and-demolition-waste 31.https://www.gov.uk/dispose-business-commercial-waste
		What are the requirements for site waste management plans in your country?	As SWMPs is a voluntary requirement, projects, companies, public departments, etc., can create their own plans. However, the general guidelines for SWMPs involves aspects of planning and allocating responsibility, identifying, managing, disposing and monitoring waste. (28) (29)	
		If SWMP is not applied in your country, are there any legal/voluntary requirements for managing waste on construction sites? (e.g., waste identification of expected waste types and amounts, source separation and collection, documentation, storing, transportation, etc.,) [xv] [xvi] [xvii] If so, please provide further information	The UK government provided a technical guidance on how to assess and classify CDW. (30) The UK government established regulations on defining responsibilities for sorting, storing, and transfer of CDW. (31)	
Maintenance, Renovation and Demolition	*Waste Audits*	Are waste audits and/or inventories applied in your country? If so, please describe if it Is a mandatory or voluntary requirement for renovation and demolition activities	Waste audits is very popular in UK and is a voluntary requirement as per country regulations. However, in order to comply with BREEAM, buildings must have pre-demolition and pre-refurbishment audits. (32) (33) Waste audits can be a legal requirement depending on the regulation of the country in UK. For example South Gloucestershire Minerals and Waste Local Plan requires developers to prepare and submit a waste audit. (34)	32.https://bregroup.com/buzz/pre-demolition-and-pre-refurbishment-audits/ 33.https://kb.breeam.com/knowledgebase/nc11-wst-01-within-breeam-2008-wst-1-criteria-requirements-concerning-the-pre-demolition-audit-were-dependent-upon-forming-part-of-the-principle-contractors-works-this-reference-has-been-removed-in/ 34.https://beta.southglos.gov.uk/wp-content/uploads/Waste-Audits-SPG.pdf
		What are the regulatory requirements/checklist for the waste audits in your country? [xviii] Generally describe the scope of requirements and guidelines that regulate the waste audits process,	To date there has been little guidance available about how to conduct audits and therefore, there are implications for the quality of audit work. Most audits are carried out by demolition contractors themselves in the form of a method statement. (32) (33) A popular resource for developing pre-demolition and pre-refurbishment audits can be found in the 'Code of Practice: Predevelopment audits' which is established by Bre. (35)	
		Are waste audits requirements regulated in each region or is it generalised for the entire country?	As audits is a voluntary requirement, projects, developers, counties, etc., can set out their requirements.	
		Are there regular inspections/monitoring of the process and the output of the waste audits, in your country? [xix] If so, please provide further information	Details in the upper point.	

(Continuation of Annex 2. Table 6: Regulatory framework for CDW management in the UK.)

Stage	Measuring Item		Comments	References
Maintenance, Renovation and Demolition	*Waste Audits*	Other than waste audits, are there any schemes, plans, policies, permits or guidelines, etc., for renovation and demolition activities, in your country? (that control and regulate waste aspects in demolition sites) [xx] If so, state them describing their scope and provide references to supporting reports/documents	Demolition & Refurbishment Resource Protocol is established by the National Federation of Demolition Contractors (NFDC). This document provides guidelines that support the implementation of resource efficiency methodologies for demolition and refurbishment including information on the planning of waste audits. (36) Waste audit guide for businesses is established by the Waste and Resources Action Programme (WRAP) and provides guidance on the development of waste audits. (37) British Standard Code of Practice for Full and Partial demolition (BS 6187: 2011) gives good practice recommendations for the proper and effective management of demolition processes including waste management aspect. (38)	35.https://condemwaste.org/wp-content/uploads/2018/10/Code-of-Practice-Pre-redevelopment-audit-July-17-V1.pdf 36.https://demolition-nfdc.com/wp-content/uploads/2022/07/DRG116_Demolition_and_Refurbishment_Resource_Protocol_2019-1.pdf 37.https://wrap.org.uk/resources/campaign-assets/waste-audit-guide-businesses 38.https://knowledge.bsigroup.com/products/code-of-practice-for-full-and-partial-demolition/standard
Recovery	*Multiple Felds*	What is the current recovery rate of CDW in your country? [xxi] [xxii]	Recovery rate from non-hazardous CDW in UK was, 92.3% in 2018 – lates statistics (39)	39.https://www.gov.uk/government/statistics/uk-waste-data/uk-statistics-on-waste#recovery-rate-from-non-hazardous-construction-and-demolition-cd-waste 40.https://www.gov.uk/green-taxes-and-reliefs/landfill-tax 41.https://www.gov.uk/guidance/check-if-you-need-to-register-for-plastic-packaging-tax 42.https://www.gov.uk/guidance/fly-tipping-council-responsibilities 43.https://www.legislation.gov.uk/uksi/2005/894/contents/made 44.https://nra.mrw.co.uk/nra/en/page/categories
		Are there economic incentives implemented in your country for promoting CDW prevention, collection, reuse, and recycling? [xxiii] If so, please describe the types of such incentives	On top of the normal landfill fees, Landfill tax was first introduced in 1996 aiming to make waste disposal to landfill less attractive to organisations, encouraging the minimisation of waste volumes. From April 2018, landfill tax became applicable to waste disposal at any site, including at unlicensed landfill sites where waste disposal is considered illegal – however, a penalty charge or court action may also be taken. (40) Tax credits for sending waste from landfill to be recycled, incinerated or reused. Tax relief is also applicable Aggregates Levy that are recycled into secondary aggregates or used in high value applications. (40) From April 2022, organisations and manufacturers are charged at a rate of £200 per tonne of finished plastic packaging components that contain less than 30% recycled plastic. (41) According to the Environmental Protection Act 1990 section 33, Fly-tipping (illegal dumping of waste) offenders are charged with financial penalties can be up to £50,000 in serious cases. (42) Increased costs for removal of hazardous waste from construction and demolition sites to encourage designers, contractors and subcontractors to use materials that are non-hazardous. (43) The MRW National Recycling Awards is the most prestigious award that is sponsored by several leading industry partners. It recognises initiatives by businesses and organisations that demonstrate excellence in improving recycling and resource efficiency. (44)	

(Continuation of Annex 2. Table 6: Regulatory framework for CDW management in the UK.)

Stage	Measuring Item		Comments	References
Recovery	*Multiple Felds*			45.https://www.gov.uk/how-to-classify-different-types-of-waste/construction-and-demolition-waste H.https://www.gov.uk/government/publications/digital-waste-tracking-service/mandatory-digital-waste-tracking 46.https://www.gov.uk/government/publications/clean-growth-strategy 47.https://www.gov.uk/government/topical-events/the-uks-industrial-strategy 48.https://www.constructionleadershipcouncil.co.uk/wp-content/uploads/2021/07/ZAW-Interactive-Routemap-FINAL.pdf 49.https://www.gov.uk/government/publications/resources-and-waste-strategy-for-england 50.https://www.gov.wales/beyond-recycling 51.https://www.gov.wales/towards-zero-waste-our-waste-strategy 52.https://www.zerowastescotland.org.uk/construction/maximising-reuse 53.https://www.gov.scot/publications/making-things-last-circular-economy-strategy-scotland/ 54. https://www.daera-ni.gov.uk/articles/waste-management-strategy 55. https://www.daera-ni.gov.uk/consultations/environment-strategy-consultation 56.https://www.gov.uk/government/news/225-million-funding-to-turn-industry-waste-into-environmental-wins
		How is CDW defined in your country, and what are the types of CDW according to that definition? (i.e., What can be counted as CDW) [xxiv xxv xxvi]	In UK, CDW can include Concrete, Bricks, Tiles, Ceramics, Wood, Glass, Plastic, Metallics, Cables, Soil, Contaminated Soil, Stones, Dredging spoil, Gypsum, Cement, Paints, Varnishes, Adhesives, Sealants, Bituminous mixtures, Coal tar, Tar, Insulation and Asbestos materials. (45) According to the above definition of CDW, Excavation waste is included in it. However, is worth noting that in other UK documentations, the term CD&E waste is used instead, to refer to construction, demolition and excavation wastes. (32)	
		Are there national strategies (plans, programmes, schemes, targets) about CDW management including prevention, collecting, sorting, reuse, recycling and disposal established in your country? [xxvii xxviii xxix xxx xxxi xxxii xxxiii xxxiv] If so, please state them, and provide references to supporting reports/documents	Clean Growth Strategy: contains an ambition for the UK to be a zero avoidable waste economy by 2050 and emphasises the importance of maximising the value we extract from our resources. (46) UK's Industrial Strategy: promotes moving towards a regenerative, circular economy, and raising productivity by using resources more efficiently. (47) The Roadmap for Zero Avoidable Waste in Construction: prepared by the Green Construction Board (GCB), in collaboration with Defra and BEIS. The diversion of waste from landfill forms a significant part in the delivery of Government's net zero carbon targets. (48) Resources and waste strategy for England: sets out how to preserve material resources by minimising waste, promoting resource efficiency and moving towards a circular economy in England. (49) The Welsh Government's Beyond Recycling Strategy: support the green recovery by taking actions which support a zero waste, net zero carbon Wales that uses its fair share of resources. (50) Towards Zero Waste One Wales, One Planet: Promoting sustainable environment, reducing waste, and achieving resource efficient economy. (51) Maximising re-use in construction: A programme from Zero Waste Scotland that provide guidance on waste prevention in construction projects as well as specific advice on maximising the reuse of materials on construction sites. (52) Making Things Last - a circular economy strategy for Scotland: a circular economy strategy to build a strong economy, protect resources and support the environment. (53) Delivering Resource Efficiency - Northern Ireland Waste Management Strategy: emphasis of waste management and resource efficiency. (54) The draft Environment Strategy: set Northern Ireland's environmental priorities for the coming decades, including reducing waste, movement towards a circular economy and improving processes for managing pollution. (55) Government funding for research centres to reduce waste and boost recycling in several industries including construction. (56)	

(Continuation of Annex 2. Table 6: Regulatory framework for CDW management in the UK.)

Stage	Measuring Item		Comments	References
Recovery	*Multiple Felds*	How is the national CDW data collected/measured in your country? (i.e., volumes/amounts of generated, recycled, reused, and landfilled waste) Are there electronic reporting measures taken by your country [xxxv] [xxxvi] (volume, amounts, types, etc.) If so, please provide further information	DEFRA is the main source of CDW statistics in UK. It provides some basic information on CDW by collecting it from licenced waste management facilities, Environment Agency (EA) permitted site returns, as well as other resources such as industry data related to aggregates, metals, woods, etc. Data collection may also be supplemented by surveys. (32) A mandatory digital waste tracking across the UK will be introduced by the year 2024. This service will provide information about where and how waste is created, who is handling it, what is done to it, and where it ends up. (54)	
	Recycle	How is CDW recycling defined in your country, and what are the types of processes that can be counted as acceptable recycling processes (of which the resultant materials are considered recycled)? [xxxvii]	The legal definition of waste guidance in UK uses the same definition of 'Recycling' as the Waste Framework Directive. According to the guidance, recycling includes any reprocessing operation of waste into products, materials or substances including reprocessing of organic material. However, recycling does not include energy recovery, reprocessing materials into fuels, and backfilling operations. (57)	57.https://www.gov.uk/government/publications/legal-definition-of-waste-guidance/decide-if-a-material-is-waste-or-not 58.https://www.gov.uk/topic/environmental-management/waste 59.https://ec.europa.eu/environment/pdf/waste/studies/deliverables/CDW_UK_Factsheet_Final.pdf
		Is there a classification of CDW types that are applicable for recycling, in your country? [xxxviii] If so, please provide further information	There is no specific and clear guidance on the types of recyclable CDW, provided by the relevant governmental authorities. However, there is a general guidance that provides information on waste and its management. Additionally, several construction websites and research and consultation agencies provide information on the types of recyclable CDW. (58)	
		Are there markets for secondary raw materials (recycled CDW materials) established in your country? If so, please provide further information on the types of these markets	The main CDW market in UK is the Recycled aggregates market. Other markets exist for recycled materials from CDW include Wood waste, Plasterboard waste, PVC waste, Glass waste, Metal waste. (59)	
	Reuse	How is CDW reuse defined in your country?	The official term adopted in the legal definition of waste guidance in UK is 'Preparation for reuse' which is the same definition used in the Waste Framework Directive. However, it is worth noting that both terms (reuse and prepare for reuse) are used synonymously in the UK governmental documentations. (60) According to the legal definition of waste guidance 'Preparation for reuse' is the operation checking, cleaning or repairing materials that have been discarded and are waste so that they can be used again for their original purpose as a non-waste without any other pre-processing. Reuse does not have an official definition in the legal definition of waste guidance. (61) (62)	60.https://www.gov.uk/government/publications/legal-definition-of-waste-guidance/decide-if-a-material-is-waste-or-not 61.https://www.enviromate.co.uk/ 62.http://www.salvo.co.uk/ 63.http://cme.resourceefficientscotland.com/
		Are there networks and sharing platforms for reuse and repair in your country? [xxxix] If so, please provide examples with references/links	There are several Sharing platforms and markets for CDW reuse (e.g., Enviromate, Salvo, Construction Material Exchange) (63)	

(Continuation of Annex 2. Table 6: Regulatory framework for CDW management in the UK.)

Stage	Measuring Item		Comments	References
Recovery	*Treatment*	Is there a definition of ownership and responsibility for the actors involved in waste handling and treatment, set by your country? (e.g., waste producers, holders, and managers, etc.) [xl] [xli] [xlii] If so, please provide further information	The code of practice 'Waste Duty of Care Code of Practice' issued Environmental Protection Act 1990 (EPA) sets out legislations and practical guidance on how to meet waste duty of care requirements including importing, producing, carrying, keeping, treating, disposing of or, as a dealer or broker have control of, certain waste in England or Wales. Scotland's and Northern Ireland's, have their own codes of practice alongside this one. (64)	64.https://www.gov.uk/government/publications/waste-duty-of-care-code-of-practice 65.https://www.gov.uk/guidance/waste-environmental-permits 66.https://www.gov.uk/register-renew-waste-carrier-broker-dealer-england 67.https://www.gov.uk/dispose-hazardous-waste/producers-and-holders 68.https://naturalresources.wales/permits-and-permissions/waste-permitting/register-or-renew-as-a-hazardous-waste-producer/?lang=en
		Issuing of permits for CDW treatment (either for establishment or undertaking) applied by your country? [xliii] If so, please provide further information	Applying to the Environment Agency for an environmental permit is mandatory if the business uses, recycles, treats, stores or disposes of waste or mining waste – meeting the permit requirements. (65) (66) For hazardous waste it is also mandatory requirement to obtain a permit (England and Wales) or if the business, produces, holds or stores hazardous waste, and if hazardous waste is removed from its premises. In Scotland and Northern Ireland, a consignment note must be obtained from the environmental agency. (67) (68)	
Residual Waste	*Multiple Felds*	Are there landfilling and incineration charges, and restrictions adopted by your country? If so, please state them and describe their criteria	On top of the normal landfill fees, Landfill tax was first introduced in 1996 aiming to make waste disposal to landfill less attractive to organisations, encouraging the minimisation of waste volumes. From April 2018, landfill tax became applicable to waste disposal at any site, including at unlicensed landfill sites where waste disposal is considered illegal – however, a penalty charge or court action may also be taken. (69) According to the Environmental Protection Act 1990 section 33, Fly-tipping (illegal dumping of waste) offenders are charged with financial penalties can be up to £50,000 in serious cases (70) Increased costs for removal of hazardous waste from construction and demolition sites to encourage designers, contractors and subcontractors to use materials that are non-hazardous. (71)	69.https://www.gov.uk/green-taxes-and-reliefs/landfill-tax 70.https://www.gov.uk/guidance/fly-tipping-council-responsibilities 71.https://www.legislation.gov.uk/uksi/2005/894/contents/made
		What is the most common disposal method for CDW in your country? [xliv]	According to DEFRA waste statistics (2018), *land treatment and release into water bodies* is the most common disposal method for Mineral wastes and Dredging spoils, as both account for 100% of the total waste. *Landfilling* is a common disposal method for Soils, which accounts for 58% of total waste received at landfill sites. Although these categories are typically CDW, they may include waste from other sources. (72) *Incineration* and *Incineration with Energy Recovery* are popular for Wood wastes, which accounts for 33% of the total waste incinerated. However, such methods are not common for most CDW due to their physical nature – other CDW that may be sent to incineration includes insulation foams and plastics (72) Exports of Metal scrap and Wood waste is another method adopted. In 2013, 13.2 million tonnes of metal scrap and 600 thousand tonnes of wood waste scrap were exported - some of these materials comes from CDW. (73)	72.https://www.gov.uk/government/statistics/uk-waste-data/uk-statistics-on-waste#total-waste-generation-and-final-treatment-of-all-waste 73.https://ec.europa.eu/environment/pdf/waste/studies/deliverables/CDW_UK_Factsheet_Final.pdf

Annex 3 Waste treatment processes and recovery

Annex 3. Table 1: Waste treatment and final destiny for different waste streams in Cyprus.

Waste streams	Treatment processes identified	Final destiny	Percentage per each final destiny
Concrete	Broken down and used as aggregates. Collection process is described in Mixed Waste streams	Waste product is available for contractors for use.	-
Ceramics	-	-	-
Gypsum	Collection process is described in Mixed Waste streams	Non-exported wastes that are shredded are transferred to licensed Establishments of processing/recycling C&D wastes for further processing and re-introduction to the market.	-
Glass	Collection process is described in Mixed Waste streams	Non-exported wastes that are shredded are transferred to licensed Establishments of processing/recycling C&D wastes for further processing and re-introduction to the market.	-
Wood	Collection process is described in Mixed Waste streams	Non-exported wastes that are shredded are transferred to licensed Establishments of processing/recycling C&D wastes for further processing and re-introduction to the market.	-
Metals	Metal wastes are collected and weighted in the process unit. Then they are separated in ferrous and non-ferrous Both categories are further processed based on the waste size. Small size wastes are temporarily stored. Average size wastes are compressed and temporarily stored. Large size wastes are cut and compressed and temporarily stored. All temporarily stored wastes are either exported or shredded.	Non-exported wastes that are shredded are transferred to licensed Establishments of processing/recycling C&D wastes for further processing and re-introduction to the market.	-
Plastics	Method 1 Plastic wastes are collected and weighted. Waste is visually inspected. Bulky or unable to recycle materials are transferred to landfill areas. Sorted material is fed in a bag-opener machine. Broken down pieces are further sorted using a vibrating sieve. Pieces smaller that 3cm are considered non-useful. Useful pieces are separated to plastic and other materials. Materials other than plastic are treated per their type. Plastic material is then compressed to sphere-shapes, weighted and stored until exported. Method 2 Collected plastic wastes are separated based on their material, PE, PP, PET, PVC. Each type is weighted and processed separately. All types follow the same process, but the end destination of each depends on the type. Large pieces are cut to smaller pieces and then all the quantity of each type is ground and weighted. During the grinding color can be added to the material if needed. Ground product is stored in 25kg bags and exported.	Plastic waste that is not transferred to landfill areas is exported.	-

(Continuation of Annex 3. Table 1: Waste treatment and final destiny for different waste streams in Cyprus.)

Waste streams	Treatment processes identified	Final destiny	Percentage per each final destiny
Mixed	Mixed inert wastes are collected, weighted and after visual inspection they are separated to the following categories a) Wall wastes (bricks, etc.) b) Steel-reinforced concrete c) Asphalt wastes d) Mixed wastes from the aforementioned materials e) Mixed wastes from all other material Waste categories a-d are grouped and processed as follows: Wastes are broken mechanically. Wastes are then magnetically separated to metal and non-metals. Non-metal waste is sorted in different size aggregates, weighted and stored. Metal waste follows metal waste process. Waste category e is processed as follows: Wastes in this category are separated to acceptable and non-acceptable wastes. Non-acceptable wastes are transferred to landfill areas. Acceptable waste is sorted either with a waste lifting clamp (mechanical/hydraulic) or with a rotating cylindrical sieve Wastes from clamp separation are characterized as useful and non-useful bulky wastes Non-useful bulky wastes are broken down to smaller piece and are transferred to landfill areas Wastes from the rotating cylindrical sieve result in three waste streams, fine powder, large size grain waste and mixed grain size waste Fine powder is collected and stored appropriately to be used in the future Large size grain waste is further separated manually based on the material. The resulting materials are glass, metals, wood, insulation, paper and plastic which are forwarded to licensed establishments or exported and aggregates, that are broken mechanically sorted and then shorted in different size aggregates, weighted and stored. Mixed grain size waste is further separated using air separation or visually using near-infrared cameras. The resulting wastes from this process are RDF, gypsum and aggregates. Aggregates are broken mechanically sorted and then shorted in different size aggregates, weighted and stored.	Final destiny depends on the end-product	-
Others (please specify)	-	-	-
Please, specify documents, statistics and any other evidence for reference about this information			
Applicable for all Source 1 Source 2			

Annex 3. Table 2: Waste treatment and final destiny for different waste streams in Czech Republic.

Waste streams	Treatment processes identified	Final destiny	Percentage per each final destiny
Concrete	Unsorted recycled concrete with particle sizes 0-250 mm can be used for backfilling. Recycled concrete up to 0-125 mm grading without further screening can be used as a substitute for soil in subgrades and foundations of various structures. Further screened recycled concrete is usually turned into recycled aggregates according to EN standards (e.g. EN 13242+A1) with various grading up to 63 mm. This material reaching end-of-waste status can be used as granular material in concrete mixtures (limited content possible especially for structural concrete), in some types of asphalt mixtures, in hydraulic bound mixtures used especially in transport infrastructure (up to 100% replacement to traditional natural aggregates) or as material for granular bases. Additional requirements or limitations may be set in product standards for the final use case of recycled concrete as aggregate. According to EN 771-3 crushed and screened recycled aggregates can be used for the production of new concrete bricks (masonry elements) and according to EN 13369 this type of recycled aggregate can be used in precast elements as well. Fine-ground recycled concrete or dust particles can be used as a filler (active filler/admixture) in concrete or asphalt mixtures replacing e.g. limestone filler or partly substituting cement.	In terms of recycling, concrete is usually downcycled to granular material or aggregates with utilization in various types of mixtures, as filling material or as granular base material. To a limited extent especially recycled concrete particles <4 mm can be further ground and hydrated cement can be partly reactivated creating an active filler. Recycled concrete can be used for backfilling. Landfilling is still done in a limited extent as well, but this will be latest between 2025 and 2030 prohibited.	Cannot be defined exactly since it is not monitored
Ceramics	Unsorted recycled ceramics (bricks and roof tiles) with particle sizes 0-250 mm can be used for backfilling. In this case, it can be even mixed with recycled material containing concrete, ceramics, mortars and plasters. Recycled ceramics up to 0-125 mm grading without further screening can be used as a substitute for soil in subgrades and foundations of various structures. Due to higher water absorption, it is necessary to secure that such use is in a non-freezing zone. Similarly to concrete by further screening and crushing the material can be turned into recycled aggregates according to EN standards. The use of such aggregates is more limited because of the higher water absorption and lower strength of this type of recycled aggregate. In lower contents it can be used in concrete – mainly lower strength classes, it can be used in hydraulic bound granular materials. If used in concrete there are limitations to the quality of the recycled material – no chimney masonry material or material invaded by fungi can be used. According to EN 771-3 crushed and screened recycled aggregates can be used for the production of new concrete bricks (masonry elements) and according to EN 13369 this type of recycled aggregate can be used in precast elements as well. Another option is if the ceramics are further ground, they can be used for clay court material fulfilling requirements for sports fields (it has to be proven that no harmful or dangerous chemical substances are present in such material). Presently fine-ground powder from ceramics waste is practically tested as an active filler for some types of concrete where it shall partly replace cement.	In terms of recycling, concrete is usually downcycled to granular material or aggregates with utilization in various types of mixtures, as filling material or as granular base or subgrade material. It is used for backfilling as well. Finely ground material is used as clay court material and so far to a limited extent especially particles milled as micro-powder can serve as active filler in concrete partly substituting cement. Landfilling is still done to some extent as well, but this will be latest between 2025 and 2030 prohibited. Use as filling material for the production of precast elements or especially concrete bricks is known and used as well. Especially for bricks another solution might be the reuse of some of these elements. In this respect internationally the REBRICK concept is known. Gamle Mursten (GM) has reached due to financial support from an EU grant programme (Horizon 2020: Eco-innovation) in less than three years (2011-2013), in collaboration with Danish, German and Italian experts, a unique technology called REBRICK, which enables the removal of buildings during controlled demolition bricks that would otherwise become waste.	Cannot be defined exactly since it is not monitored

(Continuation of Annex 3. Table 2: Waste treatment and final destiny for different waste streams in Czech Republic.)

Waste streams	Treatment processes identified	Final destiny	Percentage per each final destiny
Gypsum	Separation of paper and gypsum, crushing or grinding to reach various particle sizes. Ground gypsum is applicable as filling material or can be used for further recalcination which turns the gypsum board material into active gypsum again. Separate solution is landfilling which in general is limited in amount due to presence of sulfur in gypsum. This is directly defined by the European Commission 2003/33/EU decision which prohibits dispose gypsum products together with other municipal waste, especially if biological decomposition for such waste is expected. Gypsum waste is incompatible with such decomposition. Plasterboards, gypsum mortars, sealants and blocks as well as anhydrite are based on gypsum, and they are subject to chemical reactions with undesirable effects in the acidic environment that biodegradable waste will undoubtedly encounter during decomposition.	Recycled gypsum can be used in a very limited amounts up to 8 % in the production of new plasterboards (according to the discussions and feedback from Knauf and Rigips) – this is because of its uncalcinated stage. This use case is also limited to recycled gypsum boards, where paper is well separated and the waste material was not contaminated by other materials. If recalcination is reached the rate of reuse can be increased if gypsum boards are not contaminated by other materials or by fungi. Another possibility is to use recycled gypsum in blocks and plasters or gypsum sealants. There is also a possibility to use well-graded crushed gypsum board as insulation floor screed with grading up to 8 mm. Landfilling on landfills which are intended for this type of waste and can control the creation of chemical reactions typical for gypsum waste.	Only approximately known for plasterboard production. For the other destinies cannot be defined since it is not monitored.
Glass	The majority of the glass from construction activities is handed over to the glass industry for reuse in new glass products (crushing, melting, glass production). Part of the waste glass goes for reprocessing to foamed glass (e.g. Refaglass) or is crushed to particle size up to 11 mm and can be used as a partial substitute for natural aggregates. It can be used for the production of insulation glass wool. The treatment or kind of recycling where waste glass is turned to natural aggregate substitute is, nevertheless, minor and often limited to waste glass types that are difficult to be processed by the glass industry (e.g. lead glass, wire-glass, glass from photovoltaic).	Waste glass primarily is and shall be turned into reprocessed glass with various usages. Part is used for the production of foamed glass (insulation material or lightweight aggregates) and glass wool insulation material. Residua which cannot be used in any of these processes and products can be used as recycled aggregate or after fine-grinding as filler or replacement for e.g. silica/microsilica in concrete.	
Wood	Wood if not contaminated by mineral waste (concrete, ceramics, etc.) is shredded, chipped and crushed and used as material for various types of wooden boards (like for example OSB). It can be even further milled and fine chips or saw-dust is used for MDF or HDF fiber-boards with various applications in the construction or furniture industry. Larger elements from solid wood/timber can be reused, i.e. for example timber beam back to timber beam.	Use and final destinies are described in the previous column. Furthermore, part of the wood is reaching energy use as well, being incinerated. Landfilling of this type of waste is very rare.	Up to 90 % reused, recycled or incinerated
Metals	Metals are usually collected as scrap which is then forwarded mainly to steel mills or to foundry factories processing aluminum and other non-iron metals. Especially for the foundries insufficient separation of materials can be a complication. In the case of heterogeneous alloys, care must be taken to separate them.	Steel mills and foundries where metal scrap is turned to new metallic products.	90-100 %

(Continuation of Annex 3. Table 2: Waste treatment and final destiny for different waste streams in Czech Republic.)

Waste streams	Treatment processes identified	Final destiny	Percentage per each final destiny
Plastics	The treatment processes depend on how the plastic waste is recovered and delivered for possible further use. If PVC collected separated during flooring, waterproofing or roofing construction works it can be reused for recycled flooring systems, foils or hard PVC foams. Similar applies to the selective collection of PVC materials during deconstruction. If polystyrene offcuts are collected separately during e.g. insulation works, this type of waste can be effectively turned back into new polystyrene products. ETICs with polystyrene insulation from existing buildings are typically a problem being contaminated by mortars, adhesives and plasters. This limits generally its chemical reuse "polystyrene-to-polystyrene". The alternative use is then incineration whereas the typical problem is some of the released dangerous emissions. PE or PU if selectively collected can be reused by chemical recycling as well. Other options, especially if the plastics are mixed are: (i) pyrolysis, (ii) depolymerization or (iii) grinding to smaller flakes which can be then used for the production of compressed (or compressed under heat) boards or similar types of products. Similarly, there are industry solutions where plastic flakes, pellets or granules are used as filling material in concrete or as a kind of modifier in asphalt mixtures. Mixed plastic waste is also used for incineration either in municipal waste incinerators or as a high-energy source in the cement industry (in the latter case the presence of chlorides represents some certain problem or limitation.	Final destiny for plastic waste shall be turning plastics into plastics. Where this is not possible depolymerization or pyrolysis might be the second option. The use of waste plastics as a filling material in form of flakes or pellets shall be done carefully and with a detailed comparison with European legislation on microplastics (draft European Commission regulation from 2022 amending Annex XVII to Regulation (EC) No 1907/2006, REACH). For this type of use, it must be ensured that the incorporation of plastic particles into, for example, a concrete composite does not lead to the release of plastic particles during use. At the same time, the end-of-life scenario of such a composite product must be addressed, where subsequent crushing must not lead to the uncontrolled release of microplastics. Where any of the previous solutions are possible incineration can be proposed as a final destiny. Only limited content of plastic waste shall be landfilled.	Cannot be defined exactly since it is not monitored
Mixed	Mixed waste is so far usually (in most cases) landfilled especially if there are no recycling centers where semi-manually the non-inorganic materials (plastics, metals, wood) would be separated from the received waste.	Predominantly landfilling.	Cannot be defined exactly since it is not monitored
Others (please specify)			
Please, specify documents, statistics and any other evidence for reference about this information			
Pavlů, T., et al.: Catalogue of materials and products containing secondary raw materials for use in construction. Czech Standardization Agency, Prague 2018. Prošek, Z., et al.: Summary research report on options for increasing the use of construction and demolition waste in the construction industry, CVUT, Prague 2021. (DECOMPOSE project)			

Annex 3. Table 3: Waste treatment and final destiny for different waste streams in Italy.

Waste streams	Treatment processes identified	Final destiny	Percentage per each final destiny
Concrete	Mechanical and technological treatments of grinding, screening, granulometric selection	road construction, railway and airport embankments and foundations, industrial yards	
Ceramics	mechanical and technological treatments of grinding, screening, granulometric selection	Used in a variety of different applications, such as concrete aggregates or road construction.	
Gypsum	crushing of the artifacts and separation of the part metallic [R5]	production of building materials and products	
Glass	Manual sorting, screening, crushing and/or grinding, separation of magnetic metals, removal of light materials, automatic separation of non-metals magnetic elements, automatic separation of opaque bodies, analysis of the heavy metal content, and verification of the limits referred to in the test transfer carried out on the waste as it is according to the method to annex 3 to DM 05.02.98 [R5].	production of secondary raw materials for construction, for the formation of embankments in road subgrades, backfills and backfills, as an insulating and support layer for pipes, ducts and paving including roads and as drainage material	
Wood	washing, sorting, adjustment volumetric or chipping to submit them to recovery operations	recovery in the joinery and carpentry industry; recovery in the paper industry; recovery in the wood panel industry production of waste-derived fuel (RDF) compliant with UNI technical standards 9903-1	
Metals	Selection, dry or wet treatment for the elimination of foreign materials and/or substances in accordance with certain characteristics [R4]	secondary raw materials for the metallurgical industry	
Plastics	- Removal of foreign substances (if present), treatment to obtain plastic materials compliant with UNIPLAST-UNI 10667 specifications and for the production of plastic products in shapes usually marketed [R3] - Manual sorting and mechanical recycling (by PVC Forum)	- secondary raw materials for the industry plastic materials production of waste-derived fuel (RDF) compliant with UNI technical standards 9903-1 - street furniture, pedestrian walkways / walkways for beaches and parks; pedestrian bridges, plastic outdoor staircases; maintenance-free outdoor floors and platforms; fences, plastic panels; panels for fencing ecological islands; poles, curbs, sheets and profiles made of recycled plastic; ecological outdoor products (by PVC Forum)	

(Continuation of Annex 3. Table 3: Waste treatment and final destiny for different waste streams in Italy.)

Waste streams	Treatment processes identified	Final destiny	Percentage per each final destiny
Others (Mineral waste from construction and demolition - concrete, brick, tile and ceramic, stones)	Mechanical and technological treatments of grinding, screening, granulometric selection and separation of metal fraction and undesired fractions to obtain inert fractions of stone nature with granulometry suitable and selected, with a release test eluate compliant with the provisions of annex 3 to DM 05.02.98 [R5].	road construction, railway and airport embankments and foundations, industrial yards	
Please, specify documents, statistics and any other evidence for reference about this information			
Ministerial Decree - DM 05.02.98 PVC Forum (plastic description)			

Annex 3. Table 4: Waste treatment and final destiny for different waste streams in Spain.

Waste streams	Treatment processes identified	Final destiny	Percentage per each final destiny
Concrete	Concrete is downcycled into road-based aggregate (RBA) in a mix with other mineral waste materials like bricks and tiles from the same building. End-of-life concrete (demolition, dismantling) is reused and recovered (recycling of steel and concrete)	Road based secondary aggregates Aggregates for: -non-fines light concrete -mortars -roof elements -concrete blocks	Life cycle assessment (LCA) aspects of concrete. DOI: 10.1533/9780857098993.1.45 Sustainable construction: construction and demolition waste reconsidered. DOI: 10.1177/0734242X09103841
Ceramics	Ceramics are crushed followed by a secondary griding. Elimination of impurities take place using dry method (most used in Spain) or thermal method.	Secondary aggregates for non-fines light concrete and concrete blocks	Sustainable construction: construction and demolition waste reconsidered. DOI: 10.1177/0734242X09103841

(Continuation of Annex 3. Table 4: Waste treatment and final destiny for different waste streams in Spain.)

Waste streams	Treatment processes identified	Final destiny	Percentage per each final destiny
Gypsum	Indefinitely recyclable Controlled processing of GW to separate CaSO4·2H2O from the paper lining and any impurities.	Recycled gypsum can be used in plasterboards, gypsum blocks and plaster ceilings.	Management of end-of-life gypsum in a circular economy. DOI: 10.1016/B978-0-12-819055-5.00005-X
Glass	Despite its recyclability, end-of-life building glass is almost never recycled into new glass products. Instead, it is often crushed together with other building materials and put into landfills or recovered.	Aggregates for construction Landfill	Recycling of end-of-life building glass - Glass for Europe
Wood	Recycling hardwood It can be burned to obtain energy	Construction and any wood buildings, pellets. It can also be thrown out	Finding a greener 'end of life' for wood | Yale Environment Review
Metals	Home scrap is material generated during material production or during fabrication or manufacturing that can be directly reinserted in the process that generated it. Functional recycling The metal in certain discarded product is separated and sorted to obtain recyclable materials that are returned to production.	Scrap market. Raw material production processes that generate a metal or metal alloy. It can also finish in landfill.	What do we know about metal recycling rates? DOI: 10.1111/j.1530-9290.2011.00342.x
Plastics	Feedstock recycling, mechanical /material recycling, industrial energy recovery, municipal solid waste incineration, manufacture plastic resin, monomer processing	Thermoplastic find application in blast furnaces They photo-degradable polymers degrade in six weeks to convert back to the biomass under suitable conditions. Chlorine containing plastics, such as polyvinyl chloride (PVC), can be used in construction in windows and pipes.	Utilization and recycling of end-of-life plastics for sustainable and clean industrial processes including the iron and steel industry. DOI: 10.1016/j.mset.2019.08.002
Mixed			
Others (please specify)			
Please, specify documents, statistics and any other evidence for reference about this information			

Annex 3. Table 5. Waste treatment and final destiny for different waste streams in the UK.

Waste streams	Treatment processes identified	Final destiny	Reference
Concrete	▪ Concrete is downcycled for future use as aggregates	Recycled/ secondary aggregates (most common) can be used in concrete aggregate, fill, road base, or riprap.	3
Ceramics	▪ Transforming and repurposing ceramic waste into rubble	Repurposed into many things such as Earthworks, Fireproof bricks, Cement, Tableware	15 & 16
Gypsum	▪ Grounding Gypsum waste into a powder or turned into pellets (Closed loop recycling). ▪ Standard plasterboard, which hasn't been contaminated by paint or similar can be repurpose as composting	Grounding Gypsum is sold to manufacturers that use gypsum for different applications. Additionally, standard plasterboard recycled aerobic composting system and soil conditioner.	7
Glass	▪ Open loop recycling, turning waste flat glass into cullet (Crushed waste glass for recycling) ▪ façade glass is usually crushed and used as aggregates in road construction.	Fluxing agent in the manufacture of bricks and ceramics, Glass wool insulation (80% recycled glass content), aggregates for construction works (e.g., roads), and landfilled (almost 200,000 tonnes of glass is currently sent to landfill each year)	1, 2, 6 & 7
Wood	▪ Reclaiming, reusing and machining hardwood and softwood timber (Closed loop recycling) ▪ Open loop recycling- including mulch and compost, or biomass ▪ Burning as bioenergy	For construction purposes, landscaping, bridges, gates, fencing, and decking. Used in various end markets e.g., animal bedding, panel-board manufacture, energy through direct combustion and solid fuel - rest Is landfilled	3, 4, 5 & 7
Metals	▪ Collected, sorted and then shredded. The scrap is then melted and purified and finally allowed to cool to solidify.	Reinforcing bars, Flat bars, Channels, Yield Coil, Wire rod. The produced products consist of 98% locally sourced recycled scrap metal. Metal is largely recycled - almost no waste is lost	7 & 8
Plastics	▪ Mechanical recycling of mixed plastic and PVC from windows, cables, flooring, pipes and fittings, and rigid PVC films – collect, sort (according to the grade of the plastic), shred into powder/small particles. It can be then remelted and remolded ▪ Chemical recycling (not much popular as the first types of recycling)	Recycled PVC (22% of all PVC recycled in Europe) is used in in windows, pipes and floorings. Mixed recycled PVC is used in in horticulture or for traffic management in the form of cones and speed bumps. Other recycled plastic products include Decking, Cladding, sheets, boards, roofing tiles	9, 10, 11
Others	▪ Mineral wastes including brick, tiles, stone and asphalt is downcycled (crushing, grinding or reducing in size) for future use as aggregates. ▪ Recovering excavation waste as backfilling and recycling ▪ Recovering dredging spoils as land treatment and release into water bodies	Mineral wastes are converted into recycled/ secondary aggregates - rest is sent to landfill. Excavation waste Backfilled and recycled (44% recovered) – rest is sent to landfill. Dredging spoils is recovered (98% recovered) water	3, 12, 13 & 14

(Continuation of Annex 3. Table 5. Waste treatment and final destiny for different waste streams in the UK.)

Please, specify documents, statistics and any other evidence for reference about this information
1. Building Glass into a Circular Economy https://www.ukgbc.org/ukgbc-work/building-glass-into-a-circular-economy/ 2. Zero Avoidable Waste in Construction https://www.constructionleadershipcouncil.co.uk/wp-content/uploads/2016/05/ZAW-Report-Final-Draft-25-February-2020.pdf 3. Construction and Demolition Waste management in UK https://ec.europa.eu/environment/pdf/waste/studies/deliverables/CDW_UK_Factsheet_Final.pdf 4. Ashwell reclaimed timber https://ashwelltimber.com/about-us/ 5. Benefits of Recycling Wood https://www.slrecyclingltd.co.uk/benefits-of-recycling-wood/ 6. KNAUF INSULATION AND VEOLIA https://www.knaufinsulation.co.uk/why-knauf-insulation/veolia-partnership 7. Recycling Buildings: 10 Building Materials That Can Be Reused After Demolition http://rubberbond.co.uk/blog/recycling-buildings-10-building-materials-that-can-be-reused-after-demolition/ 8. Celsa Steel UK https://www.celsauk.com/Company.mvc/CelsaSteelUK 9. Oue Waste, Our Resources: A strategy For England https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/765914/resources-waste-strategy-dec-2018.pdf 10. Kedel Eco Friendly Plastic Products https://www.kedel.co.uk/ 11. Everything you need to know about PVC recycling https://extruflex.com/pvc-recycling 12 Digest of Waste and Resource Statistics (2017) https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/607416/Digest_of_Waste_and_Resource_Statistics__2017_rev.pdf 13. UK statistics on waste https://www.gov.uk/government/statistics/uk-waste-data/uk-statistics-on-waste#total-waste-generation-and-final-treatment-of-all-waste 14. HOW MUCH WASTE IS PRODUCED BY THE CONSTRUCTION SECTOR? https://www.constructionproducts.org.uk/media/557062/how-much-construction-waste-is-there.pdf 15. Is ceramic a sustainable material? Can it be recycled? https://mamaisonrevol.revol1768.com/en/is-ceramic-a-sustainable-material-can-it-be-recycled-2/ 16. Recycling ceramic waste powder https://pureadmin.qub.ac.uk/ws/portalfiles/portal/165108549/Recycling_ceramic_waste_powder_into_cement_based_composites_4th_final_revision.pdf

Annex 3. Table 6. Challenges for waste recovery in Cyprus.

Waste streams	Main challenges for recovery	
	Reuse	Recycling
Concrete	-	Increased project duration Lack of national programs on concrete recycling Lack of comprehensive rules and regulations on concrete recycling Increased project cost Low demand for recycled concrete Low cost-effectiveness of concrete recycling Increased transportation cost Lack of technical knowledge in concrete recycling Lack of knowledge on the value of concrete recycling Tight timeframes between project activities Lack of cooperation between project team members on concrete recycling Lack of guidelines for concrete recycling Current practice in treating concrete waste (source)
Ceramics	-	In a lot of cases recycling ceramics is not energy efficient (Various sources, similar wording)
Gypsum	Most gypsum sent to landfills comes from the demolition of older buildings. In these cases, the gypsum is not source-separated during demolition, and therefore cannot be recovered for proper recycling and/or reuse. Also, the recycling infrastructure is still developing and expanding to meet this need. (Source)	Most gypsum sent to landfills comes from the demolition of older buildings. In these cases, the gypsum is not source-separated during demolition, and therefore cannot be recovered for proper recycling and/or reuse. Also, the recycling infrastructure is still developing and expanding to meet this need. (Source)
Glass	-	Glass is becoming the contaminant Glass can be hazardous Broken glass is difficult to sort Glass is heavy The market for glass has changed (Source)
Wood	-	-
Metals	Lack of knowledge or desire to recycle (Source)	Lack of knowledge or desire to recycle (Source)
Plastics	It is highly dependent on consumer behavior It's not easy to sort plastic Recycled plastic faces a weak market since its virgin counterpart is both cheaper and of better quality Plastics are not really recycled, they are repurposed Not all recycled plastics have a market demand (Source)	It is highly dependent on consumer behavior It's not easy to sort plastic Recycled plastic faces a weak market since its virgin counterpart is both cheaper and of better quality Plastics are not really recycled, they are repurposed Not all recycled plastics have a market demand (Source)

(Continuation of Annex 3. Table 6. Challenges for waste recovery in Cyprus.)

Waste streams	Main challenges for repurposing	
	Reuse	Recycling
Mixed	The separation and sorting of different materials. The need of different process requirements.	The separation and sorting of different materials. The need of different process requirements.
Others (please specify)	-	-

Annex 3. Table 7. Challenges for waste recovery in Czech Republic.

Waste streams	Main challenges for repurposing	
	Reuse	Recycling
Concrete	The concrete-based materials that can most often be reused are precast concrete, where the main challenge is decomposition. Historically, the joints of individual precast concrete components are not disassembled and therefore special procedures are required to avoid damaging the individual components and thus reducing their performance. Barriers often include contamination of the concrete and thus the concrete cannot be reused. Another critical aspect is if the concrete is affected by any kind of chemical reactions which limit its durability and lifespan. Therefore, a key challenge is a detailed diagnostics of elements which shall be repurposed.	Recycling concrete by crushing and using it in the production of new concrete as a substitute for aggregate poses a challenge, especially in resulting applications pf the new concrete. New concretes using recycled aggregates have usually a higher water absorption and thus a poorer resistance to the environment. This makes the variability of the use of concrete with recycled aggregates lower than that of concrete with natural aggregates. Furthermore, it is necessary to have sufficient assessment of the aggregates from old concrete with respect to potential chemical reactions (alkali-silica reaction etc.) to avoid negative impacts of recycled aggregates on concrete lifespan. Another challenge is the use of fine recycled aggregates in the 0/4 mm fraction, which contain large proportions of the old cement matrix and thus have a major negative impact on the performance of the new concrete. Such material can be screened and has potential to be used as a component in cement industry or as a material suitable for alternative hydraulic binders. Barriers to further use include mainly contamination of the recycled aggregate.
Ceramics	The main challenges include procedures ranging from removing the ceramics from the site to their mechanical cleaning of mortar residues, inspection and manual sorting by color and configuration (solid, perforated) to palletizing and packaging, which is handled by a robotic line. If the ceramics do not meet their properties (frost resistance, strength) for reuse or if the individual bricks cannot be separated as a whole or cannot be sufficiently cleaned of mortar, it is necessary to move to recycling by crushing.	Recycling of ceramics is done by crushing and use in the production of mainly mortar. The biggest challenge is mainly with meeting the minimum shape index requirements and the maximum permissible limit of flat or otherwise unsuitable grains. In addition, the materials often have a higher water absorption rate, which limits the application. A new potential was identified by fine-milling of common ceramics and using the resulting filler as active fine-grained admixture to concrete (replacing e.g. silica dust or partly reducing the content of cement).

(Continuation of Annex 3. Table 7. Challenges for waste recovery in Czech Republic.)

Waste streams	Main challenges for repurposing	
	Reuse	Recycling
Gypsum	The way to reach a true reuse of gypsum is reaching in the reprocessing of waste plasterboards recalcination after being crushed, milled and cleaned from cardboard. If this is reached material can be used as substitute for standard gypsum in various gypsum products (new plasterboards, plasters, gypsum putty etc.). A different destiny for reuse is to dismantle plasterboards from existing partition walls and direct reuse of such boards in new partition walls or for similar uses.	Higher amount of recycling possible as in-fill for flooring or as granular admixture for bricks and similar masonry elements.
Glass	Reuse is understood as use of waste glass to be molten and used for new glass products. This is the majority of the waste glass. Some amount of waste is not reused because of logistic costs, i.e. the material itself could be reused by the glass industry, but the glass industry does not use it because the hauling costs are too high (e.g. travel distance).	Recycling mainly used in case of foamed glass or as crushed granular filling materials. Challenge might be fine grinding of this material to reach particle size <50 µm. This might be a substitute for microsilica or as active filler in concrete partly substituting cement, i.e. suitable and cost effective grinding techniques including effective dust-free dusty material collection (avoiding silica dust emissions because of health and safety topics).
Wood	Reuse possible for timber elements if there is a proper diagnostics related to structural health of the element and non-existence of any fungi and molds. If the diagnostics can calculate the residual lifespan and the element is checked for the new purpose of use providing required reliability and safety it might be reusable.	Recycling in form of cutting/shredding wooden waste into chips or sawdust is known. There might be two limitations or challenges: (i) the wood is not contaminated by other type of waste and it is not affected by fungi or dangerous substances which would not be acceptable in new products; (ii) hauling costs between the origin or collecting point of the waste and the production facility.
Metals	The majority of metallic waste is reused by the metallurgic industry. Possible challenge might be to get different metals collected selectively. For reuse as elements without melting in new metallic products the only challenge is a proper and usually cost demanding diagnostics which is able to analyze the residual lifespan and identify any internal defects in the metal product (especially e.g. steel girders, trusses etc.)	Reuse as defined in the left column is preferred. Recycling for metallic waste is not realistic much.
Plastics		
Mixed	Reuse is hardly possible for this type of waste.	Recycling is achievable by further sorting of the mixed waste and gaining several material streams which are represented by the material wastes mentioned earlier in this table. For sorting the largest challenge might be the level of contamination and the potential to separate various waste materials (e.g. PU foam stuck on a piece of wood or ceramics, broken glass in ceramics, lead piping elements covered by mortar and rest pieces of concrete etc.)
Others (please specify)		

Annex 4. Innovative products linked to circular economy and markets

Annex 4. Table 1: Examples of innovative circular products and markets.

Product	Manufacturer	Weblink/contact	Material/s reused/recycled	% recovered	Certificates	Market (country/ies where it is sold)	Observations
Newspaperwood	NewspaperWood	https://newspaperwood.com/	Paper (Newspapers)	-	-	Netherlands/Shipping Globally	-
Jelinek Cork Flooring	Jelinek Cork Group	https://www.jelinek.com/jelinek-cork-flooring	Wine Corks	-	-	International	-
BYBLOCK	BYFUSION	https://www.byfusion.com/byblock/#data-sheet-overlay	Repurposed plastic	-	LEED	International	-
Temporary sheeting (PPE plastic)	Protec International, Ltd	https://www.protection.co.uk	PPE. Old sheets are recycled in new sheets	Up to 60%	Joint Code of Practice (fire prevention on construction sites), different awards for sustainability, supply chain and circular economy,	Globally, although more concentrated in the UK	
Sustainable building glass	Saint-Gobain	https://www.saint-gobain-glass.co.uk/en-gb/our-sustainability-journey#:~:text=Saint%2DGobain%20has%20developed%20a,into%20new%20high%20performance%20glass.	Internal, industrial, Post-consumer cullet	Saint-Gobain will manufacture all flat glass using 50% cullet by 2025	There are three types of cullet depending on its origin, as defined by the ISO 14021 standard	Globally	
Recycled concrete mixes	Aitec [11]	https://api.environdec.com/api/v1/EPDLibrary/Files/69ef8220-1fab-487c-cf1e-08d9df0ea78f/Data	recycled inert recovery inert by-product	2,12% 2,85% 3,09%	Environdec - PCR:2012:01 Version 2.3 - Construction products and construction services 2018-11-15	Globally, although more concentrated in Italy	
Recycled concrete mixes	Gasser Markus GmbH/S.r.l.	https://www.epditaly.it/wp-content/uploads/2016/12/GM-EPD-Calcestruzzo-2022_R01_Ecoplatform-1.pdf	recycled inert	28%	EPD Italy - PCR Construction products: ICMQ-001/15 rev 3 (conforme alla EN 15804+A2)	Globally, although more concentrated in Italy	

(Continuation of Annex 4. Table 1: Examples of innovative circular products and markets.)

Product	Manufacturer	Weblink/contact	Material/s reused/recycled	% recovered	Certificates	Market (country/ies where it is sold)	Observations
Recycled concrete mixes	Eco Conglomerati S.r.l.	https://www.epditaly.it/wp-content/uploads/2016/12/Dichiarazione-EPD-2020-Eco-Conglomerati_Modifiche-Post-Audit-1.pdf	Recycled inert Light cinder Heavy	25% 15% 65%	EPD Italy - PCR Construction products: ICMQ-001/15 rev 3 (conforme alla EN 15804+A2)	Globally, although more concentrated in Italy	
Recycled concrete mixes	Beton Eisack GmbH/S.r.l.	https://www.epditaly.it/wp-content/uploads/2016/12/BE-EPD-Calcestruzzo-2022_R01_Ecoplatform.pdf	Recycled inert	26%	EPD Italy - PCR Construction products: ICMQ-001/15 rev 3 (conforme alla EN 15804+A2)	Globally, although more concentrated in Italy	
Recycled concrete mixes	Wipptaler Bau AG/Edilizia Wipptal S.p.A.	https://www.epditaly.it/wp-content/uploads/2016/12/WB-EPD-Calcestruzzo-2022_R01_Ecoplatform.pdf	Recycled inert	17%	EPD Italy - PCR Construction products: ICMQ-001/15 rev 3 (conforme alla EN 15804+A2)	Globally, although more concentrated in Italy	
Recycled aggregates	NUOVA DEMI S.p.A.	https://www.epditaly.it/wp-content/uploads/2016/12/220824_NUOVA-DEMI_EPD_aggregati-riciclati_rev.03.pdf	"grey" recycled aggregates: deriving from waste from the concrete (e.g. FR code); • «red» recycled aggregates: deriving from waste containing bricks, bricks, etc. (e.g. FRT2 code).	Recycled aggregates consist of 100% post-consumer recycled material (C&D activity).	EPD Italy - PCR Construction products: ICMQ-001/15 rev 3 (conforme alla EN 15804+A2)	Globally, although more concentrated in Italy	

(Continuation of Annex 4. Table 1: Examples of innovative circular products and markets.)

Product	Manufacturer	Weblink/contact	Material/s reused/recycled	% recovered	Certificates	Market (country/ies where it is sold)	Observations
Temporary sheeting (PPE plastic)	Protec International, Ltd	https://www.protection.co.uk	PPE. Old sheets are recycled in new sheets	Up to 60%	Joint Code of Practice (fire prevention on construction sites), different awards for sustainability, supply chain and circular economy,	Globally, although more concentrated in the UK	
Aluminum Bicycle	Nespresso and Vélosophy	Homepage - Vélosophy Cycles (velosophy.cc)	Recycled aluminum coming from used Nespresso coffee capsules			Globally	
Tableware	Granby Workshop	Granby Workshop | Architectural Ceramics	Broken ceramic plates and old building rubble			UK but shipped globally	
Porcelanico	Vives	PORCELÁNICO – Geotiles	Ceramics	Up to 90%	ISO 9001, ISO 14001, SGS and UPEC	Globally, but specifically in Spain	
Aircraft structures (ReIntegra project)	Sonaca	Sonaca, Your Global Aerospace Partner	Metal	Up to 80%		EE. UU, Canada, Mexico, Brazil, China, Rumania and Sri Lanka	
Elite Dragongly Laptops	HP	Ordenadores Portátiles, Ordenadores de Sobremesa, Impresoras, Tinta y Tóner | HP® España	Plastic bottles coming from the ocean bottom			Globally	They also produce printer tonners
Construction steel products from recycling	ARCELOR MITTAL (XCARB)	https://corporate.arcelormittal.com/climate-action/xcarb https://europe.arcelormittal.com/flipbook/Europe/XCarb_FlatProducts_brochure/	Steels produced in an electric arc furnace using high levels of scrap and 100% renewable electricity		Xcarb green steel certificate	Europe	

(Continuation of Annex 4. Table 1: Examples of innovative circular products and markets.)

Product	Manufacturer	Weblink/contact	Material/s reused/recycled	% recovered	Certificates	Market (country/ies where it is sold)	Observations
Stone wool insulation	Rockwool International	https://www.rockwool.com/	Cutaways and disassembled stone wool products	-	Several certificates including EDPs & LEED	International	ROCKWOOL's stone wool is fully recyclable, and products made with it are easily disassembled and separated. As a result, it helps their customers to reduce their waste-to-landfill
Recycled glass products	Optima	https://optimasystems.com/	Mixed glass from Optima installed products	-	Several awards and accreditations incl. ISO (see website)	International	Includes several recycled products (see website, single and double glazed partitions, doors, etc).
Recycled Steel products	Celsa UK	https://www.celsauk.com/	Recycled scrap metal	-	ISO 14001	International	Includes several recycled products (see website, reinforcing bars, flat bars, channels, etc). The produced products consist of 98% locally sourced recycled scrap metal.
Waste Based Bricks, Slips, Tiles	StoneCycling	https://www.stonecycling.com/	Derbies from CDW (inert waste)	-	Environmental Product Declaration (EPD)	International	Consists of 60% of mix waste

(Continuation of Annex 4. Table 1: Examples of innovative circular products and markets.)

Product	Manufacturer	Weblink/contact	Material/s reused/recycled	% recovered	Certificates	Market (country/ies where it is sold)	Observations
Recycled Plastic products	Kedel	https://www.kedel.co.uk/	Mix plastic waste (post-industrial, CDW, and consumer use)	-	-	International	Includes several recycled products (see website, Decking, Cladding, sheets, etc). Recycled content percentage depends on the item, as some products is made from 100% recycled plastic waste.
Recycled concrete, brick product tipping, as well as a wide range of recycled products (Dust, 20 mm road base, DGB20 road base. Crushed Filtration sand, Bottom Ash)	Recycled concrete products	Products - Recycled Concrete Products	Recycled quarry materials and aggregates	-		Australia	
Concrete with high content of recycled concrete and/or ceramics (REBETONG)	Skanska a.s.	https://www.skanska.cz/co-delame/specialni-cinnosti/vyroba-dodavka-a-cerpani-betonu/rebetong/	Plain concrete, classes: C 12/15 X0; C 16/20 X0, XC1; C 20/25 X0, XC1, XC2, eventually C 25/30 X0, XC1-XC3, XD1 as well	Up to 100% substitution of virgin aggregates	Construction technical certificate provided by Czech certification bodies	Czech Republic	
ERC-Tech prefabricated elements using recycled concrete and or ceramics	ERC-Tech a.s.	https://www.erc-tech.eu/cs/	Concrete classes C12/15 – C35/45, with specification XC1-XC4, XD1-XD2, XF1-XF4	100% substitution of virgin aggregates	Construction technical certificate provided by Czech certification bodies	Czech Republic	

(Continuation of Annex 4. Table 1: Examples of innovative circular products and markets.)

Product	Manufacturer	Weblink/contact	Material/s reused/recycled	% recovered	Certificates	Market (country/ies where it is sold)	Observations
Concrete with maximized content of recycled CDW (C10/15 to C25/30)	RED Beton s.r.o.	https://www.redbeton.cz/	Concrete classes C12/15 – C25/30	Up to 100%	Construction technical certificate provided by Czech certification bodies	Czech Republic	
plastic trench fitting (for railroads) and plastic guardrails	Stabilplastik	https://stabilplastik.cz/	Plastic waste	Up to 100%	Construction technical certificate provided by Czech certification bodies	Czech Republic	
Plastic roofing tiles EUREKO	REGRA PLAST s.r.o.	http://www.regraplast.cz/ https://www.eureko.org/	Use of PP and PE waste plastics	n.a.	Construction technical certificate provided by Czech certification bodies	Czech Republic	
Plastic window frames	ALUPLAST	https://www.alu.plast.cz/produkty/plastova-okna-a-dvere/okna/okna-aluplast.html	Plastic waste used in form of regenerate	n.a.	Construction technical certificate provided by Czech certification bodies	Czech Republic	
Plastic boards and elements for traffic signs	Replast	Czech company engaged since 1993 in the processing of recycled PVC cables. The headquarters and production can be found in Pilsen, where the company produces floor boards or components for traffic signs - sign bases, slowing and guiding thresholds and much more. All made from 100% recycled material. https://www.replast.cz/	Plastic waste (PVC)	Up to 100%	Construction technical certificate provided by Czech certification bodies	Czech Republic	
Upcycle Studios	Lendager Group	Frontpage - Lendager	Around 850 tons of concrete recovered from the construction of the Copenhagen metro	-		Denmark	
Gypsym recycling systems	ReTec	Gypsum recycling plants made by ReTec (retec-recycling.com)	Gypsum			Denmark	
Concrete façade	Studio Gang Architects	Studio Gang	Debris from abandoned constructions near the site's surroundings			Chicago, EE. UU.	

(Continuation of Annex 4. Table 1: Examples of innovative circular products and markets.)

Product	Manufacturer	Weblink/contact	Material/s reused/recycled	% recovered	Certificates	Market (country/ies where it is sold)	Observations
Hotel	T3arc	Inicio - T3Arc	Old sewage concrete tubes			Mexico	
Furniture	Vepa	Vepa	Plastic gathered from Amsterdams channels			The Netherlands	
Pellets	Bellota	Inspirados por el trabajo duro | Bellota	Wood residues generated when manufacturing their tools handles			Spain and The Netherlands	
Chipboard	Pina S.A. Losán	Losan diseño y tendencias en melaminas - madera - tablero	Wood leftovers	80%-90%		Spain	
Furniture	Mister wils	Comprar Estanterías - Estanterías Online en MisterWils	Pine tree			Spain but the ship to several countries	
Waterproof timber composites	Woodio	www.woodio.fi	Wood waste	80%			
Vitreous coating	Camacho recycling	Camacho Recycling – RECOGIDA SELECTIVA Y RECICLADO DE VIDRIO PARA APLICACIONES INDUSTRIALES	Glass	Up to 100%	ISO 9001, ISO 14001 and OHSAS 45001	Spain	
Basins	Claybrook Studio	Claybrook | Wall Tiles, Floor Tiles, Bathrooms, Paint & Wood Flooring | Free Samples & Free Delivery (claybrookstudio.co.uk)	Waste glass				
Glass powder	Slim iberica	VIDRIO GRANULAR Y POLVO DE VIDRIO (silminiberica.com)	Glass coming from recycling bins			Spain	
Vacuum cleaner	Electrolux	Electrodomésticos de gama blanca para tu hogar | Electrolux	Plastic residues coming from the Pacific Ocean, the Indic Ocean, the Atlantic Ocean, the Mediterranean Sea and the Baltic Sea.			Spain	Only 6 models were produced that were auctioned for charity

(Continuation of Annex 4. Table 1: Examples of innovative circular products and markets.)

Product	Manufacturer	Weblink/contact	Material/s reused/recycled	% recovered	Certificates	Market (country/ies where it is sold)	Observations
Eco-friendly concrete blocks	ECOLOGIC	https://www.ecobloc-catalunya.com/	Concrete with recycled content	50%	Type I Ecolabel	Spain	
Recycled cement panels	FERMACELL	https://www.fermacell.es/es	Fly ash incorporated into the cement and recycled glass	15% (Power Panel H20 BUILDING BOARD); 17% Power panel HD Building board; 42% (AESTUVER Fire protection Board)		Spain	
PP-R PIPES	AQUATHERM GMBH	http://aquatherm.es/	recycled polyethylene, including components obtained from packaging from the collection and treatment of solid urban waste or from the recovery of the plastics fraction of the sector's own CDW.	5%	Type III Ecolabel	Spain	
Lignacite block	Lignacite Ltd	https://lignacite.co.uk/	recycled and secondary aggregates	-	Several awards and accreditations incl. ISO and CE (see website)	UK	The blocks have a high level of recycled aggregate content, in some blocks exceeding 55%.
Isolating panels	Quietstone UK	Sound Absorbing, Acoustic & Fire Resistant Products : Quietstone	Glass			UK	

(Continuation of Annex 4. Table 1: Examples of innovative circular products and markets.)

Product	Manufacturer	Weblink/contact	Material/s reused/recycled	% recovered	Certificates	Market (country/ies where it is sold)	Observations
Plasterboards	Knauf	Knauf | Suppliers of gypsum-based building materials in the UK - Knauf	Recycled gypsum			UK	
Reclaimed/recycled Timber products	Ashwells	https://ashwelltimber.com/	Salvaged from landfill sites, demolition jobs	-	-	UK	Reclaimed/recycled hardwood and softwood timber for construction purposes, landscaping, bridges, gates, fencing, and decking.
K-Briq	Kenoteq	https://kenoteq.com/	CDW with high recycled content of traditional brick	-	Several awards – see website	First commercial manufacturing will be from late 2022.	K-BRIQ is a world-first sustainable brick. At least 90 percent of its content is recycled construction and demolition waste.
Recycled & Secondary Aggregates	BlueMAC Manufacturing Mineralproducts	https://www.bluemacmanufacturing.com/ https://www.bluemacmanufacturing .com/ https://www.mineralproducts.org/	Recycled asphalt, recycled concrete, recycled brick and slags	-	-	UK	The UK utilises 70 MT of recycled and secondary materials in the GB aggregates market, This contributes 28% market share. 90% of hard CDW is recycled as aggregates in UK – together with further 9%MT of recycled soft EW
Charcoal Concrete	Enniskillen's South West College	https://www.concretecentre.com/	Wood waste	-	-	Under development	waste wood charcoal can be a useful additive to concrete - use as a cement substitute at percentage of 12%,
SupaSoft	THERMAFLEECE	https://www.thermafleece.com/product/supasoft-recycled-plastic	Recycled PET	95%	-	UK	-

Annex 5. Innovative circular services and markets

Annex 5. Table 1: Examples of innovative circular services and markets.

Service	Provider	Weblink/contact	Description of service	Certificates	Market (country/ies where it is offered)	Observations
Specialized recycling services	Ds Smith	DS Smith – Packaging, Paper, Recycling	Recycling and waste management services. They also offer different solutions by sector		Worldwide	
Assessing, rating, and certifying of buildings	Building Research Establishment	https://bregroup.com/products/breeam/	BREEAM provides consistent and comparable sustainability assessment and verification across all asset types.	BREEM certificate	International	Using scientifically based sustainability metrics and indices which cover a range of environmental issues. Its categories evaluate energy and water use, health and wellbeing, pollution, transport, materials, waste, ecology and management processes.
Recycling solutions for CDW	CDE Group	https://www.cdegroup.com/	leading provider of wet processing solutions with applications across a wide range of materials within the natural processing and waste recycling sectors.	ISO: 9001, ISO 14001 and ISO 45001	International	Providing solutions in the natural sand & aggregates, and waste recycling industries. Diverting millions of tons of material from landfill, protecting sands in areas where natural reserves are in decline and enabling production to happen closer to markets.
Eco - Binder	European program HORIZON 2020 [12]	https://www.ecobinder-project.eu/	With Eco Binder, we have contributed to the development of cementitious products based on the class of low-emissivity BYF (Belite-Ye'elimite-Ferrite) binders, tested on prefabricated items	-	EU	Project completed
VEEP	European program HORIZON 2020 [12]	http://www.veep-project.eu/	With VEEP, panels for renovations and new buildings have been produced using 75% recycled material (aggregates, concrete, insulation)		EU	Project completed
ENDURCRETE Project	European program HORIZON 2020 [12]	http://www.endurcrete.eu/	With EnDurCrete a new sustainable, based reinforced concrete was developed on the use of new cements with a lower clinker content.		EU	Project completed

(Continuation of Annex 5. Table 1: Examples of innovative circular services and markets.)

Service	Provider	Weblink/contact	Description of service	Certificates	Market (country/ies where it is offered)	Observations
LIGHTCOCE	European program HORIZON 2020 [12]	http://www.lightcoce-oitb.eu/en/normal/home	With LightCoce we intend to offer an open access ecosystem for upscaling and testing of multipurpose materials in lightweight concrete and ceramics (for concrete, conventional and advanced ceramics)		EU	Ongoing project
MINRESCUE	European program HORIZON 2020 [12]	https://minrescue.gig.eu/	With Minrescue, which started in September 2020, concretes will be developed with which to reuse the scraps of extraction from the coal mines of the north England		EU	Ongoing project
Re-manufacturing Networks	Re-NetTA (Re-Manufacturing Networks for Tertiary Architectures)	https://www.remanufacturingforaec.polimi.it/remanufacturing-dabc@polimi.it https://re.public.polimi.it/retrieve/e0c31c0f-2b90-4599-e053-1705fe0aef77/RegenerationOfTheBuiltEnvironm1-Renetta.pdf	The ReNetTA project identifies re-manufacturing and reuse networks and processes as tools to reduce the generation of waste deriving from renewals/transformations carried out on short-term cycles, applying Life Cycle Management and sustainable business models. The goal is to maintain over time the value of the environmental and economic resources, integrated into manufactured products, once they have been removed from buildings, extending their useful life and their usability with the least possible consumption of other materials and energy and with the maximum containment of emissions into the environment.	-	Italy - EU.	Re-manufacturing Networks
Consultancy	Eunomia	https://www.eunomia.co.uk/	Consultancy dedicated to helping our clients to achieve better environmental and commercial outcomes.	-	UK & EU	Eunomia combines the highest levels of analytical and operational expertise with a high degree of professional competence and efficiency to respond quickly and effectively to provide consultation on waste management

(Continuation of Annex 5. Table 1: Examples of innovative circular services and markets.)

Service	Provider	Weblink/contact	Description of service	Certificates	Market (country/ies where it is offered)	Observations
Support of built environment sustainability	Natureplus	https://www.natureplus.org/	Increasing the quality, health and sustainability of the built environment through the identification, development and specification of better products and systems.	Natureplus eco-label Environmental Product Declarations (EPD)	UK & EU	Share learning through events, host awards programmes and best practice, foster innovation and new ideas, participate in research projects, advocate product standards, respond to consultations and share resources and case studies.
Recycling solution for CDW	Recycling Point – Latouros & Xenis Bros Ltd	https://www.latouros.com/	The purpose of the recycling plant is to sort the mixed C&D waste into different components of waste such as concrete, asphalt, wood, metals, paper, plastic, etc, and process the sorted waster to produce clean recycled aggregates that can be used again in the construction industry.	-	Cyprus	-
Recycling solution for CDW	SKYRA VASSAS	https://skyravassas.com/en/services-new/	Recycle construction & demolition waste. Licensed to accept and handle solid waste such as, glass, car windshields, wood and tires.	-	Cyprus	-
Recycling solution for CDW	RRC - Resource Recovery Cyprus	http://rrccyprus.com/	Waste Collection Material Separation Process Final Disposal in the Market	-	Cyprus	-
Recycling solution for CDW	ATHINODOROU GREEN EARTH LTD	https://athinodorougroup.com/	ATHINODOROU GREEN EARTH LTD specializes in Construction waste recycling which is the separation and recycling of recoverable waste materials generated during construction and remodeling. Packaging, new material scraps and old	-	Cyprus	-
Recycling/ Reusing/ Treatment solutions for CDW	Official List for CDW Process Units	https://www.kodacy.org/site/units	-	-	Cyprus	-

(Continuation of Annex 5. Table 1: Examples of innovative circular services and markets.)

Service	Provider	Weblink/contact	Description of service	Certificates	Market (country/ies where it is offered)	Observations
Management of materials from excavation, construction and demolition	Adrani Thessalonikis	https://adrani.gr/	4 streams of waste are being processed: • Excavation waste • Construction and demolition wastes consisting of concrete • Construction waste including concrete, bricks, bricks, ceramics, plaster, wood, glass, plastics, metals, cables Bulky waste and renovation waste	ISO 9001 ISO 14001	Greece	
Recycling of aggregates	Anakiklosi adranwn	http://www.anakiklosiadranon.gr/	• Receiving solid waste from demolition • Weight calculation (weighing) of waste • Sorting, separation and treatment of Excavation, Construction and Demolition Waste • Disposal for sale of the materials resulting from the treatment Transfer of other unmanaged materials to appropriate, licensed disposal, recycling and reuse sites	ISO 9001 ISO 14001 ISO 45001 Construction Products Regulation (CPR)	Greece	
WREP/R-PVC Hub	PVC Forum Italia	https://www.pvcforum.it/pvc-hub/	Rigid/Plasticized PVC		Italy	
Waste collection practice	Consorzio REC	segreteria@consorziorec.it	The service consists of the collection of construction and demolition waste originating from small/medium demolitions	-	Italy	The material that will be collected will be sent to treatment plants where it will be recycled. The final destination is construction sites, where this recycled material will substitute other scarce raw materials.

(Continuation of Annex 5. Table 1: Examples of innovative circular services and markets.)

Service	Provider	Weblink/contact	Description of service	Certificates	Market (country/ies where it is offered)	Observations
Waste collection practice	Consorzio REC	https://www.consorziorec.com/ segreteria@consorziorec.it	The service consists of the collection of construction and demolition waste originating from small/medium demolitions	/	The service is offered on the Italian market	The material that will be collected will be sent to treatment plants where it will be recycled. The final destination is construction sites, where this recycled material will substitute other scarce raw materials.
Industrial recycling of metals, batteries, vehicles, cables	Derichebourg Spain	Derichebourg España - Gestion Integral de Residuos (derichebourgespana.com)	They take charge of the waste, classify it by the material, use and recycling procedure	ISO 14000 and ISO 9000	Spain	Derichebourg Spain has focused, vocationally, most of its activity to Environment. The activity of Derichebourg Spain is clearly set in the framework of Environment Protection, promoting Recycling.
Grass recycling	Ecovidrio	Reciclaje de envases de vidrio en España | Ecovidrio	They create different campaigns so that the general population takes action in recycling. They install recycling containers in cities and they manage collection	ISO 14001 and ISO 9001	Spain	It is a non-profit organization
Collection and transport of waste, recycling and recovery	ACTECO	ACTECO - Gestión, Tratamiento y Reciclaje de Residuos	They offer supply of equipment, collection and transport of waste, storage and conditioning, recycling and recovery, and also environmental consulting.		Spain	
Recycling and eco design	Ecoembes	Ecoembes	Non-profit organization that coordinates the recycling of light household packaging in Spain and helps companies to integrate eco-design into the manufacturing of their packaging to promote the reduction in waste generation		Spain	
Support services for the circular management of construction waste	Cocircular	https://www.cocircular.es/	Comprehensive service including: waste management, data control and traceability, protocols, coordination between agents, waste channelling and quality assurance.	Recicla Cocircular Valoriza Cocircular	Spain	

(Continuation of Annex 5. Table 1: Examples of innovative circular services and markets.)

Service	Provider	Weblink/contact	Description of service	Certificates	Market (country/ies where it is offered)	Observations
Industry training	Construction Industry Training Board	https://www.citb.co.uk/	help the construction industry attract talent and to support skills development, to deliver quality in the built environment	Multi-course related certificates	UK	Provide training waste management related training courses such as SEATS, Environmental & hazardous waste introduction, Lean construction module 4: Lean Construction and Waste, etc.
Site Waste – Its Criminal	NetRegs	https://www.netregs.org.uk/media/1718/a-simple-guide-to-site-waste-management-plans.pdf	A simple guide to Site Waste Management Plans including templates		Northern Ireland & Scotland	This simple guide will help you create an effective SWMP, whether it is requested by your client or planning authority, or you just want to follow industry good practice.
Take Back to Give Back	Optima	https://optimasystems.com/glass-partitions-take-back-to-give-back/	Full take back service for any UK Optima installed glass products. It's a brand-new UK initiative, designed to support our clients as well as giving us full control over the entire lifecycle of our products, supporting circular economy.	-	UK	Optima will safely demount our products, separating them into principal material components, and return them to our UK manufacturing facility. The team will then inspect the demounted products to establish if they are fit for reuse or repurposing on future projects.
Safety on demolition sites and workforce training & support	National Federation of Demolition Contractors	https://demolition-nfdc.com/	Collect waste information from contractors annually on the types of waste produced and how they are managed		UK	Raise the standards of demolition in the UK, ensure safety on demolition sites, promote workforce training and environmentally responsible processes
The Resource Efficient House	Zero Waste Scotland & Tigh Grian Ltd	https://www.zerowastescotland.org.uk/case-study/resource-efficient-house-demonstration-construction-project	Helps businesses, the public and third sectors on both construction affordability and environmental credibility. .	Sustainability Level certificates	Scotland	A ground-breaking exemplar project that aims to promote and encourage the construction of sustainable and affordable family homes across the country – best practice to rest of UK and worldwide.

(Continuation of Annex 5. Table 1: Examples of innovative circular services and markets.)

Service	Provider	Weblink/contact	Description of service	Certificates	Market (country/ies where it is offered)	Observations
Industry training and networking	Supply Chain Sustainability School	https://www.supplychainschool.co.uk/about/	Provides the opportunity to attend training and networking events, gain CPD points, complete a self-assessment and get a bespoke action plan, complete e-learning modules and various training resources.	Multi-course related certificates	UK	Cover all aspects of the built environment, and focus on eight main topics: Sustainability, Digital, FIR, Lean Construction, Management, Offsite, People and Procurement
Sharing platforms	Enviromate	https://www.enviromate.co.uk/	Enabling and accelerating the reuse of surplus and leftover building materials - upcycle and reuse surplus, reducing the impact the industry has on our environment and building toward a more resourceful, circular economy.	-	UK	Objectives of such service include: Diverting reusable material from landfill; Increasing the product lifecycle; Reducing the extraction of vital raw materials; Enabling the transition to a circular economy; Most importantly saving the Environment
Reclaim, Reuse, Repeat	Salvo	http://www.salvo.co.uk/	Represent the reclamation industry in the UK and have a materials information exchange for low value materials		UK	Salvo is the marketplace for salvaging and reclaiming building materials. Salvo was established to promote the reuse of materials from demolition with the aim of reducing the amount of salvageable materials that end up in landfill.
Construction Material Exchange	Zero Waste Scotland	http://cme.resourceefficientscotland.com/	Exchange platform for reusing construction materials/products		Scotland	Allows companies/projects to list materials they no longer need or are unwilling to send to landfill, and offer these materials to other businesses that may have a re-use requirement for them.
Environmental solutions and waste management service	Veolia	https://www.veolia.co.uk/	Provide waste management services and developed industry best practice for demolition projects	Several accreditations including ISO	UK	Offer competitive demolition services, which include strategy development, hazard characterisation, decontamination, recycling/resale & remediation services.

(Continuation of Annex 5. Table 1: Examples of innovative circular services and markets.)

Service	Provider	Weblink/contact	Description of service	Certificates	Market (country/ies where it is offered)	Observations
Design guides	SEDA	https://www.seda.uk.net/design-guides	Guides for how to apply design for deconstruction and sustainable renovation		UK	The Guides are aimed at mainstream commercial construction and should be useful for Architects, Developers, Contractors and others within the Construction Industry who wish to reduce the environmental damage associated with their projects.
Environmental solutions and waste management service	Biffa	https://www.biffa.co.uk/	Manage resources and reduce waste whilst providing the excellent service levels required to contribute towards customers' core purpose - building for the future.	Several accreditation including ISO – see website	UK	Provide sustainable, total resource and waste management solutions to the housebuilding and wider construction sector, including construction manufacturing, plant hire and construction retail.
SKA Rating	RICS	https://www.rics.org/uk/about-rics/responsible-business/ska-rating/	SKA rating is an environmental assessment method,benchmark and standard f helps landlords and tenants assess fit-out projects against a set of sustainability good practice criteria	SKA certificate	UK	Waste is one of the 8 sustainability areas covered by SKA rating and includes measures such as reducing waste sent to landfill, designing out waste, increase recycling of construction & demolition waste, and preparing a Site Waste Management Plan
Home Quality Mark (HQM)	BRE	https://www.homequalitymark.com/	Provide impartial information from independent experts on a new home's design and construction quality and running cost	Home Quality Mark (HQM), BREEM	UK	Using a simple 5-star rating to indicates to householders the overall expected costs, health and wellbeing benefits, and environmental footprint associated with living in the home. The HQM will encourage measures and practices that help improve efficiency which includes effectively managing and reusing waste materials

Annex 6. Digital and automated solutions for circular economy in construction

Annex 6. Table 1: Examples of digital and automated solutions for circular economy in construction.

Name	Year*	Company / weblink	Origin country	Countries distributed	STAGES				STAKEHOLDERS					Contribution to waste management	Usability/acceptability/ additional comments
					Design	Constructio	Use	End of life	Client/user	Designer	Manufactu	Contractor	Waste man.		
Digital Waste Register	2020	https://ewr.moa.gov.cy/	Cyprus	Cyprus	✓	✓	✓	✓	✓	✓	✓	✓	✓	The Digital Waste Register (DWR) is an online tool that includes the electronic registration of the obliged entities (Companies and Organizations) and at the same time supports the registration of their activities (Facilities, Collection & Transport Activities and Trade/Brokerage) in combination with the declaration of waste they manage and the licenses documenting them. It also covers the obligation of obliged entities to submit the annual Waste Report. It also enables DWR managers to generate reports and carry out environmental audits.	The user can enter the EWC that they are interested in and see all of the Waste Treatment, Storage facilities and Collection activities & Transport or Trade/Brokerage that are registered with the DWR.
PointFuse Pro	2018	Pointfuse Ltd.	United Kingdom	Globally	✓	✓	✓	✓		✓		✓	✓	Provides automatic conversion of a point cloud into 3D entities. Creates a digital twin of a building, allowing to organize its selective deconstruction. Convert classified mesh walls, windows and doors into 'family' groups for use with popular downstream BIM software and FM software.	Efficient editing using simple CAD tools and automation. IFC standards adopted for BIM modelling. Outputs LOD200BIM, 2D floor plans and IPMS (office) building reports.

(Continuation of Annex 6. Table 1: Examples of digital and automated solutions for circular economy in construction.)

Name	Year *	Company / weblink	Origin country	Countries distributed	STAGES				STAKEHOLDERS					Contribution to waste management	Usability/acceptability/ additional comments
					Design	Construction	Use	End of life	Client/user	Designer	Manufacture	Contractor	Waste man.		
Aarivus	2019	Aurivus GmbH	Germany	Globally	✓	✓	✓	✓		✓		✓	✓	The aurivus AI understands structured and unstructured point clouds. Inserts BIM attributes directly into the point cloud.	AI walls, doors, and openings detection. Automatic floor placer Plug in Revit.
Schüttflix app		Schüttflix GmbH / https://schuettflix.com/cz/cs/	Germany	In Europe		✓	✓	✓			✓	✓	✓	A digital marketplace and delivery platform for bulk construction supplies.	Logistic concept for optimizing the transport of bulk materials incl. granular waste.
Revitalyze		Start-up digitsal platform revitalyze.io	Austria	Central Europe		✓	✓	✓	✓			✓	✓	Revitalyze is a digital platform for utilizing the unused resource potential of existing buildings where reuse of products from buildings to be demolished is providing suitable B2B matching between the product holder and the product buyer. As part of the services the platform provides a kind of pre-demolition analysis is provide so materials or products used in the existing building and their deconstructability at building and component level are identified. This allows to reduce disposal costs, earn extra money and contribute to circularity.	Possible lik within RECONMATIC with pre-demotilion
BatiRIM	2018	Suez & Kairnial https://www.suez.fr/fr-fr/notre-offre/entreprises/quel-est-votre-besoin/gestion-et-valorisation-des-dechets/batirim	France	Globally	✓	✓	✓	✓	✓	✓	✓	✓	✓	Creates a digital twin of a building, allowing to organise its selective deconstruction. Their professional team identifies all resources within a building or asset that are reusable, recoverable or have a reutilisation value.	Working with CARDEM in Saint-Denis on the site of the 2024 Olymic swimming pool.A 'powerful' digital tool combined with a collaborative team Their multidisciplinary team advises and supports through projects to create an efficient circle between deconstruction & construction.
Digital Waste Registry		https://wrm.ypeka.gr/	Greece		✓	✓	✓	✓	✓	✓	✓	✓	✓	Service provided by the Greek Ministry of Environment regarding the declaration and monitoring of waste by the associated enterprises and organizations.	

(Continuation of Annex 6. Table 1: Examples of digital and automated solutions for circular economy in construction.)

Name	Year*	Company / weblink	Origin country	Countries distributed	STAGES				STAKEHOLDERS					Contribution to waste management	Usability/acceptability/ additional comments
					Design	Constructio	Use	End of life	Client/user	Designer	Manufactur	Contractor	Waste man.		
National Register of Producers		https://www.eoan.gr/%CE%B5%CE%BC%CF%80%CE%B1/%CF%84%CE%B9-%CE%B5%CE%AF%CE%BD%CE%B1%CE%B9-%CF%84%CE%BF-%CE%B5%CE%B8%CE%BD%CE%B9%CE%BA%CF%8C-%CE%BC%CE%B7%CF%84%CF%81%CF%8E%CE%BF-%CF%80%CE%B1%CF%81%CE%B1%CE%B3%CF%89%CE%B3%CF%8E%CE%BD-%CE%B5%CE%BC/	Greece		✓	✓	✓				✓			All producers of packaging and other products must be registered.	
R-PVC Hub	2019	PVC Forum Italia	Italy	Replicable		✓	✓	✓			✓	✓	✓	Training, Selection and Enhancement.	R-PVC Hub
WREP	2018	PVC Forum Italia	Italy	Italy		✓	✓	✓			✓	✓	✓	Rigid/plasticized PVC Up to 90% supply chain the circular economy.	

(Continuation of Annex 6. Table 1: Examples of digital and automated solutions for circular economy in construction.)

Name	Year*	Company / weblink	Origin country	Countries distributed	STAGES				STAKEHOLDERS					Contribution to waste management	Usability/acceptability/ additional comments
					Design	Constructio	Use	End of life	Client/user	Designer	Manufactur	Contractor	Waste man.		
Circularity	-	Circularity https://circularity.com/piattaforma-circolare/	Italy	Italy	✓	✓	✓	✓	✓	✓	✓	✓	✓	The first georeferenced circular economy platform dedicated to companies that want to enhance their production waste and reduce their environmental impact.	
European Circular Economy Stakeholder Platform	-	ENEA https://circulareconomy.europa.eu/platform/en	Italy	EU		✓	✓	✓			✓	✓	✓	ENEA represents Italy in the Coordination Group of the European Stakeholder Platform for the Circular Economy (ECESP) promoted by the European Commission and the European Economic and Social Committee for the dissemination of knowledge, multi-stakeholder dialogue and the collection of good practices.	
ICESP	-	ENEA for Italian Circular Economy Stakeholder Economy https://www.icesp.it/	Italy	Italy	✓	✓	✓	✓	✓	✓	✓	✓	✓	Promote the dissemination of knowledge; foster dialogue and possible synergies between the Italian players involved in the initiatives; mapping Italian good practices; promote the integration of initiatives at the Italian level; create a permanent operational tool that can promote and facilitate intersectoral dialogue and interactions; spreading Italian excellence and the Italian way of making a circular economy starting from the traditions and typical features of our country and the related cultural, social and business models	

(Continuation of Annex 6. Table 1: Examples of digital and automated solutions for circular economy in construction.)

Name	Year*	Company / weblink	Origin country	Countries distributed	STAGES				STAKEHOLDERS					Contribution to waste management	Usability/acceptability/ additional comments
					Design	Constructio	Use	End of life	Client/user	Designer	Manufactur	Contractor	Waste man.		
O.R.SO. 3.0 Market Inerti		Regione Lombardia, ANCE Lombardia, ARPA Lombardia, ANPAR, ANEPLA https://marketinerti.arpalombardia.it/home	Italy	Italy				✓			✓	✓	✓	The purpose of "Market Inerti" is to create a meeting point between supply and demand for aggregates, allowing materials to be searched on the basis of their technical characteristics, quantities and availability. The data and quantities of the aggregates are entered by the recovery plants through the application O.R.SO. (Osservatorio Rifiuti Sovraregionale -Interregional Waste Observatory).	
Digital Deconstruction. Advanced Digital Solutions supporting reuse and high-quality recycling of building materials	2019-2026	Digital Deconstruction | Interreg NWE (nweurope.eu)	The Netherlands, France, Luxembourg, Belgium		✓	✓	✓	✓	✓	✓	✓	✓	✓	An integrated DDC system at TRL7, to be made accessible to companies in IT, engineering, construction and real estate sector as an open-source software package for further development and integration to market ready products and services. A transnational network of Regional Innovation Hubs (RIH) that supports the optimization, validation and roll-out of DDC solutions. 5pilots, where the digital tools are tested in operational environment; an interactive DDC. Navigator supporting the use and further adaptation of DDc tools.	

(Continuation of Annex 6. Table 1: Examples of digital and automated solutions for circular economy in construction.)

Name	Year*	Company / weblink	Origin country	Countries distributed	STAGES				STAKEHOLDERS					Contribution to waste management	Usability/acceptability/ additional comments
					Design	Constructio	Use	End of life	Client/user	Designer	Manufactur	Contractor	Waste man.		
Digital Deconstructio n project	2021	Digital Deconstruction project - Iceberg (iceberg-project.eu)	France, Luxembourg, Belgium					✓	✓			✓	✓	3D scanning of buildings and details screening of building interiors. Creation of reverse Building Information Model, using reconstructed 3D models of existing buildings Creation of a digital materials and buildings database with detailed information on the relevant features of the materials and their reuse potential. This information will increase the willingness of the industry to reuse these materials. Assignment of property rights to items in the Digital Market and Buildings Database. This may be done by means of blockchain technology, creating the basic market conditions for the trade in recovered building materials and the associated rights. It facilitates matchmarking between supply and demand and simplifies current and future transactions involving a large number of actors - Assessment of the recovery and reuse potential of building materials (predemolition audit) - Definition of a deconstruction and reuse strategy -Planning and implementation of the deconstruction process -Design of new buildings using recovered materials, by developing an interface compatible with design software. As such, the solutions offered by digital deconstruction support demolishers, building owners and property managers in informed decision-making and planning process in relation to building deconstruction, improving material and labour efficiency and recovering greater value from materials.	

(Continuation of Annex 6. Table 1: Examples of digital and automated solutions for circular economy in construction.)

Name	Year*	Company / weblink	Origin country	Countries distributed	STAGES				STAKEHOLDERS					Contribution to waste management	Usability/acceptability/ additional comments
					Design	Constructio	Use	End of life	Client/user	Designer	Manufactur	Contractor	Waste man.		
Material passport	2022	Multiple providers https://circuland.co.uk/ https://orms.co.uk/ https://madaster.com	Multiple parties in EU	UK & EU		✓	✓	✓	✓		✓	✓	✓	A digital document which certifies materials' identity and properties, entitling them to be re-used	Materials Passports provides information about materials' properties throughout materials' lifecycle including manufacturers, contractors, facility manager and demolition contractor. Such information involves materials' properties, location, circularity and carbon performance, material health and sourcing, reuse potential, etc.
QFlow	2018	https://qualisflow.com/	UK	UK		✓						✓		Software system that enables contractors to make informed decisions by collecting real-time materials and waste data at source	Build an automated data collection/aggregation platform for construction projects, capture and harness material and waste data on live sites.
SmartWaste	2009	https://www.bresmartsite.com/products/smartwaste/	UK	UK & EU		✓		✓	✓		✓	✓		Software system for clients & contractors to record and analyse waste	It can be used across a supply chain for the client or principal contractor to report and analyse, giving the vital information needed to identify trends and areas of improvement. This enables a more informed environmental strategy to be achieved. Based on feedback from customers - trends and areas of improvement are identified as well as help meet the requirements of BREEAM

(Continuation of Annex 6. Table 1: Examples of digital and automated solutions for circular economy in construction.)

Name	Year*	Company / weblink	Origin country	Countries distributed	STAGES				STAKEHOLDERS					Contribution to waste management	Usability/acceptability/ additional comments
					Design	Constructio	Use	End of life	Client/user	Designer	Manufactur	Contractor	Waste man.		
Recycled and secondary aggregates suppliers	2014	http://zwsaggsuppliers.org.uk/	Scotland	UK		✓			✓			✓		A map-based system for aggregate producers who have complied with the Quality Protocol	This directory only includes producers who have successfully demonstrated their compliance with the WRAP Quality Protocol to produce aggregates from inert waste.
Matchmaking for demolition	-	https://www.swecourbaninsight.com/building-the-future-through-circular-data-tools-for-mining-the-green-gold/	Sweden	N/A Prototype	✓			✓	✓	✓				Designed to bridge "the time gap between planning and demolition", and better match supply and demand across the reuse of design and construction materials.	This software tool scans the internet in Sweden for official municipality documents, targeting demolition, land allocation and exploitation - informs architects in advance of plans for demolition and construction in any specific location, enabling them to match this with their own design plans for construction within the same area.
Reclaim	-	https://www.swecourbaninsight.com/building-the-future-through-circular-data-tools-for-mining-the-green-gold/	Sweden	N/A Prototype	✓			✓	✓	✓				Aims to predict which buildings will be demolished in the future Additionally, it enables to visualise a future material bank within a wider area, investigating the potential use of the materials, following demolition, in new projects.	Uses machine learning from historical government data including: year of construction, asset value, history of permits for demolition, refurbishment, owner relations and function. Provides a forecast for which demolitions to expect within the next 10 years - recognising patterns in data for demolished buildings, identifying which buildings are likely to follow the same pattern

(Continuation of Annex 6. Table 1: Examples of digital and automated solutions for circular economy in construction.)

Name	Year*	Company / weblink	Origin country	Countries distributed	STAGES				STAKEHOLDERS					Contribution to waste management	Usability/acceptability/ additional comments
					Design	Constructio	Use	End of life	Client/user	Designer	Manufactur	Contractor	Waste man.		
SustainIQ	2017	https://sustainiq.com/	UK	Nationally	✓	✓	✓		✓	✓	✓	✓		Helps businesses measure, monitor and report on social, economic and environmental impacts, by focusing on 4 main aspects: procurement, environmental management, people, health & diversity, and community engagement & partnering	Procurement pillar measures responsibility in supply chains by calculating socio-economic impact of a projects buying processes at local, national, and international levels - promoting the use of sustainable and responsible products, material, and services. Environmental management focus on calculating environmental performance across multiple sites - alerting customers to excessive waste, energy or water usage, avoiding unnecessary cost, in addition to implementing waste management plans
Rotor DC	2014	https://rotordc.com/	Belgium	Internationally	✓	✓	✓	✓	✓	✓	✓	✓	✓	A cooperative that organises the reuse of construction materials. It dismantle, process and trade salvaged building components.	By trading in salvaged materials, Rotor DC help reduce the quantity of demolition waste, while offering quality building materials that have a negligible environmental impact. It also develops deconstruction techniques, logistical systems and remanufacturing installations for contemporary building materials, with a focus on finishing materials.

(Continuation of Annex 6. Table 1: Examples of digital and automated solutions for circular economy in construction.)

Name	Year*	Company / weblink	Origin country	Countries distributed	STAGES				STAKEHOLDERS					Contribution to waste management	Usability/acceptability/ additional comments
					Design	Constructio	Use	End of life	Client/user	Designer	Manufactur	Contractor	Waste man.		
Opalis	2012	https://opalis.eu/en	Belgium	UK & EU	✓	✓	✓	✓	✓	✓	✓	✓	✓	Facilitate the reuse of materials in construction and renovation projects.	The site shows an overview of professional retailers who sell building materials coming from old dismantled buildings. Opalis also provides technical documentation on the most common construction products on the reuse market: their main characteristics, frequency of release, availability, indicative prices, etc. Describes recent realizations in which reuse materials have been applied successfully and in an inspiring way.
Vaastu	-	https://www.anthesisgroup.com/about/our-technology/vastum-digital-waste-tracking-system/	UK	Nationally		✓	✓	✓	✓		✓	✓	✓	Deals with existing waste from all streams, tracking and recording waste movements through a series of digital transactions from producer to waste management processes and infrastructure, to final destination of reuse, recycle, recover, or disposal tracks and records waste movements	Uses something resembling blockchain technology to create a secure tracking system. Vastum can be accessed by anyone with an internet-connected device, from a mobile phone to companies operating sophisticated software systems. Data can be entered before, during or after the waste movement has taken place without slowing down operations. Data can be inputted in a way that best suits the business – directly via a browser, in bulk via spreadsheet or CSV file or by integrating the service into existing software using APIs
		www.topolytics.com													

Annex 7. Industry databases linked to circular economy

Annex 7. Table 1. Databases for circular economy in construction.

Name of database	Type of data	Purpose for RECONMATIC	Weblink/Access
European Union (EU)			
Eurostat	Recovery rate of construction and demolition waste (cei_wm040)	EU waste estimates which include data on the recovery rate of construction and demolition waste.	Database - Eurostat (europa.eu)
CYRKL	Europe's largest platform for industrial waste management and green sourcing *(it is how them present themselves)*	Provides the marketplace for various entities who generate different types of waste or by-products and seek for new solutions. RECONMATIC would be able to get some information about potential companies or business entities who might be interested in some of the project outputs.	https://cyrkl.com/en/
	A diagnosis of construction and demolition waste generation and recovery practice in the European Union	Construction and demolition waste generation and recovery practice in EU	A diagnosis of construction and demolition waste generation and recovery practice in the European Union - ScienceDirect
Czech Republic			
Czech Statistical Office	Yearly waste production, recovery and disposal	Contains various statistics and data not only related to waste codes and waste production rates, but also its distribution in regions and cities.	https://www.czso.cz/csu/czso/produkce-vyuziti-a-odstraneni-odpadu-mgyqmwjyr8
ISOH	Waste production, recovery and disposal. Register of waste treatment facilities. The data are available in detailed form to state administration authorities and in aggregated form to the public.	Statistics, data, register of waste treatment facilities. The data are normally not freely accessible to public and each user has to ask for permission and pay fee for data use.	https://isoh.mzp.cz/
Greece			
Digital Waste Registry	Service provided by the Greek Ministry of Environment regarding the declaration and monitoring of waste by the associated enterprises and organizations.	Provision of data regarding waste streams and waste management treatment practices in Greece	https://wrm.ypeka.gr/
Italy			
ISTAT	General censuses of population, services and industry, agriculture, sample surveys on households and general economic surveys at national level	National Database	https://esploradati.istat.it/databrowser/#/it/dw/categories/IT1,DATAWAREHOUSE,1.0/UP_ACC_AMBIEN
ISPRA	Air quality, water, waste, environmental indicators, climate, etc	National waste Database	https://www.isprambiente.gov.it/it/banche-dati

(Continuation of Annex 7. Table 1. Databases for circular economy in construction.)

Name of database	Type of data	Purpose for RECONMATIC	Weblink/Access
Spain			
rcdasociación	Asociación española de reciclaje de residuos de construcción y demolición	Recycling of CDW in Spain	Informe 2017 REV1 (rcdasociacion.es)
FER	Federación española de la recuperación	Reuse and Recycling activities in Spain	Revista FER – Federación Española de la Recuperación y el Reciclaje (recuperacion.org)
I hobe	Sociedad pública de gestión ambiental del Gobierno Vasco	CDW management in Basque Country	- Publicaciones (ihobe.eus)
Aprr.eus	Asociación de plantas fijas de reciclaje de residuos de construcción y demolición de Euskadi	CDW management in Basque Country	Publicaciones – Aprr.eus
AGESNA	Asociación de gestores de RCD de Madrid	CDW management in Madrid	Noticias – Agesma RCD
BEDEC	Instituto Tecnológico de Cataluña	Database for construction projects. It provides sustainability data, including CDW generation, waste sorting, CO2 emissions, energy consumed, etc.	https://itec.es/servicios/bedec/?gclid=Cj0KCQjwy4KqBhD0ARIsAEbCt6hEae0Xewt28dVsNu5p5Ae7zCbbRIlZwnqOW3k4i7uMZTYLelEeN6UaAlC5EALw_wcB
UK			
UK statistics on waste	Official statistics of waste generation, recycling, recovery, landfilled and final treatment in different UK sectors	UK waste estimates which include data on the generation, recovery rate and final treatment of construction, demolition and excavation waste	https://www.gov.uk/government/statistics/uk-waste-data
Natural Resources Wales	Official statistics of CDW and environmental information including guidelines and regulations	Official statistics of CDW components, generation, recycling, recovery, landfilled and final treatment in addition to key environmental information	https://statswales.gov.wales/Catalogue
Environment law	Information on environmental law on key areas and the everyday problems we all face.	Waste hierarchy polices, regulations and legislations	http://www.environmentlaw.org.uk/
Environmental guidance	Environmental guidance for your business in Northern Ireland & Scotland	Guidance on waste hierarchy plans, strategies, polices, regulations and legislations	https://www.netregs.org.uk/
ICE Database	Institute of Civil Engineering	Data about embodied carbon on extraction, refinement, process, transport and fabrication of construction materials and products	https://circularecology.com/embodied-carbon-footprint-database.html

Annex 8. Industry platforms and other organizations linked to circular economy

Annex 8. Table 1: Industry hubs/platforms in Cyprus linked to CDW management and circular economy.

Name of Hub/platform	Aim of this hub/platform	Purpose for RECONMATIC	Weblink/Access
Cyprus Recycling Organization	The non-profit Recycling Organization of Cyprus (OAK) has created and licensed the first Collective Excavation, Construction and Demolition Waste Management System. OAK acts as the Body, for the implementation and promotion of the operating procedures of the Collective Waste Management System from Excavations, Constructions and Demolitions of its contracted Producers. OAK created and maintains a List of all contracted and participating C&D Waste Producers of the Collective Management System.	OAK can provide a liaison with local waste management or recycling units as well with other authorities, allowing RECONMATIC to tap in a greater network and in the same time increase its impact to local society.	https://www.oak.org.cy/
Cypriot Organization of Waste Management	The Cyprus Organization of Waste Management has been established, with the main mission to operate in the capacity of the intermediate Management Body of the Collective Alternative Waste Management System	The Cyprus Organization of Waste Management can provide a liaison with local waste management or recycling units as well with other authorities, allowing RECONMATIC to tap in a greater network and in the same time increase its impact to local society.	https://www.kodacy.org/
Federation of Associations of Building Contractors of Cyprus (OSEOK)	OSEOK is the only representative of contractors in the construction sector recognized - by the state, the social partners and the involved bodies - and aims at the continuous development of the sector and its people, with responsibility, safety and respect for the Environment, the Worker and Society.	OSEOK can provide a liaison with local contractors and other authorities, allowing RECONMATIC to tap in a greater network and in the same time increase its impact to local society.	https://www.oseok.org.cy/
Cyprus Energy Agency	The Cyprus Energy Agency [CEA] is an independent, non-governmental, non-profit organization, founded in 2009. CEA was co-funded by the European Commission, through the Programme “Intelligent Energy for Europe” and by the Cyprus Union of Communities, for its establishment and first three years of operation.	Cyprus Energy Agency has participated in European Projects of the EU initiative EIT Climate-KIC which has reported among others the “State of Construction Demolition Waste management in Cyprus"	https://www.cea.org.cy/en
Cyprus University of Technology	The University offers bachelor studies in mechanical engineering, a field where students learn about building materials and components. Also, the University’s faculty members published the report “State of Construction Demolition Waste management in Cyprus (Orestes Marangos, Olympia Nisiforou, Stylianos Yiatros). This report aims to map the current state of affairs in CDW management in Cyprus, highlighting the consequences of non-proper management and new important developments that have been incorporated in the international and European legislative agenda.	Students of the programme and relevant faculty members could answer questions regarding building materials, recycled materials, etc.	http://www.cut.ac.cy/
Cyprus Union of concrete producers	A list with all the members of the Union who are involved in the process of concrete produce, like quarries	Concrete producers have direct knowledge of the concrete produce, possible waste management solutions and recycling facilities.	https://cyprusquarries.pro.cy/gr/

(Continuation of Annex 8. Table 1: Industry hubs/platforms in Cyprus linked to CDW management and circular economy.)

Name of Hub/platform	Aim of this hub/platform	Purpose for RECONMATIC	Weblink/Access
Cyprus Land & Building Developers Association	The Association is the collective voice of one of the most perennially important forces of the Cypriot economy. The sector accounts for approximately 17% of the GDP of Cyprus and it employs over 40,000 people. LBDA aims to assertively and dynamically support the implementation of policies and measures that provide incentives to Land and Building Development companies to innovate and upgrade the quality of their products with respect to the environment, opening up new markets and fulfilling their role in the development of the Cypriot economy and increasing employment.	Members of the association have direct knowledge of the CDW management, the recycling solutions and the use of recycled materials in the construction sector.	https://lbda.com.cy/
Cyprus Association of civil engineers	A list with all civil engineers in Cyprus.	They can offer insights on CDW management related to their work in the construction industry of the country, relative reports or surveys.	https://www.spolmik.org/
Cyprus Architect Association	A list with all architects in Cyrpus	They can offer insights on CDW management related to their work in the construction industry of the country, relative reports or surveys.	https://architecture.org.cy/
Association of Scientists and Environmental Engineers of Cyprus	A list with the environmental engineers in Cyprus	Environmental engineers can offer insights on CDW management related to their work in the construction industry of the country, relative reports or surveys.	https://www.facebook.com/pasmep.cy
CYPRUS CIRCULAR ECONOMY NETWORK	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. They have also published the **report, "Survey on Circular economy in construction: country report (Cyprus)**, which attempts to investigate the attitudes of users and their practices in terms of circular economy, opportunities, needs and worries related to circular economy. Also, they have published the "**Circular Economy Thinking for Construction Waste Management in islands (INFOBOOK)"**", which was produced for the EIT Climate-KIC RIS ideation Project "Circular Economy Thinking for Construction Waste Management in islands" which has received funding from the European Institute of Innovation and Technology, a body of the European Union, under the Horizon 2020, the EU Framework Programme for Research and Innovation. (see the infographic here: https://www.youtube.com/watch?time_continue=118&v=nOUChbQNuLw&embeds_euri=https%3A%2F%2Fcypruscircular.org.cy%2F&feature=emb_logo	They can offer insights on various initiatives taken regarding the circular economy, inclusing CDW management.	https://cypruscircular.org.cy/

Annex 8. Table 2: Governmental institutions in Cyprus linked to CDW management and circular economy.

Name of institution	Aim of this institution	Purpose for RECONMATIC	Weblink/Access
Statistical Service of Cyprus	The mission of the Statistical Service is the regular and timely production of statistics and the provision of reliable statistical information on events in Cyprus with the aim of: • Assisting government work in policy-making • Informing and supporting the business world and the public in general, in Cyprus and abroad • Informing and supporting organizations and scientific/research centers in Cyprus and abroad In addition, the Statistical Service acts as coordinator and technical advisor to other public institutions for statistical work.	Statistical Service of Cyprus can be an additional source of information and statistics during the RECONMATIC's progress	https://www.cystat.gov.cy/en/default
Ministry of Agriculture, Rural Development and Environment	The Ministry of Agriculture, Rural Development and Environment aims at promoting sustainable development for agriculture and fishing, while contributing to environmental protection and sustainable management of both the environment and Cyprus natural resources through projects, initiatives and actions. The Ministry's vision is a sustainable, "green" and "clean" Cyprus, which develops along the principles of sustainable development in agriculture and fishing, protects the environmental and manages natural resources effectively, while creating employment opportunities and enhancing the citizens' quality of life.	Ministry of Agriculture, Rural Development and Environment can also be a great source of information helping RECONMATIC's success and in the same time it can increase RECONMATIC's impact locally.	https://moa.gov.cy/?lang=en
Nicosia Municipality	One out of the four municipalities in Cyprus operating "Green Points". "Green Points" are collection points where citizens can bring their non-house wastes, including C&D wastes and toxic wastes for recycling.	Municipalities can offer insights regarding wastes produced by citizens, their treatment and how they are processed and recycled.	https://www.nicosia.org.cy/en-GB/home/
Limassol Municipality	One out of the four municipalities in Cyprus operating "Green Points". "Green Points" are collection points where citizens can bring their non-house wastes, including C&D wastes and toxic wastes for recycling.	Municipalities can offer insights regarding wastes produced by citizens, their treatment and how they are processed and recycled.	https://www.limassol.org.cy/en/home
Larnaca Municipality	One out of the four municipalities in Cyprus operating "Green Points". "Green Points" are collection points where citizens can bring their non-house wastes, including C&D wastes and toxic wastes for recycling.	Municipalities can offer insights regarding wastes produced by citizens, their treatment and how they are processed and recycled.	https://www.larnaka.org.cy/en/
Paphos Municipality	One out of the four municipalities in Cyprus operating "Green Points". "Green Points" are collection points where citizens can bring their non-house wastes, including C&D wastes and toxic wastes for recycling.	Municipalities can offer insights regarding wastes produced by citizens, their treatment and how they are processed and recycled.	https://pafos.org.cy/

(Continuation of Annex 8. Table 2: Governmental institutions in Cyprus linked to CDW management and circular economy.)

Name of institution	Aim of this institution	Purpose for RECONMATIC	Weblink/Access
Unit of Integrated Installations for the Management of Municipal Solid Waste (IMSW) of Limassol District	The Unit of Integrated Installations for the Management of Municipal Solid Waste (IMSW) of Limassol District is located in Pentakomo region and covers a total area of 380 acres. The commencement of the construction works began on 20/04/2015 and the completion of the works finished on 15/05/2017. The Unit has been normally operated since 9/11/2017, when terminated the trial operation period. The Unit has the ability to process approximately of 140.000 tonnes of mixed domestic waste per year, while it has the ability of mechanical management of further 20.000 tonnes per year of presorted domestic and commercial/industrial recyclable materials, which can be collected through programs of Sorting at Source. There is also design providence, in order the Unit to be managed plus 15.000 tonnes per year of pre-sorted green or/and organic biodegradable waste.	This Unit can provide information on the solid waste collected there, processed accordingly, sorted, recycled, etc.	http://www.cyprus.gov.cy/moa/wdd/wdd.nsf/All/A7388A6D24AB3221C2258402003EBD42?OpenDocument
Union of Cyprus Communities		Community authorities have direct knowledge of any waste management facilities in their area. Communities can offer insights regarding wastes produced by citizens, their treatment and how they are processed and recycled.	https://www.ekk.org.cy/
Union of Cyprus Municipalities		Municipal authorities have direct knowledge of any waste management facilities in their area. Municipalities can offer insights regarding wastes produced by citizens, their treatment and how they are processed and recycled.	https://ucm.org.cy/en/
Ministry of Interior, Technical Services (waiting for more info)	**Technical Services – Division of Solid Waste Management**, is responsible for monitoring all activities concerning CDW stream.	This division has direct knowledge of all activities related to CDW management in Cyprus.	

(Continuation of Annex 8. Table 2: Governmental institutions in Cyprus linked to CDW management and circular economy.)

Name of institution	Aim of this institution	Purpose for RECONMATIC	Weblink/Access
Ministry of Environment- Department of Environment of the Ministry of Agriculture, Rural Development and Environment. (key people: Mr. Costas Hatjipanagiotou, Director of the Department of Environment/ Mrs. Meropi Samara-Miliotou, Head of Waste Management Unit)	According to the Waste (Amending) Law 3(I)/2016 permit granting or renewal for operators for waste collection, transport and disposal and permit granting or renewal for the operation of Establishments of processing/recycling of Waste from Excavation, Construction and Demolition (W.E.C.D.) as well as licensing collective or individual WECD management systems shall be done by the Department of Environment of the Ministry of of Agriculture, Rural Development and Environment.	This department is responsible for the licenses given to all operators in Cyprus who collect and manage CD waste. They can provide information on the number of operators and the waste management itself.	http://www.moa.gov.cy/moa/environment/environmentnew.nsf/All/24D7718D0776D2A8C225837600447F7F?OpenDocument
Geological Servey Department - Ministry of Agriculture, Rural Development and Environment	The Geological Survey Department is the technical adviser of the state for all geo-matters. In particular it is the responsible government service for the undertaking of research and studies, as well as the granting of advice on geological, hydrogeological, geotechnical, ore body evaluation, geophysical, seismological and geo-environmental matters.	They can offer insights into the fossils that are extracted at the quarries and can possibly be recycled after being used in construction.	http://www.moa.gov.cy/moa/gsd/gsd.nsf/dmlIndex_en/dmlIndex_en?opendocument#

Annex 8. Table 3. Non-governmental organisations in Cyprus linked to CDW management and circular economy.

Name of institution	Aim of this institution	Purpose for RECONMATIC	Weblink/Access
Cyprus Scientific and Technical Chamber (ETEK)	The Cyprus Scientific and Technical Chamber is the statutory Technical Advisor to the State and is the umbrella organization for all Cypriot Engineers. It was established by Law 224/1990 and is a Public Law Body with an elected Governing Body. It has an office and a Service capable of promoting its objects.	Cyprus Scientific and Technical Chamber can provide a liaison with local engineers and other authorities, allowing RECONMATIC to tap in a greater network and in the same time increase its impact to local society.	https://etek.org.cy/

Annex 8. Table 4: Industry hubs/platforms in Czech Republic linked to CDW management and circular economy.

Name of Hub/platform	Aim of this hub/platform	Purpose for RECONMATIC	Weblink/Access
ARSM	ARSM is a civil association of companies or institutions and private persons engaged in solving problems related to the recycling of inert construction and demolition waste: advice, support and representation of its members in professional, legal and organizational issues in the field of recycling of building materials and in follow-up negotiations with other entities; preparation of concepts for recycling of building materials, their support in the development of legal, standard and planning regulations on a national scale and professional control of the achieved results.	ARSM is active in seeking and exchanging solutions and innovations which support better reuse and recycling, especially of mineral CDW. Some recycling companies are members as well. It can provide feedback on various solutions to be developed within RECONMATIC, similarly, potential external partners can be found for demonstration of some of the solutions. Furthermore – as already exploited especially in WP4 – some members of ARSM offered their recycling yards for sampling and machine learning activities.	http://arsm.cz/
CAObH	The Czech Circular Economy Association (ČAObH) is a voluntary non-political union of citizens and corporations connected by an interest in conserving primary resources, reducing costs at industrial concerns and reducing negative impacts on the environment and human health by reducing the amount of waste produced. The association is actually led by the former minister of environment, Dr. M. Kužvart.	CAObH established in 2021 its own cluster for the construction sector. The mission within this cluster is to cooperate and support required, updated or new technical and legislative standards. For RECONMATIC it can serve as another source of market/business information and can support the project activities in the field of upgrading recycling efficiency.	https://obehove-hospodarstvi.cz/en/
ARI	Association for Infrastructure Development (ARI) is a think tank for public infrastructure in the Czech Republic. It unifies and promotes good international practice. Through expert discussions, proposals and recommendations proactively promote clear rules of planning, public procurement, and management of transparent contractual relations according to proven international good practice, which will enable the long-term sustainable development of the Czech public infrastructure and qualitative growth of the supply sector by strengthening know-how and social responsibility. ARI also promotes alternative procurement and financing methods that will enable the long-term sustainable development of the country's public infrastructure.	ARI is besides topics related to the development of infrastructure and promotion of schemes like PPP active in the last 2-3 years in EU Taxonomy and Green Cities concepts. Especially the Green Cities concept might be close to the topics and objectives of RECONMATIC. This concept was developed by the Organisation for Economic Co-operation and Development (OECD) in collaboration with the Association of Local Governments for Sustainability (ICLEI). The concept, now being developed by dozens of cities around the world, aims to improve the environment of cities and towns in a cost-effective and sustainable way. ARI might be therefore one of the hubs that can help to promote some of the project ideas and project results achieved within RECONMATIC. The association can provide also a different group of experts for interviews and workshops.	https://www.ceskainfrastruktura.cz/

(Continuation of Annex 8. Table 4: Industry hubs/platforms in Czech Republic linked to CDW management and circular economy.)

Name of Hub/platform	Aim of this hub/platform	Purpose for RECONMATIC	Weblink/Access
CBCSD	The Czech Business Council for Sustainable Development (CBCSD) is a civil association established under Act No. 83/1990 Coll., which brings together companies and individuals who strive to create conditions for a sustainable future for business, society and the environment. The aim is to mediate the active role of the business sector in the sustainable growth of Czech society. Furthermore, to prepare and implement corporate or sectoral programmes and projects of a local, regional and national nature with a focus on linking the objectives of sustainable economic development, ensuring social values and environmental acceptability. In cooperation with the World Business Council for Sustainable Development, to provide access to plans, new trends, programmes and their outputs, and to link national programmes and projects to them where appropriate.	Consultation body for aspects related to the circular economy. The association can provide some expert opinions and might be usable for some interviews.	https://www.cbcsd.cz/
CZGBC	The CZ Green Building Council (CZGBC) aims to radically improve the sustainability of the built environment, by transforming the way it is planned, designed, constructed, maintained and operated.	Mitigating and adapting to climate change; Eliminating waste and maximising resource efficiency; Supporting the market and development of sustainable materials.	https://www.czgbc.org/

Annex 8. Table 5: Governmental institutions in Czech Republic linked to CDW management and circular economy.

Name of institution	Aim of this institution	Purpose for RECONMATIC	Weblink/Access
CENIA	CENIA is the Czech Environmental Information Agency which was established in the past as an independent organization controlled by the Ministry of Environment. CENIA regularly collects data from which publications are subsequently prepared and other information outputs assessing the status and development of individual environmental components and their pressures. The datasets are collected from individual producers and providers and the outputs are published through selected information systems operated by CENIA. Since 2005, the Information System for Statistics and Reporting (ISSaR) has been used for data publication, which is available to anyone interested in the environment in the Czech Republic, through a web interface, a broad overview of the development of and state of the environment, either in the form of visualisations of different sets of indicators or in the form of aggregated data available for download.	Source of national data and information (datasets) related to various waste streams.	https://www.cenia.cz/czech-environmental-information-agency/#_aktuality

Annex 8. Table 6: Non-governmental organisations in Czech Republic linked to CDW management and circular economy.

Name of institution	Aim of this institution	Purpose for RECONMATIC	Weblink/Access
INCIEN	The Institute of Circular Economy / INCIEN is a non-governmental, non-profit organization that has been promoting the circular economy (CE) for 7 years. INCIEN perceives the materials that surround us every day, such as wood, textiles, plastics and building materials, as wealth that needs to be managed carefully. This applies to the industries that form the backbone of our economy, as well as to cities, regions and individuals. It is precisely the circular economy, which emphasis less waste, i.e. less extraction of primary raw materials and extending the life of materials already in circulation that we see as the only sustainable way forward for our economy. The symbol of INCIEN is the hummingbird, which has always been credited with the ability to be reborn. This symbolism reflects our commitment to giving new meaning to waste and putting materials back into circulation.	INCIEN serves as an independent hub for CE-related topics. The cooperation can be used for organizing workshops and training courses or getting recommendations for additional experts for e.g. interviews. An even stronger link can be established between RECONMATIC and INCIEN by identifying synergies with the BUSGoCircular H2020 project (described further). This can serve e.g. for WP7 and joint training programs (courses).	https://incien.org/
czBIM	The Professional Council for BIM (czBIM) aims to permanently increase the quality, productivity and efficiency of the Czech construction industry by digitizing all processes of preparation, permitting, implementation, management, and maintenance of buildings through a simple, accessible and transparent environment. czBIM was founded in 2011 and is an independent platform for the popularization, promotion, standardization and development of BIM in the Czech Republic. The association defends and promotes the interests not only of its members but also of the entire private sector, ensuring that the implementation of BIM in the Czech Republic is transparent and takes into account the experience and needs of real practice. It represents the Czech chapter of buildingSMART.	National platform in CZ where topics related to BIM can be exchanged, introduced and discussed. It is also one of the platforms where later BIM-related training and education can be jointly developed and provided.	https://www.czbim.org/

Annex 8. Table 7: Industry hubs/platforms in Greece linked to CDW management and circular economy.

Name of Hub/platform	Aim of this hub/platform	Purpose for RECONMATIC	Weblink/Access
Hellenic Recycling Agency	A public organization aiming to develop and apply national policies for the sustainable – alternative management of waste. HRA organizes the alternative management of specific waste streams, such as, packaging, ELV, WEEE, ECDW etc.	Provision of data concerning the C&D waste, New measures and programmes that HRA can propose to the Minister for the Environment and Energy	www.eoan.gr/
Hellenic Solid Waste Management Association (HSWMA)	A non-profit, non-governmental organization that promotes the adoption of socially and environmentally acceptable methods for Solid Waste Management	Knowledge sharing	https://eedsa.gr/site/?lang=en
Waste management association of Crete (ESDAK)	ESDAK undertook the implementation of the Regional Waste Management Planning (P.E.S.D.A.)	Knowledge sharing	https://esdak.gr/en/o-esdak/
Hellenic Waste Management (HWM)	The Hellenic Waste Management company provides comprehensive services environmental protection and management of any type of waste throughout Greece and also has storage and transshipment facilities.	Knowledge sharing	https://www.hwm.gr/en/home-en/

Annex 8. Table 8: Governmental institutions in Greece linked to CDW management and circular economy.

Name of institution	Aim of this institution	Purpose for RECONMATIC	Weblink/Access
Hellenic Recycling Agency	A public organization aiming to develop and apply national policies for the sustainable – alternative management of waste. HRA organizes the alternative management of specific waste streams, such as, packaging, ELV, WEEE, ECDW etc.	Data concerning the C&D waste, New measures and programmes that HRA can propose to the Minister for the Environment and Energy	www.eoan.gr/
Hellenic Ministry of Infrastructure, Transport and Networks	Various aspects of CDW management including the collection of non-hazardous CDW and End-of-Life services of vehicles.	Provision of data	https://www.yme.gov.gr/?tid=745&aid=0
Hellenic Ministry of Environment and Energy	Policy making for hazardous and non-hazardous waste, construction waste and recycling.	Provision of data	https://ypen.gov.gr/

Annex 8. Table 9: Non-governmental organisations in Greece linked to CDW management and circular economy.

Name of institution	Aim of this institution	Purpose for RECONMATIC	Weblink/Access
Technical Chamber of Greece	A public legal entity having as members all qualified licensed engineers. Among its aims is to support its members & society in all science & technical fields.		www.tee.gr/en/

Annex 8. Table 10: Industry hubs/platforms in Italy linked to CDW management and circular economy.

Name of Hub/platform	Aim of this hub/platform	Purpose for RECONMATIC	Weblink/Access
Consorzio REC	Consorzio REC is the first Italian consortium of building material retailers for the collection of construction and demolition waste	Consorzio REC orients and supports the opening and management of the Preliminary Collection Centres (1) of non-hazardous construction and demolition waste produced by third parties, and related activities carried out by recovery and recycling plants, according to the provisions of the relevant legislative framework (Legislative Decree No. 152 of 3 April 2006) and in compliance with the guidelines of the Circular Economy. The aim is to direct the Preliminary Collection Centres to start the treatment, reuse, recovery and recycling, according to the principles of economy, efficiency and environmental sustainability, the waste from C&D that are delivered to them, encouraging recycling activities that use the best available techniques, in terms of health and environmental protection, in accordance with current Community and national legislation and achieving the objectives of the Circular Economy.	https://www.consorziorec.com/
Confindustria	Confindustria is the main association representing manufacturing and service enterprises in Italy, with over 150,000 small, medium and large companies.	The association's mission is to foster the affirmation of business as an engine of the country's economic, social and civil growth. In this sense, it defines common paths and shares - while respecting the spheres of autonomy and influence - objectives and initiatives with the world of economics and finance, national, European and international institutions, PA, Social Parties, culture and research, science and technology, politics, information and civil society. Confindustria interacts constantly and at different levels with international organizations and with local and national bodies, institutions and authorities.	https://www.confindustria.it/home
PVC Forum	PVC Forum Italia is the Italian association that brings together leading PVC production, compounding and processing companies, additive manufacturers and processing machine manufacturers.	PVC Forum Italia was created with the objective of promoting awareness of PVC, its application and environmental benefits, and the socioeconomic importance of the PVC industry; promoting the high quality of PVC products in all application sectors; participating in the definition of standards, norms and regulations at the national level; and contributing to the drafting of European regulations.	https://www.pvcforum.it/

(Continuation of Annex 8. Table 10: Industry hubs/platforms in Italy linked to CDW management and circular economy.)

Name of Hub/platform	Aim of this hub/platform	Purpose for RECONMATIC	Weblink/Access
Federbeton	Federbeton is, within Confindustria, the industry federation of the Associations of the cement, concrete, basic materials, manufactured products, components and structures for construction, applications and related technologies within the above-mentioned supply chain.	Federbeton aims to spread the culture of sustainable development by promoting the realization of a virtuous supply chain in the construction sector, oriented to the qualification of production processes, safety at construction sites and workplaces, the production of innovation, developing the technical knowledge of those involved in the supply chain and helping to reduce the consumption of non-renewable natural resources, in the wake of environmental sustainability and energy efficiency.	https://www.federbeton.it/
ANPAR	Trade association of fixed and mobile plants that recycle inert waste. With its representation in all Italian regions, it is the home of companies in the sector.	It aims to protect member companies by promoting in particular the use of aggregates produced by industrial processes for the recovery of inert waste	http://anpar.org/
ANCE	The National Association of Building Contractors (ANCE) is the trade association that, since May 1946, has represented nationwide private contractors of all sizes and legal forms, operating in the fields of public works, housing, commercial, office and industrial construction. Association representation is extended to construction companies performing specialized work such as foundations and installations.	ANCE (National Association of Building Constructors) Promotes policies that combine the business capabilities of the construction sector with the interests and needs of civil society, aiming for: • Economic, Social and Labor Growth • Energy-Environmental Sustainability • Welfare of the country	https://ance.it/
Circularity	Circularity help companies to rethink their business model in a sustainable way, supporting them in the valorisation of non-recoverable waste and offering integrated services including consultancy, information, certification and training.	The Circularity Platform is the geo-referenced circular economy platform dedicated to companies that want to reduce their environmental impact through the valorisation of their production waste, its sustainable transport, the recovery of their waste and the use of secondary raw materials.	https://circularity.com/en/
SITEB	SITEB, Italian Roads and Bitumen, is a nonprofit association that cross-groups major players in the road and waterproofing membrane industry.	SITEB aims to evaluate and encourage the development of innovative products and technologies, aimed at energy saving, emission reduction, recycling and reuse of materials from the road pavement demolition cycle or alternative industrial activities, while fully respecting human health and safeguarding the environment's resources.	https://www.siteb.it/

(Continuation of Annex 8. Table 10: Industry hubs/platforms in Italy linked to CDW management and circular economy.)

Name of Hub/platform	Aim of this hub/platform	Purpose for RECONMATIC	Weblink/Access
ATECAP	ATECAP is the Technical Economic Association for Ready-mixed Concrete and has been representing and protecting the interests of Italian ready-mixed concrete producers for thirty years. It is part of Federbeton, the Confindustria Federation representing the Italian cement and concrete industry, to promote the product as the ideal solution for any type of work, whether large or small, because of its structural, aesthetic, architectural and sustainability potential, which make it the building material at the base of most constructed works. It is a member of ERMCO, the European Ready-mixed Concrete Producers Association, actively working within it to ensure that European technical regulations are not a constraint but an opportunity to improve the competitive capacity of Italian producers.	it supports companies in their activities, protects entrepreneurs who operate correctly and promotes the dissemination of the culture of concrete construction, raising awareness among prescribers, administrations and major clients for the updating of tender specifications, the correct application of standards and the rigorous activity of controls.	https://www.atecap.it/index.php?option=com_content&view=category&layout=blog&id=11&Itemid=101 https://www.atecap.it/index.php?option=com_content&view=article&id=156&Itemid=131
Saint Gobain	Saint-Gobain designs, manufactures and distributes materials for the safety and living comfort of each of us and the future of all. These materials are found everywhere in our living spaces and in everyday life: in buildings, transport, infrastructure and many industrial applications.	Saint-Gobain proposes itself as a reference technological pole for the sustainable construction market and the global reference point in the efficient use of natural resources, with respect for the environment. All the proposed solutions are designed to build more energy efficient buildings, to reduce consumption and polluting emissions.	https://www.saint-gobain.it/
FIVRA	Association represents the producers of mineral wool (rock wool and glass wool) present in Italy. FIVRA's action is aimed at promoting and strengthening the use of glass wool and rock wool (sometimes called "mineral wool") as insulation in construction and industry. This means, first of all, defending and promoting thermal insulation as the main and indispensable strategy for energy saving.	FIVRA intends to promote correct energy policies that Italy must necessarily implement, not only to adapt to European standards, but also to seize the opportunities that energy efficiency offers to the country-system, in environmental terms (reduction of pollution), industrial (the reduction of energy consumption and the improvement of energy security) and social (the fight against fuel poverty)	https://www.fivra.it/
INERTIA REMTECH	RemTech Expo is the only permanent, international Environmental Technology Hub specializing in the topics of remediation, regeneration and sustainable development of territories. Within this context is Inertia: the most specialized event on the reuse of inert waste and natural, recycled and artificial aggregates. Contracting stations, general contractors, companies, managers of roads, highways and railways are some of the stakeholders involved in the debate and exhibition area.	Among the topics that Inertia addresses are demolition, sorting plants, recycling, certification, CE marking, earthmoving, mining, excavated material management, infrastructure, environmental sustainability, and major works.	https://remtechexpo.com/

(Continuation of Annex 8. Table 10: Industry hubs/platforms in Italy linked to CDW management and circular economy.)

Name of Hub/platform	Aim of this hub/platform	Purpose for RECONMATIC	Weblink/Access
Rete Ambiente	Reteambiente – Observatory of environmental legislation offers detailed and organized information on European Union, national and regional legislation	The specialized information of "Reteambiente.it - Observatory of environmental legislation" contributes to integrating the panorama of legal products of Reteambiente Srl, such as the authoritative magazine "Waste - Regulatory information bulletin", the professional training of "Reteambiente Formazione", the prestigious legal publications of the well-known brand “Edizioni Ambiente”.	https://www.reteambiente.it/
Assoambiente	It is the Association representing at national and European level the mainly private companies that manage environmental services and enterprises of the Circular Economy. The main activities carried out by member companies of Assoambiente are waste collection, also differentiated, waste transport, waste recycling, composting, energy recovery from waste, production of fuels from waste, waste disposal, remediation of sites and assets containing asbestos, waste brokering, waste water treatment.	Assoambiente has several goals in line with Reconmatic's objectives. Particularly, ASSOAMBIENTE works to promote the qualification and industrial development of the sector within the Circular Economy, also using BAT (Best Available Techniques).	https://assoambiente.org/

1. Preliminary Collection Centres (CPR) are a pre-disposal system for non-hazardous construction and demolition waste which is organized at sales centers for building materials following access to such centers by those producing such waste, regardless of the purchase of new building materials, in order to facilitate the recovery and recycling ensuring high environmental protection, to limit the flow of disposal and abandonment

Annex 8. Table 11: Governmental institutions in Italy linked to CDW management and circular economy.

Name of institution	Aim of this institution	Purpose for RECONMATIC	Weblink/Access
ISPRA	Italian Institute for Environmental Protection and Research	National waste Database: network that merges the nineteen regional agencies (ARPA) and those of the two autonomous provinces (APPA), coordinated by ISPRA. Therefore, ISPRA performs technical and scientific functions, both in support of the Ministry of the Environment and the protection of the territory and the sea and directly, through monitoring, evaluation, control, inspection and management activities of the environmental information.	ISPRA https://www.isprambiente.gov.it/it ISPRA and the Agencies ARPA/APPA are part of the National System for Environmental Protection (Sistema Nazionale per la Protezione dell’Ambiente) https://www.snpambiente.it/

(Continuation of Annex 8. Table 11: Governmental institutions in Italy linked to CDW management and circular economy.)

Name of institution	Aim of this institution	Purpose for RECONMATIC	Weblink/Access
MASE	MASE is the Ministry of Environment and Energy Security (Ministero dell'Ambiente e delle Sicurezza Energetica)	The MASE performs functions in the fields of: protection of biodiversity, ecosystems and marine-coastal heritage, land and water protection, policies to combat climate change and global warming, sustainable development, energy efficiency and circular economy , integrated management of the waste cycle, reclamation of Sites of National Interest (SIN), environmental assessment of strategic works, contrast to atmospheric-acoustic-electromagnetic pollution and the risks deriving from chemical products and genetically modified organisms.	https://www.mite.gov.it/pagina/economia-circolare
ENEA	ENEA is the National Agency for New Technologies, Energy and Sustainable Economic Development, a public body aimed at research, technological innovation and the provision of advanced services to enterprises, public administration and citizens in the sectors of energy, the environment and sustainable economic development. The aim of the institution consists in: • eco-innovative methodologies and approaches, new business models and management of urban and industrial areas; • creation, diffusion and implementation of advanced technologies; • integrated projects on the territory at various levels in urban areas and production systems; • business service activities; • circularity measurement tools; • strategies at local, national and European level; • support activities for the development and adaptation of regulatory instruments; • training and information activities.	Enea has developed similar projects to Reconmatic and represents Italy in the Coordination Group of the European Stakeholder Platform for the Circular Economy (ECESP) promoted by the European Commission and the European Economic and Social Committee for the dissemination of knowledge, multi-stakeholder dialogue and the collection of good practices.	https://sostenibilita.enea.it/economiacircolare

(Continuation of Annex 8. Table 11: Governmental institutions in Italy linked to CDW management and circular economy.)

Name of institution	Aim of this institution	Purpose for RECONMATIC	Weblink/Access
Sapienza University of Rome	Founded in 1303, Sapienza is the oldest university in Rome and the largest in Europe. Its mission is to contribute to the development of a knowledge society through research, excellence, quality education and international cooperation. The Department of Planning, Design and technology of Architecture (PDTA) of Sapienza University of Rome was established with the merger of three major areas of interest: that of design and process and product innovations involving industrial artifacts, that constituted by the body of research in the field of technological innovation and implementation processes in architecture, and that represented by all those acquisitions, related to studies on the processes of territorial transformation typical of mature industrial societies, arising from a particular attention to the problems of environmental rebalancing.	The Department PDTA includes the Area of Architectural Technology and Environmental Design, aimed at the definition and experimentation of theories, methods and technical-operational tools for the innovation, evolution and transformation of the built environment; promoter of the technological culture of design, capable of governing the entire building process with a view to quality and environmental, social and economic sustainability and circular economy, and able to provide answers to the epochal problems of resource limitation and climate change, both in new construction and redevelopment interventions, with a multi-scalar approach to the existing built heritage.	https://web.uniroma1.it/pdta/en/home

Annex 8. Table 12: Non-governmental organisations in Italy linked to CDW management and circular economy.

Name of institution	Aim of this institution	Purpose for RECONMATIC	Weblink/Access
Circular Economy Network	The Circular Economy Network is the Italian network created with the intention of supporting the transition towards a new production model that is more attentive to the environment and the use of resources.	Promote, collect and disseminate studies, research and elaborations on circular economy; define key circularity indicators and analyze national performance; analyze the main critical issues and barriers to be removed, finding possible solutions; develop strategies, policies and measures to propose to political decision-makers, promoting a positive dialogue between the business world and the institutions; enhance and contribute to the dissemination of good practices and best techniques.	https://circulareconomynetwork.it/

(Continuation of Annex 8. Table 12: Non-governmental organisations in Italy linked to CDW management and circular economy.)

Name of institution	Aim of this institution	Purpose for RECONMATIC	Weblink/Access
Legambiente	Legambiente is an Italian environmental association	Legambiente deals with sustainable development issues, implements projects financed with European, national or regional funds. Information, scientific research, involvement of people, communities and institutions at the heart of our projects.	https://www.legambiente.it/chi-siamo
Fondazione Symbola	Symbola is a Foundation that promotes and aggregates "Italian Qualities", through research, events and projects about companies and institutions that focus on innovation including sustainability and environmental issues	Fondazione Symbola carries out research and projects on sustainability and environment and publishes the annual report *GreenItaly* that points out the main aspects related to green economy and sustainability at national level, including reports on waste.	https://www.symbola.net/ricerca/green-italy-2022/

Annex 8. Table 13: Industry hubs/platforms in Spain linked to CDW management and circular economy.

Name of Hub/platform	Aim of this hub/platform	Purpose for RECONMATIC	Weblink/Access
rcdasociación	Asociación española de reciclaje de residuos de construcción y demolición	CDW recycling in Spain	Inicio - RCD Asociación (rcdasociacion.es)
FER	Federación española de la recuperación	Waste reuse and recycling in Spain	Federación Española de la Recuperación y el Reciclaje – Principal asociación del sector de la recuperación y reciclaje de residuos (recuperacion.org)
Ihobe	Sociedad pública de gestión ambiental del Gobierno Vasco	CDW management in Basque Country	Ihobe - Sociedad Pública de Gestión Ambiental del Gobierno Vasco
Aeded	Asociación española de demolición, descontaminación, corte y reciclaje	CDW demolition activities in Spain	Asociación española de demolición, descontaminación, corte y reciclaje - AEDED
Aprr.eus	Asociación de plantas fijas de reciclaje de residuos de construcción y demolición de Euskadi	CDW management in Basque Country	Aprr.eus
AGERDCYL	The purpose of the Asociación de Gestores de Residuos de Construcción y Demolición de Castilla y León (Association of Construction and Demolition Waste Managers) is to contribute to the correct management of construction and demolition waste.	CDW management in Castilla y León	http://www.agerdcyl.org/

Annex 8. Table 14: Governmental institutions in Spain linked to CDW management and circular economy.

Name of institution	Aim of this institution	Purpose for RECONMATIC	Weblink/Access
CEDEX	Center for experimental studies of public works	Contribution to the advancement of applied knowledge through the development of research work and projects, technological development and innovation. Promotion of the dissemination and transfer of Spanish knowledge and technology at national and international levels	CEDEX (cedexmateriales.es)
Ihobe	Public environmental management company of the Basque Government	The new Ihobe 2024 Strategic Plan covers the entire cycle of public policies and is supported by innovation, to contribute to the environmentally sustainable development of Euskadi and our proportional share on a global scale with the Sustainable Development Goals as a reference, materialized in the Euskadi Basque Country 2030 Agenda. This development can be an example of the path to follow in the future	Ihobe - Sociedad Pública de Gestión Ambiental del Gobierno Vasco
MITECO	National Ministry for the ecological transition and the demographic challenge	General regulations of the State and the autonomous communities, in matters under the jurisdiction of the Ministry in Spain	Ministerio para la Transición Ecológica y el Reto Demográfico (miteco.gob.es)
INE	Statistics National Institute	The National Institute of Statistics is a Spanish autonomous body in charge of the general coordination of the statistical services of the General Administration of the State and the surveillance, control and supervision of their technical procedures. We can have easy access to the statistics regarding environmental aspects	INE. Instituto Nacional de Estadística

Annex 8. Table 15: Industry hubs/platforms in the UK linked to CDW management and circular economy.

Name of Hub/platform	Aim of this hub/platform	Purpose for RECONMATIC	Weblink/Access
BRE	Building Research Establishment (BRE) create the products, standards and qualifications that help make sure that buildings, and communities are safe, efficient, productive, and sustainable-deliver their social, environmental and economic goals.	Increase the sustainability, productivity and resilience of many sectors including construction sector	https://bregroup.com/
CIWM	Chartered Institution of Wastes Management (CIWM) aim to o unite, equip and mobilise the professional community to lead, influence and deliver the science, strategies, businesses and policies for the sustainable management of resources and waste.	Empower the sustainable management of resources and waste	https://www.ciwm.co.uk/
WRAP	Waste and Resources Action Programme (WRAP) aim to tackle the causes of the climate crisis and give the planet a sustainable future	WRAP works with businesses, individuals and communities to achieve a circular economy, by helping them reduce waste, develop sustainable products and use resources in an efficient way	https://wrap.org.uk/

(Continuation of Annex 8. Table 15: Industry hubs/platforms in the UK linked to CDW management and circular economy.)

Name of Hub/platform	Aim of this hub/platform	Purpose for RECONMATIC	Weblink/Access
Constructing Excellence	Constructing Excellence aims to stimulate, debate and share a vision for change and improvement in the Construction sector by sharing, learning, collaborative working and driving innovation to deliver a demonstrably better built environment.	Supporting a green revolution including maximising productivity, diving out waste and associated carbon and achieving net-zero targets.	https://constructingexcellence.org.uk/
GCB	Green Construction Board (GCB) aim to advise government and the built environment on the regulatory and policy framework and actions required to overcome barriers to the delivery of green buildings and infrastructure as well as to promote the commercial opportunities of sustainable construction.	A recommendation from the GCB on Zero Avoidable Waste in Construction.	https://www.constructionleadershipcouncil.co.uk/
UKGBC	The UK Green Building Council (UKGBC) aims to radically improve the sustainability of the built environment, by transforming the way it is planned, designed, constructed, maintained and operated.	Mitigating and adapting to climate change; Eliminating waste and maximising resource efficiency.	https://www.ukgbc.org/
ESA	The Environmental Services Association (ESA) is the trade body representing the UK's resource and waste management industry, supporting circular economy.	ESA members collect, process and deliver circular economy and are innovating and investing for quality recycled materials, a long-term zero-waste, zero-carbon future, building sustainable infrastructure and waste management.	https://www.esauk.org/
Axion	Axion is an engineering-led company operating in the resource recovery sector and committed to putting science to work to find new ways to minimise waste and recover value from materials at end of first life.	Protect finite resources and reduce landfill by developing and supporting circular economy initiatives where products stay in use for as long as possible and where resource recovery and re-use become the default options.	https://axiongroup.co.uk/
MPA	The Mineral Products Association (MPA) the industry trade association for the aggregates, asphalt, cement, concrete, dimension stone, lime, mortar and silica sand industries	Conducting research and providing solutions to circular economy including reuse and recycle of construction minerals	https://www.mineralproducts.org/

(Continuation of Annex 8. Table 15: Industry hubs/platforms in the UK linked to CDW management and circular economy.)

Name of Hub/platform	Aim of this hub/platform	Purpose for RECONMATIC	Weblink/Access
BSI	British Standards Institution (BSI) enables people and organizations to perform better by sharing knowledge, innovation and best practice to make excellence a habit and achieve sustainable development goals.	Provide standards, guidelines and solutions for multidisciplinary businesses relating to reducing and eliminating construction waste	https://www.bsigroup.com /en-GB/
Circular Economy Hub	The UKRI National Circular Economy Research -hub (CE-Hub) brings together industry, academics, policy makers and civic society to deliver more inclusive, restorative and competitive UK Circular Economy. There are different CE Centres linked: - Circular Chemical Economy - Circular Metals - Mineral-based Construction Materials - Technology Metals Textiles Circularity CEntre	These hubs develop training and activities to a variety of stakeholders about circular economy.	https://ce-hub.org

Annex 8. Table 16: Government institutions in the UK linked to CDW management and circular economy.

Name of institution	Aim of this institution	Purpose for RECONMATIC	Weblink/Access
DEFRA	Improving and protecting the environment. Department for Environment, Food and Rural Affairs (DEFRA) aims to grow a green economy and sustain thriving rural communities in addition to supporting the world-leading food, farming and fishing industries.	Increase the sustainability, productivity and resilience of many sectors including construction sector. DEFRA's circular economy hierarchy focuses on maximising the utilisation of materials and resources by extending the life of products and recovering value at the end of life.	https://www.gov.uk/government/organisations/department-for-environment-food-rural-affairs
BEIS	Department for Business, Energy and Industrial Strategy (BEIS) is a leading economy-wide transformation by backing enterprise and long-term growth, generating cheaper, cleaner, homegrown energy and unleashing the UK as a science superpower through innovation.	Waste reduction and resource efficiency are central to the BEIS's culture and core values. As a minimum BEIS's activities will comply with all applicable legal and other requirements which relate to waste reduction, waste storage and the offsite treatment of waste generated as a result of activities.	https://www.gov.uk/government/organisations/department-for-business-energy-and-industrial-strategy

(Continuation of Annex 8. Table 16: Government institutions in the UK linked to CDW management and circular economy.)

Name of institution	Aim of this institution	Purpose for RECONMATIC	Weblink/Access
NRW	Natural Resources Wales (NRW) pursue sustainable management of natural resources and apply the principles of sustainable management of natural resources as stated in the Environment (Wales) Act 2016.	Advise, communicate, regulate and manage the construction industry and the wider public and voluntary sector about issues relating to the environment and its natural resources.	https://naturalresources.wales/? lang=en
Zero Waste Scotland	Inform policy, and motivate individuals and businesses to embrace the environmental, economic, and social benefits of a circular economy.	Develop innovation and infrastructure for a more resource efficient, circular economy for the built environment in Scotland .	https://www.zerowastescotland.org.uk

Annex 8. Table 17: Non-governmental organisations in the UK linked to CDW management and circular economy.

Name of institution	Aim of this institution	Purpose for RECONMATIC	Weblink/Access
Environment Agency	Protection and enhancement of the environment in England. Create better places for people and wildlife and support sustainable development.	Regulating major industry and waste; work with businesses and other organisations to manage the use of resources .	https://www.gov.uk/government/organisations/environment-agency
UKRI	UK Research and Innovation (UKRI) is responsible for supporting research and innovation system in the UK that gives everyone the opportunity to contribute and to benefit individuals, businesses and communities nationally and internationally.	UKRI research and development aid in enhancing the performance and address the challenges facing businesses and environment	https://www.ukri.org/
SCAPE	Creating spaces, places and experiences that leave a sustainable legacy for your community and local economy .	Improving the built environment by helping to deliver innovative design solutions and essential projects to the highest possible standard. The Construction Waste Portal forms part of our response to this ambition.	https://www.scape.co.uk/
SEPA	Scottish Environment Protection Agency (SEPA) aim to regulate, protect and improve Scotland's environment.	Protect and improve the Scottish environment by using a combination of legislation and good practice measures which supports the circular economy in the built environment.	http://www.sepa.org.uk/

Annex 9. Research and innovation projects for construction circular economy

Annex 9. Table 1: Research and innovation projects about construction circular economy.

Name of project	Title	Funding body/ies	Purpose of the project	Weblink/Access
DEFEAT	Development of an innovative insulation fire resistant façade from the Construction and Demolition Waste	European Regional Development Fund (ERDF) Cyprus Government	Development of an innovative insulation fire resistant façade from the Construction and Demolition Waste	http://defeat.frederick.ac.cy/
Transform 4 Climate	With the Transform4Climate project, the North-West Croatia Regional Energy Agency (REGEA), IRE Liguria and Cyprus Energy Agency (CEA) joined forces to develop and implement a systemic process to transform Energy into Energy and Climate Agencies.	EIT Climate-KIC project EU initiative	The EIT Climate-KIC project, Transform4Climate, aims to develop an EU wide Master strategy for the transformation of energy agencies into energy and climate agencies. The strategy will then be adapted to fit the local needs and the transformation will take place in three energy agencies partnering in the proposal. Newly set energy and climate agencies will start to operate and support the problem owners in the joint area of energy and climate, becoming local catalysers in dealing with climate change issues.	https://fedarene.org/transform4climate-empowering-europes-energy-agency-in-their-transformation-towards-energy-and-climate-agencies/
EIT Climate-KIC RIS ideation Project "Circular Economy Thinking for Construction Waste Management in islands"	EIT Climate-KIC RIS ideation Project "Circular Economy Thinking for Construction Waste Management in islands"	It has received funding from the European Institute of Innovation and Technology, a body of the European Union, under the Horizon 2020, the EU Framework Programme for Research and Innovation		
BUSGoCircular	BUS-GoCircular: Shaping a Circular Sustainable Future	Horizon2020 (European Commission)	The overall aim of BUS-GoCircular is to address and overcome the challenges of the stimulation of demand for green energy skilled workforce, along with the hands-on capacity building to increase the number of skilled workforce across the value chain. BUS-GoCircular will achieve this objective by developing and implementing a circular construction skills qualification framework with a focus on multifunctional green roofs, façades and interior elements.	https://busgocircular.eu/

(Continuation of Annex 9. Table 1: Research and innovation projects about construction circular economy.)

Name of project	Title	Funding body/ies	Purpose of the project	Weblink/Access
Life Cycle assessMEnt sofTwaRe usIng reCycled Aggregates (LC-Metrica)	Creation of a software for CDW management, including life cycle assessments	EU funding (ESPA)	Knowledge sharing	https://lcmetrica.gr/
ICEBERG	Innovative Circular Economy Based solutions demonstrating the Efficient recovery of valuable material Resources from the Generation of representative End-of-Life building materials	HORIZON 2020	This project aims to develop and demonstrate novel cost-effective circular smart solutions for an upgraded recovery of secondary building raw materials along the entire circular value chain: from end-of-life building materials (EBM) to new building products prepared for circularity, resource-efficiency and containing 30wt% to 100wt% of high-purity (>92%) recycled content.	Home - Iceberg (iceberg-project.eu)
CIRCuIT	Circular Construction in Regenerative Cities (CIRCuIT)	HORIZON 2020	It is a collaborative project running from 2019-2023 and involves 31 ambitious partners across the built environment chain in Copenhagen, Hamburg, the Helsinki Region and Greater London. CIRCuIT aims to bridge the gap between theory, practice and policy by delivering a series of demonstrations, case studies, events and other dissemination activities that showcase how circular construction approaches can be scaled and replicated across Europe to enable cities to build more sustainably and transition to a circular built environment. The objective is to demonstrate how cities can scale and replicate these activities and transition their construction sector to a circular economy.	https://www.circuit-project.eu/
HISER	Holistic Innovative Solutions for an Efficient Recycling	Horizon 2020	The main objective of HISER is to develop and demonstrate novel cost-effective holistic solutions (technological and non-technological) for a higher recovery of raw materials from ever more complex construction and demolition waste (C&DW;) by considering circular economy approaches throughout the building value chain (from End-of-Life Buildings to new Buildings).	https://www.hiserproject.eu/

(Continuation of Annex 9. Table 1: Research and innovation projects about construction circular economy.)

Name of project	Title	Funding body/ies	Purpose of the project	Weblink/Access
Decompose	Development of effective tools for minimizing the generation of construction and demolition waste, its monitoring and reuse	TA ČR (Technology agency of Czech Republic); program: Prostředí pro život	The main goal is to develop expert documents for legislative amendments leading to the minimization and reuse of construction and demolition waste and possibly a combination with secondary materials. The feasibility of the decomposition of buildings, and recycling of demolition waste will be analyzed and methodological guidelines will be developed, including the calculation of the ecological footprint and economic intensity. It will be necessary to stabilize and expand the knowledge related to the processing of construction and demolition waste, both at the beginning of the whole cycle and the recycling process itself. However, it will also be necessary to develop a conceptual approach, which will be regularly consulted with representatives of the Department of Industrial Ecology of the Ministry of Industry and Trade, CZ.	https://decompose.fsv.cvut.cz/
	Recycling technology of construction and demolition waste for zero-waste system	Czech Ministry of Industry and Trade (MPO)	The aim of the project is to move as far as possible to a waste-free system in the recycling and reuse of construction and demolition waste (CDW). The project comprehensively solves all three mentioned problems and their causes. The project will offer a service to construction and demolition companies, which will simplify the sorting of CDW directly at the construction site and ensure the processing of this waste. The sorted waste materials will be offered to the producers for take-back, the remaining materials will be taken to a recycling center, where they will be processed by a new recycling technology developed within this project. Recycling technology will reflect the need for a new generation of CDW sorting, as composite construction products are expected to begin to appear in CDW. In the course, the possibilities of using the obtained recycled materials will be addressed so that the applications comply with legislative requirements and are economically and environmentally advantageous. At this time, we promise to increase the demand for these products. By innovating the recycling process and optimizing the recycling technology of construction products, the maximum efficiency of the use of CDW will be achieved. The main result of the project will be a pilot plant (Recycling plant for a low-waste system). Other results will be 2 functional samples (Recycled concrete floor with dispersed reinforcement and Manhole containing recycled materials) and 2 proven technologies (Recycled concrete floor technology with dispersed reinforcement for use for floors and Concreting of manholes containing recycled materials).	

(Continuation of Annex 9. Table 1: Research and innovation projects about construction circular economy.)

Name of project	Title	Funding body/ies	Purpose of the project	Weblink/Access
Project No. EG21_374/0026809	Research and development of recycling technology for waste photovoltaic panels and lithium-ion batteries	Czech Ministry of Industry and Trade (MPO), program: OP PIK	The aim of the project is to design a new original technology solution for the recycling of waste (i) photovoltaic panels and (ii) lithium-ion batteries through industrial research and experimental development. The overall goal of the project is the design, construction and commissioning of two unique prototypes: (i) Prototype of a photovoltaic panel recycling plant and (ii) Prototype of a lithium battery recycling plant.	
	Recycling and conversion of construction plasterboard waste into new building products and value-added applications	Czech Ministry of Industry and Trade (MPO), program: TREND	Development of new solutions for more efficient recycling and conversion of construction plasterboard waste into new value-added building products and applications	
CEVOOH (project No. SS02030008)	Centre of environmental research: Waste management, circular economy and environmental security	TA ČR (Technology agency of Czech Republic); program: Prostředí pro život	The aim of the project is to build a long-term, professional, interdisciplinary, research base made up of key research organizations with experience and expertise to carry out research in the field of waste and circular management in a broader context. The Center, formed by a consortium of eight research organizations and universities, is focused on conducting research in the thematic areas related to the Czech Republic's transition from a linear to a circular economic model. This transition requires research in new areas such as substance flows, innovative technologies to minimize the use of primary raw materials in production, maximum material usability and recovery of waste, by-products and intermediate products, ecodesign of products, monitoring, and evaluation of not only environmental but also socio-economic processes.	
SEEPIA (project No. SS04030013)	Center for Socio-Economic Research on Environmental Policy Impact Assessment	TA ČR (Technology agency of Czech Republic); program: Prostředí pro život	The project aims to establish an interdisciplinary research center, providing long-term expert capacity for socioeconomic environmental research. The center will develop methods for policy impact evaluation, foresight, and behavioral research and provide support to the MoE and public authorities in policy-making elaborating on the European Green Deal (GD) based on the research of current and expected impacts on the environment, the economy and society.	

(Continuation of Annex 9. Table 1: Research and innovation projects about construction circular economy.)

Name of project	Title	Funding body/ies	Purpose of the project	Weblink/Access
			The Center consists of 12 research institutions and universities with broad expertise and will focus on 3 main goals: 1) Environmental and socioeconomic policy evaluation where the project will develop quantitative methods for ex-post evaluation and evaluate the effectiveness of environmental policies. The team will ex ante evaluate the impacts of the GD, compile macro-econometric and CGE models and use optimization and simulation models, including regional input-output analysis, to verify the impacts of scenarios. The project will establish a knowledge transfer hub to co-design policies as a shared analytical database with knowledge transfer among bodies of the strategic cycle chain. 2) Development and application of foresight methods: The project will also develop foresight methods to identify new trends in the form of development scenarios to map transformation processes in society, research and technologies, constituting assumptions for the identification of current and future socioeconomic and environmental challenges and their impacts. 3) Incorporating attitudes and behavior into the policy-making process: The team will develop approaches drawing from experimental and behavioral economics, social psychology and sociology. We will design and conduct behavioral experiments, evaluating the effects and acceptability of policy measures and readiness for structural changes in the direction set in the GD. Periodical sociological surveys on public opinion related to environmental problems will improve understanding of how to communicate complex policies.	
CONDEREFF	Construction & demolition waste management policies for improved resource efficiency	ENEA	The CONDEREFF project brought together 8 partners from 7 countries to exchange experiences and practices on how to move forward from existing procedures on C&D waste management towards the adoption and further exploitation of the best practices and measures applied in the field. The project focused on the possibility to enable the participating regions to advance their goals for resource efficiency and green growth through the proper management of C&D waste, which can boost demand for C&D recycled materials and support both sustainability and recycling in the construction sector.	https://projects2014-2020.interregeurope.eu/condereff/

(Continuation of Annex 9. Table 1: Research and innovation projects about construction circular economy.)

Name of project	Title	Funding body/ies	Purpose of the project	Weblink/Access
DECORUM	DEmolition and COnstruction Recycling Unified Management	ENEA	Support platform for the interaction of the various players involved in all phases of the life cycle of public works (clients/contracting authorities; designers, project managers, inspectors, analysis laboratories, construction and demolition companies, producers of recycled materials for construction and operators of treatment plants and production of recycled aggregates). The platform allows the integrated management of the various phases ensuring compliance with regulatory and environmental requirements and is divided into different sections and functional modules for the various users.	https://www.icesp.it/buone-pratiche/decorum-demolition-and-construction-recycling-unified-management
Terre Circolari	Terre Circolari	Italferr/Circularity	Italferr, for an open innovation contest (OpenItaly 2021), with the start-up Circularity develops a Proof of Concept called Terre Circolari (Circular soils). It is a digital platform that allows the connection between the producer of excavated earth and rocks, users of by-products (companies that can reuse the materials in their industrial cycle) and recovery plants. This process also makes it possible to evaluate the most sustainable alternatives, by quantifying the CO2eq emitted and classifying the best scenarios.	https://circularity.com/en/casehistory/italferr-circular-by-product-management/
VALREC		National Spanish call	The main objective of the project is the industrial research and demonstration of new advanced and cost-effective solutions to ensure more efficient and traceable cycle closure (increased reliance on secondary materials in the market) of large volumes of major building material resources (mainly concrete, ceramics and gypsum) along the entire building material supply chain. VALREC PROPOSES 3 MAJOR SOLUTIONS: • Technology for better management and sorting of CDW. • Digitisation for the traceability of CDW through Blockchain. Ecodesign to obtain new products with a high market value.	https://gbce.es/blog/proyecto/valrec/

Annex 10. Questionnaire

Questionnaire questions

Stakeholders:

- Manufacturer/supplier
- Client/developers
- Contractor
- Designer
- Waste manager

Section 1. Participant information

1. Number of employees in your company/organization? **All stakeholders*
   - Less than 10
   - Less than 50
   - Less than 250
   - 250 or more

2. Annual turnover? **All stakeholders*
   - Less than £2 million
   - Less than £10 million
   - Less than £50 million
   - £50 million or more

3. Which option/s do/does define best your principal business activity? (you can select more than one answer) **Client, Contractor, Designer*
   a. Building refurbishing/retrofitting
   b. New building construction
   c. Civil infrastructures
   d. Demolition works
   e. Not a construction activity (Please specify)

4. Which of the following describes best your role in your company/organization? **All stakeholders*
   a. Director/ Chief executive officer
   b. Manager (project and site production, sustainability, finance, etc.)
   c. Production/employee
   d. Administration/finance
   e. Another role (please specify)

5. What is the type of material/product your company is specialised in /manufacture? (you can select more than one answer) **Manufacturer*
   a. Glass
   b. Ceramics
   c. Metal
   d. Concrete
   e. Gypsum
   f. Cement
   g. Timber
   h. Plastic
   i. Other (Please specify)

Section 2. Questions

6. Have your company defined construction waste reduction and recovery measurable targets? **All stakeholders*

a. Yes
b. No
c. Unsure

1. If yes, what waste recovery percentage are you targeting this year?
    a. Less than 70%
    b. 70%-80%
    c. 80-90%
    d. More than 90%
    e. Zero waste target

7. To what extent do you think the construction industry is implementing activities aligned with circular economy from the following polices? (Likert scale) **All stakeholders*

a. Extended Producer Responsibility schemes (EPR)
b. EU Taxonomy (Green finance businesses)
c. Green Public Procurement in construction (GPP)
d. Life-cycle assessment of construction products

8. Are you implementing any Extended Producer Responsibility scheme (EPR) on your product supplies from the following? (Likert scale)? **Manufacturer*

a. Expanded guarantee/warranty
b. End-of-life take-back scheme
c. Leasing
d. Setting a minimum percentage of reusable/recyclable products placed on the market
e. Reduced hazardous substances in construction products beyond legislation or standard requirements.
f. Reduced plastic content in construction products (plastic packaging)
g. Incorporation of end-of-life costs into product prices
h. Other (please specify)

9. Do you use/request circular economy certification schemes (e.g., ISO/TC 323 standards, XP X30-901, BS 8001, etc.) for organization management or products? **Manufacturer Client, Contractor, Designer*

a. Yes
b. No
c. Unsure

10. Do you use any national or international sustainable/green construction schemes from the following? (You can choose more than one option) **Client, Contractor, Designer*

a. LEED
b. BREEAM
c. Green Star
d. Other (please specify)
e. Not using any scheme

1. What percentage of your construction projects (approximately) are certified (or in the process of being certified) under the schemes you have identified?
    a. 0-10%
    b. 10-25%

c. 25-50%
d. 50-75%
e. 75-100%

11. Do you implement/require site waste management plans for your projects? **Client, Contractor*
    a. Yes
    b. No
    c. Unsure

    1. If yes, are the following items from the list below included in your site waste management plans? (yes/no/unsure)
        a. Waste types and quantities initial estimation
        b. Waste types and quantities validation (actual)
        c. Use of list of waste codes
        d. Identification of licensed waste operators participating in the waste removal
        e. Monitoring of waste generation
        f. Treatment and final use of each waste fraction
        g. Cost estimate for waste management
        h. Others (please specify)

12. Do you implement/require pre-demolition audits when working with demolition projects? **Client, Contractor*
    a. Yes
    b. No
    c. Unsure

    1. If yes, are the following items from the list below included in your pre-demolition audits/plans? Yes/no/unsure)
        a. Existing building data (age, location, exposure, etc.)
        b. Materials inventory
        c. Reuse considerations as a prior option
        d. Waste types and quantities
        e. Use of list of waste codes
        f. Identification of licensed waste operators participating in the waste removal
        g. Treatment and final use of each waste fraction
        h. Cost estimate for waste management
        i. Others (please specify)

13. Do you monitor the following activities in your construction projects as an organisation? (yes/no/unsure) **Client, Contractor, Waste manager*
    a. Sources of waste (e.g., project type, project characteristic, material exposure, etc.) *[Client, Contractor, Waste manager]*
    b. Type and quantity/volume of waste generated and collected. *[Client, Contractor, Waste manager]*
    c. Quantity/volume of waste that is separated/sorted. *[Client, Contractor, Waste manager]*
    d. Type and quantity/volume of waste disposed [*Waste manager]*
    e. Reused, recycled, backfilled and landfilled waste rates/volumes *[Client, Contractor]*
    f. Costs and expenses for landfill tax, waste management employees, damaged materials, collecting & sorting, storage, removal, etc. *[Client, Contractor, Waste manager]*
    g. Savings resulting from waste minimization/prevention. *[Client, Contractor]*
    h. Waste generation monitoring during time *[Client, Contractor]*

14. To what extent do you implement the following best practices? (Likert scale) **All stakeholders*

a. Design for disassembly *[Client, Contractor, Designer, Manufacturer]*
b. Adaptable building design *[Client, Contractor, Designer]*
c. Consideration of maintenance and repair options during design *[Client, Contractor, Designer]*
d. Use of modular (offsite) construction *[Client, Contractor, Designer]*
e. Use of durable materials *[Client, Contractor, Designer]*
f. Use of low-carbon/non-pollutant materials *[Client, Contractor, Designer, Manufacturer]*
g. Use of non-hazardous materials and products *[Client, Contractor, Designer, Manufacturer]*
h. Reverse logistics (maintain, repair, remanufacture) *[Client, Contractor, Designer, Manufacturer]*
i. Renovation instead demolition *[Client, Contractor, Designer]*
j. Deconstruction/selective deconstruction *[Client, Contractor]*
k. On-site sorting *[Contractor, Waste manager]*
l. Reuse of excavation soils on site [*Contractor]*
m. Use of reusable formworks [*Contractor]*
n. Processing waste as recycled aggregates (e.g. according to EN 13242+A1) *[Contractor, Waste manager]*
o. Recycling solutions other than backfilling *[Contractor, Waste manager]*
p. Recycling solutions *[Manufacturer]*
q. Use of secondary materials and products *[Contractor, Manufacturer, Waste manager]*
r. Setting up waste sorting/treatment plants *[Contractor, Waste manager]*
s. Return of plastic packaging (take back scheme) *[Contractor, Manufacturer, Waste manager]*

15. What stage of BIM maturity does your company implement? (According to ISO 19650 categorisation) **Client, Contractor, Designer*

a. No BIM application. Basic CAD drawings
b. Stage 1 - 2D CAD and 3D BIM models
c. Stage 2 - federated information models (structural, architectural, MEP, energy, etc.,)
d. Stage 3 - Open BIM
e. Unsure

1. Do you integrate waste management in your BIM model projects?
    a. Yes
    b. No
    c. Unsure

16. Do you use the following technologies in construction and demolition waste management? (Yes/no/unsure) **All stakeholders*

a. AI (artificial intelligence)
b. Blockchain
c. IoT (Internet of Things)
d. GIS (Geographical Information System)
e. Geo-spatial data analysis
f. VR (virtual reality)
g. AR (augmented reality)
h. Cybersecurity
i. Collaborative platforms
j. Robotics
k. Barcodes, QR codes or RFID

l. Others (Please specify)

17. Do you obtain the following environmental data about the materials/products you use in your projects? (Likert scale) **Client, Contractor, Designer, Waste manager*

a. Embodied energy (extraction, manufacturing, and end of life) *[Client, Contractor, Designer]*
b. Embodied carbon (extraction, manufacturing and end of life) *[Client, Contractor, Designer]*
c. Recyclability *[Client, Contractor, Designer, Waste manager]*
d. Percentage of recycled content *[Client, Contractor, Designer]*
e. Percentage/information about hazardous materials' content *[Client, Contractor, Designer, Waste manager]*
f. Biodegradability *[Waste manager]*

18. Do you provide the following environmental data of your products? (Likert scale) **Manufacturer*

a. Biodegradability
b. Embodied energy (extraction, manufacturing, and end of life)
c. Embodied carbon (extraction, manufacturing and end of life)
d. Recyclability
e. Percentage of recycled content
f. Percentage/information about hazardous materials' content

19. What sources do you use to collect environmental data? (You can choose more than one option) **All stakeholders*

a. National/regional statistics
b. Existing environmental databases
c. Information provided by manufacturer/supplier
d. Environmental Product certifications/other certificates
e. Others (please specify)

20. Do you have access to secondary materials from construction and demolition? **Manufacturer*

a. Always
b. Very Often
c. Sometimes
d. Rarely
e. Never

21. Do you have access to reused and recycled product markets for construction? **Client, Contractor*

a. Always
b. Very Often
c. Sometimes
d. Rarely
e. Never

22. Do you have always access to waste treatment facilities for the following waste types near your construction site? (Likert scale) **Contractor, Waste manager*

a. Mixed
b. Concrete
c. Ceramics
d. Timber
e. Steel

f. Glass
g. Plastics
h. Gypsum
i. Bituminous
j. Asbestos
k. Other hazardous waste

23. Do you consider the use of secondary/recycled and repurposed materials and products in your projects? *Client, Contractor, Designer*
a. Always
b. Very Often
c. Sometimes
d. Rarely
e. Never

24. To what extent do you consider different options/solutions/processes for waste upcycling (higher value uses)? **Manufacturer, Waste manager*
a. Always
b. Very Often
c. Sometimes
d. Rarely
e. Never

25. Do you develop any of the following services together with your products? (Likert scale) **Manufacturer*
a. Maintenance
b. Repair
c. Update
d. Replace
e. Inspection

26. Does your company use any digital reporting procedure of waste to the Government/local administration? **Client, Contractor, Waste manager*
a. Yes
b. No
c. Unsure

27. Are there any platforms/hubs for communication and collaboration in circular economy in your country/area? **All stakeholders*
a. Yes
b. No
c. Unsure

1. If yes to previous questions, do you use/benefit from them?
    a. Yes
    b. No
    c. Unsure

28. To what extent do you think the following statements are true? (Likert scale) **Contractor, Waste manager*
a. I have the right skills for the implementation of circular economy solutions in my company

b. I have the right skills for applying innovative solutions to waste management and recovery
c. Workers in my company are adequately trained for waste handling
d. Waste is conveniently and safely transported to its planned destination (recycling facilities, landfill, etc.)
e. Waste is conveniently and safely stored until its collection
f. The site workplace is tidy and safe

29. From which medium did you receive/find this survey questionnaire? **All stakeholders*

30. Finally, you can add any comments about this questionnaire if you like. **All stakeholders*

31. If you would like to have the opportunity to participate in future activities of RECONMATIC and be added to the RECONMATIC distribution list to be updated on news and events, you can reply 'yes' below and then add your contact details. The information provided will only be used for that purpose, and you can withdraw at any time. **All stakeholders*

31.1 Full name:
31.2 Company/organization:
31.1 Email address:

Annex 11. KPI's Array

Annex 11. Table 1: KPI's array with definition of calculation criteria and sources of information.

Category	Sub-category	Code	Indicators	Measurement criteria	Data origin	Participant group	Level 1	Level 2	Level 3	Level 4	Level 5
Governance	Mission / Vision / Values	GM1	Strategies for circular economy in construction sector	Type of strategy (national/local) and specific for construction industry	Review	---	Only local strategies, but no national reference	One or more local and national strategies with general focus on circular economy and sustainability	One or more local and national strategies, few of which are focused on circular economy in construction	One or more local and national strategies, most of which are focused on circular economy in construction, some targets defined	A number of local and national strategies with very well defined targets
		GM2	Programmes and schemes for circular economy in construction sector	Type of programmes/plans (national/local) and specific for construction industry	Review	---	Only local programmes/plan, but no national reference	One or more local and national programmes/plan with general focus on circular economy and sustainability	One or more local and national programmes/plan, few of which are focused on circular economy in construction	One or more local and national programmes/plan, mostly focused on circular economy in construction	A number of local and national programmes/plan with well defined actions
		GM3	Public and industry organizations working towards circular economy in construction sector	Type of public/industry organisations (national/local) working towards circular economy and specific for construction industry	Review (CP section 1.7)	---	Only local institutions/ organisations, but no national reference	One or more local and national institutions/organisations with general focus on circular economy and sustainability	One or more national institutions/organisations with focus on circular economy in construction. Low Government representativity	One or more national institutions/organisations with focus on circular economy in construction. The Government is linked to them and contribute to policy development (some policies already developed)	One or more national institutions/organisations with focus on circular economy in construction. The Government is linked to them and contribute to policy development, they are national reference and are inserted in a national strategy

(Continuation of Annex 11. Table 1: KPI's array with definition of calculation criteria and sources of information.)

Category	Sub-category	Code	Indicators	Measurement criteria	Data origin	Participant group	Level 1	Level 2	Level 3	Level 4	Level 5
Governance	Corporate environmental responsibility	GC1	Industry definition of measurable waste recovery targets	Percentage of targeted recovery by organisations. Calculated according to the highest frequency of responses. A minimum of 50% participants should have defined measurable targets.	Questionnaire (Q6)	All	Less than 70% without measurable waste targets.	70%-80%	80-90%	More than 90%	Zero waste target
		GC2	Implementation of Extended Producer Responsibility schemes	Option a in Q7 in considered. Summation of frequencies multiplied by factors (from 1 to 5) according to Likert scale. An average result is finally calculated. 'Unsure' responses are excluded.	Questionnaire (Q7)	All	1.0-1.9	2.0-2.9	3.0-3.9	4.0-4.7	4.8-5.0
		GC3	Implementation of EPR schemes.	Options a-e and g in Q8 are considered Summation of frequencies multiplied by factors (from 1 to 5) according to Likert scale. An average result is finally calculated.'Unsure' responses are excluded.	Questionnaire (Q8)	Manufacturer	1.0-1.9	2.0-2.9	3.0-3.9	4.0-4.7	4.8-5.0
		GC4	Implementation of measures towards reduction of plastic packaging	Option f in Q8 is considered. Frequency is multiplied by factors (from 1 to 5) according to Likert scale. An average result is finally calculated. 'Unsure' responses are excluded.	Questionnaire (Q8)	Manufacturer	1.0-1.9	2.0-2.9	3.0-3.9	4.0-4.7	4.8-5.0
		GC5	Implementation of Green Public Procurement in construction	Option c in Q7 is considered. Frequency is multiplied by factors (from 1 to 5) according to Likert scale. An average result is finally calculated. 'Unsure' responses are excluded.	Questionnaire (Q7)	All	1.0-1.9	2.0-2.9	3.0-3.9	4.0-4.7	4.8-5.0

(Continuation of Annex 11. Table 1: KPI's array with definition of calculation criteria and sources of information.)

Category	Sub-category	Code	Indicators	Measurement criteria	Data origin	Participant group	Level 1	Level 2	Level 3	Level 4	Level 5
Governance	Corporate environmental responsibility	GC6	Defining/Implementation of measurable GPP targets	Existence and type of targets within the application of GPP in the country and clear objectives/targets definition.	Review (CRF section)	---	No targets defined	Individual targets for some service/product categories	National defined targets for some service/product categories	National defined targets for all Aspects of GPP but in a very general way not providing any adequate measures or guidance.	National defined targets with clearly defined objectives in each procurement by all central government procurement
	Assessment and certification processes	GA1	Use of circular economy assessment tools/certification schemes	Percentage of 'yes' responses.	Questionnaire (Q9)	Client, Contractor, Designer, and Manufacturer	0-20%	21-40%	41-60%	61-80%	81-100%
		GA2	Use of sustainable/green construction schemes (e.g. LEED, BREEAM) that include circular economy aspects	Percentage ranges in Q10.1 are multiplied by factors (from 1 to 5) according to Likert scale. An average result is finally calculated. All participants in Q10 are included in the average. Any schemes which do not include CE should be avoided from the tally.	Review and Questionnaire (Q10 and Q10.1))	Client, Contractor, and Designer	0-0.9	1.0-1.9	2.0-2.9	3.0-3.9	4.0-5.0
	Green finance businesses (taxonomy)	GG1	Implementation of EU Taxonomy (or similar scheme) in the country	Option b in Q7 is considered. Summation of frequencies multiplied by factors (from 1 to 5) according to Likert scale. An average result is finally calculated. 'Unsure' responses are excluded.	Review and questionnaire (Q7)	All	1.0-1.9	2.0-2.9	3.0-3.9	4.0-4.7	4.8-5.0

(Continuation of Annex 11. Table 1: KPI's array with definition of calculation criteria and sources of information.)

Category	Sub-category	Code	Indicators	Measurement criteria	Data origin	Participant group	Level 1	Level 2	Level 3	Level 4	Level 5
Managerial	CE management	MM1	Implementation of site waste management plans on site	Percentage average of 'yes' responses from all options in Q11, excluding 'unsure' responses	questionnaire (Q11)	Client and Contractor	0-20%	21-40%	41-60%	61-80%	81-100%
		MM2	Implementation of waste audits	Percentage average of 'yes' responses from all options in Q12, excluding 'unsure' responses.	Questionnaire (Q12)	Client and Contractor	0-20%	21-40%	41-60%	61-80%	81-100%
		MM3	Monitoring of waste traceability	Percentage average of 'yes' responses from all options in Q13, excluding 'unsure' responses.	Questionnaire (Q13)	Client, Contractor, and Waste manager	0-20%	21-40%	41-60%	61-80%	81-100%
		MM4	Implementation of best practices	Summation of frequencies multiplied by factors (from 1 to 5) according to Likert scale. An average result is finally calculated. 'Unsure' responses are excluded. Each stakeholder average is calculated separately. A final average is obtained.	Questionnaire (Q14)	All	1.0-1.9	2.0-2.9	3.0-3.9	4.0-4.7	4.8-5.0
Technological	IT and digital systems	TT1	Level of BIM implementation	Levels are split based on ISO 19650 categorisation, and it is calculated according to the highest frequency of responses	Questionnaire (Q15)	Client, Contractor and Designer	No BIM application - basic CAD drawings	Stage 1 - 2D CAD and 3D BIM models	Stage 2 - federated information models	Stage 3 - Open BIM -	
		TT2	Integration of circular economy in BIM	Percentage of 'yes' responses	Questionnaire (Q15.1)	Client, Contractor and Designer	0-20%	21-40%	41-60%	61-80%	81-100%
		TT3	Implementation of digital tools for CE	Percentage average of 'yes' responses to all options in Q16.	Questionnaire (Q16)	All	0-20%	21-40%	41-60%	61-80%	81-100%

(Continuation of Annex 11. Table 1: KPI's array with definition of calculation criteria and sources of information.)

Category	Sub-category	Code	Indicators	Measurement criteria	Data origin	Participant group	Level 1	Level 2	Level 3	Level 4	Level 5
Technological	Data management	TD1	Availability of product environmental data	Summation of frequencies multiplied by factors (from 1 to 5) according to Likert scale. An average result is finally calculated. 'Unsure' responses are excluded. Each stakeholder average is calculated separately. A final average is obtained.	Questionnaire (Q17 & Q18)	All	1.0-1.9	2.0-2.9	3.0-3.9	4.0-4.7	4.8-5.0
		TD2	CDW data collection methods (project and national)	Highest frequency of responses.	Review and questionnaire (Q19)	All	National/regional statistics	Existing environmental databases	Information provided by manufacturer/supplier	Environmental Product certifications/other certificates	
		TD3	Digital reporting of CDW data	Percentage of 'yes' responses	Questionnaire (Q26)	Client, Contractor, and Waste manager	0-20%	21-40%	41-60%	61-80%	81-100%
	Infrastructures	TI1	Available recycling facilities for CDW	Summation of frequencies multiplied by factors (from 1 to 5) according to Likert scale. An average result is finally calculated. 'Unsure' responses are excluded	Questionnaire (Q22)	Contractor	1.0-1.9	2.0-2.9	3.0-3.9	4.0-4.7	4.8-5.0
		TI2	Available markets for reused and recycled construction products and materials	Summation of frequencies multiplied by factors (from 1 to 5) according to Likert scale. An average result is finally calculated. 'Unsure' responses are excluded. Each stakeholder average is calculated separately. A final average is obtained.	Review and questionnaire (Q20 and Q21)	Client and Contractor	1.0-1.9	2.0-2.9	3.0-3.9	4.0-4.9	5.0-5.9

(Continuation of Annex 11. Table 1: KPI's array with definition of calculation criteria and sources of information.)

Category	Sub-category	Code	Indicators	Measurement criteria	Data origin	Participant group	Level 1	Level 2	Level 3	Level 4	Level 5
Technological	Infrastructures	TI3	Available communication/collaboration platforms for the development/ implementation of CE value chains	Type of platform (national/local) working towards CE and whether they are specific for construction.	Review and questionnaire (Q27)	All	Only local platforms/initiatives but no national reference	One or more local and national platforms with general focus on circular economy and sustainability, but not focused on construction	One or more local and national platforms few of which are focused on circular economy in construction	One or more local and national platforms, most of which are focused on circular economy in construction	A number of local and national platforms, most of which are specific to circular economy in construction. The Government is linked to them and contribute to policy development.
Economic	Circular business	EC1	Use of secondary materials	Summation of frequencies multiplied by factors (from 1 to 5) according to Likert scale. An average result is finally calculated. 'Unsure' responses are excluded.	Questionnaire (Q23)	Client, Contractor, Designer, and Manufacturer	1.0-1.9	2.0-2.9	3.0-3.9	4.0-4.7	4.8-5.0
		EC2	Servitization	Summation of frequencies multiplied by factors (from 1 to 5) according to Likert scale. An average result is finally calculated. 'Unsure' responses are excluded.	Questionnaire (Q25)	Manufacturer	1.0-1.9	2.0-2.9	3.0-3.9	4.0-4.7	4.8-5.0
		EC3	Implementation of waste up-cycling	Summation of frequencies multiplied by factors (from 1 to 5) according to Likert scale. An average result is finally calculated. 'Unsure' responses are excluded.	Questionnaire (Q24)	Manufacturer and Waste manager	1.0-1.9	2.0-2.9	3.0-3.9	4.0-4.7	4.8-5.0

(Continuation of Annex 11. Table 1: KPI's array with definition of calculation criteria and sources of information.)

Category	Sub-category	Code	Indicators	Measurement criteria	Data origin	Participant group	Level 1	Level 2	Level 3	Level 4	Level 5
Economic	Economic incentives	EI1	Landfill tax	Introduction of landfill tax for disposing CDW and the tax credits for diverting CDW from landfill sites.	Review (CRF)	---	No landfill tax	Landfill tax to few sites	Landfill tax to most/all sites	Landfill tax to most/all sites and tax credits for sending waste from landfill to recovery	-
		EI2	Illegal dumping fines	Max penalty/average population income.	Review	---	Less than 0.5	0.5-1.0	1.0-1.5	1.5-2.0	More than 2.0
Environmental	CDW statistics	NS1	CDW generation per capita (Tonne/inhab)	Percentage of CDW generation per capita. (Based on 2018 data)	Review (CP section 1.1)	---	Less than 0.5	0.5-1.0	1.0-1.5	1.5-2.0	More than 2.0
		NS2	CDW generation (Tonne/construction gross domestic products)	Percentage of CDW generation divided by construction GDP. (Based on 2018 data)	Review (CP section 1.1)	---	Less than 0.001	0.001-0.0049 (.00382)	0.005-0.009	0.01-0.049	More than 0.05
		NS3	Hazardous waste generation	Percentage of hazardous waste generation respect to total CDW generation (Based on 2018 data)	Review (CP section 1.1)	---	More than 2%	1.5-2.0%	1.0-1.5%	0.5-1.0%	Less than 0.5%
		NS4	CDW recovery rate	Percentage of CDW recovery including excavation waste. (Based on 2018 data)	Review (CP section 1.1)	---	Less than 70%	70%-80%	80-90%	More than 90%	100%

(Continuation of Annex 11. Table 1: KPI's array with definition of calculation criteria and sources of information.)

Category	Sub-category	Code	Indicators	Measurement criteria	Data origin	Participant group	Level 1	Level 2	Level 3	Level 4	Level 5
Environmental	CDW statistics	NS5	Incineration	Percentage of CDW incineration volume respect to total CDW generation.	Review	---	More than 20%	15%-20%	10%-15%	Less than 10%	Zero inicineration
		NS6	CDW landfilling rate	Percentage of CDW landfilling respect to total CDW generation.	Review	---	More than 30%	20%-30%	10%-20%	Less than 10%	Zero landfilling
		NS7	Illegal dumping percentage	Percentage of CDW illegal dumping respect to total CDW generation	Review	---	More than 20%	10-20%	5%-10%	Less than 5%	Zero illegal dumping
	Circular Design	ND1	Consideration of disassembly in design	Option a in Q14 is considered. Summation of frequencies multiplied by factors (from 1 to 5) according to Likert scale. An average result is finally calculated. 'Unsure' responses are excluded.	Questionnaire (Q14)	Client, Contractor, Designer, and Manufacturer	1.0-1.9	2.0-2.9	3.0-3.9	4.0-4.7	4.8-5.0
		ND2	Consideration of maintenance and repair in design	Option c in Q14 is considered. Summation of frequencies multiplied by factors (from 1 to 5) according to Likert scale. An average result is finally calculated. 'Unsure' responses are excluded.	Questionnaire (Q14)	Client, Contractor, and Designer	1.0-1.9	2.0-2.9	3.0-3.9	4.0-4.7	4.8-5.0
		ND3	Consideration of the use of durable materials in design	Option e in Q14 is considered. Summation of frequencies multiplied by factors (from 1 to 5) according to Likert scale. An average result is finally calculated. 'Unsure' responses are excluded.	Questionnaire (Q14)	Client, Contractor and Designer	1.0-1.9	2.0-2.9	3.0-3.9	4.0-4.7	4.8-5.0

(Continuation of Annex 11. Table 1: KPI's array with definition of calculation criteria and sources of information.)

Category	Sub-category	Code	Indicators	Measurement criteria	Data origin	Participant group	Level 1	Level 2	Level 3	Level 4	Level 5
Environmental	Circular Design	ND4	Consideration of non-hazardous materials in design	Option g in Q14 is considered. Summation of frequencies multiplied by factors (from 1 to 5) according to Likert scale. An average result is finally calculated. 'Unsure' responses are excluded.	Questionnaire (Q14)	Client, Contractor, Designer, and Manufacturer	1.0-1.9	2.0-2.9	3.0-3.9	4.0-4.7	4.8-5.0
		ND5	Consideration of the use of secondary materials in design	Option q in Q14 is considered. Summation of frequencies multiplied by factors (from 1 to 5) according to Likert scale. An average result is finally calculated. 'Unsure' responses are excluded.	Questionnaire (Q14)	Contractor, Manufacturer, and Designer	1.0-1.9	2.0-2.9	3.0-3.9	4.0-4.7	4.8-5.0
		ND6	Consideration of modular (off-site) construction in design	Option d in Q14 is considered. Summation of frequencies multiplied by factors (from 1 to 5) according to Likert scale. An average result is finally calculated. 'Unsure' responses are excluded.	Questionnaire (Q14)	Client, Contractor, and Designer	1.0-1.9	2.0-2.9	3.0-3.9	4.0-4.7	4.8-5.0
		ND7	Consideration of adaptable building design	Option b in Q14 is considered. Summation of frequencies multiplied by factors (from 1 to 5) according to Likert scale. An average result is finally calculated. 'Unsure' responses are excluded.	Questionnaire	Client, Contractor, and Designer	1.0-1.9	2.0-2.9	3.0-3.9	4.0-4.7	4.8-5.0
Social	Knowledge, skills and awarenee	SK1	Awareness of available recovery solutions for CDW	Option a in Q28 is considered. Summation of frequencies multiplied by factors (from 1 to 5) according to Likert scale. An average result is finally calculated. 'Unsure' responses are excluded.	Questionnaire (Q28)	Contractor, and Waste manager	1.0-1.9	2.0-2.9	3.0-3.9	4.0-4.7	4.8-5.0

(Continuation of Annex 11. Table 1: KPI's array with definition of calculation criteria and sources of information.)

Category	Sub-category	Code	Indicators	Measurement criteria	Data origin	Participant group	Level 1	Level 2	Level 3	Level 4	Level 5
Social	Knowledge, skills and awareness	SK2	Knowledge and skills in effective/ innovative solutions and methods for CDW reuse and recycling	Option b in Q28 is considered. Summation of frequencies multiplied by factors (from 1 to 5) according to Likert scale. An average result is finally calculated. 'Unsure' responses are excluded.	Questionnaire (Q28)	Contractor, and Waste manager	1.0-1.9	2.0-2.9	3.0-3.9	4.0-4.7	4.8-5.0
	Health and safety	SH1	Training for waste handling	Option c in Q28 is considered. Summation of frequencies multiplied by factors (from 1 to 5) according to Likert scale. An average result is finally calculated. 'Unsure' responses are excluded.	Questionnaire (Q28)	Contractor, and Waste manager	1.0-1.9	2.0-2.9	3.0-3.9	4.0-4.7	4.8-5.0
		SH2	Adequate waste transport measures	Option d in Q28 is considered. Summation of frequencies multiplied by factors (from 1 to 5) according to Likert scale. An average result is finally calculated. 'Unsure' responses are excluded.	Questionnaire (Q28)	Contractor, and Waste manager	1.0-1.9	2.0-2.9	3.0-3.9	4.0-4.7	4.8-5.0
		SH3	Adequate waste storage	Option e in Q28 is considered. Summation of frequencies multiplied by factors (from 1 to 5) according to Likert scale. An average result is finally calculated. 'Unsure' responses are excluded.	Questionnaire (Q28)	Contractor, and Waste manager	1.0-1.9	2.0-2.9	3.0-3.9	4.0-4.7	4.8-5.0
		SH4	Reduction of H&S risks onsite	Option f in Q28 is considered. Summation of frequencies multiplied by factors (from 1 to 5) according to Likert scale. An average result is finally calculated. 'Unsure' responses are excluded.	Questionnaire (Q28)	Contractor, and Waste manager	1.0-1.9	2.0-2.9	3.0-3.9	4.0-4.7	4.8-5.0