This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 723583

RE[4] Project

REuse and REcycling of CDW materials and structures in energy efficient pREfabricated elements for building REfurbishment and construction

D1.2 Statistics Assessment	
Author(s)1:	CETMA
Date:	31/05/2017
Work package:	WP1 - Mapping and analysis of CDW reuse and recycling in prefabricated elements
Distribution[2]	PU
Status[3]:	Draft
Abstract:	The deliverable D1.2 (Statistics Assessment) belongs to T1.1 (WP1). The scope of this report is to assess the information and data collected into the deliverable D1.1 (Data collection on CDW), submitted in M9, in order to: compare the data collected with data coming from other studies in progress at the time of the Project proposal writing; identify sources of inaccuracy (e.g. scarce authority of the source, figures statistically insignificant, skewed purposely or misinterpreted) or, on the contrary, the best practices regarding statistics in participating countries; formulate recommendations to ensure that CDW can be effectively traced and that statistics duly reflect the actual waste arising.
File Name	Deliverable D1.2_StatisticsAssessment_Final_V4.0

Version	Date	Description	Written By	Approved by
0.0	26/04/2017	Initial draft version	CETMA	
1.0	25/05/2017	Draft version for revision	CETMA	
2.0	26/05/2017	Draft version for QC revised by STRESS	CETMA	

1Just mention the partner(s) responsible for the Deliverable
2 PU: Public, RE: restricted to a group specified by the consortium, CO: Confidential, only for members of the consortium; Commission services always included.
3 Draft, Revised, Final

3.0	29/05/2017	Draft version for QC revised by ROS	CETMA	
4.0	31/05/2017	Final version	CETMA	Project Coordinator

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ACRONYMS & ABBREVIATIONS

ADEME	French Environment and Energy Management Agency
ANMP	National Association of Portuguese Municipalities
BIBM	Federation for the European Precast Concrete Industry
BRE	Building Research Establishment
BREEAM	Building Research Establishment Environmental Assessment Method
CDW	Construction and Demolition Waste
C&D	Construction & Demolition
CYSTAT	Statistical Service of Cyprus
DEFRA	Department for the Environment, Food and Rural Affairs
DEPA	The Danish Environmental Protection Agency
DoA	Description of the Action
EAPA	European Asphalt Pavement Association
ERMCO	European Ready Mixed Concrete Organization
EWC	European Waste Classification
EWC-STAT	European Waste Classification for statistics
EU	European Union
GGP	Green Public Procurement
ISAG	Information System for waste and recycling
ISOH	Database of the Ministry of Environment
LCA	Life Cycle Assessment
LCC	Life Cycle Cost
LoW	List of Waste
MS	Member State
MUD	Modello Unico di Dichiarazione Ambientale
NACE	Statistical classification of economic activities in the European Community
NSO	National Statistics Office
PAH	Polycyclic Aromatic Hydrocarbons
PC	Participating Country (in RE^4-project)
QC	Quality Check
SIRAPA	The Portuguese Environment Agency`s Integrated Registration System
SMED	Svenska Miljö Emissions Data
SWMP	Site Waste Management Plan
UK	United Kingdom
WFD	Waste Framework Directive
WP	Work Package
WRAP	Waste Resources Action Programme

1. EXECUTIVE SUMMARY

1.1 The **deliverable D1.2** (Statistics Assessment) belongs to Task 1.1 (Diagnosis of CDW management in EU) of the WP1 (Mapping and analysis of CDW reuse and recycling in prefabricated elements) that concerns the need of a baseline study to define a collective outline and to map the current best practices related to various aspects of reuse and recycling of CDW in prefabricated elements (including technological, standardization issues and policy measures).

1.2 The **primary objective** of this report is to assess the information and data collected into the deliverable D1.1 (Data collection on CDW), submitted in M9, in order to:

- compare the collected data with data coming from other studies in progress at the time of the Project proposal writing (January 2016);
- identify sources of inaccuracy (e.g. scarce authority of the source, figures statistically insignificant, skewed purposely or misinterpreted) or, on the contrary, the best practices regarding statistics in participating countries;
- formulate recommendations to ensure that CDW can be effectively traced and that statistics duly reflect the actual waste arising.

1.3 This report is useful for several **stakeholders**, such as RE^4-Project partners and anyone involved in the management of CDW, or involved in making decisions that could affect its generation (i.e. policymakers, developers, contractors, site managers, etc.).

1.4 The **methodology** used is based on a four-stage approach: 1. Study design; 2. Data collection; 3. Data analysis, and 4. Statistics assessment, and it is finalized to collect and analyse the quantitative and qualitative data necessary for the assessment of the current situation regarding the management of CDW within the EU and Taiwan (the extra-EU country involved in the Project) against the background of national (and/or regional, where appropriate) waste management plans and prevention programmes.

1.5 **Information** has been **sourced** from deliverable D1.1 and other available public sources including comprehensive reports and scientific literature listed in the references section.

1.6 The **structure of the report** is composed of the following chapters and contents:

Chapter 1 (Executive summary) gives the main points of the report, wrapping up the main conclusions of the document.

Chapter 2 (Introduction) gives a brief description of RE^4- Project, summarises the final scope of the report and provides details about links with other deliverables of the Project (e.g. D1.1).

Chapter 3 offers an **overview of the methodology** employed in carrying out this assessment study describing the general approach used, the main phases of the statistics assessment plan

and identifying the key studies analysed to compare and contrast information and data collected.

Chapter 4 analyses the **availability and quality of CDW data and sources** in EU Member States and in Taiwan, identifying and describing some good and bad practices of statistics methodologies applied at national level.

In general, for CDW statistics data, it is difficult to obtain sufficient and standardize information for all of the EU-28 Member States (EU-28 MS) (especially in the recycling rate). In fact, each Member State can freely decide on the data collection methods to be used (i.e. surveys, administrative or other sources, or some combination of these methods). As reported in the study "Resource Efficient Use of Mixed Waste" by Deloitte, most of the MS, that present a similar level of data quality, are geographically clustered and can be divided into three categories (good data quality, modest data quality, and poor data quality, (Table 5). In deliverable D1.1, methodologies for CDW statistics are collected, and some good practices are identified in EU countries (such as Denmark, Germany, The Netherlands, etc.) together with bad practice examples (e.g. Romania).

Chapter 5 focuses on the key aspects of CDW management in terms of definition of CDW in EU MS, CDW generation and treatments, identified national policies, regulations and non-legislative instruments, key drivers and barriers for increasing resource efficiency in CDW management.

In most European countries there was an increase in the generation of CDW in the last decade (2004-2014) from 766 million tonnes in 2004 (first reference year for EUROSTAT waste data) to 868 million tonnes in 2014 (last reference year available), with an increment of 13% in 10 years. This category of waste constitutes one of the largest waste streams, since it represents the 35% of the total waste in EU-28 MS analysed in this report. The CDW generated by the EU countries include high proportion of inert materials (e.g. concrete, masonry, asphalt, etc.), but also of wood, metal, glass, gypsum and plastics as well as hazardous substances (treated wood, lead paint and asbestos from demolished old buildings). The data related to generation of CDW (Figure 5 and Figure 6) show important differences between EU countries. This wide geographical variation could be viewed as lower estimates, as this type of waste is often dumped illegally. The data are also hard to interpret because of the different waste definitions and reporting mechanisms in different countries. Other reasons are economic situation of the country, the local architectural habits, and cultural or technical issues.

For what concerns recycling of CDW, data and information are very limited, particularly regarding their development over time. The term recycling is difficult to apply consistently to CDW across countries as there is a broad range of recycling and recovery activities executed. In order to compare the CDW treatment performance in the last reference year (2014) between EU-28 MS, and have a reliable result, EUROSTAT database is used and the category "EWC_12.1 Mineral waste from construction and demolition" (Figure 6) selected. In 2014, 273

million tonnes of non-hazardous mineral waste from C&D were treated in the EU-MS. Looking at the types of waste treatment operation employed in 2014, 82% of this waste was subject to recycling, 11% to landfilling and 6% to backfilling. Significant differences may be observed among the EU MS concerning the use they made of the various treatment methods. For instance, some EU countries had very high recovery (other than energy recovery) rates (e.g. Germany, United Kingdom, France and Italy).

In terms of recycling rate (and comparison with the target of 70% recycling of construction, demolition and excavation waste across Europe by 2020 introduced by Waste Framework Directive 2008/98/EC) the latest figures available (Figure 15) would indicate that progress is being made and the EU target is achievable. However, closer examination of the figures reveals that there is a huge difference between the top performers and those who as yet have not grasped the opportunity presented by CDW recycling. The main reasons for these differences are related to the availability of waste management facilities in the different MS, high level of landfill tax or landfill ban on recyclables.

Several drivers for increasing resource efficiency in CDW management are identified as one of the main outputs of data collection and statistics assessment activities and can be divided into the following main categories: legal and regulatory drivers, economic drivers, social and cultural drivers, local geography and infrastructure drivers. For each category, one or more driving forces are described in detail. Together with drivers, a categorized list of barriers are highlighted that represent the primary obstacles to the increment of the second raw materials used in construction practice.

Even if secondary raw materials market is not still well developed in Europe, it represents a big business opportunity in the next years. The outlook is especially promising in Western Europe, where authorities are creating legal frameworks and encouraging the development of CDW recycling services.

The final section, **Chapter 6**, proposes a number of **lessons learned and defines a limited set of key recommendations**, evaluating all real or acclaimed distortions recognized, split up over regulatory changes, clarification guidance and other non-regulatory recommendations.

The document is complemented by a section of **references** and **3 annexes** (Annex 1. List of national authorities (directly/indirectly) consulted; Annex 2. (A and B) Legislative and regulatory overview and Non legislative instruments overview; Annex 3 List of CDW recycling facilities identified per country).

2. INTRODUCTION

2.1 Background - RE^4 in a nutshell

The **overall goal of the RE^4-Project** is to promote new technological solutions for the design and development of structural and non-structural pre-fabricated elements with high degree of recycled materials and reused structures from partial or total demolition of buildings. The developed technologies will aim at energy efficient new construction and refurbishment, thus minimizing environmental impacts. The RE^4-Project targets the demonstration of suitable design concepts and building elements produced from CDW in an industrial environment, considering perspective issues for the market uptake of the developed solutions. The technical activities will be supported by LCA and LCC analyses, certification and standardization procedures, demonstration activities, professional training, dissemination, commercialisation and exploitation strategy definition, business modelling and business plans. The overarching purpose is to develop a RE^4-prefabricated energy-efficient building concept that can be easily assembled and disassembled for future reuse, containing up to 65% in weight of recycled materials from CDW (ranging from 50% for the medium replacement of the mineral fraction, up to 65% for insulating panels and concrete products with medium mineral replacement coupled with the geopolymer binder). The reusable structures will range from 15-20% for existing buildings to 80-90% for the RE^4-prefabricated building concept.

2.2 Scope of the report and links with other Project Deliverables

The deliverable **D1.2**: **Statistics Assessment** belongs to the *Diagnosis of CDW management in EU Task* (T1.1) of the *Mapping and analysis of CDW reuse and recycling in prefabricated elements* (WP1). **WP1** concerns the need of a baseline study to define a collective outline and to map the current best practices related to various aspects of reuse and recycling of CDW in prefabricated elements (including technological, standardization issues and policy measures).The specific objectives of WP1 are the following:

- reviewing and mapping the current situation of re-use and recycling of different CDW materials, processes and technologies, with specific reference to prefabricated elements;
- reviewing current European legislation regarding CDW in general, specifically legislation and current situation in the countries of the partners, including costs of landfill disposal;
- providing inputs to feed the Decision support system (DSS) function related to possible end-uses (WP2).

According to the Description of the Action (DoA), the scope of this report is to assess the information and data collected into the deliverable D1.1 (Data collection on CDW), submitted in M9, in order to:

- compare the collected data with data coming from other studies in progress at the time of the Project proposal writing (January 2016);
- identify sources of inaccuracy (e.g. scarce authority of the source, figures statistically insignificant, skewed purposely or misinterpreted) or, on the contrary, the best practices regarding statistics in participating countries;

- formulate recommendations to ensure that CDW can be effectively traced and that statistics duly reflect the actual waste arising.

2.3 Geographical scope and level of detail

This report focuses on EU-28 Member States and one non-EU Countries (Taiwan). The countries involved in RE^4-Project like Partners are Italy, United Kingdom, Sweden, Spain, Belgium, Germany, Czech Republic, and Taiwan. A brief description of CDW recycling market at global level is also included in order to better understand the framework in which the European market is inserted. Clearly the level of detail (in comparison with D1.1) cannot be great, because the scope of this report is to draw attention to more specific issues and provide comparison between different countries.

2.4 Who should read this report

This report is addressed to several **stakeholders**, primarily to RE^4-Project partners and to all actors directly or indirectly involved in the management of CDW, or involved in making decisions that could affect its generation (i.e. policymakers, developers, contractors and site managers, etc.).

2.5 Structure of the document and contents

In order to fulfil the abovementioned objectives, this deliverable is broken down into the following chapters:

- **Chapter 1** (Executive summary) gives the main points of the report, wrapping up the main conclusions of the document.
- **Chapter 2** (Introduction) gives a brief description of RE^4- Project, summarises the final scope of the report and provides details about links with other deliverables of the Project (D1.1).
- **Chapter 3** offers an **overview of the methodology** employed in carrying out this assessment study describing the general approach used, the main phases of the statistics assessment plan and identifying the key studies analysed to compare and contrast information and data collected.
- **Chapter 4** analyses the **availability and quality of CDW data and sources** in EU Member States and Taiwan, identifying and describing some good and bad practices of statistics methodologies applied at national level.
- **Chapter 5** focuses on the **key aspects of CDW management** in terms of definition of CDW in EU MS, CDW generation and treatments, identified national policies, regulations and non-legislative instruments, Key drivers and barriers for increasing resource efficiency in CDW management.
- **Chapter 6** (Conclusion), proposes a number of **lessons learned and defines a limited set of key recommendations**, evaluating all real or acclaimed distortions recognized, split up over regulatory changes, clarification guidance and other non-regulatory recommendations. They include both measures/actions that the Commission can take, e.g. where guidance from the Commission could be useful to improve the situation at national/regional/local level, and

problems that could be solved by national/regional/local authorities of the MS. The core part is devoted to "*CDW data quality and comparability at EU level*", that is the main objective of this report.

- The document is complemented by a section of **references** and **3 annexes** (Annex 1. List of national authorities (directly/indirectly) consulted; Annex 2. (A and B) Legislative and regulatory overview and Non legislative instruments overview; Annex 3 List of CDW recycling facilities identified per each country).

3. APPROACH AND ASSESSMENT METHODOLOGY

3.1 Description

CETMA and the other involved Project partners developed a four-stage methodology to collect and analyse the quantitative and qualitative data necessary for the assessment of the current situation regarding the management of C&D waste within the EU and Taiwan (the extra-EU country involved in the Project).

The assessment methodology was based on the following requirements:

- simple and straight forward in order to summarise the main content and the results of the D1.1
- enable an easy and quick comparison between D1.1 data and other studies
- repeatable for future assessments
- include an overall qualitative assessment.

The statistics assessment plan involved the workflow as depicted in Figure 1.

Figure 1 Data analysis plan workflow

STAGE 1. Study design includes:

- the definition of a **list of countries** to be considered and **partners responsibilities** for data collection in those countries
- the **identification of data and information** on CDW management to be collected and analysed (as described in D1.1)
- the definition of **timeline** for the assessment activity.

The following table (Table 1) synthesizes the main phases and tasks, responsibilities and deadlines of the statistics assessment plan.

STAGES OF STATISTICSS ASSESSMENT PLAN	Responsible	DEADLINE
STAGE 1. STUDY DESIGN	**CETMA**	**30/09/2016**

STAGES OF STATISTICSS ASSESSMENT PLAN	Responsible	DEADLINE
Definition of a list of countries to be considered and partners responsibilities for data collection in those countries	CETMA and all partners involved in this task	15/09/2016 (during the Project kick-off meeting)
Identification of data and information on CDW management	CETMA	20/09/2016
Planning of the activities	CETMA	20/09/2016
STAGE 2. DATA COLLECTION	**CETMA**	**28/02/2017**
Start of desk study	CETMA and all partners involved in this task	30/11/2016
Start of field study - Involvement of key stakeholders	CETMA and all partners involved in this task	30/11/2016
Data collection (submission of D1.1)	CETMA	28/02/2017
STAGE 3. DATA ANALYSIS	**CETMA**	**30/04/2017**
Analysis of data and information collected	CETMA	30/04/2017
STAGE 4. STATISTICS ASSESSMENT	**CETMA**	**31/05/2017**
First draft of the D1.2	CETMA	26/04/2017
Second draft version of D1.2 for the internal reviewers (ROS and STRESS)	CETMA	25/05/2017
Final version of D1.2, ready for submission	CETMA	31/05/2017

Table 1 Stages of Statistics assessment plan

STAGE 2. Data collection (What we did in D1.1)

The data collection activity is characterized by two different and complementary methods: the desk study and field study.

The desk study consists of the collection and the review of data and information already available and it was carried out at the second stage of the Statistics assessment plan. A properly designed desk study includes:

- Identification of the main sources to be used
- Selection and collection of the main data
- Review and interpretation of the data available.

In addition to literature and online sources, a range of relevant stakeholders were contacted during the consultation phase of D1.1 production. Each partner has provided information about the belonging country, establishing direct contacts (if necessary) with the relevant stakeholders that were able to provide the information required for this assessment. The majority of stakeholders were primarily from the Ministry of Environment or the proper Agency for Environmental Protection and Research (e.g. ISPRA in Italy) for the quantitative data on CDW. Interviews (where convenient), by telephone or by email with relevant stakeholders were conducted to assess the quality of information already collected in the desk study and to gain information and data not available through desk research. Interviews were not formally structured, but lead by the demand for data and information in the given case based on the draft fact sheets.

The organisations/sources listed in the ANNEX 1 provided significant input to deliverable D1.1 and indirectly to D1.2.

STAGE 3. Data analysis
The results of all stakeholders inputs (field study) are combined with the outcome of the literature research (desk study) and analysed for each key topic identified during the study design phase.

STAGE 4. Statistics assessment (What we did in D1.2)
Before making conclusions and recommendations from the results, it is important to understand the reliability of the data and the assumptions used to generate these results. Checks need to be conducted to reveal significant issues, and check for completeness and consistency should be also conducted. This is the main goal of D1.2.

3.2 Other studies analysed for the assessment

For the statistics assessment of data and information identified and collected by RE^4 Partners involved in this task, it is decided to compare them with analyses provided by another study completed in August 2016, entitled "*Resource Efficient Use of Mixed Wastes*". It is a project of the European Commission, led by BIO by Deloitte in partnership with BRE, ICEDD, VTT, RPS and FCT of NOVA University of Lisbon (online source). This study aims to investigate the current CDW management situation in EU MS. At the time of Project proposal writing, this study was on going and results not available.

Another document considered is a study that the European Commission published in 2011 (Service contract on management of construction and demolition waste by BIO Intelligence Service by Deloitte) and in which the existing situation of CDW recycling is analysed (Bio Intelligence Service 2011b).

4. AVAILABILITY AND QUALITY ASSESSMENT OF CDW-RELATED DATA AND SOURCES IN EU MEMBER STATES AND TAIWAN (GOOD & BAD PRACTICES)

The quality, in the general statistical sense, denotes the closeness of computations or estimates to the (unknown) exact or true values. Statistics are never identical with the true values because of variability (the statistics change from implementation to implementation of the survey due to random effects) and bias (the average of the estimates from each implementation is not equal to the true value due to systematic effects). A basic distinction is between sampling and non-sampling errors, which are both subject to variability as well as bias.

In this paragraph it is analysed the collection methods identified in D1.1 and the quality of CDW data.

The main common source for CDW data (in terms of **waste generation** and **treatment**) used in D1.1 was EUROSTAT (last reference year of available data is 2014), as reported in Table 2 and in ANNEX 1.

Country	Last reference year	Main source
Belgium	2014	EUROSTAT
Bulgaria	2014	EUROSTAT
Cyprus	2014	EUROSTAT
Croatia	2014	EUROSTAT
Estonia	2014	EUROSTAT
France	2014	EUROSTAT + ADEME (for data of 2012)
Greece	2014	EUROSTAT
Hungary	2014	EUROSTAT
Latvia	2014	EUROSTAT
Lithuania	2014	EUROSTAT
Luxembourg	2014	EUROSTAT
Malta	2014	EUROSTAT
Netherlands	2014	EUROSTAT
Romania	2012	EUROSTAT
Slovenia	2014	EUROSTAT

Table 2 List of Countries, main common statistics data source and reference year (Author' elaboration based on D1.1)

For what concerns the waste statistics at EU level, in 2002 the **Regulation (EC) No 2150/2002** was adopted, creating a framework for harmonising EU statistics in this specific field. Starting with reference year 2004, the Regulation requires EU MS to provide data on the generation, recovery and disposal of waste every two years following common methodological recommendations. Data on waste generation and treatment are currently available for reference years from 2004 to 2014.

The information on waste generation has a breakdown in sources (several business activities according to the NACE classification and household activities) and in waste categories (according to the European Waste Classification for statistical purposes).

The information on waste treatment is broken down in five treatment types (recovery, incineration with energy recovery, other incineration, disposal on land and land treatment) and in waste categories. All values are measured in tonnes of waste and in kg per capita, based on the annual average of the population (Table 10).

Differences in data coverage across the MS exist and methodological changes in individual countries may still have a significant impact on the comparability of waste statistics and on the time series presented, in particular at a national level. In fact, MS are free to decide on the data collection methods to be used. The general options are: surveys, administrative or other sources, such as the reporting obligations under Community legislation on waste management, statistical estimation procedures on the basis of samples or waste-related estimators, or some combination of these methods.

In some cases (for example for participating countries in RE^4-project), Project Partners provided data coming from **national sources/authorities** as summarized in Table 3 and in ANNEX 1.

Country	Last reference year	Main National source
Austria	2014	Federal Ministry of Agriculture, Forestry, Environment and Water Management
Belgium		Environment Brussels Environment Wallonie
Cyprus	2014	CYSTAT (in addition to data from EUROSTAT)
Czech Republic (Participating country in RE^4-project)	2014	ISOH - Database of the Ministry for Environment
Denmark	2009	Danish ISAG system
Germany (Participating country in RE^4-project)	2012	Federal Ministry for Environment
Ireland	2011	Environmental Protection Agency (EPA) Central Statistics Office (CSO)
Italy (Participating country in RE^4-project)	2014	ISPRA - Istituto Superiore per la Protezione e la Ricerca
Malta	2014	National Statistics Office (NSO) Waste Serve Malta
Poland	2013	Central Statistical Office
Portugal	2012	Portuguese Environment Agency (SIRAPA)
Slovakia	2013	Ministry of Environment
Spain (Participating country in RE^4-project)	2015	Spanish Federation of Construction and Demolition Waste - FERCD
Sweden (Participating country in RE^4-project)	2012	EPA (Naturvårdsverket) - Data collected by SMED (Svenska Miljö Emissions Data)
Switzerland	2015	Wüest & Partner AG: Bauabfälle in der Schweiz – Hochbau; Studie
United Kingdom (Participating country in RE^4-project)	2012	DEFRA - Digests of Waste and Resource Statistics

Table 3 List of National Authorities for waste data collection (Author' elaboration based on D1.1)

It is necessary to highlight that data about generation, composition and recycling of CDW are very limited, particularly regarding its development over time and it is easier to find information at national level.

Regarding the methodology for CDW statistics used at national level and considering the information provided by D1.1, it is found that 17 countries (Austria, Bulgaria, Croatia, Cyprus, Czech Republic, Estonia, Finland, Greece, Hungary, Ireland, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Poland and Sweden) used methods in line with EUROSTAT guidelines on waste statistics (Manual of waste statistics, EUROSTAT, 2013).

In D1.1 other interesting information was collected about current statistics practice in Denmark, France, Germany, Italy, Portugal, Romania, Slovakia, Slovenia, Spain, Switzerland, and United Kingdom. The Table 4 depicts the national statistics institution in charge of waste data collection and the related methodology or guidelines based on.

Country	National Authorities	Methodology / Guideline
Denmark	Danish Environmental Protection Agency (DEPA)	Statutory Order on Waste data system N° 1306/2012 EUROSTAT guidelines
France	French Environment Ministry	French Environment Ministry statistics guidelines
Germany (Participating country in RE^4-project)	Individual statistical offices of the Federal States Federal Statistical Office	Environmental Statistics Act EUROSTAT guidelines
Italy (Participating country in RE^4-project)	Istituto Superiore per la Protezione e la Ricerca (ISPRA)	Estimation methodology by ISPRA
Portugal	Statistics Portugal (from 2008 to 2012) Portuguese Environment Agency (only for 2009)	Statistics Portugal reports to EUROSTAT data regarding CDW in accordance with the respective guidelines, with few adaptations. Regarding waste generation, the data was collected according to national legislation through the national waste registration platform, the MIRR.
Romania	National Environmental Agency (ANPM)	N.A.
Slovakia	Waste Management Centre Environmental Management of the Slovakian Environmental Agency Statistical Office of Slovak Republic	Government regulation 442/1992
Slovenia	Statistical Office of Republic of Slovenia	National Statistics Act Annual Programme of Statistical Surveys Decree on waste
Spain (Participating country in RE^4-project)	Autonomous Regions Spanish Statistical Office Other institutions: Spanish Federation of Construction and Demolition Waste (FERCD); Council of Ministers.	Decision 2011/753/EU
United Kingdom (Participating country in RE^4-project)	Environment Agency (England), Natural Resources (Wales), Northern Ireland Environment Agency (NIEA) Scotland Environment Protection Agency (SEPA) DEFRA	N.A.
Taiwan (Participating country in RE^4-project)	The information is collected from the local CDW recycling companies and previous projects.	For Taiwan is not available a detail of methodology used for CDW statistics.

Table 4 National statistics institutions in charge of waste data collection and the related methodology or guidelines (Author' elaboration based on D1.1)

Taking into account the information provided by D1.1, Switzerland lacks a central CDW treatment data collection, which could depict actual CDW streams more precisely. The data is derived from building stock and activity in construction, demolition and renovation sectors.

As reported in the study "Resource Efficient Use of Mixed Waste" (Task 4: Assessment of the reliability of CDW statistics), in terms of data quality, EU MS are homogeneously spread in three categories. A third of the MS displays a good data quality, a third displays a modest data quality and a last third a poor quality (Table 5).

Good	Modest	Poor
Austria	Belgium	Bulgaria
Czech Republic	Estonia	Croatia
Denmark	France	Cyprus
Germany	Hungary	Finland
The Netherlands	Italy	Greece
Poland	Lithuania	Ireland
Portugal	Luxembourg	Latvia
Slovakia	Spain	Malta
Slovenia	United Kingdom	Romania

Table 5 Distribution of EU MS for CDW data quality production (Bio Service by Deloitte, 2016)

Most of the MS that present a similar level of data quality are geographically clustered. MS characterized by a good quality level of the CDW data are nearly all located in Central Europe. These form an important area from The Netherlands to Poland in the W-E direction, and from Denmark to Slovenia in the N-S direction. Portugal also presents a good level of CDW data quality while it is not geographically close from the other MS of the same category.

At the opposite, one third of the EU MS displays a poor quality of their CDW data. Among them, 4 are located in Northern Europe (i.e. Sweden, Finland, Latvia and Ireland) and 6 in Eastern Europe (i.e. Romania, Bulgaria, Greece, Cyprus, and Malta), Figure 1.

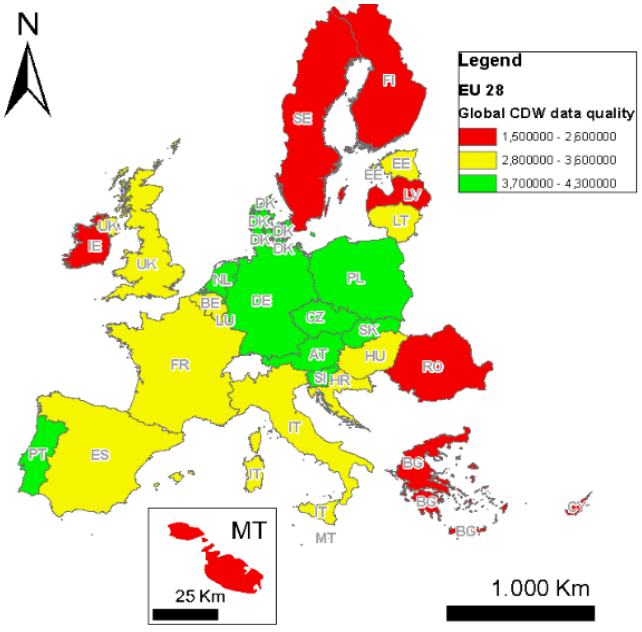

Figure 1 Geographic distribution of MS and CWD data quality (Bio Service by Deloitte, 2016)

Good and bad practices of statistics data production identified in D1.1 are summarized into the following boxes.

- **COUNTRIES PROVIDING GOOD DATA QUALITY**

Box 1. Focus on Denmark

The Danish EPA is in charge of collection of statistical data. All waste producers, receivers, exporters and importers in Denmark are, according to the Statutory Order on Waste data system n° 1306/2012, obliged to give information of waste amounts, waste origin, planned treatment and waste receiver. The waste is classified according to the List of Waste (LoW) codes and the waste producer is classified according to industry or NACE code. The statistics are based on total reports from every waste operator in Denmark. The report includes information about waste producer, recipient, waste type, and treatment, weight in metric tons. The report includes all types of waste including CDW. The statistics are published yearly, and raw data are available to the public on the system's website (https://www.ads.mst.dk). The quality of waste data is checked through checking with earlier data- and own control systems at the Danish EPA. In case of uncertainty, direct contacts are taken to the stakeholder in order to ensure correct raw data.

Box 2. Focus on Germany (administrative data sources)

CDW data generation is input oriented, which means that treatment plants report directly to the individual statistical offices of the states (Länder), which then report the data to the Federal Statistical Office. The methodology used for gathering data on CDW generation and treatment follows EUROSTAT guidelines.

Box 3. The Netherlands (survey for data collection)

Statistics on CDW generation and treatment in The Netherlands are obtained through a survey. Information is collected according to LoW codes (Chapter 17), used to distinguish CDW. All waste transports are registered in The Netherlands (consignment registry) and there is a reporting obligation.

For waste generation, all data entries are analysed and, to avoid double counting, the assumption is that waste generation is equal to waste collection, which is true for most waste types. Amounts coming from industry and municipalities (households waste) are known from other surveys.

For waste treatment, instead, an average of waste treatment per waste code is determined. Several assumptions have to be made because it is impossible to follow the different pre-treatment flows until the final treatment.

The main recommendation is to extend waste statistics and to:

- Include consumption, lifetime and stocks
- Include better forecasts on CDW generation in future
- Provide better insights in urban mine
- Provide better insights in suboptimal waste management
- Include composition of built environment
- Provide more effective indicators when the value is also considered.

Box 4. Focus on Slovakia

In comparison with the data by EUROSTAT, the Slovak Ministry of Environment (MoE) data generation is more comprehensive. It is possible that the MoE in Slovakia also includes excavation waste in the CDW report and therefore the numbers are higher. In comparison to the WFD, Slovakia is using three additional treatments.

Box 5. Focus on Slovenia (combination of survey and administrative data sources)

Statistical data on CDW is collected and analysed by the Statistical Office of Republic of Slovenia. Statistical data concerning waste is gathered based on:

- The National Statistics Act,
- The Annual Programme of Statistical Surveys,
- The Decree on waste.

However, as observed during the ReBirth Project (http://en.re-birth.eu), there are limitations to the statistics, especially considering waste from building demolition and renovation activities where the quantities are poorly reported, as well as regarding the reported quantities of waste disposed of on illegal dumps, or the use of recycled aggregates or products. In fact, the statistics say that, in Slovenia, more CDW is recycled than actually generated.

- **COUNTRIES PROVIDING MODEST DATA QUALITY**

Box 6. Focus on Italy

CDW national generation is estimated based on information within Modello Unico di Dichiarazione Ambientale (MUD) database, relating to the annual declarations done by the entities identified pursuant to art.189 of D. Lgs. 3th April 2006 n.152, such as traders, businesses and Institutions carrying out recovery operations and waste disposal, etc. MUD data are subjected to a specific estimation methodology by ISPRA; particularly, CDW generation data are estimated through removing MUD declarations of intermediate steps of waste management cycle in order to avoid duplication of data, taking into account inventory CDW amount at the end of previous year, and excluding imported CDW.

Box 7. Focus on UK

The CDW recovery rates were submitted to the Statistical Office of the European Union (EUROSTAT). However, the estimation methodology was not able to use accurate data regarding aggregate production or identify specific European Waste Classification for Statistics (EWC-STAT) codes in generation and treatment of CDW. DEFRA (Department for Environment Food & Rural Affairs) is aware of the above limitations and is currently aiming to address them in conjunction with the industry in time for the 2016 Data submission.

However it is useful to highlight as a good practice a regional reporting method, SMARTWaste (www.smartwaste.co.uk). It is an online reporting platform managed and owned by BRE (introduced in 2008); it is a web based tool for companies designed to monitor and measure CDW as well as

other environmental impacts. It can be used to prepare, implement and monitor site waste management plans (SWMP). SWMP's describe how materials will be managed efficiently and disposed of legally during construction, explaining how the re-use and recycling of materials will be maximised. This involves estimating how much of each type of waste is likely to be produced and the proportion of this that will be re-used or recycled on site, or removed from the site for re-use, recycling, recovery or disposal.

Box 8. Focus on France (the French example of identifying waste from demolition and refurbishment of buildings)

The French regulation for construction and building projects specifies how to identify waste from demolition and refurbishment of buildings. The buildings concerned are those with a surface area of more than 1000 square meters for each floor or farm, industrial or commercial building that has been exposed to hazardous substances. The works concern the reconstruction and/or demolition of a major part of the structure of the building. The contracting entity has to carry out the identification before applying for the demolition permit or before accepting estimates for contracting.

The identification lists the nature, the amount and the location of material and waste and their means of management, notably those which are re-used on site, recovered or eliminated. This list is provided to anyone involved in the demolition works.

At the end of the works, the contracting authority writes an assessment of works indicating the nature and the amount of material actually re-used on site and of waste that is recovered or eliminated. The contracting entity sends the form to the French Environment and Energy Management Agency which presents a yearly report to the Ministry in charge of construction.

This good practice is identified by EU Construction & Demolition Waste Management Protocol.

- **COUNTRIES PROVIDING POOR DATA QUALITY**

Box 9. Focus on Romania

Monitoring the CDW volumes in Romania is very challenging. Firstly, most of the times, CDW is mixed with the municipal waste and no separate collection containers are provided for CDW. Secondly, a large number of business operators generating CDW, do not report it. Moreover, the local authorities are not involved at all in collecting the data. The ANPM mentions in its 2012 Annual Report that the data gap is also due to the lack of specific legislation on CDW and of the difficulty in identifying those waste holders. The quality of the reported data is globally very uncertain and underestimated.

5. MAIN ASPECTS ANALYSED AND ASSESSED

5.1 Definition of CDW analysed in this report

In accordance with "EU Construction & Demolition Waste Management Protocol", clear and unambiguous definitions of CDW are a crucial starting point and it is important to pay proper

attention to the exact use of wording. The field of CDW management is characterized by different terms and concepts, due to the large variety of perspectives and stakeholders involved. As CDW management is primarily a local activity, strong differences in terminology exist between MS.

The Waste Framework Directive 2008/98/EC defines waste "as any substance or object which the holder discards or intends or is required to discard" (Article 3 - Definitions).

CDW is further specified in Waste Framework Directive in reference to the European list of Waste (Category 17). The "definition" is based on the nature of the waste (type of material). The Category 17 provides codes for several individual materials that can be collected separately from a construction or demolition site. It includes waste streams [i.e. hazardous and non-hazardous; inert, organic and inorganic] resulting from construction, renovation and demolition activities: CDW originates at sites where construction, renovation or demolition takes place. In detail, construction waste contains several materials, often related to cut-offs or packaging waste. Demolition waste comprises all materials found in constructions. Renovation waste can contain both construction-related materials and demolition-related materials.

The main categories of CDW materials analysed in details in this report and in D1.1 are: **concrete** (EWC 170101), **bricks** (EWC 170102), **tiles** and **ceramic** (EWC 170103), **asphalt** (EWC 170302), **wood** (EWC 170201) and **gypsum** (EWC 170802).

5.2 Legislative and non-legislative instruments at national level. Overview analysis

The CDW management governance is characterized by a complex interplay of goals, instruments and their implementation activities (Figure 2). The CDW management is still the main focus of several environmental programmes in Europe and around the world in the last years.

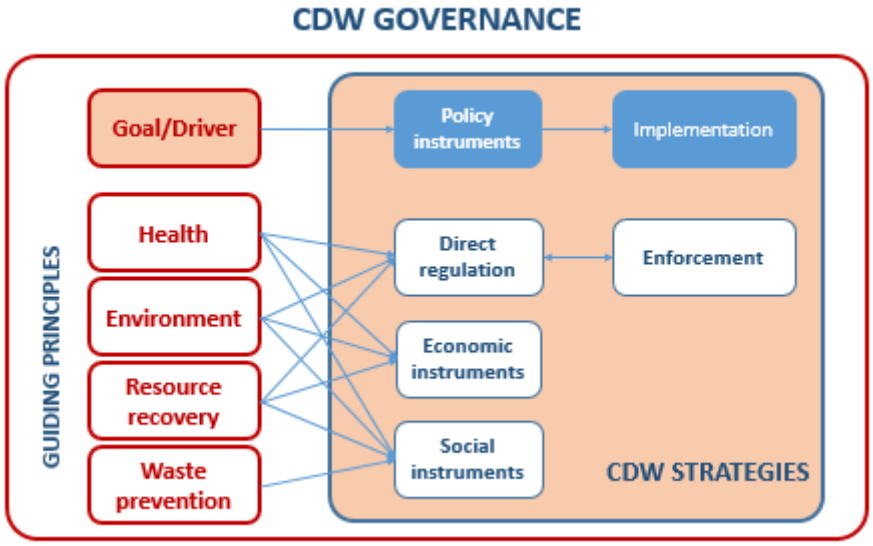

Figure 2 CDW governance - Author's elaboration based on (UNEP, 2015)

- **Identified national policies and regulations**

EU CDW management policies aim to reduce the environmental and health impacts of CDW and improve the EU's resource efficiency. The long-term aim of these policies is to reduce the amount of CDW generated and when their generation is unavoidable to promote it as a resource through a higher level of recycling and a safe disposal of waste. However, it is not addressed by a dedicated directive, therefore only the general instruments in the Waste Framework Directive can be applied.

At national level, the current policies and standards influencing the management of CDW can be classified into the following main categories:

- ✓ **Waste framework policies**: National policies or regulation on waste, usually at least transposing concepts, targets, and obligations set in the European WFD.
- ✓ **Landfill regulations**: as stated above, stricter control of landfilling of certain types of waste represents a major driver towards better management of CDW.
- ✓ **CDW policies**: when specific obligations regarding the management of CDW are not directly included in the waste framework policies, specific policy or legal documents may have been developed, specifically addressing the issue of CDW.
- ✓ **Secondary raw material regulation and standards**, e.g. standards on the quality of secondary materials from CDW.
- ✓ **CDW sites regulations and standards**, e.g. requirements for buildings specifically addressing CDW.

A mapping of the main policies and standards per country and category (national/regional) above mentioned are summarised in the ANNEX 2.

- **Non legislative instruments**

- ✓ **Quality assurance schemes**
- ✓ **Economic instruments** (i.e. landfill taxes / bans, economic levies such as the "Aggregate Levy" in UK). The economic instruments are analysed in detail by another public deliverable of the Project (i.e. D8.5 Use of economic instruments and waste management performances), available in M9.

A mapping of the main non legislative instruments per country are summarised in the ANNEX 2.

End of Waste application in EU-28

The Article 6.1 of the WFD introduced the **End-of-Waste (EoW) status:** *"Certain specified waste shall cease to be waste within the meaning of point (1) of Article 3 when it has undergone a recovery, including recycling, operation and complies with specific criteria to be developed in accordance with the following conditions:*

(a) the substance or object is commonly used for specific purposes;
(b) a market or demand exists for such a substance or object;
(c) the substance or object fulfils the technical requirements for the specific purposes and meets the existing legislation and standards applicable to products; and

(d) the use of the substance or object will not lead to overall adverse environmental or human health impacts.
The criteria shall include limit values for pollutants where necessary and shall take into account any possible adverse environmental effects of the substance or object."

In several MS, EoW criteria have been already developed for inert CDW or recycled aggregates:

- **Austria**
- **Belgium** (Flanders and Bruxelles Region)
- **France**
- **The Netherlands** (Recycling Aggregates from stony waste: Regulation No IENM / BSK-2015/18222 of February 5, 2015)
- **United Kingdom**
- **Germany**
- **Italy** (Aggregates made from CDW for paving roads)

In many EU MS (i.e. Cyprus, Czech Republic, Estonia, Greece, Ireland, Latvia, Lithuania, Luxembourg, Malta, Poland, Portugal, Romania, Slovakia, Slovenia, Sweden, Denmark and Finland, Spain, and Hungary) there is a lack of CDW specific EoW criteria and associated evaluation with no detailed rules for EoW for CDW in existing legislation. For Switzerland and Taiwan (for rules similar to EU ones) not data were found.

5.3 CDW generation performance

For centuries, the construction sector has been a voracious consumer of raw materials and has become more responsible for the greatest waste stream. This paragraph gives an overview on the development of CDW generation in the European Union (EU) and in one non-member country (i.e. Taiwan).

According to the data published by EUROSTAT, in the reference year 2014, the total generation of waste from economic activities and households in the EU-28 amounted to **2.502 million tonnes**. Looking at the share of each economic activity and of households in total waste generation in the EU-28 in 2014, we observe that (Figure 3) construction activities (NACE Section F) contributed 35% of the total (with **868 million tonnes** - the great part is inert excavated soil) and was followed by mining and quarrying (NACE Section B) with 28% or 704,6 million tonnes, manufacturing (NACE Section C) with 10% or 255,2 million tonnes), households (8% or 208,5 million tonnes) and energy (NACE Section D) with 4% or 93,21 million tonnes; the remaining 15% was waste generated from other economic activities (agriculture, forestry and fishing - NACE Section A).

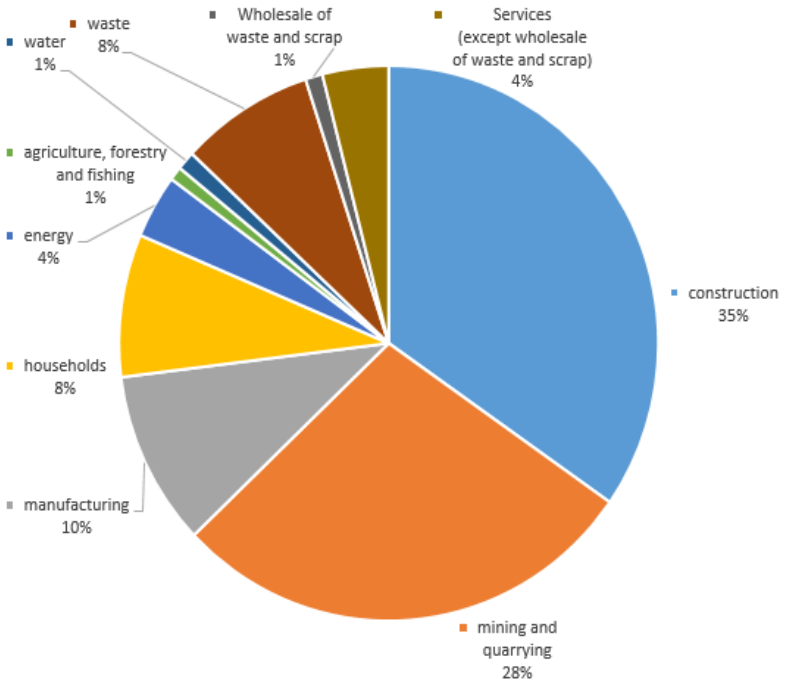

Figure 3 Waste generation by economic activity and households, EU-28 (%) - (Author's elaboration on EUROSTAT data of 2014)

The **total waste generated** by economic activities and households in 2014 may also be **expressed in relation to population size**. The average amount of waste generated across the EU-28 in 2014 was equivalent to almost **five tonnes** (4.931 kg) **per capita**. However, big differences between EU Member States can be observed which are mainly due to differences in the generation of mineral waste (Table 6). Among the waste generated in the EU-28 in 2014, 95,02 million tonnes (3.79% of the total) were hazardous waste (i.e. harmful for health or the environment). This was equivalent to an average of 187 kg of hazardous waste per capita in the EU-28 (Table 6).

	Total waste in EU-28			Total non-hazardous waste in EU-28			Total hazardous waste in EU-28		
	2010	2012	2014	2010	2012	2014	2010	2012	2014
Million tonnes	2.454	↑ 2.494	↑ 2.502	2.356	↑ 2.397	↑ 2.407	97,77	↓ 97,62	↓ 95,02
Kg per capita	4.871	↑ 4.944	↓ 4.931	4.677	↑ 4.750	↓ 4.744	194	↓ 193	↓ 187

Table 6 Waste generation in EU-28 in million tonnes and kg per capita (2010-2012-2014) – Author's elaboration based on EUROSTAT data

Regarding CDW, compared with 2010, 0.94% more non-hazardous CDW was generated in 2014 in the EU-28 and 0.74 % more hazardous waste, the first one increasing in quantity terms from 843 to 851 million tonnes, the latter from 16,19 to 16,31 million tonnes (Table 7).

Concerning CDW generation in kg per capita, the average amount of hazardous and non-hazardous waste generated across the EU-28 in 2014 was equivalent to **1.710 kg per capita** (Table 7), with an increment of 34 kg in comparison with 2012 (1.675 kg per capita).

	Total CDW in EU-28			Total non-hazardous CDW in EU-28			Total hazardous CDW in EU-28		
	2010	2012	2014	2010	2012	2014	2010	2012	2014
Million tonnes	860,04	↓ 845,94	↑ 868,06	843,85	↓ 829,74	↑ 851,75	16,19	16,19	↑ 16,31
Kg per capita	1.707	↓ 1.676	↑ 1.710	1.675	↓ 1.644	↑ 1.678	32	32	32

Table 7 CDW generation in EU-28 in million tonnes and kg per capita (2010-2012-2014) – Author's elaboration based on EUROSTAT data

The CDW generated within construction sector during construction, renovation, maintenance and demolition / selective deconstruction of buildings or civil works (roads, bridges, etc.) is composed not only of a high proportion of inert materials (e.g. concrete, masonry, asphalt, etc.), but also of wood, metal, glass, gypsum and plastics as well as hazardous substances (e.g. treated wood, lead paint and asbestos from demolished old buildings).

Its composition varies and depends on the construction project that generates the waste stream. In 2014, 32% of total CDW was made of mineral wastes (281,35 million tonnes), 1,8% of (ferrous and non-ferrous) metal wastes (15,7 million tonnes), and 1% (8,73 million tonnes) of wood wastes (Table 8).

	Total	Soils	Mineral wastes	Dredging spoils	Metal wastes	Wood wastes	Plastic wastes	Glass wastes	Other
Million tonnes	**868,04**	442,42	281,35	79,6	15,7	8,73	0,93	0,86	38,45
%	-	51%	32,4%	9,2%	1,8%	1%	0,1%	0,1%	4,4%

Table 8 CDW generation in EU-28 in million tonnes by waste category (2014) – Author's elaboration based on EUROSTAT data

The Figure 4 shows the total waste generated in 2014 in comparison with the total waste generated by construction sector across EU MS.

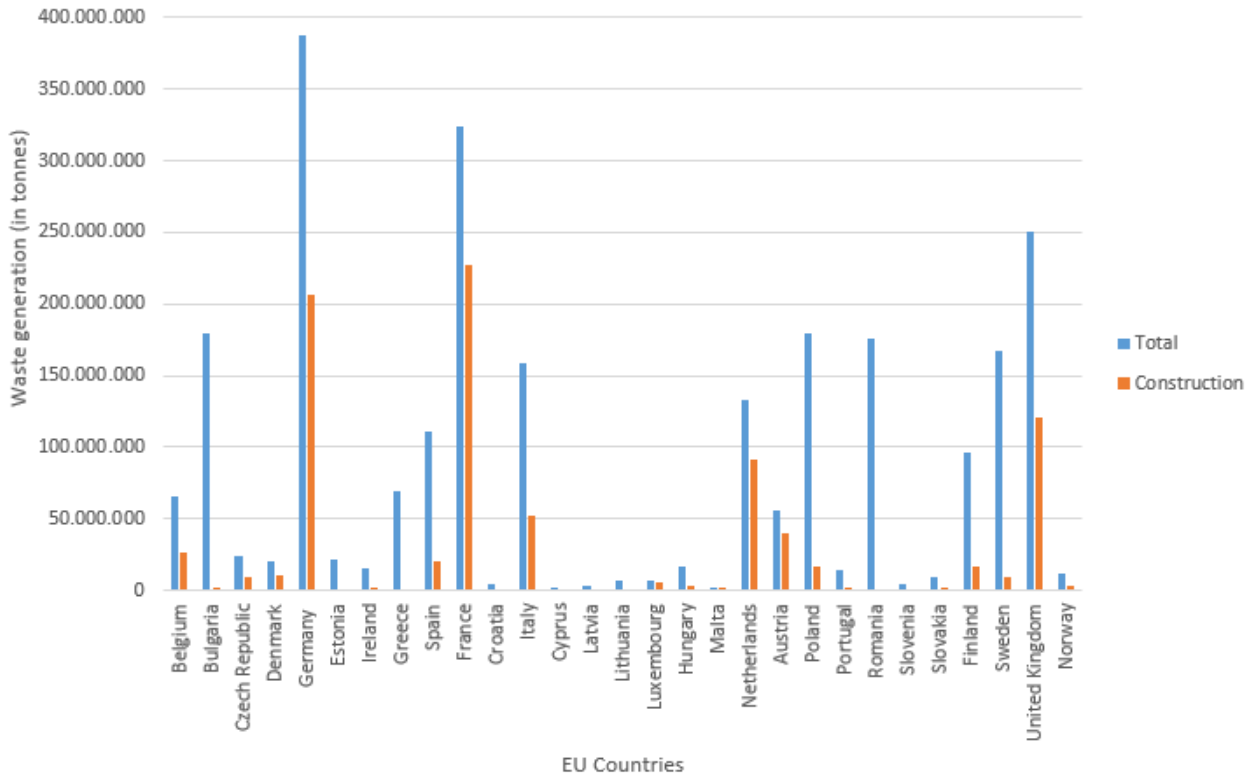

Figure 4 Waste generation in construction sector, EU-28 (Author's elaboration on EUROSTAT data of 2014)

The data related to generation of CDW (Figure 4, Figure 5, and Figure 6) demonstrate important differences between EU countries. Five countries (i.e. France, Germany, United Kingdom, Netherlands and Italy) report high quantity of CDW generation. Seventeen countries (i.e. Bulgaria, Cyprus, Estonia, Greece, Croatia, Hungary, Ireland, Iceland, Lithuania, Luxembourg, Latvia, Malta, Norway, Portugal, Romania, Slovenia and Slovakia) present very low levels of CDW generation (below 1% of the total each).

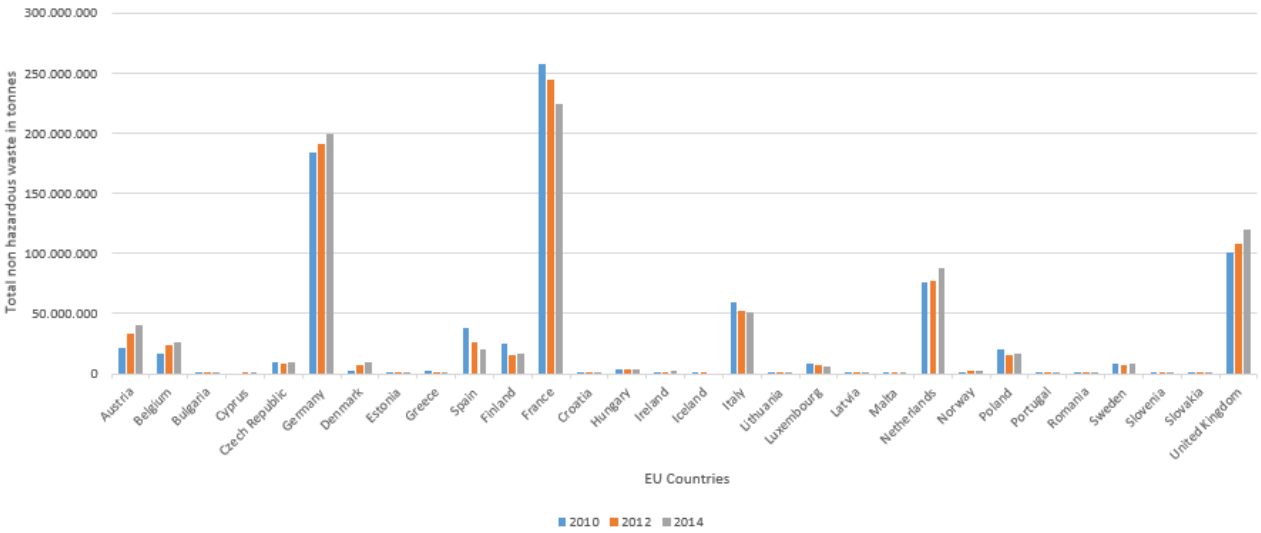

Figure 5 Generation of total non-hazardous waste in construction sector (in tonnes) – EU Countries, reference years 2010-2012-2014 (Author's elaboration on EUROSTAT data)

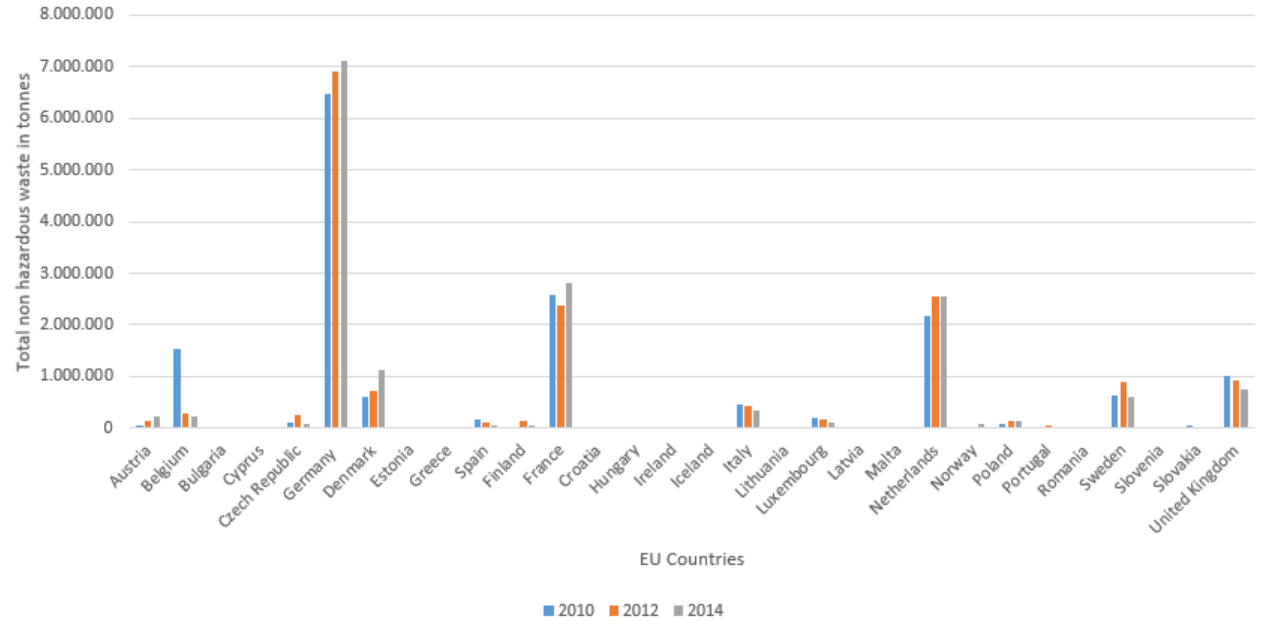

Figure 6 Generation of total hazardous waste in construction sector (in tonnes) – EU Countries, reference years 2010-2012-2014 (Author's elaboration on EUROSTAT data of 2017)

In 2014, the above-mentioned five countries (i.e. France, Germany, United Kingdom, The Netherlands and Italy) represented the 80.2% out of the total of non-hazardous CDW (Figure 8) and 78.8% of the total of hazardous CDW in Europe (Figure 7). The highest share of the EU-28 total non-hazardous waste is accounted by France (26%), just ahead of Germany (24%) and the United Kingdom (14%) (Figure 8).

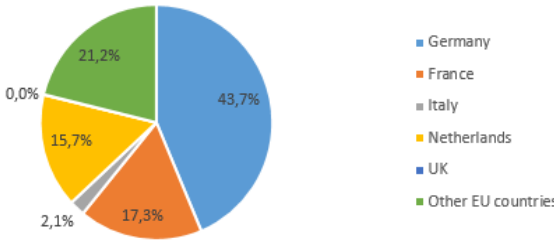

Figure 7 % of hazardous CDW generation by country, 2014 - Author's elaboration on EUROSTAT data

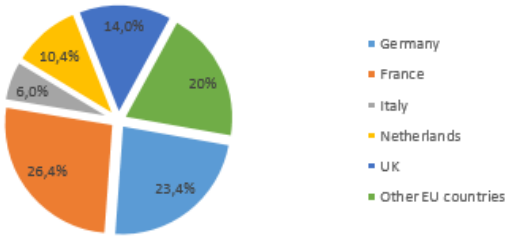

Figure 8 % of non-hazardous CDW generation by country, 2014 - Author's elaboration on EUROSTAT data

In 2014, the total waste generated by the construction sector and expressed in relation to population size (Figure 9) varies considerably, ranging from 10.748 kg per capita in Luxemburg to 53 kg per capita in Romania.

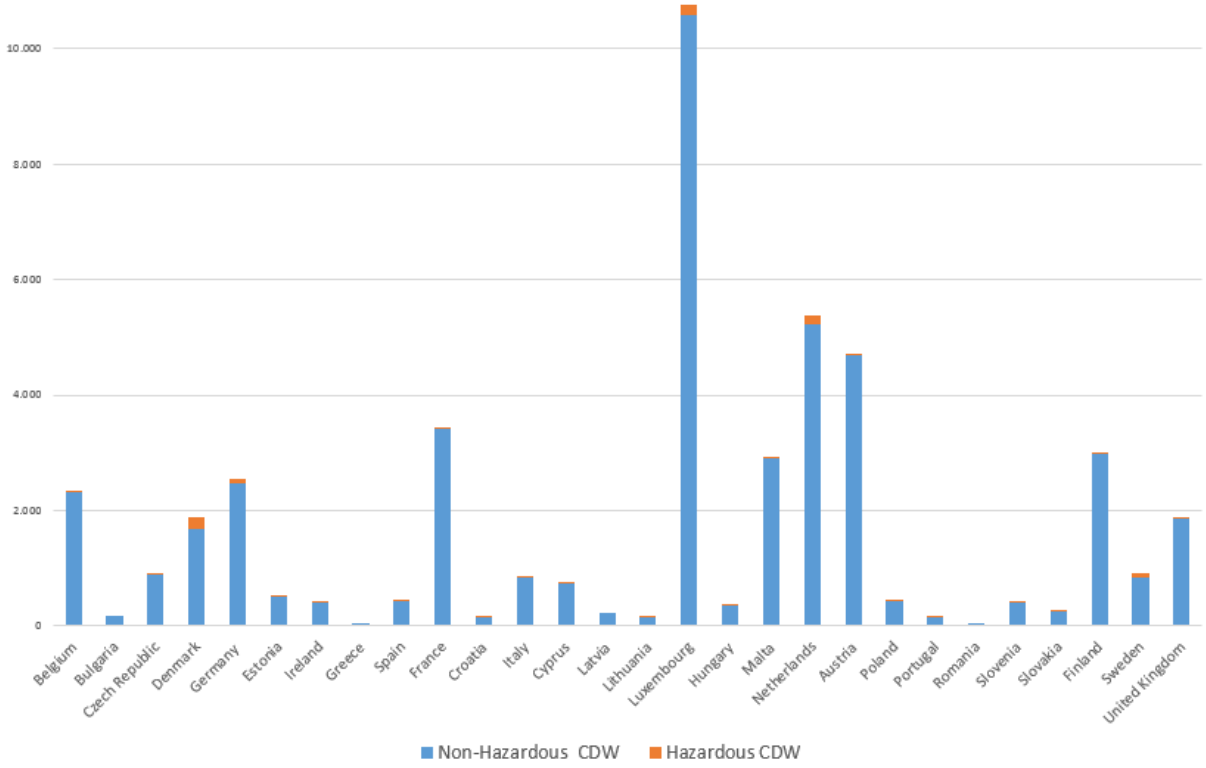

Figure 9 Generation of total waste in construction sector (in kg per capita) – EU Countries, reference year 2014 (Author's elaboration on EUROSTAT data)

This wide geographical variation of CDW generation (Figure 5, Figure 6 and Figure 9) could be viewed as lower estimates, as this type of waste is often dumped illegally. The data are also hard to interpret because of the different waste definitions and reporting mechanisms in different countries.

Other explanations include: economic reasons (the quantities of CDW waste generated is highly dependent on the rate of new constructions, and the economic growth of the country), architectural

habits (the types of materials used in construction shows great regional variation, e.g. in some regions brick is the main construction material, whereas in others concrete represents the majority; wood is a major construction material in northern countries like Finland or Sweden, etc.), cultural issues (e.g. demolition is seen as a failure in countries such as France, whereas it is regarded in a more positive way in other countries), or technical issues (the quality of the materials used in old construction influences the rate of demolition, e.g. more demolition is expected in new MS because of the low quality of the concrete used in old constructions).

The following table (Table 9) compares EUROSTAT data with data collected at national level of the above-mentioned five countries (France, Germany, United Kingdom, The Netherlands, and Italy).

Country	Total CDW – Reported quantities (in Mt)						Data source
	HAZ			NON HAZ			
	2010	2012	2014	2010	2012	2014	
France	2.56	2.38	2.58	258.13	244.33	229.16	EUROSTAT
Germany	6.46	6.90	7.12	184.52	190.62	199.34	EUROSTAT
	-	-	-	-	192	-	Federal Ministry for Environment
United Kingdom	1.02	0.92	0.75	101.21	107.92	119.65	EUROSTAT
	1.02	1.06	-	45.42	44.79	-	DEFRA
The Netherlands	2.18	2.56	2.56	75.88	76.61	88.17	EUROSTAT
Italy	0.45	0.42	0.35	58.89	52.55	51.33	EUROSTAT
	-	0.85	0.79	-	51.63	50.21	ISPRA
Total EU-28	**16.19**	**16.19**	**16.31**	**843.85**	**829.74**	**851.75**	EUROSTAT

Table 9 Total CDW (in million tonnes) in France, Germany, United Kingdom, Netherlands and Italy (Author's elaboration on D1.1 and EUROSTAT)

In Taiwan, there are about 1,2-1,9 million tons per year generation of construction waste in Taiwan (Ying-Ying Laia, 2016).

5.4 CDW treatment performance

In accordance with EU Waste Statistics Regulation, waste treatment includes all waste entering treatment facilities (public and private) for final treatment (excluding waste pre-treatment). Statistics on waste treatment are broken down into the following five treatment categories (Table 10).

Types of recovery and disposal operations	Definition
1. Energy recovery (R1)	Use principally as a fuel or other means to generate energy
2. Waste incineration (D10)	Incineration on land

3. Recovery (other than energy recovery) (R2 to R11) • 3a: recycling • 3b: backfilling	**Recycling:** any recovery operation by which waste materials are reprocessed into products, materials or substances whether for the original or other purposes. It includes the reprocessing of organic material but does not include energy recovery and the reprocessing into materials that are to be used as fuels or for backfilling operations. **Backfilling:** any recovery operation where suitable waste is used for reclamation purposes in excavated areas or for engineering purposes in landscaping or construction instead of other non-waste materials which would otherwise have been used for that purpose.
4: Landfilling (D1, D5, D12)	A waste disposal site for the deposit of the waste onto or into land (for instance underground), including: internal waste disposal sites (for instance own waste disposal carried out by the producer of waste at the place of production), and a permanent site (older than one year) which is used for temporary storage of waste, But excluding: ▪ facilities where waste is unloaded in order to permit its preparation for further transport for recovery, treatment or disposal elsewhere, and ▪ storage of waste prior to recovery or treatment for a period less than 3 years as a general rule, ▪ storage of waste prior to disposal for a period less than 1 year.
5: other forms of disposal (D2, D3, D4, D6, D7).	D2: Land treatment (e.g. biodegradation of liquid or sludgy discards in soils, etc.) D6: Release into a water body except seas/oceans D7: Release into seas/oceans including sea-bed insertion

Table 10 Types of recovery and disposal operation (Author's elaboration on EU Waste Statistics Regulation)

The term **recycling** is difficult to apply consistently to CDW across EU MS as there is a broad range of recycling and recovery activities executed. Currently, there is no "recycling" in the treatment options of EUROSTAT, but "recovery" is provided instead. However the two terms are not completely equivalent. Normally the term "recovery (other than energy recovery)" spans a concrete list of "recovery operations" defined in an annex to the Waste Framework Directive. Of these operations, roughly 90% can be classified as recycling, while the remaining 10% cannot be classified as recycling (European Parliament - Policy Department - Economic and Scientific Policy, 2008).

In this report, in order to compare the CDW treatment performance in the last reference year (2014) between EU-28 MS, and have a reliable result, it is used EUROSTAT database and selected the waste category "**EWC_12.1 Mineral waste from construction and demolition**" (Figure 10).

Code	Description	Definition	Includes	Source branches (nomenclature of LoW is **bold**, NACE is non-bold)	Excludes
12.1	Mineral waste from construction and demolition	**Kind of waste:** Concrete, bricks, and gypsum waste from construction and demolition Insulation materials Mixed construction wastes Track ballast **Origin:** Construction and demolition **Hazardous:** When containing, oil, heavy metals, coal tar, organic pollutants	Waste hydrocarbonised road-surfacing material	In general construction and demolition activities. In detail: • **Construction and demolition wastes** (41 Construction of buildings; 42 Civil engineering; 43 Specialised construction)	Solid waste from soil remediation -> see cat. 12.3 Soils and stones -> see cat. 12.6 Insulation and construction materials containing asbestos -> see cat. 12.2 PCB containing wastes -> see cat. 07.7 Pure and sorted fractions of glass -> see cat. 07.1

Figure 10 Mineral waste from Construction and Demolition (EWC_12.1) (EUROSTAT, 2010)

In the last reference year 2014, EU MS reported the treatment of this fraction (EWC_12.1) as shown in Table 11 and Table 12. **273.08 million tonnes of non-hazardous mineral waste from C&D** were treated in the EU-28.

Looking at the types of waste treatment operation employed, 82% of this waste category was subject to recycling, 11% to landfilling and 6% to backfilling. Backfilling is the use of waste in excavated areas for the purpose of slope reclamation or safety or for engineering purposes in landscaping.

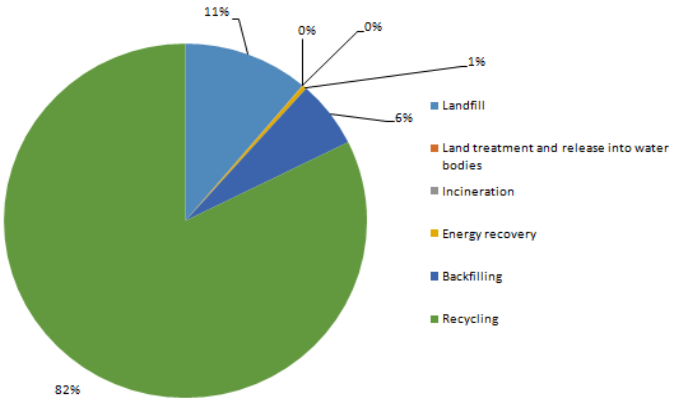

Figure 11 % of non-hazardous mineral waste from construction and demolition (by treatment) - Author's elaboration on EUROSTAT data

Significant differences may be observed among the EU MS concerning the use they made of the various treatment methods. For instance, some EU countries had very high recovery (other than energy recovery) rates (for example, Germany, United Kingdom, France and Italy).

Country	Total	Recycling	Landfill	Backfilling	Energy recovery	Incineration
EU-28	273.080.000	224.730.000	30.530.000	16.660.000	1.040.000	100.000
Belgium	3.049.508	2.877.325	171.948	0	136	99
Bulgaria	681.995	652.508	29.487			
Czech Republic	3.549.352	2.071.050	359.713	1.118.288		
Denmark	3.174.229	2.910.767	125.618	0	137.510	334
Germany	72.214.934	61.427.689	4.323.031		603.258	89.449
Estonia	723.118	581.606	18.052	123.459	0	0
Ireland	398.461	193.465	1.048	203.948	0	0
Greece	140.112	595	139.486	31	0	0
Spain	7.040.822	4.466.158	2.107.496	467.168	0	0
France	59.961.713	38.160.220	17.546.559	4.249.525	4.157	1.252
Croatia	284.279	191.777	86.801	5.701	0	0
Italy	31.318.365	29.990.797	1.007.178	316.790	25	3.575
Cyprus	111.232	42.283	68.949	0	0	0
Latvia	113.431	92.541	9.588	11.298	4	0
Lithuania	575.420	417.067	44.989	113.364	0	0
Luxembourg	496.708	409.555	0		0	0
Hungary	2.409.293	1.772.132	327.447	309.568	0	146
Malta	1.068.245	518.629	1.325	548.290	0	0
Netherlands	17.600.467	17.468.518	11.324	0	120.292	333
Austria	9.159.881	7.572.192	576.123	1.011.546		
Poland	5.105.138	3.952.760	213.484	938.515	321	58
Portugal	578.780	556.519	22.261		0	0
Romania	656.358	277.048	232.799	146.500	11	0
Slovenia	522.124	509.501	12.611	0	0	12
Slovakia	423.678	229.247	192.121	0	1.507	712
Finland	1.679.337	1.395.649	115.075	0	168.481	132
Sweden	922.353	505.746	413.161	1.196	2.250	0
United Kingdom	49.122.298	45.482.723	2.367.263	1.272.312	0	0

Table 11 Non-hazardous mineral waste from construction and demolition treatment (tonnes) - Author's elaboration on EUROSTAT data (2014)

	Total	Recycling	Landfilling	Backfilling	Energy recovery	Incineration
EU-28	6.700.000	4.320.000	1.910.000	30.000	380.000	40.000
Belgium	28.298	83	28.178	0	0	37
Bulgaria	18		16			2
Czech Republic	34.073		227	26.864		
Denmark	130.086	113.806	8.414	0	7.866	0
Germany	4.169.647	2.549.376	1.253.355		337.656	22.879
Estonia	1.092	0	0	0	1.092	0
Ireland	0	0	0	0	0	0
Greece	0	0	0	0	0	0
Spain	56.338	85	56.253	0	0	0
France	590.072	141.053	444.715	0	275	4.029
Croatia	3.160	0	0	0	3.160	0
Italy	71.006	28.183	42.023	0	0	800
Cyprus	0	0	0	0	0	0
Latvia	0	0	0	0	0	0
Lithuania	13	0	0	0	0	13
Luxembourg	0	0	0	0	0	0
Hungary	6.701	196	4.121	0	51	2.333
Malta	0	0	0	0	0	0
Netherlands	1.301.894	1.265.835	26.329	0	1.498	8.232
Austria	159	0	0	0		
Poland	4.315	2.787	528	0	0	1.000
Portugal	278	0	278		0	0
Romania	1.543	1.029	514	0	0	0
Slovenia	2.223	2.223	0	0	0	0
Slovakia	11.711	12	998	0	0	85
Finland	47.942	5.638	10.113	0	28.584	3.607
Sweden	95.414	79.446	11.654	0	4.314	0
United Kingdom	140.293	121.153	17.398	1.742	0	0

Table 12 Hazardous mineral waste from construction and demolition treatment (tonnes) - Author's elaboration on EUROSTAT data (2014)

According to the waste management hierarchy, landfilling is the least preferable option and should be limited to the minimum necessary. Even if landfilling is the second treatment for CDW used in Europe, after recovery (other than energy recovery) and before backfilling, in terms of tonnes of

wastes treated, its percentage is just 11% of the total of CDW. The first country, in terms of tonnes of CDW sent to landfill disposal is France, with 17.5 million tonnes of CDW (29% of the total CDW treated in France in 2014), followed by Germany (with 4.3 million tonnes) and Spain (with 2.1 million tonnes). The following figure (Figure 12) shows the comparison between EU MS regarding the percentage of hazardous and non-hazardous mineral waste from construction and demolition by treatment (recycling and backfilling).

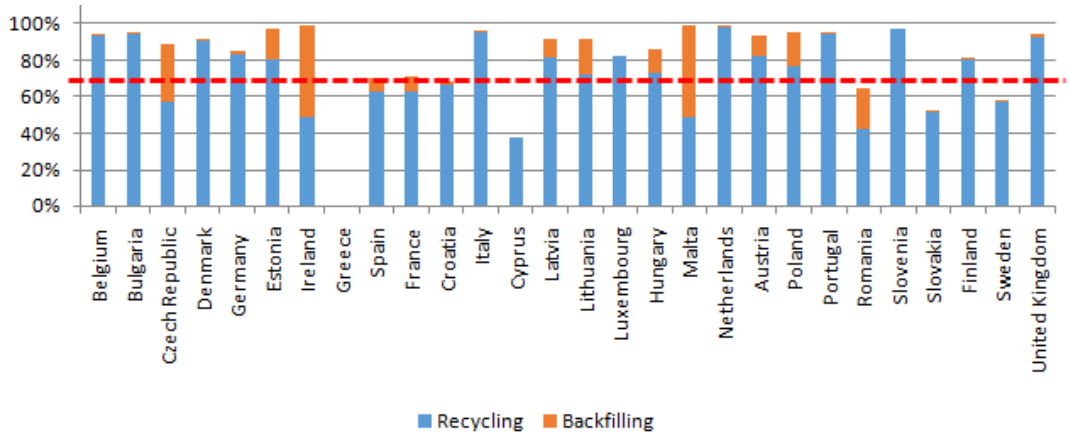

Figure 12 % of hazardous and non-hazardous mineral waste from construction and demolition (by treatment) - Author's elaboration on EUROSTAT data (2014)

In Taiwan, the primary treatment options for CDW include:

- Reuse directly as a material for backfilling
- Recycling into fine or coarse aggregates for making construction materials, e.g. concrete, brick.

In this country, there are some companies collecting the CDW and producing construction materials (source: D1.1) and there are 64 treatment and reuse facilities that treat 14,5 million tons in 2014 (Ying-Ying Laia, 2016).

Currently, 20 EU countries (i.e. Austria, Italy, Belgium, Bulgaria, Czech Republic, Denmark, Estonia, Finland, France, Ireland, Latvia, The Netherlands, Norway, Poland, Portugal, Slovenia, Spain, Sweden, Switzerland, United Kingdom, Hungary) have introduced a tax on construction and inert waste sent to landfills (ETC/SCP, 2012). Although there is some variation regarding the waste types covered by the landfill tax, it is not very large between countries. The landfill tax level varies greatly between countries and also depending on the waste type concerned (Figure 13).

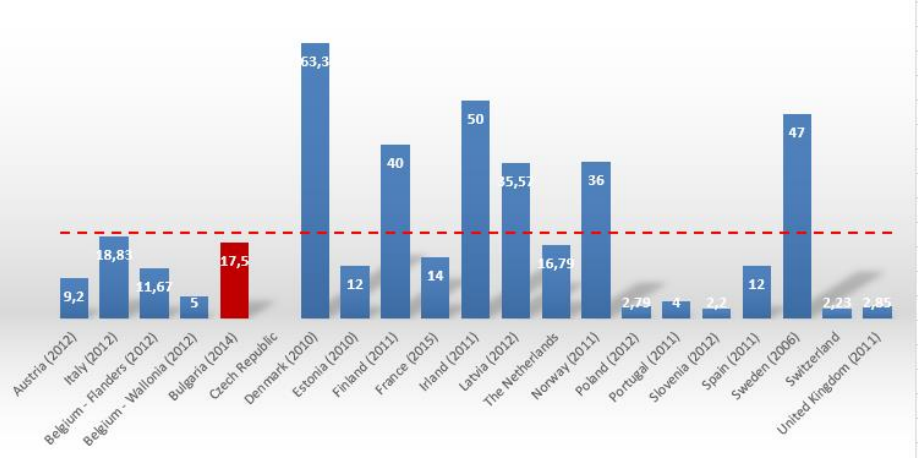

Figure 13 Landfill tax level in 20 EU Countries - Author's elaboration based on ETC/SCP working paper 1/2012 (Data of Bulgaria coming from D1.1)

A list of CDW recycling facilities by country is available in Annex 3.

5.5 Ambitious waste targets and local and regional waste management

The Waste Framework Directive (WFD) sets a target for 70% recycling of construction, demolition and excavation waste across Europe by 2020.

The 70% recycling target for CDW in the new Waste Framework Directive 2006/12/EC and amendments includes "preparing for re-use, recycling and other material recovery including backfilling operation…". Further, the definition of recycling explicitly excludes "… the reprocessing into materials that are to be used as fuels or for backfilling operations".

Since the mid-1990s, Denmark, Germany and The Netherlands have been consistently recycling in excess of 70% of their CDW (Figure 14), even in the absence of EU-level legislation, creating the conditions to facilitate high recycling rates of CDW.

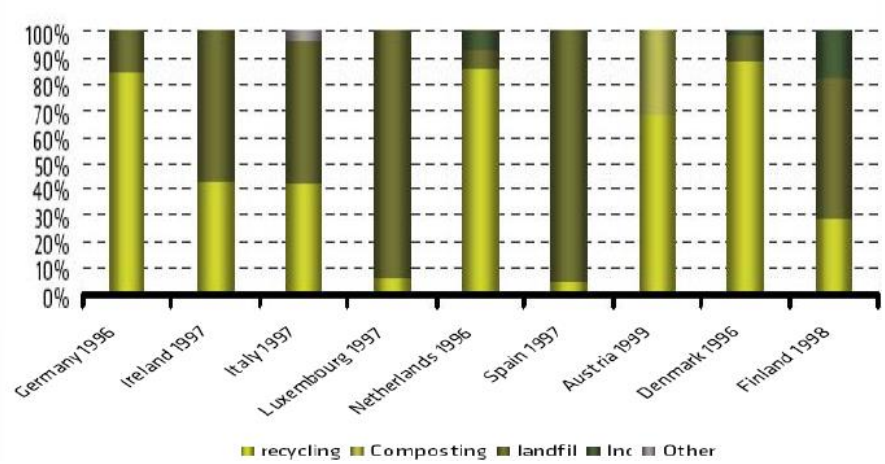

Figure 14 Treatment of CDW, selected EU countries, selected years 1996-1999 (prior to the introduction of the Waste Statistics Regulation) - (European Parliament - Policy Department - Economic and Scientific Policy, 2008)

The European Commission published a study in which the existing situation of CDW recycling is analysed (Bio Intelligence Service 2011b). This study estimates recycling rates of the MS and calculates the difference from the recycling target of the WFD. While 9 countries fulfil already the Directive's target or are close to it (Austria, Belgium, Denmark, Estonia, Germany, Ireland, Netherlands and the United Kingdom), 8 countries report comparably low recycling rates. Nevertheless, the findings of this study suggest that the recycling target in the WFD of 70% should be achievable for most MS.

Regarding the development of the recycling targets, the study comes to the following conclusions. First, from a quantitative point of view, the best practices in Europe show that recycling rates over 80% or 90% are feasible. For those countries which are already achieving higher re-use, recycling and recovery rates, the WFD does not provide an incentive to achieve higher targets. In principle, differentiated targets for these MS could be set in the WFD, or alternatively, in their national legislation.

The latest figures available (Figure 15) would indicate that progress is being made and the EU target is achievable. However, closer examination of the figures reveals that there is a huge difference between the top performers and those who as yet have not grasped the opportunity presented by CDW recycling.

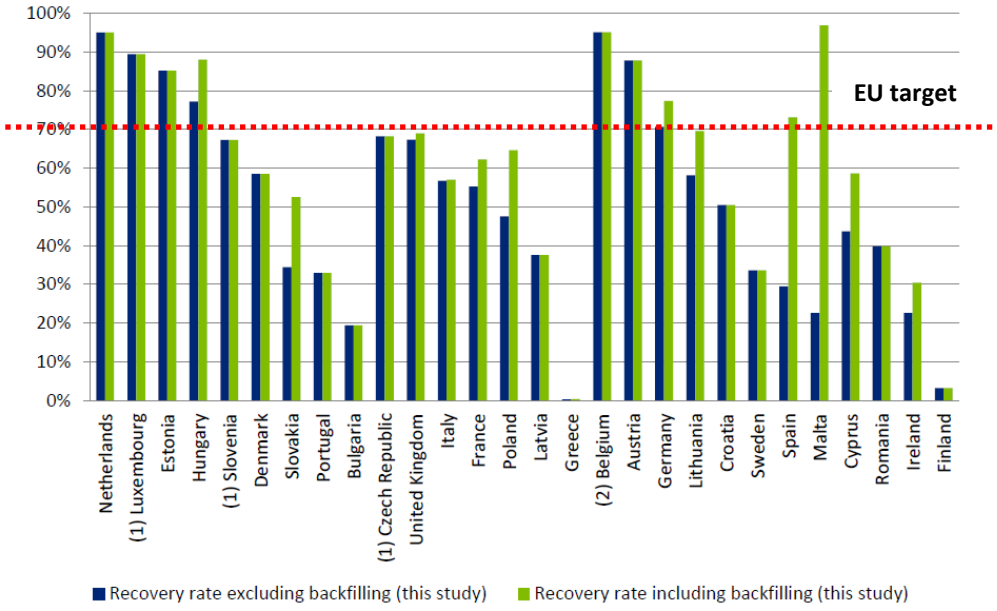

Figure 15 Recovery rates of CDW in EU-28 MS in 2012 (Bio Service by Deloitte, 2016)

One explanation for the difference in waste management routes is the availability of waste management facilities in the different MS. Many of the MS with higher proportions of recovery have a good spread of facilities available, whereas many MS with low recovery levels such as Croatia, Estonia and Slovakia have a limited spread of facilities. In addition, some MS have landfill bans (or partial bans) in place. For example, the Netherlands has a national landfill ban on recyclables while Belgium has bans only in some regions.

Currently, no reliable and more updated data exist on recycling rates of CDW in the EU from other studies. The Waste Statistic Regulation provides information on generation and composition of CDW for all countries. However, the Statistic Regulation does not provide specific information about recycling. In general, data about generation, composition and recycling of CDW are very limited, particularly regarding its development over time.

It is not easy to use EUROSTAT database to compare recycling rates in EU-28 MS for the following two main reasons:

1. Lack of data on the treatment of CDW
2. Lack of "recycling" as a treatment option.

For the first problem, EUROSTAT's advice is to use "EWC_12 Total mineral waste" as equivalent to CDW. But the EWC_12 definition is a wider as it contains certain other types of waste, more likely to be industrial in nature, (European Parliament - Policy Department - Economic and Scientific Policy, 2008).

The second problem concerns the lack of "recycling" as a treatment option in the WSR data, in which "recovery" is provided instead. But the two terms are not completely equivalent, as described in the previous paragraph. Therefore, it should be investigated in detail whether the WSR definition of "recovery" is sufficient to represent data for measuring compliance with the target defined in terms of "recycling" of CDW.

In Taiwan the EU target is not applicable, however for comparison reasons, the reuse ratio of construction waste was found and it is about 64%-80% (Ying-Ying Laia, 2016).

5.6 Key drivers and barriers for increasing resource efficiency in CDW management

This paragraph shows the main drivers and barriers for increasing resource efficiency in CDW management, already identified in the D1.1. The drivers as well as the barriers are presented in the following tables (Table 13) in a random order and are not ranked in relation to significance and improvement potential. This mapping activity is useful for the definition of the final conclusions of the report, in which lessons learned from the data collection and statistics assessment and related recommendations are summarised.

KEY DRIVERS	
Legal and regulatory drivers	
Legislative pressure and sustainable waste management approach	The strong legal framework enables a good level of CDW management leading to higher recovery rates of CDW. In addition, other instruments, such as national government sponsored programs, regulation and standards
Government sponsored programmes (e.g. WRAP in UK) and schemes for recycling (e.g. BREEAME)	

Public request for solutions reducing industrial footprint	on environmental performances of building, construction sites and materials can be a strong driver for the development of secondary raw materials demand.
Economic drivers	
Dependence on imports of scarce raw materials	Recycling of CDW is an important step towards a reduction of resource extraction and the associated environmental impacts. Especially in countries like Germany, the Netherlands or Denmark, where access to raw materials is limited. CDW offers a huge potential of high quality raw materials, which can be efficiently recovered and processed to feature a similar quality of other high quality starting materials.
Economic incentives (e.g. Aggregates levy in UK) to support the market	Economic incentives play a crucial role in driving CDW management performance, measures such as landfill taxes and charges for unsorted CDW favour selective collection and recycling of CDW. For what concerns the GPP tools, even if it is a voluntary instrument, it has a key role to play in the EU's efforts to become a more resource-efficient economy. It can help to stimulate a critical mass of demand for recycled materials, that otherwise would be difficult to get onto the market. GPP is therefore a strong stimulus for eco-innovation.
Tax on landfilling and burning waste	
Green Public Procurement (GPP)	
Social and cultural drivers	
Development of green / sustainable thinking of end users	A new way of thinking among consumers has been developing throughout the last decades. A new common vision is emerging, that promises the ultimate reconciliation of environmental and economic concerns. The so called "green thinking" that in the next future will become the driver for a demand of zero impact greenhouse.
Local geography and infrastructures drivers	
Scarcity of land for disposal	In the next future, the scarcity of land to be devoted to landfill disposal of waste, together with the increasing costs of landfilling treatment, will be one of the main drivers for secondary raw materials recycling.

Near treatment infrastructure is an incentive to recycle CDW	Transportation costs, together with long distances from end use place, can be an obstacle for the increment of recycled CDW. In order to improve cost-effectiveness of recovery, treatment infrastructure within a maximum of 30 km area from urban area is needed.

KEY BARRIERS	
Legal and regulatory barriers	
Variable regulations, fees, management	Fragmentation of regulatory framework in the EU is perceived as a barrier. The suggestion is avoiding instrument overload - this creates the danger of redundancy or negative interactions. Ideally, the minimum set of instruments with maximum impact has to be used.
Fragmented legislation at national level	
Economic barriers	
High initial investment cost; Cost and time of sorting	Operating costs of CDW sorting, recovery, and recycling are declared as being too high by most construction companies.
High availability and low cost of raw materials	Primary raw materials are still available at low prices. In countries with abundant virgin construction like Sweden, Finland and Italy, the transportation costs for virgin materials are low and lower than transporting CDW. Therefore, secondary building materials lack attractiveness. To ensure the competitiveness of recycled CDW it is suggested to: - increase the price of primary raw materials or/and - decrease VAT for recycled materials (positive incentive).
Cost of disposal - Landfill is the preferable way of waste handling	The main corresponding policy option is making landfilling of waste unattractive, by introducing a ban or high levies on landfilling.
Market conditions - no large demand of recycled materials	Currently, the demand of secondary raw materials is still not very high. Material flows in the construction sector are governed by a complex socio-technical system in which awarding authorities decide in interaction with other actors (engineer, architects, and

	contractors) on the use and demand of construction materials. Future demand and market growth of this kind of materials will be driven mainly by lower price of secondary raw materials in comparison with virgin materials and availability of recycled materials within the same geographic distance to end markets.
Eurozone crisis	The financial crisis had a drastic impact on the economy of Europe and especially on the construction sector and differed widely by countries. This crisis had an impact also on recycled materials. Currently the construction sector is recovering. The 2017 started without very encouraging economic expectations but the construction sector has the potential to grow somewhat more (2.1%). There is an interesting window of opportunity created by a combination of cheap credit and a more favourable perception of building as an investment shelter (EUROCONSTRUCT, 2016).
Social and cultural barriers	
Misconception of the quality of recycled products	Recycled materials and products have a negative image and are not trusted by builders and developers. This obstacle can be overcome through : - Turning waste into a valuable raw material through quality certification of secondary raw material from CDW - Communicating on the benefits of secondary raw material - Developing EoW criteria - Introducing GPP.
Lack of interest in CDW waste management (and waste management in general)	In some MS (e.g. Croatia and Cyprus) it is highlighted a lack of interest in not only CDW waste management, but in the waste management in general, with relatively scarce CDW-specific information, brochures and education. A higher engagement by all stakeholders is needed.
Technical barriers	

Lack of knowledge and experience for designing and implementation of CDW management activities	Currently there is still a relevant lack of know-how and experience for designing and implementing CDW management activities and lack of coordination between the different actors of this value chain.
Slow technology adoption	
Ineffective sorting and contamination of waste flow	In order to overcome these limits, it is suggested to: - Encouraging the sorting of CDW "at source" - Introducing selective demolition/ controlled deconstruction - Introducing technical guidelines and standards.
Specification of products, standards and guidelines	In some cases, standards and guidelines are needed (special rules for secondary raw materials use and selective demolition practices). The existence of quality standards and norms which apply to recycled CDW and ensure the circulation and marketing of a high quality product, ready for use in new construction projects can be considered strong drivers.
Local geography and infrastructures barriers	
Lack of facilities for recycling and inconvenience of their location of facilities	In some MS (e.g. Cyprus), existing facilities are not able to satisfactory cover the entire country. As a result, CDW generated in many areas of the country has to be transported over long distances for treatment. This significantly increases the treatment costs leading to uncontrolled disposal in illegal landfills. In some cases (e.g. France) it is observed an apparent reluctance of local authorities to authorise new facilities.
Continuing dependence on landfill disposal	According to the waste management hierarchy, landfilling is the least preferable option and should be limited to the minimum necessary.
Illegal disposal of CDW	Illegal disposal of waste has been a problem for a long time, especially in situation where transportation distances from generator to landfill are long and transportation costs weight heavily. However, in the next future, the actions addressed to promote recycling will discourage

	illegal dumping, reducing negative environmental effects upon groundwater, surface-water, air, flora, fauna and landscape.
CDW data collection barriers	
Lack of reliable data on generation and treatment of CDW	Over the last decade, there was a significant improvement on accurate CDW data at site, company, regional and national levels. However, there is still limited high quality detailed information when it comes to different types of CDW materials (especially at national level).

Table 13 Mapping of drivers and barriers for CDW recycling - Author's elaboration based on D1.1

5.7 CDW sector - the recycled materials market

At global level, the CDW recycling market is the largest opportunity and has high potential particularly in Europe where it is strongly driven by the Waste Directive, with the recycling target of 70% by 2020. The analysis conducted by Frost & Sullivan entitled "European Construction and Demolition Recycling Services Market", finds that this market is likely to hit Euro 17 billion (US$ 24 billion) by 2020, a Euro 3 billion increase compared to 2013 revenues. The outlook is especially promising in Western Europe (Figure 16), where authorities are creating legal frameworks and are encouraging the development of CDW recycling services. Western Europe offers the most opportunity given high collection rates, low business risk and CDW recycling targets of 70% recovery rate by 2020. Market revenues will also get a leg up from the future optimisation of collection and recycling technologies.

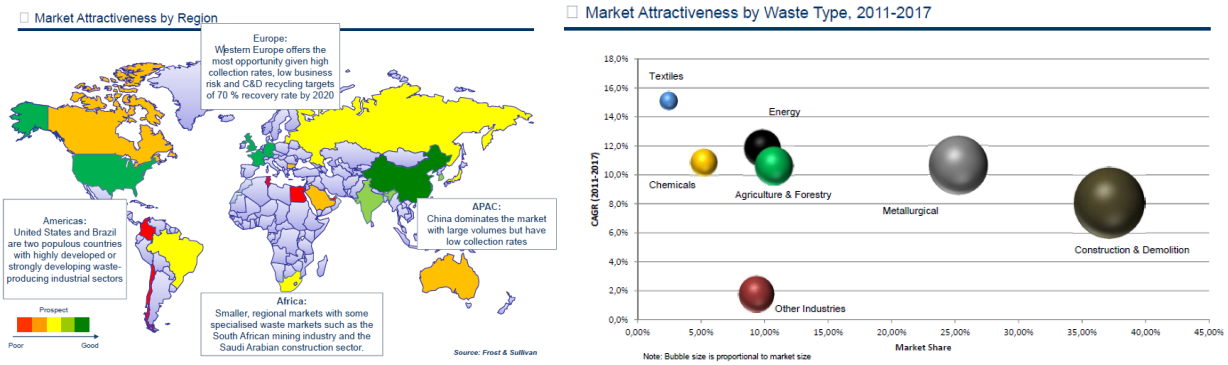

Figure 16 Market attractiveness by region (left) and Market attractiveness by Waste Type 2011-2017 (right) - (TEKES, 2012)

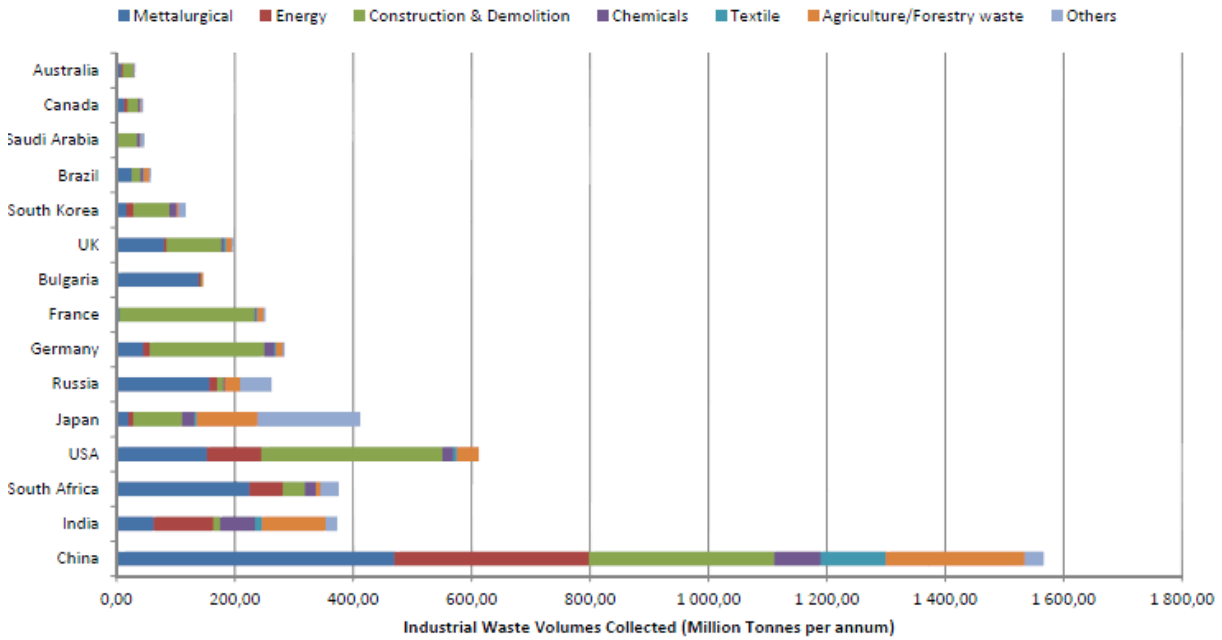

Figure 17 Industrial Waste Volumes Collected (Million Tonnes per annum) - (TEKES, 2012)

European market of CDW is characterized by three important trends which can lead to rapid development of new solutions for CDW management. First of all, **increase of prices** for waste disposal is observed and this process may stimulate development of companies interested in CDW management. Moreover, it is predicted that EU countries will move towards **unification of regulations** aimed at CDW management. Finally, the unification process will also change the tasks of EU **local governments** and it is expected that they will be more **responsible for local waste management**. As a result, the governments will have to reduce the volume of landfill waste and to achieve appropriate levels of preparation of re-use, recovery and recycling waste. These factors may create new possibilities for development and commercialization of innovative sorting and recycling technologies, as described in the (HISER Project).

Table 14 maps the primary forces (i.e. drivers and barriers/obstacles) that will characterize the global recycled market in the following 7 years.

Rank	Driver	1-2 years	3-4 years	5-7 years
1	Legislative pressure and sustainable waste management approach	H	H	H
2	Dependence on imports of scarce raw materials	H	H	H
3	Scarcity of land for disposal	M	H	H
4	Demand for solutions reducing industrial footprint	M	M	H

Rank	Barrier	1-2 years	3-4 years	5-7 years
1	High initial investment cost	H	H	M
2	Euro-zone crisis	H	M	L
3	Continuing dependence on landfill disposal	H	M	L
4	Slow technology adoption	M	M	L

Table 14 Mapping of key CDW market forces (Author's elaboration based on Frost & Sullivan study)

The interest in CDW recycling is increasing even beyond developed countries. In the Gulf region, where major infrastructure projects are on the rise but baseline recycling levels are low (4% in Qatar in 2012) several CDW recycling projects have been developed using Public-Private Partnership (PPP) model. These projects include plants established in Amman (Jordan), Kuwait, and Dubai and Sharjah (United Arab Emirates). In countries such as China and India where urban infrastructure development and re-development are expanding rapidly, CDW recycling has become a business opportunity for the private sector, but with the current CDW recycling rates estimated at 5% in China (2013) and 50% in India (2014), there is still some way to go to fulfil that potential (United Nations Environment Programme, 2015).

- **CDW market by Hot Spot Country in Europe**

The top 3 country markets in Europe identified by international studies (Frost & Sullivan) are Germany, France, and United Kingdom. The following table (Table 15) summarises the main aspects of the recycling market in the construction sector (wastes, products and key companies) by hot spot country identified.

C&D Sector	Germany	France	UK
Wastes	Mineral waste, soil and track ballast, asphalt, concrete, bricks, tiles	Mineral waste, wood, glass, metals, plastics, gypsum	Mineral waste; wood; gypsum
Products	Roads and paths construction, landfill covers	Glass, metal, plastic elements, paper, bricks, road construction, clinkers, roofing granules, aggregate for paving materials, and asphalt filler, chipboard, steel	Recycled aggregates: Current use: pipe bedding, sub-base and base courses in highway pavement construction

C&D Sector	Germany	France	UK
			Potential use:precast concrete products Wood waste: used for animal bedding or panel-board manufacture Gypsum plasterboard which is used in the manufacture of new plasterboard
Key Companies	Remondis, Alba, Buhck Group, Jackob Becker, BIBKO, SITA, Veolia, Titech, SutcoRecyclingtechnik	Veolia, SITA, Nicollin, Vauche, FCC, Remondis, Van Gansewinkel, Titech	Remondis, Veolia, SITA, Titech, FCC, Biffa, Shanks, Viridor

Table 15 CDW Materials and Recyclable Products by Hot Spot Country (Author's elaboration based on Frost & Sullivan study)

Germany

Germany generated 199.342.097 tonnes of non-hazardous wastes in construction sector in 2014 (the 23% of the total wastes produced in EU-28).

Germany presents one of the higher recovery rates for CDW in Europe and has already achieved the 70% target of WFD. This recovery rate is due also to the higher targets defined under § 14 Promotion of recycling and other material recycling of the Circular Economy Act (KrWG).

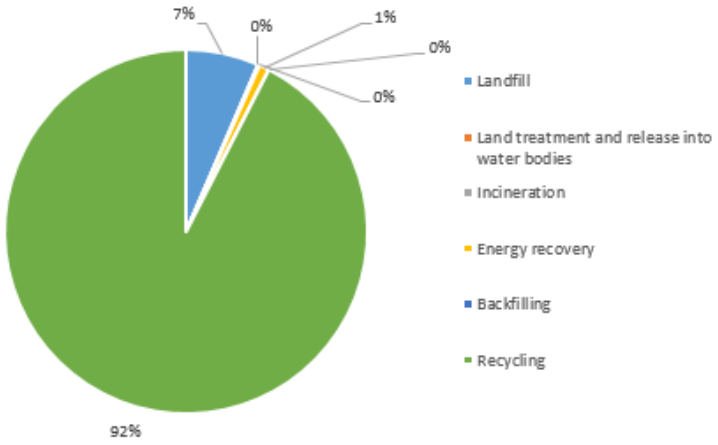

Figure 18 Non-hazardous mineral waste from construction and demolition treatment (tonnes) in Germany - Author's elaboration on EUROSTAT data

In terms of composition of CDW, it consists of building rubble, road construction, soil and stones, as well as building site waste. Construction gypsum plasters are collected separately.

The German construction industry recycles around 92% of the annual non-hazardous mineral construction waste. The 7% of the same waste is sent to backfilling, the data about the other treatments are negligible (Figure 18).

As a consequence, less construction waste needs to be disposed at landfills and less natural resources need to be used to provide new construction materials. The achievements of the construction industry are reported every two years in form of monitoring reports to the German national government. This transparent approach leads to confidence in all implicated sectors.

The potential applications of several building materials are reported in the following Table 16.

CDW material	Application
CONCRETE	Concrete waste in Germany is mainly used as filling material for roadworks. In addition, the first architectural projects are finalised using RE concrete (Neubau von Forschungs- und Laborgebäude Lebenswissenschaften Humboldt-Universität). Due to limited access to sand and other aggregates necessary for concrete the use of RE concrete is very common.
BRICKS	Bricks are reused in smaller applications, where full bricks could be dismantled from the building.
WOOD	Due to a surplus of wood in Germany, recycled materials are mainly used for energy generation. In addition, in buildings constructed after World War II, wooden elements were often treated, which implies that material cannot be reused inside buildings.
GYPSUM	In Germany plasterboards offer a high potential for recycling, whereas gypsum plaster boards are rarely generated from CDW.

Table 16 Main applications of CDW in Germany by product (source: D1.1)

France generated 224.793.291 tonnes of non-hazardous wastes in construction sector in 2014 (the 26% of the total wastes produced in EU-28). The French construction industry recoveries (recycling and backfilling treatments) around 71% of the annual non-hazardous mineral construction waste. The 29% is sent to landfilling. The data of other forms of treatments are negligible (Figure 19).

Recycled aggregates are the main CDW product, mainly used for backfilling and road building. Plaster and wood are two other waste streams for which recycling is already operational.

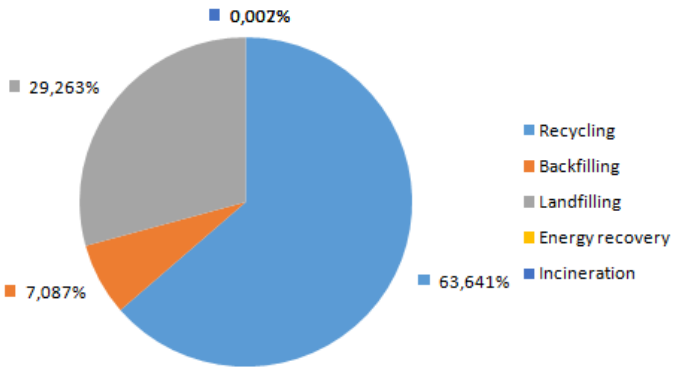

Figure 19 Non-hazardous mineral waste from construction and demolition treatment (tonnes) in France- Author's elaboration on EUROSTAT data (2014)

United Kingdom generated 119.646.735 tonnes of non-hazardous wastes in construction sector in 2014 (the 14% of the total wastes produced in EU-28).
The UK construction industry recycles around 92% of the annual non-hazardous mineral construction waste. 4.82% is sent to landfilling and 2.6% to backfilling. Other forms of treatments may be considered negligible (Figure 20).
The CDW recycled materials market in UK is characterized by the following drivers/levies:

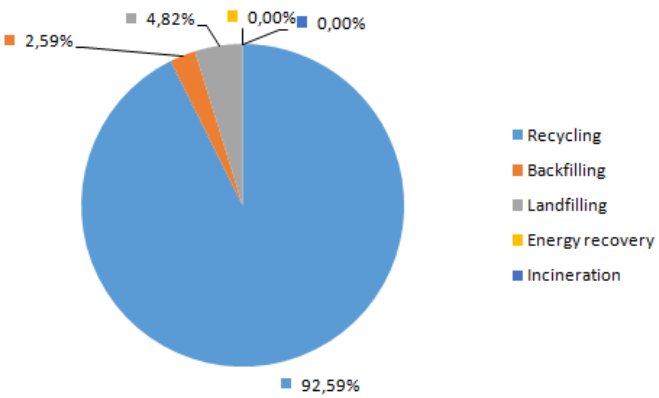

Figure 20 Non-hazardous mineral waste from construction and demolition treatment (tonnes) in United Kingdom- Author's elaboration on EUROSTAT data (2014)

- **Strong market growth before the introduction of Aggregates Levy.**
- **The Aggregates Levy.** Aggregates levy is a tax that applies to the commercial exploitation of aggregate (digging, dredging or importing rocks, sand or gravel). It was introduced as an environmental tax in 2002 by the UK Government to encourage the recycling of aggregate. The levy is charged at a flat rate of £2 for every tonne of aggregate extracted. It is also applied at a proportional rate for quantities less than a tonne.
- **Increasing cost of landfill, including the impact of the landfill tax.** The Landfill Tax applies to the disposal of waste in landfills. It was introduced as an environmental tax in 1996 by the UK Government to increase diversion of waste from landfills. The cost for this is currently £84.40/tonne standard rate and £2.65/tonne lower rate. The lower rate is paid on "inactive waste" such as rocks or soil.
- **BREEAM** (Building Research Establishment Environmental Assessment Method) **awards credits** to projects that meet targets for diverting CDW from landfills. This has led to an increase in recycling with construction contractors demanding better performance from their waste management subcontractors.
- **WRAP** (Waste Resources Action Programme) has developed a number of projects aiming to increase recycling of CDW. Working together with the government and the construction industry they provide assistance to companies in diverting CDW from landfills. In addition, they provide assistance in financing recycling plants.
- **Increasing willingness of clients** to use such materials, implying greater technical awareness and confidence in these material
- More "professional" marketing of recycled and secondary materials.

The main CDW product in the UK is **recycled aggregate** which is mainly used as unbound recycled aggregate for pipe bedding, sub-base and base courses in highway pavement construction. However, research conducted in Northwest England over the last ten years demonstrated the

potential for using recycled aggregate as a replacement for virgin aggregate in a number of different precast concrete products (i.e. concrete building blocks, paving blocks and flags). According to the Minerals Production Association (MPA) 29% (61 out of 210 million tonnes) of aggregates used in the UK in 2014 came from recycled or secondary sources. The Aggregates Levy has significantly increased the use of recycled aggregates.
Other CDW products include **wood waste** which is used for animal bedding or **panel-board** manufacture and **gypsum plasterboard** which is used in the manufacture of new plasterboard.

The **key players in the top 3 EU countries** along the value chain of CDW Recycling & Services is represented in the following table (Table 17).

Company	Coverage in Hot-Spot Countries	Collection	Recycling	Incineration	Landfilling
Remondis	Germany, France, UK				
Veolia Environment	Germany, France, UK				
Alba	Germany				
Buhck Group	Germany				
Jackob Becker	Germany				
SITA Suez	Germany, France, UK				
Titech	France, UK, Germany				
Nicollin	France				
Vauche	France				
FCC	France, UK				
Biffa	UK				
Viridor	UK				
Shanks	UK				

Table 17 Mapping of key companies along the value chain of CDW Recycling & Services (Author's elaboration based on Frost & Sullivan study)

- **REMONDIS** is a full service provider in the areas of minerals recycling, demolition and dismantling work as well as in the production of construction materials. It is present in Germany, France and United Kingdom (www.remondis.com). Figure 21 depicts REMONDIS' recycling business.

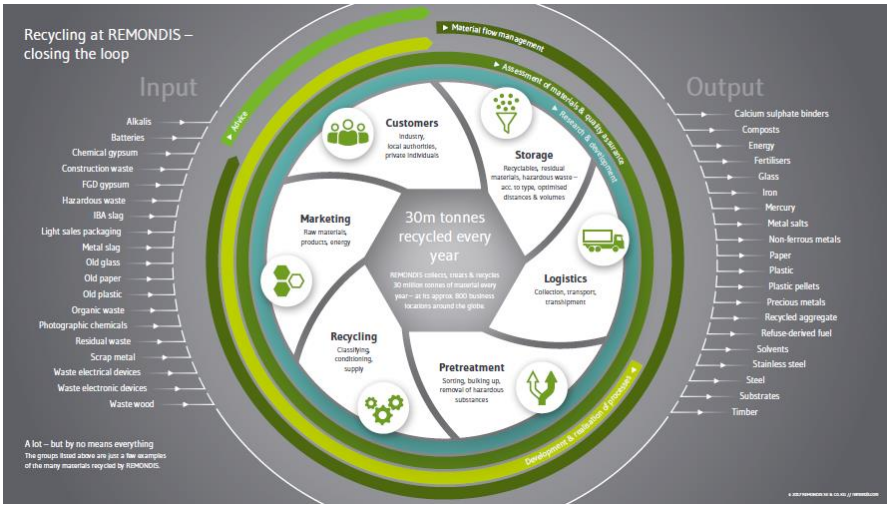

Figure 21 REMONDIS' recycling business model (on-line source)

- **VEOLIA ENVIRONMENT** provides industrial waste management services, from flow logistics upstream to technologically advanced treatments downstream. It is present in Germany, France and United Kingdom (http://www.veolia.com).

- **TITECH** is a global leader in sensor-based sorting systems continues to spearhead the market's development by constantly working to offer the best technology available. It is present in Germany, France and United Kingdom (www.titech.com).

- **CDW market by Hot Spot products at EU level**

The following table summarizes application field, production (in terms of value or quantity), waste generation, treatment options, environmental impacts, and drivers and barriers in the recycling market for several building materials (concrete, bricks, tiles and ceramics, asphalt, wood, (natural or synthetic) gypsum.

MATERIAL	MAIN APPLICATION	PRODUCTION	WASTE GENERATION [IN TONNES]	TREATMENT OPTION	ENVIRONMENTAL IMPACTS	DRIVERS AND BARRIERS
Concrete	Buildings, roads, infrastructure	• The value of concrete production is 74 billion € (Source: The Concrete initiative Project) • Ready-mixed concrete: - 338 millions of m^3 (Source: ERMCO - 2013) • Precast concrete: - 24 billion € of production in 2015 - 5.500 companies (Source: BIBM)	1/3 of CDW consists of concrete (Pepe, 2015)	Landfill; Recycling into aggregates for road construction or backfilling; Recycling into aggregates for concrete production; Re-use of precast elements (concrete blocks). The 30% of concrete waste is recovered as aggregates for road construction or backfilling in the EU while a small part is recycled into aggregates for concrete production. Concrete could yet	Land-use, transportation	<u>Barriers:</u> - Low cost and availability of raw materials - Perceived quality of secondary raw materials (Existing/potential) <u>Drivers:</u> - Landfill taxes/bans - Advanced, new techniques of sorting - Aggregates levy in UK - Quality certification for recycled materials - Green Public Procurements

MATERIAL	MAIN APPLICATION	PRODUCTION	WASTE GENERATION [IN TONNES]	TREATMENT OPTION	ENVIRONMENTAL IMPACTS	DRIVERS AND BARRIERS
				be re-used as precast elements (concrete blocks). On the other hand, steel is recycled up to 98% in the EU-27 (Deloitte, 2016). • Precast concrete: Precast concrete is completely complying with the principles of circular economy, as it is fully recyclable and can be reused in other construction applications, e.g. smaller pieces of concrete are used as gravel for new construction projects. Furthermore, the concrete rubble will		

MATERIAL	MAIN APPLICATION	PRODUCTION	WASTE GENERATION [IN TONNES]	TREATMENT OPTION	ENVIRONMENTAL IMPACTS	DRIVERS AND BARRIERS
				carbonate and absorb CO_2 from the atmosphere. 10% of total aggregate may be replaced by good quality crushed concrete e.g. in road construction (BIBM).		
Bricks	Bricks: masonry, construction	6.8 billion Euros sales in 2003 (for 23 European countries) No data available on quantities Source: (Bio Intelligence Service, 2011)	N/A	Landfill; Recycling (replaces sand, gravel, stones, rocks e.g. to fill roads, to produce tennis sand, to serve as aggregate in concrete); Re-use (Brick-to-brick in Belgium)	Land-use, transportation	Barriers: The reduced prices of new products (Existing/potential) Drivers: Landfill taxes or landfill bans to promote alternatives; selective demolition
Tiles and ceramic	Tiles: covering of roofs, floors, walls			Landfill; Recycling (replaces sand, gravel, stones, rocks e.g. to fill roads, to produce tennis sand, to serve as aggregate in concrete); Re-use	Land-use, transportation	Barriers: The reduced prices of new products (Existing/potential) Drivers:

MATERIAL	MAIN APPLICATION	PRODUCTION	WASTE GENERATION [IN TONNES]	TREATMENT OPTION	ENVIRONMENTAL IMPACTS	DRIVERS AND BARRIERS
						Landfill taxes or landfill bans to promote alternatives; selective demolition
Asphalt	Pavement for road construction and maintenance	Total production of hot and warm mix asphalt in EU-28 in 2015: 225,9 Number of companies: production only (>387); production and laying (>1.530); Laying only (>7.795) Source: (EAPA, 2015)	All available reclaimed asphalt (in 21 EU countries): 45,75 Source: (EAPA, 2015)	Landfill; Recycling in a stationary plant; In-situ recycling; Material recovery	Potential emission of PAH when asphalt is contaminated with tar; land-use; transportation	(Existing/potential) Drivers: - Increment of raw material prices; landfill ban; - Information/communication on economic benefits associated with recycling practices Barriers: - Availability and low cost of raw material; - Lack of knowledge for the improvement of the manufacturing process
Wood	Roof structure, building framework, floors, doors, etc.	Total production value: 268.4 billion Euros (2007) - Furniture industry accounts for 48%	Total amount of waste generated within the EU-27: 70.5 million tonnes (2004)	Landfill; Recycling into derived timber Products; Energy recovery	Production of methane (CH_4), land-use, transportation	(Existing/potential) Drivers: - Less availability of raw materials - Increment of price of raw materials

MATERIAL	MAIN APPLICATION	PRODUCTION	WASTE GENERATION [IN TONNES]	TREATMENT OPTION	ENVIRONMENTAL IMPACTS	DRIVERS AND BARRIERS
		- Construction Sector accounts for 20% Estimated consumption of construction wood in EU-27: 41.5 million tonnes Source: (Bio Intelligence Service, 2011)	Estimation for C&D wood waste: 10-20 million tonnes generated/year 116in the EU-27 Source: (Bio Intelligence Service, 2011)	- Recycled into derived timber products: 30% of wood waste - Recovered for energy: 34% Source: (Deloitte, 2016)		- Advanced, new techniques of sorting <u>Barriers</u>: - The intensity of the competition between material and energy recovery - Prices for sorting, storage and treatment of specific waste wood fractions - Contamination with hazardous substances
(Natural or synthetic) Gypsum	Natural gypsum is extracted from open-cast or underground mines. Synthetic gypsum is generated during flue gas cleaning processes at coal-fired power stations. Main applications in buildings (non load-bearing building elements): plasterboard, decorative	Turnover of over 7.5 billion Euro 160 quarries and about 200 factories (plaster powder plants, plaster block plants and plasterboard plants) (source: Eurogypsum)		Landfill; Recycling into new plasterboards (in substitution of natural or synthetic gypsum	Plasterboards disposal, Land-use, transportation	(Existing/potential) <u>Drivers</u>: - Less availability of raw materials - Increment of price of raw materials - Advanced, new techniques of sorting <u>Barriers:</u> - High availability and low cost of raw material - Selective deconstruction techniques are already

MATERIAL	MAIN APPLICATION	PRODUCTION	WASTE GENERATION [IN TONNES]	TREATMENT OPTION	ENVIRONMENTAL IMPACTS	DRIVERS AND BARRIERS
	plaster, building plaster, plaster block, gypsum based self levelling screed, gypsum fibreboards)	Primary producers of natural gypsum are Spain (52%), France (8.1%), Germany (7.3%), the UK (6%), Italy (5.5%) and Poland (5.2%) accounting for 24 million tonnes of gypsum produced in 2008 (Monier et al., 2011).				designed but are not implemented because too costly - In most countries, landfill taxes are too low to encourage the development of recycling - Export of gypsum wastes for backfilling (e.g. former salt mines in DE) - The manufacturing processes currently do not allow the re-introduction of a higher recycled gypsum powder content.

Table 18 CDW market by hot spot products at EU level

6. CONCLUSIONS: LESSONS LEARNED FROM THE DATA COLLECTION AND STATISTICS ASSESSMENT AND RELATED RECOMMENDATIONS

From the collected data and from the statistics assessment six lessons and related recommendations can be delineated; these are reported in the following:

LESSON LEARNED 1: Unfavourable market conditions for recycled CDW materials

Currently the recycle and reuse of materials represent a niche market, as a direct result of two main barriers:

- Lack of trust in recycled CDW materials, despite the fact that they fulfill requirements and quality standards equal to the primary raw materials (linked to LESSON LEARNED 2.)
- Low prices of natural raw materials (easily and locally available) and landfilling treatment.

RECOMMENDATIONS

Overcoming the above-mentioned barriers could be a solution *per se*. In addition the following recommendations are suggested:

- Promoting Green Public Procurement (GPP) as a framework for obliging a specific requirement for the use of secondary raw materials (minimum content of recycled materials) in public construction works (in particular for the aggregates market)
- Making landfilling of waste unattractive, by introducing a ban or increasing the landfill tax levels
- Introducing incentives for economic operators in order to choose recycled material over natural
- Including environmental costs within the cost for natural aggregates (e.g. *Aggregates Levy* in UK)
- Introducing taxes on resources extraction, that could contribute to increase the prices of virgin materials and make secondary raw materials more competitive
- Introducing innovative and advanced techniques for sorting (on-site sorting) and demolition activities (selective demolition/ controlled deconstruction)
- Targeted marketing efforts could be aimed at CDW actors on more technical subjects. More professional marketing of recycled and secondary materials is needed.

LESSON LEARNED 2: Low perceived quality of CDW derived materials

The misconception of the quality of CDW derived materials is a huge cultural barrier to overcome, especially for their use in structural application, due to the lack of confidence that reduces the demand for recycled materials derived from CDW. In addition, there is uncertainty about the potential health risk for workers using recycled materials.

RECOMMENDATIONS

The main corresponding recommendations to overcome this long-standing problem are summarized below:

- Improving CDW industry professionals expertise
- Sharing and promoting best practices and informing end users about ongoing European projects related to recycling
- Giving potential users clear information about availability of recycled materials and the advantages of using secondary raw materials in construction and renovation works
- Quality certification of secondary raw materials from CDW
- Introduce a different use of words, preferring secondary raw materials to wastes.

LESSON LEARNED 3: Improving the legislative framework for CDW recycling

The strong legal framework enables a good level of CDW management leading to higher recovery rates of CDW. However much more might be done.

RECOMMENDATIONS

- A stronger legislative framework (including a limitation of backfilling, an introduction of mandatory selective demolition, etc.) would increase CDW recovery
- Harmonize the use of economic instruments at EU level. For example, a harmonization of landfill taxes could contribute to avoid the export of CDW to countries where the landfilling of a particular waste is permitted or the landfilling is cheaper.

LESSON LEARNED 4: Revise the target for 70% recycling of construction, demolition and excavation waste across Europe by 2020

The data and available studies show that high recycling rates appear to be achievable, especially in countries characterised by a high demand for construction materials, limited primary resources and, thus, a well-developed market for secondary construction material. The assessment that about half of the MS will have to strengthen their efforts to reach the existing target of 70% recycling of CDW by 2020 indicates that an increased target will not be met by the majority of MS.

RECOMMENDATIONS

- The targets need to be constructed with some allowances made for the individual market conditions within each MS. Differentiated target for different groups of MS could be set in the WFD or alternatively, in each national legislation
- Review the target, focusing on the use of recycled CDW into higher value construction applications (such as concrete).

LESSON LEARNED 5: Improving CDW data availability, quality and comparability at EU level (EUROSTAT)

Starting from the data collection practices analysis all over Europe and in accordance with the study by Deloitte (Bio Service by Deloitte, 2016), in order to best measure CDW management practices, more detailed data should be collected in terms of waste generation and treatment by country/region, sector, activity and material/product as depicted in the following table (Table 19).

	Country/Region	Sector	Activity	Material/Product

Waste generation	(EU Country)	Construction	Construction Activity / Demolition Activity	Concrete, bricks, ceramic and tiles, etc.
Waste treatment	(EU Country)	Construction	Construction Activity / Demolition Activity	Concrete, bricks, ceramic and tiles, etc.

Table 19

RECOMMENDATIONS

- Having a common definition of CDW: different definitions are applied throughout the EU, which makes cross-country comparisons very difficult. In some countries even materials from land levelling are regarded as CDW. A unique and common definition of this category can help to compare data among different countries and avoid making big mistakes in interpretation
- Investigating ways of improving the harmonisation of methodology and data compilation between countries
- Establishing of a standard procedure for the estimation of standard errors
- Increasing transparency, traceability, monitoring and reporting
- Promoting strong collaboration between different institutes seems to gather very efficient results regarding data quality.

LESSON LEARNED 6: Construction sector needs a "Cultural revolution". Turning waste management into resource management

As briefly reported in paragraph 5.7, the secondary raw materials market (with the support of future or available driving forces) can be an important business opportunity. Some big waste operators (e.g. Veolia) are focusing its strategy on moving away from a resource operator and changing to a manufacturing company shaping the circular economy.

RECOMMENDATIONS

- Development of information/communication system. New messages addressed to key actors of construction and demolition process and CDW operators
- Promoting the principles of circular economy as a business opportunity not only as strategy to improve a business reputation
- Professionalisation of operators (waste managers/builders/contractors/architects/engineers/ workforce).

7. REFERENCES

- Contacted stakeholders: see Appendix 1.
- Literature sources: see references of D1.1
- Other online sources:

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[27] Ying-Ying Laia, L.-H. Y.-F.-H.-M. (2016). Management and Recycling of Construction Waste in Taiwan. ELSEVIER.

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Generation of waste by waste category, hazardousness and NACE Rev. 2 activity (env_wasgen)

Treatment of waste by waste category, hazardousness and waste operations (env_wastrt)

8. ANNEXES

ANNEX 1. LIST OF NATIONAL AUTHORITIES (DIRECTLY/INDIRECTLY) CONSULTED BY COUNTRY

Country	Data	Source	Contact [website]	Contact [email]
Austria	CDW generation	[19] Bundesministerium für Land- und Forstwirtschaft, Umwelt und Wasserwirtschaft: Die Bestandsaufnahme der Abfallwirtschaft in Österreich Statusbericht 2015		
	CDW treatment	As above		
	CDW export/import	As above		
	CDW treatment facilities	As above		
Belgium (PC)	CDW generation	EUROSTAT	http://ec.europa.eu/eurostat/data/database	estat-esac@ec.europa.eu
	CDW treatment	Environment Brussels	http://www.environment.brussels/state-environment/summary-report-2011-2012/waste/construction-and-demolition-waste	http://www.leefmilieu.brussels/wie-zijn-wij/contacteer-ons
		OVAM	www.ovam.be/sites/default/files/Publicatie%20bedrijfsafvalstoffen%202004-2012%20%28uitgave%202014%29.pdf	info@ovam.be
		Hiser Project	http://www.hiserproject.eu/index.php/news/80-news/158-mass-flow-of-bricks-concrete-gypsum-and-wood-in-belgium-the-netherlands-spain-and-finland	david.garcia@tecnalia.com
		Environnement wallonie	http://environnement.wallonie.be/rapports/owd/pwd/catflux1.pdf	martine.gillet@spw.wallonie.be
	CDW export/import	EUROSTAT	http://ec.europa.eu/eurostat/data/database	estat-esac@ec.europa.eu
	CDW treatment facilities	EUROSTAT	http://ec.europa.eu/eurostat/data/database	estat-esac@ec.europa.eu
		EUROSTAT	*ec.europa.eu/environment/waste/studies/.../CDW_Belgium_Factsheet_Final.pdf*	begsvfacreception@deloitte.com
Bulgaria	CDW generation	EUROSTAT	http://ec.europa.eu/eurostat/data/database	
	CDW treatment	EUROSTAT	http://ec.europa.eu/eurostat/data/database	

Country	Data	Source	Contact [website]	Contact [email]
	CDW export/import	Deloitte, D.B.b., Bulgaria, in Construction and Demolition Waste Management in 2015	http://ec.europa.eu/environment/waste/studies/mixed_waste.htm	
	CDW treatment facilities	Deloitte, D.B.b., Bulgaria, in Construction and Demolition Waste Management in 2015	http://ec.europa.eu/environment/waste/studies/mixed_waste.htm	
Croatia	CDW generation	EUROSTAT	http://ec.europa.eu/eurostat/data/database	
	CDW treatment	EUROSTAT	http://ec.europa.eu/eurostat/data/database	
	CDW export/import	-	-	
	CDW treatment facilities	-	-	
Cyprus	CDW generation	EUROSTAT	http://appsso.eurostat.ec.europa.eu/nui/show.do?dataset=env_wasgen&lang=en	
	CDW treatment	EUROSTAT	http://appsso.eurostat.ec.europa.eu/nui/show.do?dataset=env_wastrt&lang=en	
	CDW export/import	Construction and Demolition Waste Management in Cyprus, Version 2-September 2015	http://ec.europa.eu/environment/waste/studies/deliverables/CDW_Cyprus_Factsheet_Final.pdf	
	CDW treatment facilities	Cyprus Recycling Organisation (OAK)	http://www.oak.org.cy/files/monades/2015/201505limassol-monada.pdf http://www.oak.org.cy/files/monades/2015/201505larnaca-nicosia-monada.pdf http://www.oak.org.cy/files/monades/2015/201505nicosia-monada.pdf	
Czech Republic (PC)	CDW generation	http://www.arsm.cz/dok/Sbornik_RECYCLING_2016.pdf	http://www.arsm.cz/	arsm@arsm.cz
	CDW treatment	http://ec.europa.eu/environment/waste/studies/deliverables/CDW_Czech%20Republic_Factsheet_Final.pdf	https://www.czso.cz/csu/czso/home	lucie.vackova@czso.cz
	CDW export/import	http://ec.europa.eu/environment/waste/studies/deliverables/CDW_Czech%20Republic_Factsheet_Final.pdf	http://www.mzp.cz/en/	
Denmark	CDW treatment	Deloitte, D.B.b., *Denmark*, in *Construction and Demolition Waste Management in* 2015	http://ec.europa.eu/environment/waste/studies/deliverables/CDW_Denmark_Factsheet_Final.pdf	
	CDW export/import			

Country	Data	Source	Contact [website]	Contact [email]
	CDW treatment facilities			
Estonia	CDW generation	EUROSTAT	http://ec.europa.eu/eurostat/data/database	
	CDW treatment	EUROSTAT	http://ec.europa.eu/eurostat/data/database	
	CDW export/import	Deloitte, D.B.b., *Estonia, in Construction and Demolition Waste Management in* 2015	http://ec.europa.eu/environment/waste/studies/mixed_waste.htm	
	CDW treatment facilities			
Finland	CDW generation	Deloitte, D.B.b., *Finland*, in *Construction and Demolition Waste Management in* 2015	http://ec.europa.eu/environment/waste/studies/deliverables/CDW_Finland_Factsheet_Final.pdf	
	CDW treatment			
	CDW export/import			
	CDW treatment facilities			
France	CDW generation	EUROSTAT	http://ec.europa.eu/eurostat/data/database	
		ADEME	http://www.ademe.fr/dechets-chiffres-cles	Laurent CHATEAU <laurent.chateau@ademe.fr>
		Observation and Statistics department (SOeS)	http://www.statistiques.developpement-durable.gouv.fr/logement-construction/s/entreprises-btp-enquetes-thematiques.html	CHAUVET-PEYRARD Axelle (Cheffe de bureau) - CGDD/SOeS/SDSLC/BSEPC <a.chauvet-peyrard.-.bsepc.sdslc.soes.cgdd@developpement-durable.gouv.fr>
		Fédération Française du Bâtiment (FFB)	http://www.dechets-chantier.ffbatiment.fr/res/dechets_chantier/PDF/Dechets_QR_231014_V5protegee.pdf	coullonS@national.ffbatiment.fr
	CDW treatment	Observation and Statistics department (SOeS)	http://www.statistiques.developpement-durable.gouv.fr/logement-construction/s/entreprises-btp-enquetes-thematiques.html	CHAUVET-PEYRARD Axelle (Cheffe de bureau) - CGDD/SOeS/SDSLC/BSEPC <a.chauvet-peyrard.-.bsepc.sdslc.soes.cgdd@developpement-durable.gouv.fr>
		Observatoire Régional des Déchets d'Île-de-France (ORDIF)	www.ordif.com	Blandine Barrault <b.barrault@ordif.com>
		SNED	http://www.sned.fr/mediatheque/Brochure_SNED_dechets_web.pdf	
	CDW export/import	Observation and Statistics department (SOeS)	http://www.statistiques.developpement-durable.gouv.fr/publications/p/2543/1154/rapport-2013-mouvements-transfrontaliers-dechets-cadre.html	

Country	Data	Source	Contact [website]	Contact [email]
	CDW treatment facilities	Observatoire Régional des Déchets d'Île-de-France (ORDIF)	www.ordif.com	Blandine Barrault <b.barrault@ordif.com>
		ADEME	http://www.ademe.fr/dechets-chiffres-cles	Laurent CHATEAU <laurent.chateau@ademe.fr>
Germany (PC)	CDW generation	Mineral waste in Germany (2012) broken down into different streams, source Federal Ministry for Environment	[8] https://www.umweltbund esamt.de/daten/abfallkreislaufwirtschaft/abfallaufkommen#textpart-3, access date 02.01.2017	
	CDW treatment	[25] Federal Statistical Office, 2014: Waste balance, Artikelnummer 5231001147004		
	CDW export/import	[10] https://www.umweltbundesamt.de/themen/abfall-ressourcen/grenzueberschreitende-abfallverbringung/grenzueberschreitende-abfallstatistik, access date 02.01.2017		
	CDW treatment facilities	-	-	
Greece	CDW generation	EUROSTAT	http://ec.europa.eu/eurostat/data/database	
	CDW treatment	EUROSTAT	http://ec.europa.eu/eurostat/data/database	
	CDW export/import	-	-	
	CDW treatment facilities	-	-	
Hungary	CDW generation	EUROSTAT	http://ec.europa.eu/eurostat/data/database	
	CDW treatment	EUROSTAT	http://ec.europa.eu/eurostat/data/database	
	CDW export/import	-		
	CDW treatment facilities	Deloitte, D.B.b., *Hungary, in Construction and Demolition Waste Management in* 2015	http://ec.europa.eu/environment/waste/studies/mixed_waste.htm	

Country	Data	Source	Contact [website]	Contact [email]
Ireland	CDW generation	Environmental Protection Agency (EPA)	http://www.epa.ie/pubs/reports/waste/stats/EPA_National_Waste_Report_2008.pdf	
			http://www.epa.ie/pubs/reports/waste/stats/EPA_NWR_09_web.pdf	
			http://www.epa.ie/pubs/reports/waste/stats/EPA_NWR_2010_web.pdf	
			http://www.epa.ie/pubs/reports/waste/stats/EPA_NWR11_12Nov11_haz%20tables%20updated%20as%20per%20errata.pdf	
	CDW treatment	Environmental Protection Agency (EPA)	http://www.epa.ie/pubs/reports/waste/stats/EPA_National_Waste_Report_2008.pdf	
			http://www.epa.ie/pubs/reports/waste/stats/EPA_NWR_09_web.pdf	
			http://www.epa.ie/pubs/reports/waste/stats/EPA_NWR_2010_web.pdf	
			http://www.epa.ie/pubs/reports/waste/stats/EPA_NWR11_12Nov11_haz%20tables%20updated%20as%20per%20errata.pdf	
	CDW export/import	Construction and Demolition Waste Management in Ireland, Version 2- September 2015	http://ec.europa.eu/environment/waste/studies/deliverables/CDW_Ireland_Factsheet_Final.pdf	
	CDW treatment facilities	Construction and Demolition Waste Management in Ireland, Version 2- September 2015	http://ec.europa.eu/environment/waste/studies/deliverables/CDW_Ireland_Factsheet_Final.pdf	
Italy (PC)	CDW generation	ISPRA - Rapporto rifiuti speciali 2016	http://www.isprambiente.gov.it/it/pubblicazioni/rapporti/rapporto-rifiuti-speciali-edizione-2016	
	CDW treatment			
	CDW export/import			
	CDW treatment facilities	ISPRA - Rapporto rifiuti speciali 2016	http://www.isprambiente.gov.it/it/pubblicazioni/rapporti/rapporto-rifiuti-speciali-edizione-2016	
Latvia	CDW generation	EUROSTAT	http://ec.europa.eu/eurostat/data/database	
	CDW treatment	EUROSTAT	http://ec.europa.eu/eurostat/data/database	
	CDW export/import	Latvian Environmental, Geological and Meteorological Centre	https://www.meteo.lv/en/	
	CDW treatment facilities	EUROSTAT	http://ec.europa.eu/eurostat/data/database	

Country	Data	Source	Contact [website]	Contact [email]
Lithuania	CDW generation	EUROSTAT	http://ec.europa.eu/eurostat/data/database	
	CDW treatment	EUROSTAT	http://ec.europa.eu/eurostat/data/database	
	CDW export/import	-	-	
	CDW treatment facilities	EUROSTAT	http://ec.europa.eu/eurostat/data/database	
Luxembourg	CDW generation	EUROSTAT	http://ec.europa.eu/eurostat/data/database	
	CDW treatment	EUROSTAT	http://ec.europa.eu/eurostat/data/database	
	CDW export/import	Deloitte, D.B.b., *Luxembourg, in Construction and Demolition Waste Management in* 2015	http://ec.europa.eu/environment/waste/studies/mixed_waste.htm	
	CDW treatment facilities	EUROSTAT	http://ec.europa.eu/eurostat/data/database	
Malta	CDW generation	Malta today	http://www.maltatoday.com.mt/environment/environment/70252/paceville_megaprojects_will_generate_2_million_cubic_metres_of_construction_waste#.WFqSBEYw2Qk	maltatoday@mediatoday.com.mt
		National Statistics Office	https://nso.gov.mt/en/News_Releases/View_by_Unit/Unit_B3/Environment_Energy_Transport_and_Agriculture_Statistics/Documents/2016/News2016_007.pdf	mario.borg@gov.mt
		Eurostat	http://ec.europa.eu/eurostat/data/database	estat-esac@ec.europa.eu
	CDW treatment	Eurostat	http://ec.europa.eu/eurostat/data/database	estat-esac@ec.europa.eu
		Waste Serve Malta	https://www.wasteservmalta.com/constructionwaste	<info.ws@wasteservmalta.com>; <suzanne.a.dimech@wasteservmalta.com>; <louiselle.sciberras@wasteservmalta.com>
	CDW export/import	Deliotte Report	*ec.europa.eu/environment/waste/studies/deliverables/CDW_Malta_Factsheet_Final.pdf*	begsvfacreception@deloitte.com
	CDW treatment facilities	National Statistics Office	https://nso.gov.mt/en/News_Releases/View_by.../2016/News2016_007.pdf	mario.borg@gov.mt
Netherlands	CDW generation	EUROSTAT	http://ec.europa.eu/eurostat/data/database	
	CDW treatment	EUROSTAT	http://ec.europa.eu/eurostat/data/database	
	CDW export/import	National Waste Management Plan	-	

Country	Data	Source	Contact [website]	Contact [email]
	CDW treatment facilities	EUROSTAT	http://ec.europa.eu/eurostat/data/database	
Portugal	CDW generation	Portuguese Environment Agency	https://www.apambiente.pt/index.php?ref=x178	geral@apambiente.pt
	CDW treatment			
	CDW export/import			
	CDW treatment facilities			
Poland	CDW generation	Krajowy plan gospodarki odpadami 2022	http://monitorpolski.gov.pl/	
	CDW treatment	Study "Environenment 2014", Central Statistical Office	http://ec.europa.eu/environment/waste/studies/deliverables/CDW_Poland_Factsheet_Final.pdf	
	CDW export/import	Study "Environenment 2014", Central Statistical Office	http://ec.europa.eu/environment/waste/studies/deliverables/CDW_Poland_Factsheet_Final.pdf	
	CDW treatment facilities	http://www.s-ge.com/sites/default/files/private_files/BBK_Waste_management_report_Poland_0.pdf		
Romania	CDW generation	EUROSTAT	http://ec.europa.eu/eurostat/data/database	
	CDW treatment	EUROSTAT	http://ec.europa.eu/eurostat/data/database	
	CDW export/import	-	-	
	CDW treatment facilities	EUROSTAT	http://ec.europa.eu/eurostat/data/database	
Slovakia	CDW generation	http://odpad.sk/wp-content/uploads/2016/09/POH_SR_2016-2020.pdf	http://www.minzp.sk/o-nas/mzp-sr/	
	CDW treatment	http://odpad.sk/wp-content/uploads/2016/09/POH_SR_2016-2020.pdf	http://www.minzp.sk/o-nas/mzp-sr/	
	CDW export/import	http://www.enviroportal.sk/uploads/spravy/2013-04-2-mt-odpady.pdf	http://www.minzp.sk/o-nas/mzp-sr/	

Country	Data	Source	Contact [website]	Contact [email]
	CDW treatment facilities	https://www.b2match.eu/danubereg ionbusinessforum2012/system/files/ Kaufmann.pdf	http://www.sazp.sk/public/index/index.php	peter.kaufman@sazp.sk
Slovenia	CDW generation	EUROSTAT	http://ec.europa.eu/eurostat/data/database	
	CDW treatment	EUROSTAT	http://ec.europa.eu/eurostat/data/database	
	CDW export/import	Statistical office of the Republic of Slovenia		
	CDW treatment facilities	EUROSTAT	http://ec.europa.eu/eurostat/data/database	
Spain (PC)	CDW generation	Spanish Federation of Construction and Demolition Waste	http://www.rcdasociacion.es/	reciclaje@rcdasociacion.es
	CDW treatment	Spanish Statistical Office	http://www.ine.es/	biblioteca@ine.es
	CDW export/import	Spanish State Waste Framework Plan (PEMAR) for 2016-2022. Spanish Ministry of Agriculture, Fisheries and Food	http://www.mapama.gob.es/es/calidad-y-evaluacion-ambiental/planes-y-estrategias/pemaraprobado6noviembrecondae_tcm7-401704.pdf	
	CDW treatment facilities	Waste treatment specialist EMGRISA	http://www.emgrisa.es/	info@emgrisa.es
Sweden (PC)	CDW generation	Deloitte, D.B.b., *Sweden*, in *Construction and Demolition Waste Management in* 2015.	http://ec.europa.eu/environment/waste/studies/deliverables/CDW_Sweden_Factsheet_Final.pdf	
	CDW treatment	Deloitte, D.B.b., *Sweden*, in *Construction and Demolition Waste Management in* 2015.	http://ec.europa.eu/environment/waste/studies/deliverables/CDW_Sweden_Factsheet_Final.pdf	
	CDW export/import	Deloitte, D.B.b., *Sweden*, in *Construction and Demolition Waste Management in* 2015.	http://ec.europa.eu/environment/waste/studies/deliverables/CDW_Sweden_Factsheet_Final.pdf	
	CDW treatment facilities	Deloitte, D.B.b., *Sweden*, in *Construction and Demolition Waste Management in* 2015.	http://ec.europa.eu/environment/waste/studies/deliverables/CDW_Sweden_Factsheet_Final.pdf	

Country	Data	Source	Contact [website]	Contact [email]
Switzerland	CDW generation	[23] Wüest & Partner AG: Bauabfälle in der Schweiz – Hochbau; Studie 2015 [21] BAFU Switzerland 2006: Richtlinie für die Verwertung mineralischer Bauabfälle: http://www.bafu.admin.ch/publikationen/publikation/00030/index.html?lang=de Groups of waste in Switzerland 2015, source: Wüest & Partner AG: Bauabfälle in der Schweiz – Hochbau; Studie 2015, p. 27 [20] Verordnung über die Vermeidung und die Entsorgung von Abfällen (Abfallverordnung, VVEA) 814.600; 19.07.2016; CH		
	CDW treatment	no data found		
	CDW export/import	no data found		
	CDW treatment facilities	[23] Wüest & Partner AG: Bauabfälle in der Schweiz – Hochbau; Studie 2015		
United Kingdom (PC)	CDW generation	Department for Environment, Food & Rural Affairs (DEFRA)	https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/482255/Digest_of_waste_England_-_finalv3.pdf https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/567502/Digest_waste_resource_2016_rev4.pdf	
	CDW treatment	Department for Environment, Food & Rural Affairs (DEFRA)	https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/482255/Digest_of_waste_England_-_finalv3.pdf https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/567502/Digest_waste_resource_2016_rev4.pdf	

Country	Data	Source	Contact [website]	Contact [email]
	CDW export/import	Construction and Demolition Waste Management in United Kingdom, Version 2-September 2015 (Revised 27/01/16)	http://ec.europa.eu/environment/waste/studies/deliverables/CDW_UK_Factsheet_Final.pdf	
		Wood Recyclers Association (WRA)	http://www.woodrecyclers.org	
		Statistical Office of the European Union (EUROSTAT)	http://ec.europa.eu/eurostat/statistics-explained/index.php/File:Overall_packaging_waste_recycling_rate_and_share_of_export_for_recycling,_2011_new.JPG	
	CDW treatment facilities	Construction and Demolition Waste Management in United Kingdom, Version 2-September 2015 (Revised 27/01/16)	http://ec.europa.eu/environment/waste/studies/deliverables/CDW_UK_Factsheet_Final.pdf	

ANNEX 2.

A. LEGISLATIVE AND REGULATORY OVERVIEW

Country	Category	Policy / Regulation / Standard
Austria	National	Recycled Construction Materials Regulation (2016) ÖNORM B 3140 ÖNORM B 3151
Belgium	Regional	**Flanders** Decree of 2012 on the management of material cycles and waste VLAREMA, which is the implementation order of the Decree of 2012 **Brussels Capital Region (BCR)** BRUDALEX (2017) **Wallon Region** Waste decree of 27 June 1996
Bulgaria	National	National act "Law limiting the harmful effects of waste on the environment" (1997) The Waste Management Act of 2003

Country	Category	Policy / Regulation / Standard
		Ordinance on construction and demolition waste management and use of recycled construction materials (2012)
Croatia	National	Law on Sustainable Waste Management (OG 94/13) Act on Sustainable Waste Management (OG No. 94/13) Waste Management Strategy of the Republic of Croatia (OG No. 130/05) Ordinance on waste management (OG No. 23/14, 51/14, 121/15, 132/15) Ordinance on by-products and end-of-waste status (OG No. 117/14) Waste Management Plan of the Republic of Croatia for 2007-2015 (OG No. 85/07,126/10, 31/11, 46/15) Ordinance on the waste catalogue (Official Gazette 90/15) Ordinance on the methods and conditions for the landfill of waste, categories and operational requirements for waste landfills (Official Gazette 114/15) Ordinance on construction waste and waste containing asbestos (Official Gazette 69/16) Ordinance on thermal treatment of waste (Official Gazette 75/16) Decision on the adoption of the Waste Management Plan of the Republic of Croatia for the period 2017 – 2022 (Official Gazette 3/17)
Cyprus	National	Waste Law of 2011 N. 185(I)/2011 Solid and Hazardous Waste (Management of Excavation, Construction and Demolition Waste) Regulations of 2011
Czech Republic	National	Waste Act No.185/2011 Government regulation No. 312/352/2014 Amendment of the Waste Act 229/2014
Denmark	National	Environmental Protection Act no. 879 26/06/2010 Statutory Orders on waste, recycling of residual products and soils from building and sorted un-contaminated CDW (Order no. 1309/2012, Order no. 1662/2010)
Estonia	National	"Waste Act" which has several amendments since 2004, but is also transposing the EU Mining Waste Directive 2006/21/EC (2010) and new Waste Directive 2008/98/EC
Finland	National	Waste Act (646/2011) Land use and building Act (132/1999) Environmental Protection (Act 527/2014)
France	National	Law 2009-967 of 3 August 2009

Country	Category	Policy / Regulation / Standard
		Law2010-788 of 12 July 2010 Decree n 2011-610 of 31 May 2011 Order n 2010-1579 of 17 December 2010 Decree n 2011-828 of 11 July 2011 Decree n 2016-288 of 10 March 2016 Law 2015-992 of 17 August2015 Decree n 2014-1501 of 12 December 2014
Germany	National	Circular Economy Act (KrWG) Abfallverzeichnisverordnung, AVV
Greece	National	Law 2939/2001 Law 3854/2010 (modification of previous law) JMD36259/1757/E103/2010 (CDW, Solid Marble Wastes, concrete) JMD 50910/03 Law 4030/2011 (paragraph 4) Law 4042/2012-part B Law4067/2012 (New Construction Code)
Hungary	National	Act on Environmental Protection (A környezetvédelménekáltalánosszabályairólszóló 1995. évi LIII. Törvény) Act on Waste (A hulladékrólszóló 2012. évi CLXXXV. törvény) Governmental Decree on Hazardous waste (A veszélyeshulladékkalkapcsolatostevékenységekvégzésénekfeltételeirőlszóló 98/2001. (VI. 15.) Korm. Rendelet) Ministerial decree on the List of waste (A hulladékjegyzékrőlszóló 72/2013.(VIII. 27.) VM rendelet) Ministerial decree on construction and demolition waste (Azépítésiésbontásihulladékkezelésénekrészletesszabályairólszóló 45/2004. (VII. 26.) BM-KvVMegyüttesrendelet) Act on the Formation and Protection of the Built Environment (Azépítettkörnyezetalakításárólésvédelmérőlszóló 1997. LXXVIII. törvény) Government decree on building and construction activity (Azépítőiparikivitelezésitevékenységrőlszóló 191/2009. (I. 15.) Korm. Rendelet) Ministerial decree 45/2004

Country	Category	Policy / Regulation / Standard
Ireland	National	Policy Documents issued by the Department of Environment, Community and Local Government (DECLG) Regional Non-Hazardous Waste Management Plans prepared by local authorities National Hazardous Waste Management Plans published by the Environmental Protection Agency (EPA) Planning Guidelines for Future Developments published by DECLG Best Practice Guidelines on the Preparation of Waste Management Plans for Construction & Demolition Projects published by DECLG Industry Support Documentation published by the Training and Employment Authority (FAS) and the Construction Industry Federation (CIF)
Italy	National	D.lgs. 152/2006 e ss.mm.ii, "Norme in materia ambientale Codice ambiente)" D.M 5/2/98 (amended by Decreto 5/4/06 n.186) D.Lgs. 36/2003 of 13/01/2003 D.M 27/09/2010 (amended by D.M. 24/06/2015) D.M. n.203 del 8/05/2003 Circolare 15/7/05 n. 5205 Green Public Procurement DM 161/2012 DL 69/2013 (amended by L.98/2013) D.L. 12-9-2014 n. 133
Latvia	National	Latvian Waste Management Act Law on Waste Management
Lithuania	National	Law on Waste Management of 16 June 1998, Nr. VIII-787, with last amendments in 2011, which transposes the Waste Framework Directive; Order of the Minister of Environment No D1-367 on the Requirements on waste generation and management account, adopted 3/05/2011; National Strategic Waste Management Plan for the period of 2014-2020, approved by the Resolution of the Government of the Republic of Lithuania, with the last amendments in June 2016; Requirements for regional and municipal waste management plans approved by the order of the Minister of Environment No D1-1004 and adopted 16/12/2010;

Country	Category	Policy / Regulation / Standard
		Order of the Minister of Environment No 699 on the Environmental Protection Requirements for Waste Incineration, adopted 31/12/2002 with the last amendments on 14 October 2011; Order of the Minister of Environment No 217 on the Rules on Waste Management, adopted 14/07/1999 with the last amendments on 3 May of 2011; Order of the Minister of Environment No. 444 on the Rules on Construction, Operation, Closure and Care after closure of Landfills of Waste, adopted 18 October 2000, as amended; National Waste Prevention Programme, adopted in 2013.
Luxembourg	National	Law on Management of Waste (LMW) n.24 of 21 March 2012 Grand-Ducal Regulation of 24 February 2003 on landfilling of waste
Malta	National	Waste Regulations (L.N. 184 of 2011) Legal Notice 168 of 2002 focusing on Waste Management (Landfill) Regulations Legal Notice 382 of 2009 focusing on Deposit of Waste and Rubble (Fees) (Amendment) Regulations Legal Notice 344 of 2005 focusing on Abandonment, Dumping and Disposal of Waste in Streets, and Public Places or Areas Regulations Legal Notice 295 of 2007 focusing on Environmental Management Construction Site Regulations Approved Supplementary Planning Guidance concerning inert waste disposal in quarries.
Netherlands	National	Environmental Management Act of 1 May 2004 Environmental Protection Act Decree on landfills and waste bans Decree on notification of industrial and hazardous waste
Poland	National	Act on waste (2001) Act on packaging and packaging of waste (2005) Act on maintaining cleanliness and order in municipalities (2011) Act on Waste 2012
Portugal	National	Decree-Law 46/2008 of 12 March Ordinance 40/2014 of 17 February Decree-Law 73/2011 of 17 June Decree-Law 26/2010 of 30 March

Country	Category	Policy / Regulation / Standard
		Decree-Law 183/2009 of 10 August Decree-Law 18/2008 of 29 January Ordinance 417/2008 of 11 June Ordinance 209/2004 of 3 March Ordinance 335/97 of 2 September
Romania	National	Government Emergency Ordinance No. 78/2000 Government Decision no. 856/2002 on waste management Decision no. 349/2005 Law no. 211/2011 on waste regime [republished in 2014]
Slovakia	National	Act on Waste
Slovenia	National	The Decree on Waste - A framework decree governing waste management more specifically is the Decree on Waste5 of 31 December 2011.on Act which regulates the protection of environment from the impact of pollution as a prerequisite for sustainable development; The Decree on the management of waste arising from construction work Decree on waste landfill of 22 February 2014; Decree on the implementation of the Regulation (EC) No. 1013/2006 on shipments of wasteof 8 August 2007
Spain	National	Royal Decree 180/2015, of 13 March Law 22/2011, of 28 July Royal Decree 105/2008, of 1 February, on Construction and Demolition Waste production and management. Royal Decree 1481/2001, of 27 December, regulating the disposal of waste by landfill
	Regional	• Andalucía: Decree 73/2012, of 20 March, on approval of the Regulation of Waste in Andalucía. • Aragón Decree 262/2066, of 27 December, on approval of the Regulation of production, property and management of the CDWs in Aragón. It also establishes a jurisdiction on the public service of valorisation of debris in Aragón. • Basque Country Decree 112/2012, of 26 June, on regulation of the production and management of CDW in Basque Country. • Canarias

Country	Category	Policy / Regulation / Standard
		Decree 112/2004, of 29 July, on regulation of the procedure and requirements for the grant of authorisation related to waste management. Furthermore, it sets down the Registration of the Waste Management Association of Canarias. • Cantabria Decree 72/2010, of 28 October, on regulation of the production and management of CDWs in Cantabria. • Castilla la Mancha Decree 189/2005, of 13 December, on approval of the waste management plan concerning construction and demolition of Castilla La Mancha • Castilla y León Decree 11/2014, of 20 March, on approval of the regional waste management plan «Plan Integral de Residuos de Castilla y León» • Extremadura Decree 20/2011, of 25 February, establishing a jurisdiction on the production, property and management of the CDWs in Extremadura. • Galicia Law 10/2008, of 3 November, on waste management in Galicia. • Madrid Order 2726/2009, of 16 July, of the Council of Environment, Housing and Land management, for CDW management in Madrid. • Navarra Foral Decree 23/2011, of 28 March, on regulation of the production and management of CDW in Navarra. • Valencia Law 10/2000, of 12 December, for waste in Valencia.
Sweden		Swedish Environmental Code (Miljöbalken) Planning and Building Act (Plan ochBygglag)
Switzerland	National	Ordinance for Avoidance and Disposal of Waste (VVEA) Swiss standard SN 670 071 regulates general recycling of mineral CDW into RC construction materials SN 670 902-11-NA regulates geometrical properties of mineral aggregates and is part of the Swiss version of EN 933-11

Country	Category	Policy / Regulation / Standard
		SN 670 102b-NA regulates aggregates for concrete production and has integrated the use of recycled aggregates according to EN 933 under compliance with the BAFU guideline SN 670 119-NA regulates aggregates for use in hydraulically bonded and loose applications, e.g. construction of roads, train tracks etc. It is part of the Swiss version of EN 13285 BAFU (Federal Agency for Environment) regulations The *Guideline for the use of mineral construction waste* (2006) regulates how mineral construction waste is to be sorted, labelled, treated and quality controlled before it is used to create new RC materials. SIA 430 regulates disposal of CDW on-site and separation of waste streams
United Kingdom	National	Landfill Tax (1996) Aggregates levy (2002)
	Regional	• England and Wales Waste (England and Wales) Regulations 2011 Hazardous Waste (England and Wales) 2005 Regulations and subsequent amendments Environmental Permitting (England and Wales) Regulations 2010 and subsequent amendments The List of Wastes (England) Regulations 2005 and subsequent amendments The List of Wastes (Wales) Regulations 2005 and subsequent amendments • Scotland Waste (Scotland) Regulations 2011 Special Waste (Scotland) Regulations 1997 and subsequent amendments The Landfill (Scotland) Regulations 2003 and subsequent amendments The Special Waste (Scotland) Regulations 1997 and subsequent amendments • Northern Ireland Waste Regulations (Northern Ireland) 2011 Hazardous Waste Regulations (Northern Ireland) 2005 and subsequent amendments The Waste Management Licensing Regulations (Northern Ireland) 2003 and subsequent amendments The List of Wastes Regulations (Northern Ireland) 2005 and subsequent amendments
Taiwan	National	Recycling green concrete label of green building" to encourage the use of CDW in construction work

B. NON LEGISLATIVE INSTRUMENTS OVERVIEW

Country	Non legislative instruments
Austria	Federal Waste Management Plan (FWMP)
	Guidelines, leaflets and best practices (Austrian Construction Materials Recycling Association)
	Resource Management Agency
Belgium	
Flanders	Government projects – Materials Programme
Wallonia	WALOSCRAP and BATILOOP projects, managed by Green Win and supported by the Walloon Construction Confederation
Bulgaria	Bulgaria is associated to European Quality Association for Recycling
	Landfill tax
	Voluntary agreement between government, business and construction industry
	Sustainability standards, such as BREAAM, LEED, HQE, DGNB
Croatia	Construction and demolition waste management plan
	Croatia Green Building Council
	Certification systems: LEED
Cyprus	First Excavation, Construction and Demolition Waste (ECDW) Management System
	Second ECDW Management System known as Cypriot Organisation (2015)
Czech Republic	Standards: BREEAM and LEED
	Scheme of "take back"
	Raw Material Policy
	VAT tax for certain types of recycled materials
Denmark	Landfill tax
	DGNB (Danish Green Building Council), sustainability certification of buildings
	Sustainability standards covering the public sector: Life Cycle Assessment (LCA) tool for buildings, including end-of-life. "Bæredygtigtbyggeri" - which includes guidance on the importance of including the whole life cycle of the building
Estonia	Waste Recycling Cluster (eventually becoming the Recycling Competence Centre)
Finland	Landfill tax

Country	Non legislative instruments
	Sustainability assessment schemes: PromisE (developed in Finland), BREEAM and LEED
France	Landfill tax ("*TGAP*" in French for general tax on polluting activities)
	Incentives and budget lines dedicated to waste prevention and management
	French Environment and Energy Management Agency, ADEME
	Sustainable Construction Methodological Guidebook
	Building certification standards covering CDW: HQE (2005), BREEAM (1990) and LEED (1998)
	Industry sustainability standard covering CDW
	Public sector sustainability standard covering CDW
	Environment Assurance Plan
Germany	Guideline for Sustainable Construction that provides in its latest edition guidance with regards to the demolition of buildings
	Federal States have developed guidelines for the dismantling of buildings
	LAGA (Bund/LänderArbeitsgemeinschaftAbfall) is a working committee of the Conference for Ministers for Environment (UMK) and aims to ensure the implementation of waste legislation
Greece	"Greek Recycling Organization". National Organization for the Alternative Management of Packaging and Other Products
	Building certification standards: BREEAM and LEED
Hungary	Building certification standards: BREEAM and LEED
Ireland	Best Practice Guidelines on the Preparation of Waste Management Plans for Construction & Demolition Projects published by DECLG in 2007
	Introduction to Site Waste Management and Environmental Awareness Training Course
	EPA Viewpoint on the use of European Waste Catalogue (EWC) Chapters 17 and 19 (12 codes) published in 2014
	Guidelines for the Management of Waste from National Road Construction Projects published by the National Roads Authority (NRA) in 2008
	Building Research Establishment Environmental Assessment Method (BREEAM) and Leadership in Energy and Environmental Design (LEED)
	Design out Waste: A design team guide to waste reduction in construction and demolition projects published by the Waste Resources Action Programme (WRAP)
Italy	LEED
	Region and/or province, has approved guidelines, recommendations or other instruments for CDW management and control.
	Liguria Region, with D.G.R. n. 734 of 20th June 2015, has adopted measure to introduce the criteria for CDW delivery produced among construction activities of small dimensions, and send to recovery facilities according to D.M. 5.2.1998 simplified procedure

Country	Non legislative instruments
Latvia	
Lithuania	BREEAM certification
	Second international conference Green Buildings – Vilnius 2016 took place, with the aim to helps investors, developers, design and construction teams and occupiers to use natural resources more efficiently
Luxembourg	The SuperDrecksKëscht® in Luxembourg are activities and campaigns of the Ministry for Sustainable Development and Infrastructure, the Chambre des Métiers (Chamber of Trade) and Chambre de Commerce (Chamber of Commerce) regarding the national waste management
Malta	Construction and tunnel project underway that would result in a sizable amount of CDW, which would 'increase the political pressure for land reclamation projects
Netherlands	Rijkswaterstaat Environment performs various knowledge and implementation tasks relating to the environment
	The program Waste To Raw material (VANG) is the effort by the government to encourage the transition towards a circular economy
Poland	BREEAM, DGNB and LEED
	• Guidelines for municipalities regarding implementation of municipal waste • Guidelines on waste management for households • Guidelines on backfilling operations
	Development of Program for Asbestos Abatement in Poland 2009-2032
Portugal	Sustainability standards that cover CDW (e.g. BREEAM)
	Code of practice RERU (Outstanding Regime for Urban Rehabilitation)
Romania	Sustainability standards that cover CDW (e.g. BREEAM, LEED)
Slovakia	Slovak association supporting recycling of CDW – ZRMS, is a member of international European Quality Association for Recycling which aims to exchange best practices among members
	Operational Programme Environment financed by European Funds supported waste management infrastructure in Slovakia with about €570 million
Slovenia	Sustainability standards that cover CDW (e.g. BREEAM)
	Waste disposal tax
Spain	Reference guide for manufacturers, companies, technicians, public bodies and local authorities' administration concerning the correct management and reuse of CDW in Spain prepared by the Spanish Association of CDW recycling ("RCD asociación")
Sweden	Landfill tax
	Swedish version of BREEAM
Switzerland	ARV Association for Building Material Recycling and Waste Information Switzerland offer comprehensive leaflets regarding a variety of subjects

Country	Non legislative instruments
United Kingdom	Building Research Establishment Environmental Assessment Method (BREEAM)
	Code for Sustainable Homes (last updated in 2010)
	Building Research Establishment (BRE) Home Quality Mark (HQM) (introduced in 2015)
	Royal Institution of Chartered Surveyors (RICS) SKA rating. This is an environmental assessment method, benchmark and standard for the fit-out of non-domestic buildings
Taiwan	Guidelines for recycling and reusing of CDW
	Research works and projects have been conducted using CDW as a part of construction material
	Policy of Ministry of Interior and Environmental Protection Administration (EPA) addressing to guide CDW recycling

ANNEX 3. LIST OF CDW RECYCLING FACILITIES IDENTIFIED BY COUNTRY

BELGIUM (EU participating country in RE^4-project)

1. L. JANSSENS - Hollebeekstraat 122 - 2840 Rumst (Reet)
   http://www.ljanssens.be/
2. LAVAERT GROUP - Aalbeeksesteenweg 25 - 8930 Lauwe
   http://www.lavaertgroup.com
3. DE CEUSTER - Hoogbuul 31 - 2250 OLEN
   http://www.dchrecycling.be/
4. D.s.v. - TerHeidelaan 69, 3200 Aarschot
   http://www.dsvnv.be/
5. RECYHOC - Rue du canon 65 - 7536 Vaulx (Tournai)
   http://www.recyhoc.be/
6. ADAMS MASSENHOVEN - ZAGERIJSTRAAT 9 - B 2240 MASSENHOVEN
   www.adams-polendam.be
7. SODEVER - Chaussée de Tubize 298 - 1420 Braine-L'alleud
   http://www.sodever.be/
8. MEULDERS & ZN - Waterlees 1 A - 2220 Heist-Op-Den-Berg
   Industriezonehttp://www.gebroedersmeulders.be/engine/
9. TRADECOWALL - Avenue De La Plante 22 - 5000 Namur
   http://www.tradecowall.be/
10. CONTAINERDIENST STEFFENS - Emmaburgerweg 21A - 4728
    Hergenrathhttp://www.containerdienst-steffens.be/
11. MARTENS KOEN GRONDWERKEN - Oostkerkestraat 36 - 8300
    Westkapellehttp://www.martenskoen.be/
12. VYMETAL RECYCLING - 77 Beukenhofstraat - 8570 Vichte
    http://www.vymetal.be/
13. W.S.R.B. WETTERS SORTEER- EN RECYCLAGEBEDRIJF - Biezeweg13b - 9230
    Wetterenhttp://www.wsrb.be/
14. DILISSEN - Lievenbauwenslaan 6 - 3900 Overpelt
    http://www.dilissen.be/
15. LAVAERT GROUP - Aalbeeksesteenweg 25 - 8930 Lauwe
    http://www.lavaertgroup.com
16. DAMMAN - Zegersstraat 6 - 8700 Tielt
    http://dammangrondwerkentielt.be/nl
17. YVES MAES - Kanaalweg 3404 - 3980 Tessenderlo
    http://www.containersmaes.be/index.php/nl/
18. BRUCO - Venhof 3-5 - 2110 Wijnegem
19. http://www.hurenafvalcontainer.be/

20. JAN STALLAERT - Damstraat 195 - 1980 Zemsthttp://www.viabuild.be/activities/Production_of_concrete_and_recycling_construction_materials-19-0-0
21. FEREDECO - Rue du Tronquoy, 24 - 5380 Fernelmont http://www.feredeco.be/

FRANCE (Non participating country in RE^4-project)

1. BRIQUETERIES DU NORD - 9ème Rue - Port Fluvial - 59000 LILLE http://www.bdn.fr/
2. TRIOUEST - ZI La Ville en Bois - 6 Rue Lafayette - 44110 Châteaubrianthttp://www.triouest.com/fr/gestion-des-dechets
3. DE COSTER LODE - Peerderbaan 105 - 3940 Hechtel-Ekselhttp://www.lodedecoster.be/diensten/#recycling
4. CHAP-YT - Vaartkant Links 39 A - 2960 Sint – Lenaartshttp://chapyt.be/index.php/en/recycling-of-cellular-concrete/
5. RAMBAULT TRAVAUX PUBLICS - 20 rue du Petit Rosé - 79100 Thouarshttp://www.rambaulttp.com/
6. BRIQUETERIES DU NORD - 10 rue Port Fluvial - 59000 Lille http://www.bdn.fr/
7. LELEU ET FILS - 10 rue de Coupigny - 76390 Illois https://www.leleu-fils.fr/
8. AUBINE - 26 Avenue DesChampsPierreux - 92000 Nanterre http://recyclage.veolia.fr/
9. METALLURGIQUE D'EPERNAY SA - Zone IndustrielleDe L Ile Belon - 51200 Epernay http://www.sme-recyclage.com
10. ECOSITE CROIX IRTELLE - La Croix Irtelle - 56250 La Vraie Croix http://www.charier.fr

GERMANY (EU participating country in RE^4-project)

1. KLIXER RECYCLING UND SERVICE GMBH - Hauptstr. 59, 02694 Großdubrau http://www.klixer-recycling.de/
2. HEINRICH GESTRING GMBH & CO KG - Franz-Schlüter-Str. 30, 44147 Dortmund http://www.gestring.com/intro.htm
3. EMS-JADE-MISCHWERKE GMBH KG. FÜR STRAßENBAUSTOFFE - In Der Riede 11, 49692, Cappeln http://www.ems-jade.de/
4. B + R BAUSTOFF-HANDEL UND RECYCLING HAFEN-DÜSSELDORF GMBH - Wesermünder Str. 15 40221 Düsseldorf Nordrhein-Westfalen www.br-duesseldorf.de
5. JANKER ENTSORGUNG GMBH - Boxdorfer Str. 8, 90765 Fürth Bayern www.janker-entsorgung.de

6. BERLIN-HENNICKENDORFER - BAUSTOFFRECYCLING GMBH - Berlinerstr. 32, 15378 Hennickendorf
7. DAPPEN ABBRUCH U. RECYCLING GMBH - Fuggerstr. 8, 41352 Korschenbroich
8. HORBA HOHENSEEDENER RECYCLING UND BAUSTOFF GMBH - Schulplatz 9, 39307 Hohenseeden Sachsen-Anhalt
9. MIRO - Annastraße 67-71 - 50968 Köln
   http://www.bv-miro.org/

IRELAND (Non participating country in RE^4-project)

1. PACON WASTE & RECYCLING LTD - Unit 4F, Fingal Bay Business Park, Balbriggan, North County Dublin
   http://www.pacon.ie/
2. MPA - Unit 10 Nutts Corner Business Park - Dundrod Rd, Crumlin - County Antrim BT29 4SR
   http://www.mineralproducts.org/prod_agg_recy01.htm

ITALY (EU participating country in RE^4-project)

1. CAVE ROSSETTI - Via XXIV Maggio 180, 21015 Lonate Pozzolo (VA), Italy
   http://www.cave.it/
2. CO.GE.ST. Impianti e lavori - 50013 Campi Bisenzio - Firenze
   Italyhttps://www.cogestimpiantielavori.it/
3. CAPODIECI A. & FIGLI srl, 30, Via Murri - 72023 Mesagne (BR), Italy
   http://www.capodiecisrl.com/
4. SICILSCAVI DI SPAMPINATO SALVATORE - Via Nizzeti, 194 95022 - Acicatena (CT), Italy
   http://www.sicilscavi.net/
5. NCL GROUP SRL - VIA MOROLENSE SP 122 KM 1,700 - 03013 Ferentino (Frosinone) – Italy
   http://www.nclgroup.it/
6. NEW WORLD RECYCLING - 67015 - Montereale (AQ), Fraz. S. Vito, Italy
   http://www.riciclaggioinerti.com/
7. ADM SCAVI - 1/C, V. Sempione - 28040 - Marano Ticino (NO), Italy
   http://www.admscavi.eu/chi-siamo/sito-di-recupero.html
8. CERCHIO CHIUSO srl - Via della Pisana – Rome, Italy
9. ECO LOGICA 2000 srl - Via Ardeatina – Rome, Italy
10. ECO.SAM srl - Via Valle Fienata – Anguillara Sabazia (RM), Italy
11. FONTANA LARGA srl - Via Pian dell'Olmo – Riano (RM), Italy
12. SEIPA srl - Via di Porta Medaglia – Rome, Italy
13. RIME 1 srl - Via della Magliana – Rome, Italy
14. CENTRO RECUPERI MINNELLA s.r.l. - 6/A, Z.I. Lotto - 92025 Casteltermini (AG), Italy
    http://www.smaltimentorifiutiminnella.it/
15. IPS srl - Via Tagliata, 1 - 83018 San Martino V.C. (AV), Italy
    http://www.ipssrl.com/azienda.html

SWEDEN (EU participating country in RE^4-project)

1. Swerec AB - Box 39 - SE 431 21 Mölndal
   www.swerec.se
2. FORTUM - Fortum Waste Solutions AB - SE-692 85 Kumla
   http://wastesolutions.fortum.com/en/
3. Stena Metall AB - P.O

UNITED KINGDOM (EU participating country in RE^4-project)

1. CHURNGOLD SURFACING LIMITED - St Andrews House - Gloucester Road North - Bristol BS11 9DQ
   http://www.churngold.com/construction/services/demolition-recycling.html
2. BYWATERS – Twelve trees Crescent, Bow , E3 3JG
   http://www.bywaters.co.uk/
3. WASTECYCLE LIMITED - Enviro Building, Private Road No. 4, Colwick Industrial Estate, Nottingham, NG4 2JT
   https://www.wastecycle.co.uk/
4. EUROPEAN METAL RECYCLING Ltd - Sirius House, Delta Crescent, Westbrook, Warrington, Cheshire WA5 7NS
   http://www.emrgroup.com/

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