

SPOKE 04

CITY, ARCHITECTURE AND SUSTAINABLE DESIGN

RT1 STRATEGIC PLAN FOR THE DEVELOPMENT OF THE
CONSTRUCTION AND SUSTAINABLE DESIGN SECTORS

CRITICAL ISSUES OF CIRCULARITY OF THE BUILDING SECTOR IN FRIULI VENEZIA GIULIA REGION

ANNEX TO DELIVERABLE DS4_RT1.2 | CRITICAL ISSUES
IN THE BUILDING SECTOR

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Il Report fornisce una sintesi dell'attività svolta dal componente prof. ing. Anna Frangipane dell'Unità dell'Università di Udine (UniUD), nell'ambito del "iNEST DS4_Research Task 1.2 Report on critical issues in the building sector".

Come definito dal Research Task Leader della ricerca, CRESME: "L'obiettivo dell'attività è quello di individuare i nodi da affrontare alla scala dell'edificio per la definizione del modello di sostenibilità e transizione digitale ipotizzato". Il lavoro inizierà con la ricerca delle principali criticità del settore edilizio del Paese e del caso studio. Il Research Task lavorerà su cinque aspetti del settore delle costruzioni: le filiere; la struttura dell'offerta; i modelli organizzativi; la produttività; la diffusione delle tecnologie".

Nell'ambito di tale compito generale, l'Unità UniUD ha indirizzato il lavoro di ricerca ai temi dell'"economia circolare nel settore edilizio", considerando trasversalmente i cinque aspetti di interesse, con l'obiettivo di contribuire all'implementazione della sostenibilità e della transizione digitale per il caso studio della Regione Friuli Venezia Giulia.

In questa direzione, è stato ritenuto fondamentale il ruolo del portatore di interesse "appaltatori/costruttori" e la ricerca è stata, quindi, condotta avendo come primo referente ANCE-FVG, la sezione regionale dell'Associazione Nazionale Costruttori Edili (ANCE), nella persona del suo direttore, dott. Fabio Millevoi, e di alcuni associati interessati, in rappresentanza della varietà del settore. La scelta è stata supportata dalla sensibilità all'interno dell'associazione per lo sviluppo di reti a supporto della transizione verso un'economia circolare nel settore delle costruzioni, come dimostra la partecipazione al partenariato al [Progetto UE Interreg Italia-Austria \(2021-2027\) ATTENTION, Improving Zero-Waste Processes in Construction Value Chains](#) (No. ITAT-11-025), recentemente finanziato sulla Priorità 1-Innovazione e Imprenditorialità.

Sebbene ogni componente dell'economia circolare nelle costruzioni, come definita dal recente studio dell'UE [Study on circular economy principles for buildings' design. Final Report \(2021\)](#), sia essenziale al processo, quella degli appaltatori/costruttori è la componente necessaria affinché la teoria diventi pratica, secondo logiche di profitto imprescindibili: il modello di *business*, banalmente, deve essere tale da rendere possibile la transizione dall'economia lineare all'economia circolare, non solo in termini di fattibilità, ma, soprattutto, di profitto, nella direzione di modelli di *business* sostenibili.

Al fine di delineare il *gap* del contesto italiano, in generale, e regionale, come caso di studio, tra un approccio lineare e uno circolare al settore edilizio, la ricerca, partendo da un quadro normativo generale europeo e nazionale, si interessa delle competenze della filiera della circolarità delle costruzioni per concentrarsi, poi, sul caso di studio della Regione Friuli Venezia Giulia, così come delineato attraverso un efficace dialogo con ANCE-FVG, in termini di criticità e possibili scenari di sviluppo.

A integrazione, il Report fa, infine, riferimento a un parallelo, ulteriore coinvolgimento e divulgazione rivolto ad altri stakeholder, a supporto dell'attività di ricerca svolta.



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1. EXECUTIVE SUMMARY

This Final Report provides a synthesis of the activity carried out by Anna Frangipane, member of the Unit of Udine University (UniUD), within the “iNEST DS4 Research Task 1.2 Report on critical issues in the building sector”, led by CRESME.

As defined by the leader of the Research Task: “The objective of the activity is to identify the nodes to be addressed at the building scale for the definition of the hypothesised sustainability and digital transition model. The work will start by researching the main criticalities of the country's construction sector and the case study. The task will work on five aspects of the construction sector: supply chains; the structure of supply; organisational models; productivity; and technology diffusion”.

Within such a general task, UniUD Unit addressed the research work to the issues of “Circular Economy in the Building Sector”, crossing the five aspects of interest, aiming in contributing in the implementation of sustainability and digital transition for the case study of Friuli Venezia Giulia Region.

In that, the major role of the component “contractors/builders” has been considered and the research has been, therefore, carried out having as first referent the Regional Section of the National Association of Contractors and Builders, ANCE-FVG, in the person of its Executive Director, Dr. Fabio Millevoi, and of some interested associated, representing the variety of the Sector.

The choice has been supported by the awareness raising in the Association for the development of networks toward Circular Economy in the building sector, as evidenced by its partnership to the [EU Interreg Italy-Austria \(2021-2027\)](#) Project ATTENTION, Improving Zero-Waste Processes in Construction Value Chains (No. ITAT-11-025), just financed on the Priority 1-Innovation and Entrepreneurship.

Although each component of the “Circular Economy in Constructions”, as defined by the recent EU [Study on circular economy principles for buildings’ design. Final Report](#) (2021), is essential to the process, the one of the “contractors/builders” is the necessary component for theory to become practice, according to unavoidable profit logics: the business model, trivially, must be such as to make possible the transition from the linear economy to the circular economy, not only in terms of feasibility, but, above all, in terms of profit, in the direction of sustainable business models.

In order to outline the gap of the Italian contest, in general, and the regional one, as a case study, between a linear and a circular approach to the building sector, the research, starting from a general European and national regulatory framework, approaches competences of the circularity chain of constructions to focus, then, to the case study of Friuli Venezia Giulia Region, as outlined through an effective dialogue with ANCE-FVG, in terms of critical issues and a possible scenarios of development.

Reference to parallel, further involvements and dissemination, supporting the research, addressed to other stakeholders is provided at the end.

2. REGULATORY FRAMEWORKS

In order to better understand the complexity of the building sector, as related to the upgrade from a linear economy to a circular economy, it is essential to refer to the regulatory framework, both at European and national level, as it is the main reference and driver to possible positive actions. Therefore, an overview is presented, synthetising their articulated structure.

2.1 European Regulatory Framework

One of the first evidence, in EU Regulatory Framework, of a deep attention to circular economy, as related to waste production (short life materials), can be probably found in the [Packaging and packaging waste Directive \(PPWD\) 94/62/EC](#), dating 1994. Following, [Directive \(EU\) 2018/852](#) is its first amendment and contains updated measures designed to:

- prevent the production of packaging waste, and
- promote the reuse, recycling and other forms of recovering of packaging waste, instead of its final disposal, thus contributing to the transition towards a circular economy.

The Directive covers all packaging placed on the European market and all packaging waste, whether it is used or released at industrial, commercial, office, shop, service, household or any other level, regardless of the material used.

The PPWD is undergoing a revision, to make packaging easier to reuse and recycle, to reduce unnecessary packaging and waste, and to promote the use of recycled content. The [newly amended version was voted by the Environment Committee](#) of the EU Parliament in October 2023 and its approval in Parliament Plenary session is expected for November 2023.

The building sector is involved in this process, as well.

However, the [Waste Framework Directive \(WFD\) 2008/98/CE](#) is the turning point in the direction of the circular economy principles, introducing the “Waste Hierarchy” as a common reference to be (Figure 2.1), as well as “By-Products” and “End of Waste Status” definitions.



Figure 2.1 - The Waste hierarchy, as introduced by the Waste Framework Directive, 1998 [[EC Environment, 2023](#)].

The Waste Framework Directive lays down some basic waste management principles. It requires that waste be managed:

- without endangering human health and harming the environment
- without risk to water, air, soil, plants or animals
- without causing a nuisance through noise or odours
- and without adversely affecting the countryside or places of special interest.

The Directive also introduces the "polluter pays principle" and the "extended producer responsibility"; it has been last emended by the [Directive \(EU\) 2018/851](#).

The building sector is, in somehow, the “black sheep” of the waste generation field, being responsible of the 37.5% of the total waste (Figure 2.2), as referred by [Eurostat data, 2023](#). Such a waste consists, mainly, in “major mineral waste”, as the one produced by the mining and quarrying activities (long life waste), accounting, together, to the 64% of the total waste, i.e., 3.1 tonnes per inhabitant (Figure 2.3).

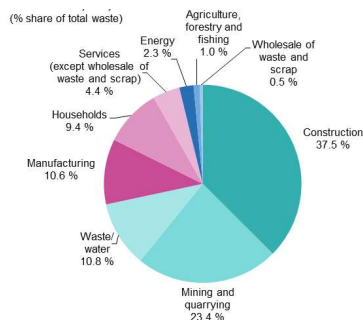


Figure 2.2 - Waste generation by economic activities and households, EU, 2020 (% share of total waste) [[Eurostat, 2023](#)].

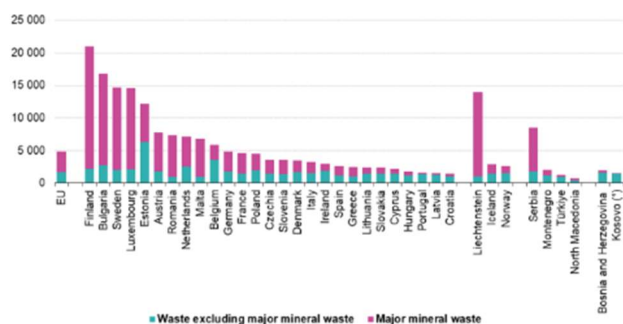


Figure 2.3 - Waste generation in EU, 2020 (kg per capita) [[Eurostat, 2023](#)].

Such an emergency has been outlined by [EU Green Deal Policy, 2019](#), stating that:

- “To deliver the European Green Deal, there is a need to rethink policies for clean energy supply across the economy, industry, production and consumption, large-scale infrastructure, transport, food and agriculture, construction, taxation and social benefits.” (p. 4);
- “While the circular economy action plan will guide the transition of all sectors, action will focus in particular on resource-intensive sectors such as textiles, construction, electronics and plastics.” (p. 7);
- “The Commission will consider legal requirements to boost the market of secondary raw materials with mandatory recycled content (for instance for packaging, vehicles, construction materials and batteries.” (p. 8);
- “The construction, use and renovation of buildings require significant amounts of energy and mineral resources (e.g., sand, gravel, cement). Buildings also account for 40% of energy consumed. Today the annual renovation rate of the building stock varies from 0.4 to 1.2% in the Member States. This rate will need at least to double to reach the EU’s energy efficiency and climate objectives. In parallel, 50 million consumers struggle to keep their homes adequately warm. To address the twin challenge of energy efficiency and affordability, the EU and the Member States should engage in a ‘renovation wave’ of public and private

buildings. While increasing renovation rates is a challenge, renovation lowers energy bills, and can reduce energy poverty. It can also boost the construction sector and is an opportunity to support SMEs and local jobs” (p. 9).

Consequentially, the [Circular Economy Action Plan, 2020](#), addresses to the sector at paragraph “3.6. Construction and buildings”, stating that:“The built environment has a significant impact on many sectors of the economy, on local jobs and quality of life. It requires vast amounts of resources and accounts for about 50% of all extracted material. The construction sector is responsible for over 35% of the EU’s total waste generation. Greenhouse gas emissions from material extraction, manufacturing of construction products, construction and renovation of buildings are estimated at 5-12% of total national GHG emissions. Greater material efficiency could save 80% of those emissions. To exploit the potential for increasing material efficiency and reducing climate impacts, the Commission will launch a new comprehensive Strategy for a Sustainable Built Environment. This Strategy will ensure coherence across the relevant policy areas such as climate, energy and resource efficiency, management of construction and demolition waste, accessibility, digitalisation and skills. It will promote circularity principles throughout the lifecycle of buildings by:

- addressing the sustainability performance of construction products in the context of the revision of the Construction Product Regulation, including the possible introduction of recycled content requirements for certain construction products, taking into account their safety and functionality;
- promoting measures to improve the durability and adaptability of built assets in line with the circular economy principles for buildings design and developing digital logbooks for buildings;
- using [Level\(s\)](#) to integrate life cycle assessment in public procurement and the EU sustainable finance framework and exploring the appropriateness of setting of carbon reduction targets and the potential of carbon storage;
- considering a revision of material recovery targets set in EU legislation for construction and demolition waste and its material-specific fractions;
- promoting initiatives to reduce soil sealing, rehabilitate abandoned or contaminated brownfields and increase the safe, sustainable and circular use of excavated soils.

Furthermore, the ‘Renovation Wave’ initiative announced in the European Green Deal, to lead to significant improvements in energy efficiency in the EU, will be implemented in line with circular economy principles, notably optimised lifecycle performance, and longer life expectancy of build assets. As part of the revision of the recovery targets for construction and demolition waste, the Commission will pay special attention to insulation materials, which generate a growing waste stream.”

The reference to [Level\(s\)](#) is a very important point, to be underlined. Level(s) is, in fact, the “European framework for sustainable buildings”, providing “a common language for assessing and reporting on the sustainability performance of buildings. It is a simple entry point for applying circular economy principles in our built environment”. In that, “Level(s)” offers an extensively tested system for measuring and supporting improvements, from design to end of life. It can be applied to residential buildings or offices. Level(s) is based on six macro-objectives. These can be tracked through sixteen indicators. The Level(s) common framework is based on six macro-objectives that address key sustainability aspects over the building life cycle. The sustainability indicators within each macro-objective describe how the building performance can be aligned with the strategic EU policy objectives in areas such as energy, material use and waste, water, indoor air quality and resilience to

climate change. The macro-objectives refer to: “Greenhouse gas emissions along a buildings life cycle”, “Resource efficient and circular material life cycles”, “Efficient use of water resources”, “Healthy and comfortable spaces”, “Adaption and resilience to climate change” and “Optimised life cycle cost and value”. Even if the circular approach to constructions is crossing all the six area, the indicators of “Resource efficient and circular material life cycles” objective strictly fit the circular construction issues: “Optimize the building design to support lean and circular flows, including: Building materials use and quantities, Minimize construction and demolition waste generated to optimize material use, Replacement cycles and flexibility to adapt to change, Potential for deconstruction as opposed to demolition”, having as indicators: “Bill of quantities, materials and lifespans; Construction & Demolition waste and materials; Design for adaptability and renovation; Design for deconstruction, reuse and recycling”.

The recent [Directive \(EU\) 2023/1791](#) on Energy Efficiency points out in its premise the role of the building sector in energy saving policies: “The global warming potential over the full life cycle measures the GHG emissions associated with the building at different stages along its life cycle. It therefore measures the building’s overall contribution to emissions that lead to climate change. That is sometimes referred to as a carbon footprint assessment or the whole life carbon measurement. It brings together carbon emissions embodied in building materials with direct and indirect carbon emissions from use stage. Buildings are a significant material bank, being repositories for carbon intensive resources over many decades, and so it is important to explore designs that facilitate future reuse and recycling at the end of the operational life in line with the new circular economy action plan. Member States should promote circularity, durability, and adaptability of building materials, in order to address the sustainability performance of construction products.” (p. 2)

The just issued “[Commission Notice-Technical guidance on the application of do no significant harm under the Recovery and Resilience Facility Regulation C/2023/6454](#)” provides a meaningful reference to the building sector, as well, where the “Do No Significant Harm”, i.e., [DNSH](#), takes on a major role.

In “[Guiding principles for the DNSH assessment](#)”, it is underlined that: “... the measure’s design could set out that tender or procurement specifications will contain specific conditions related to DNSH. This could include, for instance, a minimum percentage of construction and demolition waste that will be prepared for reuse and recycling”.

Besides, “Member States should provide a substantive DNSH assessment for those environmental objectives that require it” and, among the required actions, “The transition to a circular economy, including waste prevention and recycling” makes express reference to “lead to significant inefficiencies in the direct or indirect use of any natural resource at any stage of its life cycle which are not minimised by adequate measures”, specifying that: “inefficiencies can be minimised by significantly increasing the durability, reparability, upgradability and reusability of products or by significantly reducing resources through the design and choice of materials, facilitating repurposing, disassembly and deconstruction, in particular to reduce the use of building materials and promote the reuse of building materials”.

A circular approach is, moreover, at the base of the DNSH Check List (Annex IV), when it is stated, for example, that, as referred to the “Example 1: Energy efficiency measures in existing buildings, including replacement of heating and cooling systems”, in order to guarantee “Transition to a circular economy, including waste prevention and recycling” without a DNSH assessment” it must be verified that: “The measure requires the economic operators carrying out the building renovation to ensure that at least 70 % (by weight) of the non-hazardous construction and demolition waste (excluding naturally occurring material referred to in category 17 05 04 in the European List of Waste established

by Decision 2000/532/EC) generated on the construction site will be prepared for re-use, recycling and other material recovery, including backfilling operations using waste to substitute other materials, in accordance with the waste hierarchy and the EU Construction and Demolition Waste Management Protocol. The measure includes technical specifications for the renewable energy generation equipment that can be installed about their durability, reparability and recyclability as specified on page X of the RRP [i.e., Recovery and Resilience Plan]. In particular, operators will limit waste generation in processes related to construction and demolition, in accordance with the EU Construction and Demolition Waste Management Protocol. Building designs and construction techniques will support circularity and in particular demonstrate, with reference to ISO 20887 or other standards for assessing the disassemblability or adaptability of buildings, how they are designed to be more resource efficient, adaptable, flexible and dismantlable to enable reuse and recycling. Similarly, several recall to circularity in construction are present in the following “Example 2: Waste management (construction and demolition waste processing)”, “Example 3: Waste incinerator (example of non-compliance with DNSH)” and “Example 4: Transport infrastructure (roads)”, addressing the requirements to be in a very clearly.

As a matter of fact, the European regulation framework toward a circular approach in constructions if more than defined and all the tools needed for driving a fast process seem to be on the desk.

2.2 National Regulatory Framework

Italian regulations have taken up the European addresses on packages and wastes, with consequent Laws/Decrees, adapting the principles of the quoted European Directive to the national contest.

Namely, in detail:

- the [Directive \(EU\) 2018/852](#) has been transposed to the [Legislative Decree No. 116 \(2020\)](#), in force since 26.09.2020, and, then, amended by the [Legislative Decree No. 213 \(2022\)](#), coming in force on 23.12.2022;
- the [Waste Framework Directive \(WFD\) 2008/98/CE](#) has been recently last transposed to the [Legislative Decree No. 213 \(2022\)](#).

Despite the delay of circular economy in the building sector, as a hole, better defined hereafter, in Italy the reuse target defined for 2025 by the PPWD, i.e., 70% in load of the packaging recycled, has been overpassed (Figure 2.4), attending, in 2022, the 71.5% ([CONAI, 2022](#)). Such a result could be a consequence of a diffused use of “heavy” packaging materials. However, the changes in the PPWD Regulations, to be voted on November, 22, could change such a positive result, aiming in reduce recycling process and implementing reuse, in coherence with the Waste hierarchy statements ([nordesteconomia.gelocal.it](#)).



Figure 2.4 - Percentage of recycled packaging materials: steel, aluminium, paper, wood, plastic and bio-plastic, glass [[CONAI, 2022](#)]

In Italy, Construction and Demolition Waste (C&D Waste) represent 50.2% of the not hazardous waste and 3.8% of the hazardous waste (Figure 2.5).

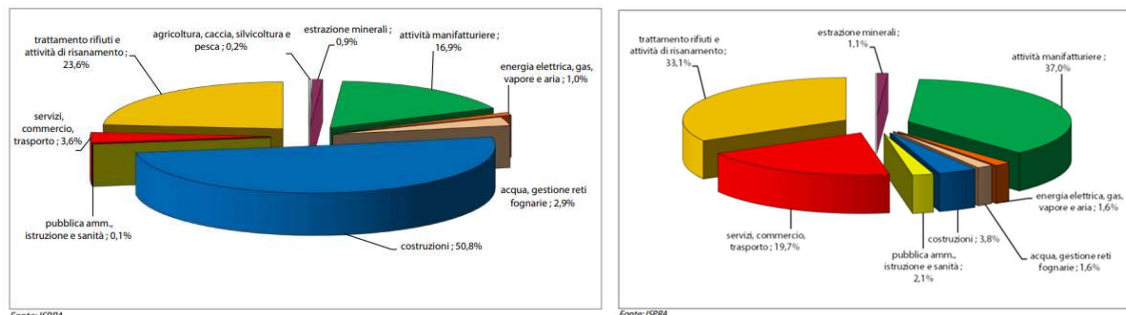


Figure 2.5 - Rates of C&D Waste as compared to the total not hazardous and hazardous wastes, in blue [ISPRa Centro Nazionale dei Rifiuti e dell'Economia Circolare, 2023, 17, 19]

The WFD target for 2020, applied to the building sector, i.e., to the C&D Waste, has been widely achieved in terms of % of reuse, reaching in 2021 the 80.1% (Figure 2.6), in load. Italian “heavy building techniques”, mainly based on the use of stone/brick bearing walls and reinforced concrete frames, are the players of such an achievement.



Figure 2.6 - Trends in the rate of preparation for re-use, recycling and other material recovery, excluding back-filling, of construction and demolition waste, years 2017-2020 [ISPRa Centro Nazionale dei Rifiuti e dell'Economia Circolare, 2023, 215]

C&D Wastes represent the 62.9% of all the not hazardous material recycled (Figure 2.7). Changes in C&D Waste acceptance requirements for reuse, as related to the End of Waste procedures (DL 198/2022), are endangering such a good result; from November 3rd companies are required to fulfil new authorisation procedures within 180 days; an alert about a decrease in recyclable material has been launched by involved companies (reteambiente.it).

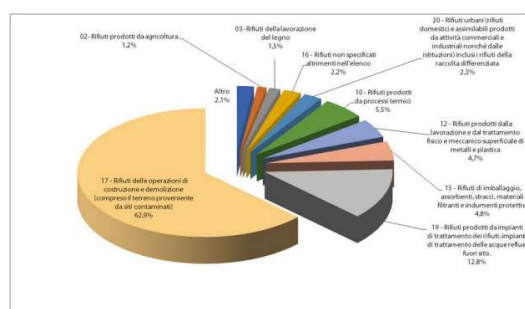


Figure 2.7 - Rates of C&D Recycled non Hazardous Waste as compared to the total, in yellow [ISPRa Centro Nazionale dei Rifiuti e dell'Economia Circolare, 2023, 17, 19]

The [Next Generation EU Policy, 2021](#), based on [EU Green Deal Policy, 2019](#), is supporting the “[Piano Nazionale di Ripresa e Resilienza \(PNRR\)](#)” (National Recovery and Resilience Plan), dating 2021. In the framework of challenges and opportunities offered by the green and digital transitions, “The Plan is developed around three strategic axes shared at a European level: digitisation and innovation, ecological transition, and social inclusion... The Plan primarily consists of 6 Missions or Policy Areas which correspond to the 6 pillars of the EU Next Generation Plan” ([mef.gov.it](#)).

The aforementioned issues related to End of Waste procedures, endanger the circularity of the process achievements through PNRR investments, as recently put in evidence: “The problem therefore concerns not the recycling rate, but the circularity rate, i.e. the actual use of these materials, which are correctly transformed into products by companies in the sector, but which then find it difficult to find an outlet in the various markets and in particular in road works and, more generally, in large infrastructures. The main cause lies in the still widespread mistrust on the part of public contracting stations. It is precisely road works, railway works and port and airport work that could be an opportunity, in view of the funds provided by the National Recovery and Resilience Plan for the realisation of works, for the use of recycled aggregates to replace primary goods, especially for the realisation of foundation layers and for road sub-bases or embankments. The effect produced by this low utilisation is that many plants are now saturated, have reached their storage limits, and the entire construction chain risks coming to a standstill once the delivery of materials from demolition is impossible. In the areas of central Italy where the complex post-earthquake reconstruction is being tackled, and which represents the largest construction site in Europe, more than 50 per cent of the recycled products obtained from the treatment of rubble are just waiting to be used” ([anpar.org](#)).

A strategic input is offered by the [Strategia Nazionale per l’Economia Circolare](#) (National Strategy for Circular Economy), dating June 2022, published by the Ministry of Ecological Transition. Putting in evidence, in the box “toward Buildings’ Circular Economy” (pp. 73-74) that “It is estimated that 80% of environmental pollution and 90 % of production costs derive from product design phases, which is why it is significant to work upstream using eco-design and eco-design to make sustainable use of resources at different stages of the life cycle: choose lightweight and durable materials that are recyclable or made from recovered and recycled materials, conceiving products that can be repaired, reused and disassembled at the end of their life cycle so as to favour recovery and not landfill recovery and not disposal in landfills. Moreover, the choice of well-designed materials can also promote energy savings during the building's operational phase”, the Strategy aims in implementing products’ design policies: “This type of action will be stimulated through reforms in both the public and private sector. These include the application of Required Environmental Criteria [i.e., due criteria in Green Public Procurement, as better defined below] related in public tenders (but also applied to some extent in the private sector in the case of Superbonus [i.e., national funding for energy saving renovation works]), dedicated to the renovation or construction of new buildings, include for example certain limitations to select building components with specific recycled content, necessary to favour environmentally friendly products and the circular economy. The envisaged reforms should give precise and unified indications following the principles of eco-compatibility and indicate unambiguous tools for the recognition of sustainable products, such as environmental labels, as is already being promoted at European level with the Ecodesign Directive (Directive 2009/125/EC)”.

Public Authorities play a main role in the process, through Green Public Procurement, in being the tenders of potentially virtuous examples, both from an experimental point of view, allowing to better fit policies to reality, and as a driver of the process, implementing circular supply chains growth (Figure 2.8).

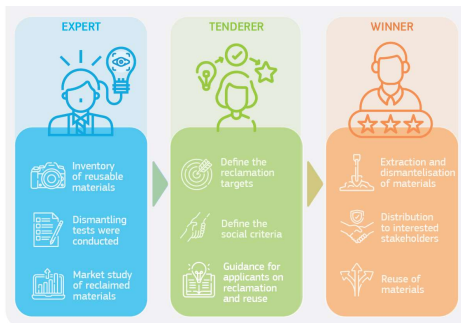


Figure 2.8 - Agents involved in a Green Public Procurement process of circular economy: experts, tenders, winners [Bruxer, 2022]

An important input to circular process has been recently introduced in the public sector by [DM 23.06.2022 Criteri ambientali minimi per l'affidamento del servizio di progettazione di interventi edilizi, per l'affidamento dei lavori per interventi edilizi e per l'affidamento congiunto di progettazione e lavori per interventi edilizi](#) (Required Environmental Criteria for the awarding of design services for building interventions, for the awarding of works for building interventions and for the joint awarding of design and works for building interventions), defining, for the building sector, the general requirements stated by [DM 11.10.2017 Criteri ambientali minimi per l'affidamento di servizi di progettazione e lavori per la nuova costruzione, ristrutturazione e manutenzione di edifici pubblici](#) (Required Environmental Criteria for the award of design and works services for the new construction, renovation and maintenance of public buildings).

DM 23.06.2022 introduces the concept of “Criteri Ambientali Minimi (CAM)” (Required Environmental Criteria): “the environmental requirements defined for the various stages of the purchasing process, aimed at identifying the best environmental design solution, product or service throughout the life cycle, taking into account market availability” (gpp.mite.gov.it). For the building sector, DM 23.06.2022 (in force from 04.12.2022) states that “The new provisions of the Building CAM, in particular the contractual clauses and technical specifications, depending on the scope of application and taking into account certain limitations such as in the case of interventions that do not concern entire buildings or in the case of contracts for maintenance services of buildings or technical facilities, apply in tenders for the awarding (joint or separate) of design services and works for building interventions by public administrations. In the mandatory technical specifications, there is a new reorganisation of the criteria into sections dedicated to the territorial-urban scale and the building scale, those relating to construction products and the building site. Particular attention has also been given to existing buildings that fall under the regulations of the code for cultural heritage and landscape, as well as those of historical-cultural and testimonial value identified by urban planning, providing for the application of the criteria as long as they are compatible and under precise conditions. On the other hand, the adoption of the rewarding criteria, in the general context of CAM, makes it possible to favour operators that implement strategies increasingly aligned with the EU regulatory framework and to increase the attraction of public and private capital on the works to be realised. Among these criteria are particularly noteworthy new approaches to design and use of materials such as life cycle analysis or LCA the assessment of the level of exposure to non-financial risks or ESG (environmental, social, governance, safety, and 'business ethics') of economic operators (e.g. construction companies, building material suppliers, engineering companies)” (territorio.regione.emilia-romagna.it).

The adoption of CAM has been quoted by the European Community among EU notable policies in Circular economy for Building Design: “The Italian procurement code ([Codice degli Appalti](#)) requires required environmental criteria (Criteri Ambientali Minimi - CAM) to enhance the sustainability process of construction products, of new public and refurbished buildings and of public

construction sites management. CAM's criteria are based on: the sustainable site analysis, in which the considered building is located; the building's technical specifications, which include the material technical specifications; and the recycled content value for specific material categories. The mandatory nature of CAM has accelerated change and brought more attention to environmental aspects. Some GPP requirements have already been extended to private building projects such as detailed requirements for recycled content in insulation materials to access incentives (tax credits and discounts). An overall key learning was that effectiveness requires detailed criteria with specific thresholds" ([European Commission, 2021, 46](#)).

However, such a virtuous framework of recycling finds a relevant obstacle in the EoW, i.e., End of Waste issues, where EoW, or "cessation of waste status waste", refers to a process whereby a waste, which has undergone a waste, subjected to a recovery process, loses this status to acquire that of product. The notion of end of waste originated in the EU with Directive [2008/98/EC](#) of 19.11.2008, the Waste Framework Directive. A waste ceases to be waste when it has undergone to a recovery operation and meets all the precise conditions set out in Article 6 of the Framework Directive, as amended by Directive [2018/851/EU](#):

- the substance or object is intended to be used for specific purposes;
- a market or demand exists for that substance or object;
- the substance or object fulfils the technical requirements for specific purposes and complies with existing legislation and existing standards applicable to the products;
- the use of the substance or object will not lead to overall adverse environmental or human health impacts human health.

When all conditions are fulfilled at the same time, the waste resulting from the recovery process is no longer a waste as it has become a product" ([SNPA, 2022, 5](#)).

The concept of EoW, received, at national level, by [Legislative Decree No. 152 \(2006\)](#), is, therefore, strictly related to those of "secondary raw materials", "upgrading" and "downgrading", i.e., the possibility of defining processes and labelling, which could allow, the reuse of the material coming from a selective deconstruction and the upgrading of material coming from a selective demolition legal and profitable ([Hoernig, 2022](#)).

3. ABOUT DRIVING TARGET GROUPS FOR CIRCULARITY IN CONSTRUCTIONS

The transition from a linear economy (cradle to waste) to a circular economy (cradle to cradle) in the building sector requires a paradigm shift, involving all components of the supply chain, identified in the European Commission's concise document [Circular Economy-Principles for Building Design \(2020\)](#) in:

- Target Group 1: Building users, facility managers, owners;
- Target Group 2: Design teams (engineering & architecture of buildings);
- Target Group 3: Contractors and builders;
- Target Group 4: Manufacturers of construction products;
- Target Group 5: Deconstruction and demolition teams;
- Target Group 6: Investors, developers and insurance providers;
- Target Group 7: Government/Regulators/Local Authorities.

It would be appropriate, however, to integrate the supply chain with Target Group 8: Education and research, which is necessary for the professional and higher education of the listed categories, the human capital that conditions the quality of the results.

The [European Circular Economy Stakeholder Platform](#), launched in April 2017, provides an idea of the Target Groups involved at European level. The Platform lists 56 Italian Good Practices, but just 2 of them are referred to the building sector.

While, mainly in the North of Europe, all the Target Groups seem to be consistent, the Italian contest sees, at the forefront, in a relevant role, Target Group 4, Target Group 5, Target Group 7 and Target Group 8, while the remaining Target Groups, up to now, seem to wait for the positive input of those. Manufacturers of construction products, Deconstruction and demolition teams, Government/Regulators/Local Authorities, Education and research are, therefore, expected to be the drivers of the process in the years to be, launching the challenge, with their different competences and skills, as summarised thereby, having in mind parallel Target groups at European level.

3.1 Target Group 1: Building users, facility managers, owners

Target Group 1, i.e., Building users, facility managers, owners, is involved at its highest levels, referring to important national/international real estates, which get benefit by their international connection and experience.

Despite Italy has a Home Ownership Rate of 74.3%, greater than the average of European countries, amounting to 69.1% in 2022, ([tradingeconomics.com](#)), the ownership representative limit their activity in complaining the European process fallout, evidencing a stale context in danger of being swept away by the pressures of the international/national real estate investments. Such a vulnerable condition can be verified surfing the official website of [Confedilizia](#), a relevant ownership association, founded in 1883, whose interest for circular economy issues is of no relevance.

3.2 Target Group 2: Design teams (engineering & architecture of buildings)

The involvement of Target Group 2, i.e., Design teams (engineering & architecture of buildings), sees a recent input in up-grading meetings, mainly related to CAM requirements. Recent educational activities for professional are summarised, as an example, in Table 3.1.

date

event

organizer/s

03.07.2023	Aspetti pratici ed applicativi della normativa sui rifiuti e sullo sviluppo dell'economia circolare	Euroconference Ordine Ingegneri di Verona e Provincia
31.03.2023	Economia circolare: Transizione energetica ed ecosostenibilità nei cambiamenti climatici	Ordine degli Ingegneri di Caserta
25.03.2023	#ForumIngegneriCamuni-II Edizione Conversazione sulla creazione di valore per l'economia circolare con la prof.ssa ing. Elza Bontempi	Associazione Ingegneri Camuni Ordine Ingegneri Brescia
25.03.2023	Sostenibilità, economia circolare, ecodesign, LCA. Un nuovo approccio all'innovazione	Ordine degli Ingegneri Provincia di Modena Commissione innovazione tecnologica dell'Ordine degli Ingegneri Provincia di Modena
16, 25.11.2022	Costruire verde - progettazione e gestione del cantiere secondo criteri di sostenibilità ambientale	Consiglio Nazionale degli Ingegneri
14.10.2022	Valorizzazione dei rifiuti da costruzione e demolizione e buone pratiche di economia circolare	Ordine Ingegneri Provincia di Milano in collaborazione con Regione Lombardia, ANCE Lombardia e ARPA Lombardia

Table 3.1 - Recent educational activities for professionals organised by national/local bodies.

Besides, it is very interesting the attention recently paid, a few years ago, by Italian architects to the [Harvest Maps](#) tool, a web platform born in the Netherlands, which identifies and locates waste materials from demolitions. The project has been stopped by the conflict with national waste regulations, nevertheless, the interest in Urban Mining Potential is still alive, as demonstrated by the activities of the [10th Urban Mining Festival](#), carried out in Milan, from 15 to 26.11.2023, even if yet far from the construction components.

3.3 Target Group 3: Contractors and builders

The interest in Circular Economy of Contractors and Builders seems to be mainly related to the CAM adoption, i.e. the Green Public Procurement Required Environmental Criteria.

In this direction, the National Association of Builders, [ANCE](#), recently supported, together with [Federcostruzioni](#) and [GBC Italia](#), a series of up-grading events addressed to the professional field, carried out in relevant Italian sites and fairs, organised in steps, under the common label of [Ciclo di seminari per professionisti. Sostenibilità dei prodotti da costruzione: dai nuovi CAM alle normative europee per gli edifici. Il Life Cycle Assessment per la valutazione degli impatti ambientali](#), i.e., “Seminar series for professionals. Sustainability of construction products: from new CAM to European building regulations. The Life Cycle Assessment for the evaluation of environmental impacts” (Table 3.2).

step	location	site	date
1 st step	Naples	ACEN Headquarter	26.06.2023
2 nd step	Rome	ANCE Headquarter	5.06. 2023
3 rd step	Bologna	CERSAIE	25.09.2023
4 th step	Bari	SAIE	20.10.2023
5 th step	Rimini	Ecomondo	9.11.2023
6 th step	Milan	MadeExpo	16.11.2023

Table 3.2 - Recent educational activities for professionals supported by ANCE, Federcostruzioni and GBC Italia.

Such an activity is a first hint toward a collaboration among different stakeholders as the local boards of professionals, the media player [The Plan](#), and the organiser [Maggioli](#), the promoters [Confindustria Ceramica](#) and [Federbeton](#), evidencing a positive engagement in network building, even if lacking the presence of the tenders, i.e., local authorities, an absence emphasising the gap in between regulators and supply chains.

Among other interesting dissemination activities, as an example, reference is made to the meeting [L'economia circolare nel settore delle costruzioni](#) (i.e., Circular Economy in the construction sector), organised by the Town of Milan, ANCE-Lombardia, Milan University, Pisa School of Advances Studies and the Ministry of Ecological Transition, taking place on the 27.10.2022. The meeting, between representatives of public bodies, research institutes, trade associations and operators in the demolition industry, has been organised to take stock of the situation regarding the transition construction industry and more specifically on the delicate transition of from waste to raw material to safeguard natural resources, confirming the strong involvement of the Milan area and of major Universities - as Pisa School of Advances Studies is - to the topic and the obstacles stopping the process.

3.4 Target Group 4: Manufacturers of construction products

At national level, the premium rate provided by buildings' environmental labels - as [CasaClima](#) and [Leed](#) certifications are - and, more recently, the one related to the fulfilment of CAM (Required Environmental Criteria) in Public Procurement, addressed, since many years ago, the manufacturers to a process of analysis of their production in terms of [Life Cycle Assessment](#) (LCA), preventing an out of business process to be.

It is mainly the case of a production sector requiring huge amounts of energy, as the one of mineral building materials, i.e., concrete, ceramics/bricks and glass is.

Both at company and industry association, official documents and events document a deep involvement in communicating the positive role of natural/long standing materials, balancing the energy costs of their production.

In this direction, just as a framework reference, it is worthy to refer to some recent activities:

- [Federbeton](#), the national association of concrete producer, just published the last issue of its [Rapporto di sostenibilità](#) (Sustainability Report), carrying on the initial activity, dating 2012, launched by [Aitec](#), one of the its associated partners;
- [Confindustria Ceramica](#), the national association of ceramics/tiles producers, supports of information days on sustainability issues addressed to the professional, having as location the most important trade fairs, and parallel information activities, focusing on the relationship between the production and sustainability ([ceramica sostenibile](#));
- [Assovetro](#), the national association of glass producers, strong of the high rate of recycled products, despite the high energy cost, published, in 2022, its [2° Rapporto di Sostenibilità](#) (2nd Sustainability Report), summarising the activity of 19 associated partners, focusing on environmental, economic and social performances.

Besides, single companies, mostly related with the North Europe contest, publish their own documents, as:

- the [Annual and Sustainability Report 2022](#) by the German Concrete Producer Heidelberg, just officially acquiring, in November 2023, the historical national concrete companies Italcementi e Calcestruzzi;
- the [Sustainability Italian web page](#) by Wienerberger S.p.A. Unipersonale, associated to Wienerberger AG, world leader in the brick production sector;
- the [Sustainability Italian web page](#) by Saint Gobin glass, French leader in glass products.

Common reference for the labelling of their products is the [Environmental Product Declarations](#) (EPD), the document describing the environmental performance of the product from a life cycle perspective by carrying out its Life Cycle Assessment (LCA), in accordance with international standards, i.e. the [ISO 21930- Sustainability in buildings and civil engineering works](#) and EN 15804

standards, implemented in Italy by the [UNI EN 15804:2021- Sostenibilità delle costruzioni- Dichiarazioni ambientali di prodotto-Regole quadro di sviluppo per categoria di prodotto](#).

It is important to underline that, while witnesses of a strong involvement toward a circular economy approach in the building sector, such documents and activities restrict their impact to the recycling approach, leaving the field of reuse still to be developed at national level, while addressed labelling systems are running in North Europe countries.

It is the case of the C2C-Cradle to Cradle certification, promoted by the [Cradle to Cradle Products Innovation Institute \(C2CPII\)](#), “an independent, non-profit organization dedicated to maximizing the positive impacts of products and materials. As the standard setting and certification body for the Cradle to Cradle Certified® Product Standard, C2CPII works closely with leading organizations worldwide to guide and validate their efforts to apply the principles of material health, product circularity, clean air and climate protection, water and soil stewardship, and social fairness to product design and manufacturing. The standard provides designers, manufacturers, and suppliers with a framework for continually improving what products are made of and how they are made. Cradle to Cradle Certified is a respected mark of products and materials made for the circular economy. Version 4.0 was released on 16 March 2021”. Nevertheless, even such an approach focuses on production of building materials and potential reuse, relegating to the background the certification of existing materials, whose labelling evidences major issues in sampling and testing before/after the dismantling/deconstruction processes.

3.5 Target Group 5: Deconstruction and demolition teams

At European level the Target group 5, i.e., Deconstruction and demolition teams, finds an important reference in [ECDB- EuRIC Construction & Demolition Branch \(ECDB\)](#). “It is the Construction & Demolition Branch of [EuRIC](#), leading association of recycling industries, founded in 2023 ... in response to the increase of the demand and markets for recycled aggregates and other C&D recycling products in Europe, contributing to the achievement of the EU's climate and environmental objectives. The aim of ECDB is to represent the European construction and demolition waste recycling industries towards the European institutions and to cooperate with other European and international stakeholders, with the support of other EuRIC branches impacted. ECDB members are national recycling federations active in the collection, recycling and trade of construction and demolition materials”.

The Target Group 5 finds, in Italy, a first referent in [ANPAR-Associazione nazionale Produttori Aggregati riciclati](#) (National Association of Recycled Aggregate Producers), “founded in 2000 to be the trade association for stationary and mobile plants that recycle inert waste. With its representation in all Italian regions, it is the home of the sector's companies. It aims to protect its member companies by promoting in particular the use of aggregates produced by industrial inert waste recovery processes.”

In 2020 a more focused association has been founded: [NADECO- Associazione Nazionale Demolizione ed Economia Circolare per le Costruzioni](#) (National Association for Demolition and Circular Economy in Construction), “a non-profit organisation with the aim of protecting the interests of specialist companies in the field of demolition, environmental remediation and construction and demolition waste treatment within the framework of the market economy, promoting their connection, progress and development, and representing them in their dealings with institutions and administrations, economic and political organisations and other components of society. One of the Association's objectives is to work towards the creation of a legislative framework capable of standardising the regulations affecting the sector at a European level, with a particular focus on the issues of the circular economy and environmental sustainability. To this end, it identifies and shares

the criteria that qualify the sector in terms of technology, safety, and the training of workers, to determine and set those parameters that are indispensable for carrying out the activity in a context of professionalism”.

3.6 Target Group 6: Investors, developers and insurance provider

Target Group 6, i.e., Investors, developers and insurance provider, is involved at its highest levels, as important national/international real estates are, which get benefit by their international connection and experience, but no relevance can be found when dealing with regional/local subjects.

It is not a surprise, therefore, that [COIMA](#), “a leading group for the investment, development and management of property assets on behalf of international and Italian institutional investors. Active in the Italian real estate sector since 1974, among its most important projects, the group has developed and still manages the Porta Nuova neighbourhood, one of the most prestigious urban regeneration plans in Europe” ([coima.com](#)), pays a special attention to circular economy, also through a dedicated body, the Riccardo Catella Foundation, focusing on [C2C issues](#), a step head from different size realities.

Among the players of Target Group 6, it seems interesting to give a reference to [GBC-Italia](#), the national office of the [Green Building Council-GBC](#), strongly engaged since several years ago in circularity issues, as evidenced by the report [Economia circolare in edilizia](#) (i.e., Circular Economy in the Building Sector), dating May 2109.

3.7 Target Group 7: Government/Regulators/Local Authorities.

European Community is supporting the policy of circularity through several action. Among them, a reference is offered by the [European Circular Economy Stakeholder Platform \(ECESP\)](#), “a joint initiative by the European Commission and the European Economic and Social Committee. It is a European one-stop-shop for the circular economy community: a place for dialogue and a bridge between existing circular economy initiatives. The ECESP's 24-member Coordination Group, whose mandate started on 1 May, has now published its [work plan for 2023](#).”

In Italy, one of the nine Departments of [ISPRA-Istituto Superiore per la Protezione e la Ricerca Ambientale](#) (Higher Institute for Environmental Protection and Research), is the Centro Nazionale dei rifiuti e dell'economia circolare (National Centre for Waste and the Circular Economy), issuing, every year, the [Rapporto Rifiuti Speciali](#) (Special Wastes Report), the first data reference for Circular Economy in the building sector.

European and National Standard Agencies can be comprised in Target 7, as well.

In Italy, [UNI-Ente Nazionale di Normazione](#) (National Standards Body), since 1998, published standards about recycled materials, following the European CEN standards. Initially addressed to plastics, packaging, wood, tires ..., it recently focused on the building sector with a general reference practice about by-products, strictly related to the aforementioned CAM-Criteri Ambientali Minimi (Required Environmental Criteria):

- [UNI-PdR 88:2000- Requisiti di verifica del contenuto di riciclato e/o recuperato e/o sottoprodotto, presente nei prodotti](#) (Verification requirements for the recycled and/or recovered and/or by-product content which is present in the products)

and a more specific one on selective deconstruction:

- [UNI-PdR 75:2020- Decostruzione selettiva-Metodologia per la decostruzione selettiva e il recupero dei rifiuti in un'ottica di economia circolare](#) (Selective deconstruction-Methodology for selective deconstruction and waste recovery from a circular economy perspective).

Reference practices are open to discussion for 5 years and can be then withdrawn or transformed into a standard, as conceivably will be. The launch of such document has, in the present framework, a very important meaning and will probably evidence a severe impact on the building sector.

3.8 Target Group 8: Education and research

Education for Circularity in the building sector, at different levels of intervention, is a major issue. Among relevant EU examples, the [Nordic Sustainable Construction](#)—“a programme under the Nordic Council of Ministers, which contributes to the Nordic Vision 2030 of becoming a sustainable and integrated region by 2030 in respect to sustainable construction and housing” - offers a list of opportunity in sustainability training, in general, comprised classes addressed to demolition/deconstruction skills.

Besides, recently, [SUPSI](#), the University of Applied Sciences and Arts of Southern Switzerland, launched a continuous learning short class, [La circolarità nel settore della costruzione](#) (i.e., Circularity in the Construction Sector), introducing “participants to these topics, with a day of visits and exchange of experiences at exemplary projects implemented in the canton, at companies and institutions involved in recycling and at the material library SUPSI”. Despite the minor impact of the offer, the fact that a relevant institution, as SUPSI is, considers of interest such an activity is the evidence of a role that universities should take on not only in their curricular, but, also, in continuous learning programme.

The Polytechnic School in Milan has, at national level, in that, a driving role. In the period November 2023- March 2024, the 2nd edition of the [Corso di perfezionamento “Economia circolare - da rifiuti a risorse: un’economia in transizione”](#) (i.e., Advanced Course “Circular economy - from waste to resources: an economy in transition”) will take place.

A synthesis of [research projects supported by the European Community](#), addressed to the reduction of environmental impacts, to resources efficiency implementation, to definition of proper indicators for sustainability metering and related topic, at the basis of circular economy principles, as related with the building sector, Public Procurement as a driver, ..., would be itself a research project, as one can verify by surfing the European Research Database ([CORDIS](#)). A first query for “circular economy + construction” lists more than 1000 documents referring to projects financed through different Programmes, as those of excellence, financed by the [Framework Programmes for Research and Technological Development \(FP\)](#), running since 1984 (Figure 3.1).

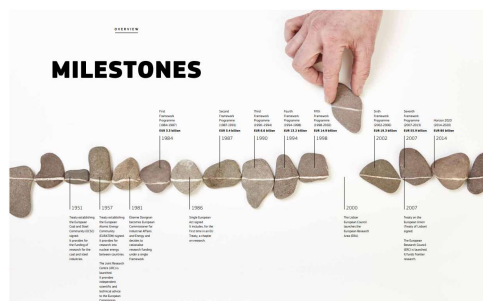


Figure 3.1 - Framework Programmes for Research and Technological Development Milestones [[sfe.lnl.infn.it](#)].

Several parallel funding programmes support the application of research results. Among them, attention could be paid, as well, to [INTERREG](#) and [LIFE](#) Programmes, an important litmus test for

the Project Scenarios envisaged in Chapter 6, as describing the interaction of EU Members (the first) and the interest of stakeholders in innovation trends (the second).

Some relevant project funded by the [Framework Programmes for Research and Technological Development \(FP\)](#) related to the building sector, are summarised in Table 3.2.

project	period	partners	lead partner	contents
CIRCuiT	06.19-11.23	32	Københavns Kommunes	“Four European cities - Copenhagen, Hamburg, Helsinki’s region of Vantaa and Greater London - are planning to undertake a full circular and regenerative transition. These cities joined in a partnership to create a value chain that will allow them to become fully smart, eco-friendly, regenerative, and circular economies. The EU-funded CIRCuiT project will aim to present the whole system of elements engaged in the transition process: from dismantling buildings for reuse of materials to Circularity Hubs and CIRCuiT Academy, promoting the development of further solutions. In 36 demonstration projects, CIRCuiT will present the tools of today and the future that will boost regeneration while substantially reducing the use of virgin raw materials.”
BAAM	09.15-02.19	15	Bruxelles Environnement	BAMB will enable a systemic shift where dynamically and flexibly designed buildings can be incorporated into a circular economy. Through design and circular value chains, materials in buildings sustain their value - in a sector producing less waste and using less virgin resources. Instead of being to-be waste, buildings will function as banks of valuable materials - slowing down the usage of resources to a rate that meets the capacity of the planet. The project has developing and integrating tools that will enable the shift: Materials Passports and Reversible Building Design - supported by new business models, policy propositions and management and decision-making models. During the course of the project these new approaches has been demonstrated and refined with input from 6 pilots.

Table 3.2 - Relevant Projects funded by FP Programme

[INTERREG Programme](#), running since 1990 (Figure 3.2), is the EU instruments that strengthens cooperation between regions and countries.

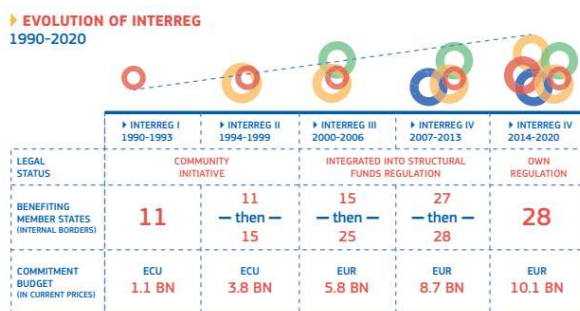


Figure 3.2 - Evolution of INTERREG 1990-2020 [ec.europa.eu].

“Through its cohesion policy, the European Union is working to reduce disparities in development and quality of life in European ‘regions’. Cohesion policy supports actions that helps European regions to be more innovative, more sustainable, and more inclusive; thus, improving quality of life for its peoples and communities. The bulk of the funds available for reducing regional disparities is managed at the regional or national levels within each country. Nonetheless, the EU believes that regional development can also be improved through interregional cooperation ‘across borders’”.

The Interreg Europe Programme, financed by the Cohesion policy’s European Regional Development Fund (ERDF), was therefore designed to support interregional learning among policy relevant organisations across Europe.

The Programme’s objective is to enable public authorities and other relevant organisations to actively learn from the experience of other regions. This is a learning process which involves identifying, analysing, and transferring good practices with the aim of improving regional development policy instruments and ultimately delivering solutions that benefit all citizens” (www.interregeurope.eu).

A relevant project funded by the [INTERREG Programme](#), related to the reuse of building materials, is summarised in Table 3.3.

project	period	partners	lead partner	contents
FCRBE	2018-2013	10	Rotor	<p>“Today in NW-Europe, only 1% of building elements are reused following their first application. Although a large number of elements are technically reusable, they end up being recycled by crushing or melting, or disposed. The result is a high environmental impact and a net loss of economic value.</p> <p>This project aims to increase by +50%, the amount of reclaimed building elements being circulated on its territory by 2032.</p> <p>Focusing on the northern half of France, Belgium and the UK, the project also covers, with a lesser intensity, the Netherlands, Ireland, the rest of France and Luxembourg. This area houses thousands of SMEs specialised in the reclamation and supply of reusable building elements. Despite their obvious potential for the circular economy, these operators face significant challenges: visibility, access to important projects and integration in contemporary building practices. Today, the flow of recirculated goods stagnates and may even decrease due to a lack of structured efforts”.</p>

Table 3.3 - A relevant Project funded by INTERREG Programme.

[LIFE Programme](#), running since 1992, is the EU funding instrument for the environment and climate action, acting through the [European Climate, Infrastructure and Environment Executive Agency](#). “The LIFE Programme finances innovative projects demonstrating the effectiveness of new techniques and methodologies in the environmental sector. Besides the so-called “traditional” projects, LIFE also finances “integrated” projects combining LIFE funds with other sources of support to maximise their impact over large areas. LIFE projects can also provide technical assistance, strengthen capacity building and carry out preparatory activities for the development of the European legislation in the environment sector” (Figure 3.3).



Figure 3.3 - LIFE Programme numbers [cinea.ec.europa.eu].

In order to provide an idea, the level of involvement of the national context into the EU policies, some relevant programme financed by those programmes, related to the building sector, are summarised in

Table 3.4 (Framework Programme), Table 3.5 (INTERREG Programme), Table 3.6 LIFE Programme.

project	period	partners	Italian partner	contents
KARMA	03.23-05.27	7	Eurokom Association	“The KARMA Project aims to bring about change in the construction industry by further adapting and developing policy tools that foster circular construction practices. By promoting the principles of sustainability, resource efficiency, and waste reduction, KARMA aims to reshape the way buildings are designed, constructed, and demolished. The project seeks to review policies and strategies that encourage the reuse, recycling, and repurposing of construction materials. The project's policy tools will provide guidance to policymakers, construction professionals, and stakeholders, enabling them to implement circular construction practices at various levels, from local to regional. By driving the transition towards circular construction, KARMA aims to create a lasting impact and contribute to a greener, more sustainable future.”
HOUSEFUL	05.18-04.23	16	Fondazione Icons	“HOUSEFUL project proposes an innovative paradigm shift towards a circular economy for the housing sector by demonstrating the feasibility of an integrated systemic service composed of 11 circular solutions. HOUSEFUL will introduce solutions to become more resource efficient throughout the lifecycle of a building, taking into account an integrated circular approach where energy, materials, waste and water aspects are considered. This approach fosters new forms of co-creation, increasing the collaboration among stakeholders of the housing value chain to develop new circular solutions and services. HOUSEFUL concept will be large scale demonstrated at 4 demo-sites in Austria and Spain, adapting the concept to different scenarios, including in social housing buildings. HOUSEFUL solutions will be evaluated from an environmental (Life Cycle Assessment), economic (Life Cycle Cost) and social (Social Assessment) point of view.”

Table 3.4 - Some relevant Projects funded by FP Programme with Italian partner/s

project	period	partners	Italian partner	contents
URGE	09.19-05.22	9	Comune di Prato	“URGE, an abbreviation for 'circular building cities' is an Action Planning network on circular economy in the construction sector - a major consumer of raw materials. As there is a gap in circular economy principles' implementation in this sector, URGE brings together nine cities and their stakeholders to inspire and learn from each other in developing their integrated urban policy. This supports integration of circularity in the construction tasks, thus contributing to sustainable cities.”
CONDEREFF	06.18-05.03	8	ENEA, advisory partner	“The CONDEREFF project brings together 8 partners from 7 countries to exchange experiences and practices on how to move forward from existing procedures on C&D waste management towards the adoption and further exploitation of the best practices and measures applied in the field. The project will enable the participating regions to advance their goals for resource efficiency and green growth through the proper management of C&D waste, which can boost demand for C&D recycled materials and support both sustainability and recycling in the construction sector.”
SYMBI	04.16-03.21	7	Camera di Commercio del Molise	“SYMBI project will contribute to improve the implementation of regional development policies and programmes related to the promotion and dissemination of Industrial Symbiosis and Circular Economy from 7 participating countries faced to policies

alignment with the Circular Economy strategy of the European Commission to transform Europe into a more competitive resource-efficient economy. INDUSTRIAL SYMBIOSIS looks at interactions between the environment, the economy and industry, and promotes the sharing of materials to minimize waste, following the example of a natural ecosystem, where everything is reused. Industrial symbiosis strengthens regional growth and competitiveness fostering: Material and energy savings, reusing waste and energy by-products of industrial processes; New business models with secondary raw resources trading and innovative waste management services; Mitigation of external volatility risks, reducing dependencies on imported materials and fossil fuel.”

Table 3.5- Some relevant Projects funded by INTERREG Programme with Italian partner/s

project	period	partners	Italian partner	contents
CVDCIRCLE	11.23-04.27	8	Gruppo Gatti Spa Università degli Studi di Brescia Regione Lombardia Cavart SpA Pavoni SpA ESEB Prandelli Santo srl	“CDWCIRCLE has the ambitious goal of achieving total recycling of treated CDW thanks to a radical innovative sorting technology that allows to separate the inert fractions (aggregates, bricks, tiles, etc) and will enable the production of added-value secondary raw materials to be re-used in the construction sector. A new CDW recycling plant, able to treat up to 90.000 ton/year of CDW, will be designed and constructed by the partners Cavart and Binder, and installed in one of the authorized sites of Gatti Costruzioni company in the Brescia area... Following the testing phase, the partners will develop proper business models, supporting the supply chain of the new market niche and establishing ecosystem with stakeholders active in the field.”
LOWaste	09.11-06.14	5	Comune di Ferrara La Città Verde Impronta Etica HERA	“The LOWaste project aimed to reduce urban waste and preserve natural resources by developing a local market for recycled materials. Project beneficiaries worked toward this goal by enhancing existing green public procurement schemes, by promoting waste prevention and encouraging the use of recovered materials, and by raising awareness of how waste can be reduced through reuse or the purchase of recycled products.”

Table 3.6- Some relevant Projects funded by LIFE Programme with Italian partner/s

4. THE CASE STUDY OF FRIULI VENEZIA GIULIA REGION

4.1 Regional policy toward circular economy

With Resolution 17.02.2023, the Friuli Venezia Giulia Region adopted [La strategia per lo sviluppo sostenibile \(SRSvS FVG\)](#) (i.e., Sustainable Development Strategy), which sees in Macro Area 6-Sustainable Development and Circular Economy (SSEC) - of the 12 identified (as in Tab. 3.6.B, p. 45 of the document) - the reference to the 3 Lines of Intervention SSEC1-Sustainable Production and Consumption Models with a view to the Circular Economy; SSEC2-Promoting the Transition to a Circular Economy; SSEC3-Promoting Sustainable Consumption and Procurement of the Public Administration. Competent structures are, respectively, the Directorate for Environmental Protection, Energy and Sustainable Development with ARPA FVG (Regional Environmental Agency), the Directorate for Productive Activities and Tourism and the Directorate for Infrastructure and Territory. Macro Area 6-Sustainable Development and Circular Economy (SSEC) is linked to 3 of the 8 Lines of the [Piano Strategico Regionale 2018-2023](#) (Regional Strategic Plan 2018-2023), approved on 08.02.2109: L4-Competitiveness and Employment; L6-Agriculture and Environment; L8-Tax Simplification and Autonomy (as in Tab. 3.6.E, p. 47 of the document).

The FVG SRSvS also identifies significant correspondences between Macro Area 6, Scelte Strategiche Nazionali della Strategia Nazionale per lo Sviluppo Sostenibile (SNSvS, 2022) (National Strategic Choices of the National Strategy for Sustainable Development) and the Missions of the [PNRR](#) (p. 95):

- to Line SSEC1-Sustainable production and consumption patterns with a view to the circular economy correspond the National Strategic Choices Prosperity II: Financing and promoting sustainable research and innovation, Prosperity IV: Affirming sustainable production and consumption patterns and the PNRR Missions M1: Digitisation, Innovation, Competitiveness, Culture and Tourism; M2: Green Revolution and Ecological Transition; M4: Education and Research;
- to Line SSEC2-Promoting the Transition to a Circular Economy correspond the National Strategic Choices Prosperity IV: Affirming sustainable patterns of production and consumption; Prosperity VI: Reducing climate-changing emissions and decarbonising the economy and PNRR Mission M2: Green Revolution and Ecological Transition;
- to Line SSEC3-Promoting Sustainable Consumption and Procurement of Public Administration corresponds the National Strategic Choice Prosperity IV: Affirming sustainable patterns of production and consumption and, again, the PNRR M2 Mission: Green Revolution and Ecological Transition.

Related regional policies and plans are identified, among others, in [Regional Law No. 34 \(2017\) - Disciplina organica della gestione dei rifiuti e principi di economia circolare](#) (Organic regulation of waste management and principles of circular economy), in the [Strategia regionale per la specializzazione intelligente \(S4\) del Friuli Venezia Giulia per il periodo 2021-2027](#) (Regional Strategy for Smart Specialisation (S4) of Friuli Venezia Giulia for the period 2021-2027) and in [Regional Law No. 3 \(2021\) - contributi applicazione economia circolare, riduzione consumi e efficientamento energetico](#) (application contributions circular economy, consumption reduction and energy efficiency).

It is interesting to point out that:

- the [Regional Law No. 34 \(2017\)-Disciplina organica della gestione dei rifiuti e principi di economia circolare](#), in Art. 3, paragraph 10, indicates “In order to extend the life cycle of goods that the possessor no longer intends to use, the Region supports the creation of municipal reuse centres aimed at the temporary display of used goods but still usable in their current state or goods intended for preparation, through repair or disassembly, for reuse”;

- the [Strategia regionale per la specializzazione intelligente \(S4\) del Friuli Venezia Giulia \(2021-2027\)](#), implementing the [Strategia regionale di ricerca e innovazione \(S3\) per la specializzazione intelligente del Friuli Venezia Giulia \(2014-2020\)](#) (Regional Strategy for Research and Innovation (S3) for the smart specialisation of Friuli Venezia Giulia (2014-2020)), defines 5 areas of specialisation, identifying as first "1. Energy transition, circular economy and environmental sustainability" (p. 103); at the same time, it identifies the Osservatorio sull'economia circolare sostenibile (i.e., Monitor on Sustainable Circular Economy) as the tool to "provide companies with information and support to increase efficiency, measure their "sustainability", introduce circularity criteria in the choice of suppliers, and promptly adapt to European and national regulations on circular economy", at the service of Industrial Innovation Harbour, part of the Friuli Venezia Giulia Science and Innovation System, through the [ARGO](#) project (pp. 44-47);
- the [Regional Law No. 3 \(2021\)-Contributi applicazione economia circolare, riduzione consumi ed efficientamento energetico](#) (Contributions for the application of circular economy, consumption reduction and energy efficiency) finances "projects for process innovation and organisational innovation that are aimed at the following actions:
 - the realisation of investments aimed at implementing measures in the circular economy;
 - the implementation of investments aimed at reducing the energy consumption of production activities based on energy audits;
 - the acquisition of studies and specialised technical advice on the circular economy, eco-design of products and the production of goods and services with reduced energy consumption
 - the introduction into the company organisation of the activity of the EGE [Energy Management Expert], also through employment with a job contract.

4.2 The institutional point of view: the Waste Authority of FVG Region

On 16.06.2023, an interview has been carried out at the [Servizio Disciplina Gestione Rifiuti e Siti Inquinati](#) (Service Discipline Waste Management and Polluted Sites).

The interview aimed in investigating the degree of involvement of the Region in the topic of Circular Economy in the building sector and the presence in the area of virtuous examples.

As evidence, the building sector is not a key player in the Circular Economy Regional Policies, while other sectors have defined interesting supply chains. It is the case, for example, of:

- the paper mill, in Ovaro, which set up the supply chain of scrapes, as evidenced by the [Bilancio di Sostenibilità](#) (Sustainability Budget) of the owning Group (p. 31);
- the [Repalnet Project](#), a network of reusable pallets;
- the [ReCap Project](#), an on-going pilot project, involving the Region FVG, for coffee caps recycling.

Besides, FVG Region supports the activity of the [Centri del Riuso](#) (Reuse Centres), areas equipped for the delivery by consignors of used goods, they do not intended to be disposed of, and for the subsequent collection of those goods by users for reuse. They mainly address: to furniture and furnishings; electrical and electronic equipment; clothing; household goods; sports equipment; giftware; toys; publications; children's articles; bicycles.

Speaking about the building sector, the major issues preventing, up to now, the definition of proper policies are the lack of training offers addressed to the operator and the presence of contaminants in

the recyclable material, as it is the case of asbestos and chrome, present in concrete dating the '60thies and '70thies.

4.3 Research activities: the CINDERELA Project

It is worthful to make reference to [CINDERELA Project](#), an EU Project recently developed in FVG Region, in the direction of the transition to circular economy for the construction sector, being a reference that could be part of a process of implementation to be.

The project “has received funding from the European Union’s Horizon 2020 research and innovation programme under grant agreement No. 776751” and is based on a consortium “composed by 13 partners from 7 countries: Slovenia, Italy, Serbia, Spain, Poland, Netherlands, Macedonia. The consortium is structured in 6 local demonstration activities and several organizational structures to guarantee the unity of the aim and outcomes of the project. The partners along with the supporting parties cover the whole value chain of each local demonstration activity, which includes academia, public authorities, waste generators and end-users.”

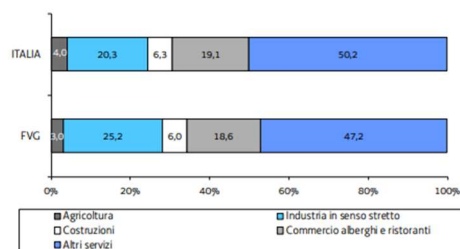
One of the results of the project has been the setup of a data base, [CINDEROSS](#), providing “information on all things relevant for exploiting a circular economy business model”, implemented by the Pordenone Technology Park Andrea Galvani, one of the development parks of FVG Region. The CINDERELA Project offers an important potential environment of development in the field, but, unfortunately, his knowledge is restricted to the stakeholders.

5. CRITICAL ISSUES IN FVG: A DIALOGUE WITH ANCE-FVG

5.1 The building sector in FVG

The building sector in Friuli Venezia Giulia employs about 30,000 workers, which represents 6% of the employed (Figure 5.1), about 11,000 of them are registered with the FVG Building Funds (Casse Edili FVG, 2023).

Graf. 11.1 - FVG ITALIA OCCUPATI PER SETTORE DI ATTIVITÀ ECONOMICA (valori %) - Anno 2021



Fonte: ISTAT, Rilevazione sulle forze di lavoro

Figure 5.1 - Employment percentages in Italy and FVG for different economic activities: Agriculture, Industry, Constructions, Trades/Hotels/Restaurants in 2021 [RFVG, 2022, 161].

This structure is essentially made up of small and medium-sized companies, with a reduced financial exposure capacity, but a potential rapidity of adaptation to change, which employ, at a national level, 61.6% of the companies 1 single employee, 34.1% from 2 to 9 employees, 4% from 10 to 49 employees and 0.3% more than 50 employees (Figure 5.2).

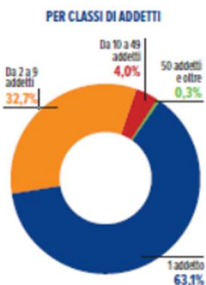


Figure 5.2 - Percentage of employees in the construction sector, as related to the company size [ANCE, 2022, 46].

The entire building sector in FVG is, on the whole, attributable to 140,000 employees, that is about 12% of the population and 27% of the employed, to which 22% of the regional GDP is linked (ANCE-FVG, 2023).

5.2 The interviewees

In deepening the issues related the challenges of the circular chain of constructions in Friuli Venezia Giulia, the collaboration with ANCE-FVG, through the director, Dr. Fabio Millevoi, made it possible to involve in the definition of a reference framework, at regional level, some associates, willing to compare experiences, planning and knowledge.

They represent contexts characterised by different scales of intervention and different skills:

- i. an international General Contractor;
- ii. a construction company operating in the North-East and Central Italy area;
- iii. a construction company operating on a regional scale;
- iv. a company in the technical systems engineering sector;

- v. a company active in the waterproofing sector and in the removal of asbestos components;
- vi. a personal company operating in the restoration sector.

ANCE-FVG counts, among the associated companies, also demolition and recycling activities; two of them have been involved in the survey to complete the reference group:

- vii. a company active in the excavation and aggregate recovery/marketing sectors;
- viii. a company active in the building site material collection and recycling.

The companies involved represent, despite the limited dimension of the sample, the variety in competences and activities and provides a good description of regional skills and company sizes (Figure 4.3).

Role of the Company



Figure 5.3 - Activity of the interviewed companies taking part to the dialogue with ANCE-FVG.

5.3 The interviews

Between April 2023 and July 2023, six meetings took place with the selected interviewees, organised by the director of ANCE-FVG, Dr. Fabio Millevoi, in order to focus circular economy issues at regional scale.

A detailed questionnaire was initially submitted to the interviewees, intended to support the one-to-one meeting, following an introductory one, and to provide a synthesis of the discussion carried out. However, it became evident, in the following, that it would not be filled by all of them in for several reasons:

- lack of time
- fear of sharing one's knowledge
- fear of highlighting the absence of knowledge.

The written feedback following the meetings, in fact, was limited to the highest ranked players: the international General Contractor (*i*) and the construction company operating in the North-East and Central Italy area (*ii*), whose high-level extra-regional involvement could effort knowledge sharing, with no fear of loss of competitiveness in the regional contest.

In detail, interviews were carried out with the following scheduling:

- 13.04 international General Contractor (*i*)
 - construction company operating on a regional scale (*iii*)
 - company in the technical systems engineering sector (*iv*)
 - company active in the excavation and aggregate recovery/marketing sectors (*vii*)
- 29.05 construction company operating on a regional scale (*iii*)
 - company active in the excavation and aggregate recovery/marketing sectors (*vii*)
- 01.06 company in the technical systems engineering sector (*iv*)

- 05.06 international General Contractor (i)
 construction company operating in the North-East and Central Italy area (ii)
 personal company operating in the restoration sector (vi)
- 09.06 company active in the waterproofing sector and in the removal of asbestos components (v)
- 31.07 company active in the building site material collection and recycling (viii).

The fragmented dialogues, summarised by points in Annexe 1, has been, then, reassembled, through the critical synthesis of what has emerged, into a general framework, allowing to identify a number of critical issues, the starting point for defining improvement actions and consequent predictable scenarios. This activity was supported by preliminary and synthesis work carried out with the Director of ANCE-FVG, Fabio Millevoi, in several meetings, taking place on 03.04, 09.05, 13.06, 24.07, 28.08, 04.10, 11.10, 23.10.2023

The meetings, however, immediately led to the verification of what had been hypothesised, i.e., that, for the categories represented by ANCE-FVG, the topic of deconstruction and reuse of building materials - which, as described, is becoming increasingly important at a European level and in some national contexts - is of marginal interest, if any, which in itself constitutes a serious motivation to continue the study in the direction of a shared transition model.

Participation in the meetings and the reflections that emerged, the fruit of a frank and constructive exchange of ideas, show, however, an attention, not taken for granted, by the participants, probably due not only to the perception of a process to come that could reserve important market shares, but perhaps also from the awareness that the topic has a social-environmental value, which encounters both personal sensitivities - moreover at the basis of participation in the meetings - and the need for a fine-tuning of paths/actions of social/environmental value for the company, in the direction of future sustainability certifications/approval of social-environmental balance sheets.

5.4 Identification of regional circular economy critical issues

The analysis of the European, national and regional context and the discussion with operators led to the identification of a number of critical points at regional level, summarised in 9 Critical Issues (Figure 5.4).



Figure 5.4 - Focus on critical issues in FVG building sector.

Critical issue No. 1

The first critical issue emerging from the study of the institutional context is a deep dissociation between what is in place at the institutional level and the shared knowledge in the category on the topic of the circular economy.

In fact, the institutional vision exceeds that of the companies, probably due to a top-down communication lack of effectiveness.

The national declination of European policies (substantially linked to the [Waste Framework Directive \(Dir. 2008/98/EC\)](#), to the [Energy Performance of Buildings Directive \(Dir. 2010/31/EU\)](#), to the [European Green Deal \(COM/2019/640 final\)](#), to the [Renovation Wave for Europe strategy \(COM\(2020\) 662 final\)](#) and to the [Next Generation EU \(NGEU, 2020\)](#), through the [Piano Nazionale di Ripresa e Resilienza \(PNRR 2021-2026\)](#)) offers a general institutional reference framework in Friuli Venezia Giulia, which can be linked to the transition towards a circular economy, well outlined and easily declined for the building sector, in a series of recent policy documents, i.e. the [Strategia per lo sviluppo sostenibile \(SRSvS FVG\)](#), the [Piano Strategico Regionale 2018-2023](#), the [LR 34/2017 \(Disciplina organica della gestione dei rifiuti e principi di economia circolare\)](#), the [Strategia regionale per la specializzazione intelligente \(S4\) del Friuli Venezia Giulia per il periodo 2021-2027](#) and the [LR 3/2021 \(contributi applicazione economia circolare, riduzione consumi e efficientamento energetico\)](#).

Surprisingly, the category has only partial knowledge of this articulated definition of regional policies towards a circular economy, also for the construction sector, a circumstance that prevents medium to long-term planning, in relation to the funding axes activated. As an example, the mentioned ARGO project is known in ANCE-FVG, also as related to activities carried out in collaboration, but not yet focused is the potential that the connected system could assume in the building sector, hypothesising a possible implementation of re-use centres connected to port and intermodal logistics, in general.

Critical issue No. 2

The absence of structured and capillary top-down communication on circular economy issues, particularly in the construction sector, is flanked by the absence of discussion tables for defining common actions among stakeholders, in line with other neighbouring realities, such as the Veneto Region. Such an absence brings to Critical issue No. 2. In detail, with DGR no. 148 of 24.02.2023, published in BUR no. 34, dating 10.03.2023, has activated the [Protocollo d'intesa per la definizione di proposte operative per l'attuazione dell'economia circolare nell'edilizia tra Regione del Veneto e ANCE Veneto \(associazione nazionale costruttori edili\), ANPAR \(Associazione Nazionale Produttori Aggregati Riciclati\), ARPAV \(Agenzia Regionale per la Prevenzione e Protezione Ambientale del Veneto\), Confindustria Veneto, Legambiente Veneto, Università IUAV di Venezia, Università degli Studi di Padova](#) (Memorandum of understanding for the definition of operational proposals for the implementation of the circular economy in the building industry among Veneto Region and ANCE Veneto (National Association of Building Constructors), ANPAR (National Association of Recycled Aggregate Producers), ARPAV (Veneto Regional Agency for Environmental Prevention and Protection), Confindustria Veneto (Veneto Industry Association), Legambiente Veneto (Veneto Environment League), IUAV University of Venice, University of Padua), which aims “to activate shared and complementary strategies that favour the application of the circular economy in the building sector, in particular by promoting:

- the reduction of natural resource consumption through the use of recovered aggregates and other materials to replace similar virgin materials;
- the use of renewable natural resources;
- the development of a high quality and competitive reclaiming industry that will steer the market towards a greater and more established confidence in the quality of reclaimed material;
- an analytical reading of the current regulatory framework in force, identifying the relative criticalities and possible initiatives aimed at overcoming them;
- the analysis of the design and construction process of a building construction, as expressions of the principle that all activities, starting from the extraction and production of building materials/components, should be organised in such a way that someone's waste becomes a resource for someone else, in a strategic vision based on process optimisation and circular economy;
- the promotion of the use of BIM through actions to support the dissemination of knowledge of the same, as a fundamental tool in the achievement of circularity objectives, through the digital representation and management of buildings, allowing an effective Life-Cycle Assessment that gives awareness of the environmental damage or potential due to what happens in each of the phases of the life cycle of a building;
- the possibility of developing a web platform, aimed at collecting and sharing the activities carried out by individual subscribers, to be eventually made available to operators in the sector”.

For these purposes “a “Tavolo per l'edilizia sostenibile-circolare” (Sustainable-Circular Buildings Table)” is established, ... [which] constitutes a moment of debate, sharing and concertation for all the actions that each Party undertakes to implement. The Table is coordinated by the Veneto Region ... periodically checks the state of implementation of the Memorandum of Understanding and the results achieved. If deemed appropriate, in consideration of specific issues to be dealt with, the participation to the Table may be opened to further organisations from the business, professional, academic-scientific world and associations registered to the National Register of the Third Sector operating in the territory ...” The reference to the Third Sector is of particular importance: the possibility of involving fragile and disadvantaged categories in the supply chain, in a work process whose value is not linked to productivity, but to employment as such, with a view to economic-social-environmental sustainability, could be the way to overcome the barriers of profit, drawing, however, a social-environmental advantage for work that is particularly burdensome in terms of man-hours, but, in any case, necessary and to the benefit of the community.

Critical issue No. 3

At the same time, missed opportunities are the PNRR calls for proposals and funding for energy efficiency, where the focus on certain parameters, such as DNSH-Do No Significant Harm and ESG-Environmental, social, and governance compliance, has been privileged over the initiation of ‘circular thinking’, a circumstance that outlines Critical issue No. 3: the burden that the coming deconstruction of buildings and efficiency measures carried out in very recent times constitutes for future generations.

The fact that the D4D-Design for Deconstruction approach has not been duly taken into account in public and private interventions, despite the extensive discussion at European level, constitutes a problem to come of which the category is fully aware.

Paradoxically, in fact, although burdened by the Italian building site habit of placing installations inside the masonry, buildings constructed in the 1950s-60s-70s-80s are more easily dismantled/ deconstructed/ demolished than those of very recent construction.

Critical issue No. 4

Besides, Critical issue No. 4 is configured: the lack of planning by operators with instruments that are in any case in place.

In particular, the reference is to the [Centri del riuso](#) (Reuse Centres), which can be financed with the contribution of the Friuli Venezia Giulia Region, whose operability is currently limited to objects/furniture/clothes and to the absence of dedicated entries in the [Prezziario regionale](#) (Regional Price List of Public Works), updated in 2022, an operational tool of strong possible incentive to circularity policies, in which the only reference for the term 'recovery' is related to aggregates, carpentry, hollow tiles, roof tiles.

Critical issue No. 5

Critical issue No. 5, put in evidence by two companies active in the excavation and aggregate recovery/marketing sectors and in the building site material collection and recycling, is related to the dimension of the supply chains of circularity and to its ownership.

From a profit point of view, a circular supply chain makes sense only if the dimension of the material processed is such to guarantee the investment to activate it. It is basic, therefore, to define collection networks of the material to be processed (reused or recycled) supporting the process with proper volumes.

In that, time has shown that, due to bureaucratic issues, a 'one referent ownership' seems to be the most appropriate one.

Critical issue No. 6

Critical issue No. 6, intrinsic to the national building sector as a whole, is the absence of information on the subject of the circularity of construction, for the aforementioned different phases in which it is structured (recovery inventory or reclamation audit; dismantling; selective deconstruction; selective demolition; collection; storage; regeneration; marking; distribution and reuse), in terms of possible and/or existing supply chains (i.e. [NADECO- Associazione Nazionale Demolizione ed Economia Circolare per le Costruzioni](#) (Demolition Works National Association and Circular Economy for Constructions); [Elenco Produttori e Utilizzatori di Sottoprodotti](#) (List of Producers and Users of By-products); [Piattaforma Italiana degli attori per l'Economia Circolare](#) (Italian Platform of Actors for the Circular Economy); [restado.de](#); [concular.de](#); [Cradle to Cradle certified](#)).

As a matter of fact, in the absence of a compulsory recovery/reuse of building components, beyond the percentages required by the above-mentioned Ministerial Decree 183/2022 [CAM edilizia](#) (Building's Required Environmental Criteria), related to recycled mineral materials, by-passed by entrepreneurs with reference to the existing market of recycled aggregates, the costs of upgrading are, at present, an unnecessary burden, both in relation to the second raw material, and to human capital. There is a widespread perception that investing in literacy, information and training weakens, as things stand, the competitiveness of companies in terms of profit, and there is a strong belief that the absence of literacy, information and training can compromise future competitiveness.

In this, the role of trade associations, such as ANCE-FVG, is fundamental, in the direction of preparing a sector for a qualitative leap forward in this still to be defined sector.

This gap in knowledge and training does not allow, moreover, a rational approach to the subject, in terms of current supply chains, relating to renovation and demolition/deconstruction work, and future supply chains, those that could be defined today in the design of demolition/deconstruction of new buildings.

Systems for reusing surplus building site, shared spaces, public and/or private, for storing materials and components - otherwise very costly for individual companies, real/virtual exchange platforms - are lacking, in fact, even only as a design idea.

Critical issue No. 7

The application of the principles of the circular economy finds, then, a further obstacle, also in Friuli Venezia Giulia Region, in certain ways of operating that constitute well-known criticalities for the national building sector. Thus, the disposal of dismantling/demolition/deconstruction materials according to alternative channels linked to the “black economy”, both for the logic of unaccounted for profits and for evident management difficulties linked to costs and procedural difficulties, in a distinction that is more burdensome for companies than for private individuals, can be traced back to Critical issue No. 7.

Critical issue No. 8

The difficult relationship between knowledge sharing and competition between the parties of a Target Group (associations and associates) and between Target Groups is also attributable to common ways of operating in the sector. As is well known, it is very complex, in fact, to spread the culture of networking and sharing information, since, in restricted contexts, local and direct competition is perceived as more relevant than global competition, with the obvious risk of an unmanageable overtaking from outside. This way of operating is all the riskier in a context, characterised, as mentioned, by small and very small enterprises.

Critical issue No. 0

The vagueness of the above is linked to the last criticality, which could have been indicated as “Critical issue No. 0”, being the true underlying critical issue, if that had not been considered as distracting from the relevant issues summarised. This is the absence of structured data on demolition, deconstruction and reuse of construction materials and building components, a limitation not only regional, but common to the entire national context. The sector data, in fact, when available, from what has been deepened, refer only to the waste sector, in relation to the code “CER 17-Rifiuti da costruzione e demolizione (compreso il terreno escavato proveniente da siti contaminati)” (EWC 17-Construction and demolition waste (including excavated soil from contaminated sites)), as recently described for Friuli Venezia Giulia Region (Rignini, 2023). The collection of this kind of data, needed for the assessment of trends, profits, gaps, potential, is certainly onerous and available, at present, just for pilot study realities. It is the case of the work carried out at the TU Wien (Kleeman et al., 2018), which led to the definition of a fundamental framework for the evaluation of the potential of the reuse market in construction in the city of Vienna, an application of the broader field of investigation of urban mining.

The availability of data is also indispensable for the evaluation of interventions at different scales (single building, block, neighbourhood), for different design types (non-standardised buildings and modular buildings), for different construction techniques (traditional construction site, prefabrication site).

6. SCENARIOS OF TRANSITION, IN DIALOGUE WITH ANCE FVG.

Having in mind the outlined critical issues of the transition to circular economy in Friuli Venezia Giulia Region, the dialogue with ANCE-FVG aimed in defining possible scenarios in the implementation of a road map toward 2050 EU targets.

The activity carried out by the mentioned INTERREG Project [FCRBE- Facilitating the circulation of reclaimed building elements in Northwestern Europe](#) represents a precious and influential reference and has been chosen as the base for the dialogue with ANCE-FVG, envisaging possible scenarios in activating circular economy regional drivers.

One of the products of the FCRBE Project is the Report [A roadmap to foster reuse practices in the construction sector. A collection of inspiring actions for public authorities](#), addressed to the partners' contest, i.e., Belgium, France, Luxembourg, Netherlands, United Kingdom.

The FCRBE roadmap is structured in 5 blocks of actions (Figure 6.1):

- 1 fostering the demand for reusing building materials
- 2 fostering the proper reclamation of reusable building materials
- 3 bridging the gap
- 4 establishing a supportive framework
- 5 monitoring evolutions.

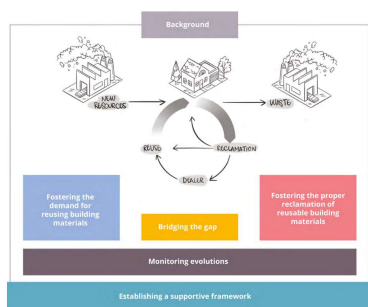


Figure 6.1 - Actions toward reuse practices [FCRBE, 2022].

and each block is, in turn, organised in subtasks (Figure 6.2).

6.1 FOSTERING THE DEMAND FOR REUSING BUILDING MATERIALS	6.2 FOSTERING THE PROPER RECLAMATION OF REUSABLE BUILDING MATERIALS	6.3 BRIDGING THE GAP	6.4 ESTABLISHING A SUPPORTIVE FRAMEWORK	6.5 MONITORING EVOLUTIONS
6.1.1 Encouraging and supporting meetings and seminars to attract reuse projects	6.2.1 Raising private sector awareness of reclamation	6.3.1 Documenting the reclamation chain	6.4.1 Integrating reuse in Green Building Rating Systems	6.5.1 Surveying the reclamation track
6.1.2 Encouraging and supporting building commissions to adopt reuse projects	6.2.2 Raising destination contractors' awareness of possible reclamation projects	6.3.2 Analyzing existing reuse practices	6.4.2 Developing LCA and EPD for reclaimed materials	6.5.2 Identifying reuse in building projects
6.1.3 Setting reuse objectives in public tenders	6.2.3 Raising citizens' awareness of possible reclamation pathways	6.3.3 Fostering collaborative operations	6.4.3 Integrating reuse in environmental impact assessment tools	6.5.3 Surveying future material flows
6.1.4 Doing visibility to active enterprises and available reclaimed materials stocks	6.2.4 Consulting operators' reclamation needs	6.3.4 Supporting enterprises that adopt reuse practices	6.4.4 Developing labels for reclaimed practices	
	6.2.5 Identifying alternatives for reuse	6.3.5 Identifying synergies between the social economy and salvage activities	6.4.5 Ensuring a common approach regarding the fitness for reuse	
	6.2.6 Establishing a list of greenest buildings	6.3.6 Fostering the sales of the stock	6.4.6 Developing adapted insurance schemes	
	6.2.7 Developing material passports for reclaimed building systems	6.3.7 Fostering urban salvage yards	6.4.7 Facilitating the access to the technical documentation for public domain and reused building materials	
		6.3.8 Identifying the access to land and storage resources	6.4.8 Clarifying Co-working	
		6.3.9 Dealing with logistic issues	6.4.9 Clarifying the suitability of equipment for the reuse of waste sites	
		6.3.10 Adapting education and training programmes	6.4.10 Identifying environmental risks of new products	
			6.4.11 Adapting liability for reclaimed products	

Figure 6.2 - Subtasks toward reuse practices [FCRBE, 2022].

As underlined in the document, “Policy makers can indeed have a strong influence ... they have at their disposal a wide range of possible actions, such as “determine and enforce standards and rules [...], encourage novel developments through taxes, subsidies and investments, enable change by providing infrastructure, information and skills, exemplify good practices through procurement and engage the public and industry through media campaigns and company initiatives”, and the roadmap addresses to them.

The 35 subtasks of the EU Project FCRBE have been, therefore, quoted, in the range: very easy (VE) - easy (E) - difficult (D) - very difficult (VD), as related to their feasibility in a shared evaluation with the Executive Director of ANCE-FVG, Dr. Fabio Millevoi, as related to the level of intervention to support them: national (N), regional (R), local (L) (Table 6.2).

1 Fostering the demand for reusing building materials	2 Fostering the proper reclamation of reusable building materials	3 Bridging the gap	4 Establishing a supportive framework	5 Monitoring evolutions
1.1 encouraging and supporting specifiers and contractors to adopt reuse practices N: E, R: E, L: E	2.1 raising private owners' awareness of reclamation procedures N: VE, R: VE, L: VE	3.1 documenting the reclamation trade N: E, R: E, L: VE	4.1 integrating reuse in green building rating systems N: VE, R: VE, L: D	5.1 surveying the reclamation trade N: D, R: E, L: VE
1.2 assisting and supporting building commissioners to adopt reuse practices N: VD, R: D, L: E	2.2 raising demolition contractors' awareness of possible reclamation pathways N: VE, R: VE, L: VE	3.2 analysing existing reuse practices N: VD, R: D, L: D	4.2 developing LCA and EPD for reclaimed materials N: E, R: D, L: VD	5.2 monitoring reuse in building projects N: E, R: E, L: VE
1.3 setting reuse objectives in public tenders N: E, R: E, L: VD	2.3 raising diyers' awareness of possible reclamation pathways N: VD, R: VD, L: VD	3.3 fostering collaborative dynamics N: VD, R: VD, L: D	4.3 integrating reuse in environmental impact assessment tools N: VE, R: VE, L: D	5.3 surveying future material flows N: E, R: E, L: VE
1.4 giving visibility to active enterprises and available reclaimed materials stocks N: VD, R: D, L: E	2.4 conducting systematic reclamation audits N: VD, R: D, L: E	3.4 supporting enterprises that adopt reuse practices N: E, R: E, L: VD	4.4 developing labels for reclaimed products N: D, R: VD, L: VD	
	2.5 specifying dismantling for reuse N: D, R: D, L: D	3.5 developing synergies between the social economy and salvage activities N: D, R: D, L: D	4.5 ensuring a common approach regarding the fitness for reuse N: E, R: E, L: E	
	2.6 establishing a list of 'protected materials' N: VD, R: VD, L: VD	3.6 federating the actors of the sector N: VD, R: D, L: D	4.6 developing adapted insurance schemes N: D, R: VD, L: VD	
	2.7 developing material passports for reclaimed building elements N: VD, R: VD, L: VD	3.7 fostering urban salvage yards N: VD, R: D, L: E	4.7 facilitating the access to the technical documentation for past, present and future building materials N: D, R: D, L: D	
		3.8 facilitating the access to land and storage spaces N: VE, R: VE, L: VE	4.8 clarifying CE-marking N: D, R: VD, L: VD	
		3.9 dealing with logistics issues N: D, R: E, L: E	4.9 clarifying the conditions of application for the end-of-waste status N: D, R: VD, L: VD	
		3.10 adapting education and training programmes N: VE, R: VE, L: VE	4.10 internalising environmental costs of new products N: E, R: E, L: VD	
			4.11 adapting fiscalità for reclaimed products N: VE, R: VD, L: VD	

Table 6.1 - Subtasks FCRBE roadmap, quoted for FVG contest, as related to feasibility (VE: very easy, E: easy, D: difficult, VD: very difficult, in N: national, R: regional and L: local contests).

The feasibility of subtasks is summarised in Table 6.2, as related to their frequency.

	no. of very difficult subtasks	no. of difficult subtasks	no. of easy subtasks	no. of very easy subtasks
national level	10	10	8	7
regional level	9	11	9	6
local level	10	8	7	10

Table 6.2 - Feasibility of the FCRBE roadmap subtasks at different levels of interventions, as related to their frequency.

The comparison among feasibility at different levels shows that there is a quite a balance in the 3 level of intervention, i.e., about 50% of the subtasks are easy or very easy for all of them. In order to allow a better understanding of the potential of the actions at the different levels, the evaluation has been turned into a chart (Figure 6.3), evidencing the feasibility of subtasks in a scale ranging from 1 (i.e., Very Difficult) to 4 (i.e., Very Easy), passing through 2 (i.e., Difficult) and 3 (i.e., Easy).

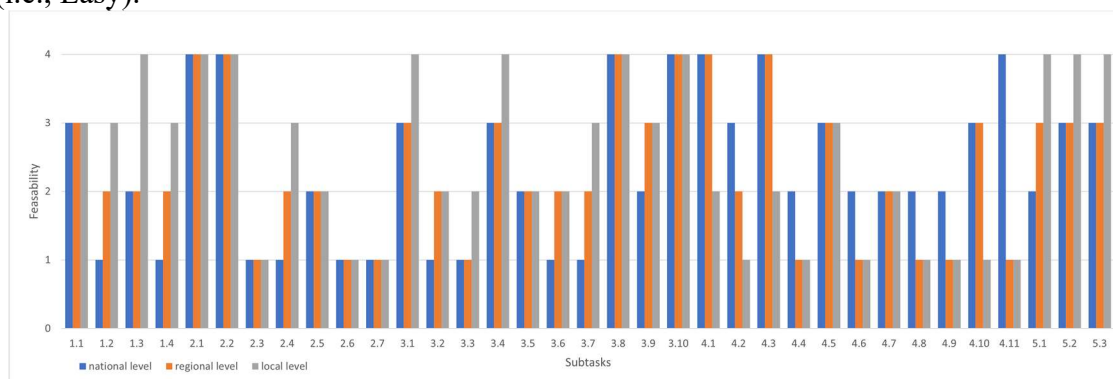


Figure 6.3 - Feasibility of the FCRBE roadmap subtasks at different levels of interventions, as referred to FVG Region: 1= Very Difficult; 2= Difficult; 3= Easy; 4= Very Easy.

The graph allows to put in evidence that there are subtasks for which the intervention at national/regional level is essential, while others could be run easily or very easily just at local level. Besides, there are tasks that turn out to be difficult or very difficult at all levels of possible interventions. Such a prevalence in feasibility should be taken in to consideration.

This expeditive analysis outlines 3 scenarios for FVG Region, in which the Regions plays different roles.

6.1 Scenario No. 1

Scenario No. 1 is the one in which subtasks are running just at national level.

The road map has several obstacles:

- for block 1. FOSTERING THE DEMAND FOR REUSING BUILDING MATERIALS, 2 subtasks of 4 are missed, that the intervention at local level could easily solve;
- for block 2. FOSTERING THE PROPER RECLAMATION OF REUSABLE BUILDING MATERIAL, 5 subtasks of 7 are missed, but just 1 of them could find a solution at regional/local level;
- for block 3. BRIDGING THE GAP, 6 subtasks of 10 are missed, but just 1 of them could find a solution at local level;

- for block 4. ESTABLISHING A SUPPORTIVE FRAMEWORK, 5 subtasks of 11 are missed, but none of them could find a solution at regional/local level;
- for block 5. 5. MONITORING EVOLUTIONS, 1 subtask of 3 is missed, but it could find a solution at local level.

Having in mind the driving role of national authorities up to now, as outlined, this scenario seems credible. In getting the goal, however, the interaction in between the national and the local level turns to be essential, together with a joint evaluation among the 3 levels of intervention for defining the more suitable responsibility for the missing subtasks, even if regional involvement seems to be not so essential as the local one and this is a point to be taken in serious account, better defining the role of regions in the process.

6.2 Scenario No. 2

The fact that Friuli Venezia Giulia Region is 1 of the 5 on 20 Italian Region, having an upper level of regulatory autonomy, envisage Scenario No. 2, the one in which part of the national actions could be taken in charge, reducing the administrative distance with local authorities and, in this way, speeding the process, also as related to the missed subtasks.

This could turn into a challenging opportunity, not far from reality, also having in mind the activity carried out, up to now, in the direction of circular economy transition.

Nevertheless, the action carried out just at regional/local level, with no special support from the central administration, could turn to be a very heavy load.

6.3 Scenario No. 3

Scenario No. 3 is the one in which the activity carried out in Friuli Venezia Giulia Region is supported at national level, in the direction of a balanced idea of national benefit.

The model developed at regional scale in FVG Region should act as an example for central authorities, allowing the process to be enlarged to the country, based on the effectiveness of the interventions related to different subtasks. The engagement at regional level in this case study could, besides, define a series of proxies to be adopted, allowing to strength the action at regional scale even in those regions having a lower regulatory autonomy.

As a case study, FVG Region could, also, fostered by the infrastructure facilities and the favourable geographical position, on the borders of Central Europe and opened to maritime connections, plan a series of pilot projects in the supply chain of materials, to be reproduced in the other regions, when fitting similar conditions.

In that, the monitoring evolution block could be implemented by applying the 7 principle for monitoring the evolution to a circular economy, defined by the [Bellagio Declaration \(2020\)](#), as stated by [ISPRA-Istituto Superiore per la Protezione e la Ricerca Ambientale](#) (Higher Institute for Environmental Protection and Research) and [EEA-European Environmental Agency](#), under mandate from the [network of heads of EPAs in Europe](#), as in Figure 6.4:

1. monitor the Circular Economy Transition
2. define indicator groups
3. follow indicator selection criteria (RACER)
4. exploit a wide range of data and information sources
5. ensure multilevel monitoring
6. allow for measuring progress towards targets
7. ensure visibility and clarity.

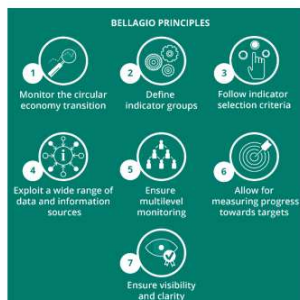


Figure 6.4 - Principles for monitoring the evolution to a Circular Economy [[Bellagio Declaration \(2020\)](#)]

The principles, however, depends on the availability of adequate data, quoted at point no. 4 of the Declaration as: “The data underpinning a monitoring framework for the Circular Economy Transition may consist of:

- *Official statistics from the European Statistical System or National Statistical Offices, other data produced by EU institutions, national or local authorities, as well as from international organisations) - Exploiting and integrating official information sources.*
- *Policy information - Tracking policy developments and implementation including qualitative assessments.*
- *New data sources - Exploiting new information sources beyond official statistics, such as data from the private sector and trade associations, research models, or from new applications of digital technologies”.*

At the moment, at national level and, moreover, at regional level, such data are lacking and it is considered a major action to define and to collect them, as evidenced for Critical Issue no. 0.

The support by the central administration could help in filling the gap testing a scheme to be replicate and declined, when needed, in the other regional contests.

7. FURTHER INVOLVEMENTS AND DISSEMINATION

7.1 Communication at Confartigianato Udine, the Udine area Craftsmen's association

The first results of the on-going research were presented at the “Matching Days” event, organised in the town by Confartigianato Udine, the Udine area Craftsmen's association.

The speed dating “Decostruzione selettiva” (Selective Deconstruction) opened the event, involving about 50 people.

7.2 The involvement of the Board of Engineers of Udine

In order to disseminate the issues of Circular Economy in the building sector, a proposal of activating a, advisory commission of the Board of Engineers of Udine area was submitted by the undersigned, enrolled since 1987, and 3 colleagues.

The Advisory Commission “Circular Economy” was approved by the Board of Engineers on the 29th June 2023.

After some exploratory meetings, carried on during the summer 2023, in October 2023 a call was opened to interested colleagues, in order to expand the skills of the components. It was decided that a dimension of 10 persons would be the proper one and the recruitment end at the beginning of November.

The Advisory Commission is intended to organise meetings of introduction to the topic, in the direction of a shared knowledge of issues, challenges and opportunities.

7.3 Communication at the C2C Scientific Colloquium

The work carried out up to September 2023 was presented at the C2C Scientific Colloquium, preceding the 8. International Cradle to Cradle Congress 2023, Berlin, 9-10/09/2023.

The Scientific Colloquium was attended by nearly 50 people.

The contents of the presentation were, besides, available for discussion in the Poster Session of the Congress, where some contacts were activated.

7.4 The involvement of the Public Estate Offices

In order to better understand the rate of interest of Public Estate Offices, one to one talks took place in November 2023.

The first one was involving a contact person of the Technical Office of Udine University, the second a contact person of the Udine Office of the Ente di Decentramento Regionale-EDR (Udine Office of the Regional Decentralisation Body), having in charge the maintenance of schools and roads in Udine District.

The outcome of both meetings was desarming, as, despite the personal interest of the involved people, the awareness of both Public Estate Offices about the issues of circular economy looks very poor.

As no constraints have been addressed by reference Central Bodies, at national scale, the Offices carry on the tenders for new constructions and management following the procedure adopted in the past, just having in mind the aforementioned CAM issues, but with a limited relevance.

Anyway, the interest of possible dissemination meetings to be is very evident

8. CONCLUSIONS AND DEVELOPMENTS

In this Report, the activity carried out during the first phase of the UNIUD research contribution to iNEST | Spoke 4: City, Architecture, Sustainable Design | RT1.2. Critical issues in the building sector, has been outlined.

The activity refers to the definition of Critical issues in the building sector in Friuli Venezia Giulia Region related to the transition from linear to circular economy.

It consisted of an initial acquisition of information, defining a general framework, at EU, national and regional level, aimed in supporting an effective dialogue with the construction sector representative, offered by ANCE-FVG, the Office in Friuli Venezia Giulia Region of the National Association of Builders.

The dialogue was organised in several meetings with the Executive Director of it, Dr. Fabio Millevoi, and with several associated partners.

The increased awareness on the issues discussed, also thanks to the sharing of knowledge acquired in general (EU documents, Italian Government and Regional Administration), application (sharing of guidelines, recycling/reuse networks) and study (reports, research groups) has seen new ways of approaching the sector hypothesised, enriching the discussion with operational proposals that are easy to implement (re-use of plant components, re-use of insulating panels, activation of re-use centres for materials/components for restoration, re-use of sheaths), in relation to both innovative projects and consolidated practices in other contexts.

Following the discussions, a list of critical issues was defined, together with three possible scenarios of transition.

The definition of a formal agreement with ANCE-FVG for carrying on the dialogue in the framework of iNEST future activities is on the way.

Besides, a parallel activity has been planned, addressed to the involvement of other stakeholders, increasing the awareness of the need of action, mainly in the case of the just launched Commission for Circular Economy, active since July in the Board of Engineers of Udine area.

The author is grateful to CRESME, in the person of arch. Lorenzo Bellicini, for accepting this contribution as part of the activities of iNEST | Spoke 4: City, Architecture, Sustainable Design | RT1.2. Critical issues in the building sector and of Dr. Antonella Stemperini for the positive interaction on the topics of the research.

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ANNEXE 1 - MEETINGS' CONTENTS

It is hereby synthesised by points the result of the dialogue with eight associated companies to ANCE-FVG:

- i.* an international General Contractor;
- ii.* a construction company operating in the North-East and Central Italy area;
- iii.* a construction company operating on a regional scale;
- iv.* a company in the technical systems engineering sector;
- v.* a company active in the waterproofing sector and in the removal of asbestos components;
- vi.* a personal company operating in the restoration sector;
- vii.* a company active in the excavation and aggregate recovery/marketing sectors;
- viii.* a company active in the building site material collection and recycling,

collected during 6 meetings carried out between April and July 2023.

13 04 2023: first introduction meeting

The dialogue has been moderated by Anna Frangipane and Fabio Millevoi, addressing general questions:

international General Contractor (*i.*)

- interest of foreign contexts
- problems for heavy renovation work in densely urban areas: for an important work in Venice, night shifts
- the challenge is to optimise the process
- if it has to be done, you are capable, as was the case with the FVG earthquake (1976) sites
- there are storage areas abroad for unused material
- virtuous examples should be considered, such as the EIB construction site in Luxembourg, a pioneer project for recycled materials

company in the technical systems engineering sector (*iv.*)

- the company is 55 years old
- for them recovery is an issue
- there are regulations for flue gases and a value chain for companies that recover gases; other noble gases could become business, as well as rare materials in electronic parts
- the problem of plastics, which are difficult to separate
- electrical materials require expensive and complex techniques, but could be implemented
- costs and procedures must be evaluated

construction company operating on a regional scale (*iii.*)

- active since 2014
- very interested, daily experience
- for demolition and deconstruction methods there is a lot to do
- think of attractive recovery systems
- problem of non-recoverable materials (as in the real case of chairs in demolition of an Auditorium)

company active in the excavation and aggregate recovery/marketing sectors (*viii.*)

- for them it has been a business for years, since the “Decreto Ronchi” (Italian Waste Regulation, 1998), linked to the rules of logistics and market
- short supply chain processes for material weight
- value of the material depends on the type, location and competition of primary resources
- 99% of the material is used for road sub-bases, after crushing and screening
- in Milan more sorting
- techniques and market rules are needed: the public client must know to whom to give the advantages
- the regulatory apparatus must stimulate the process
- the recent A4 motorway construction site for the 3 lanes did not use recycled material
- in Switzerland standard on different recycled contents for different concrete strengths

29 05 2023: one to one insight

The dialogue has been moderated by Anna Frangipane and Fabio Millevoi, allowing a more detailed speech:

company active in the excavation and aggregate recovery/marketing sectors (*viii.*)

- typical aspects of their work
- they only know the guidelines for the EoW, as demolishers
- the reference document is the Environmental Consolidation Act
- never seen a recovery inventory
- in operation since the early 1990s, a consequence of the 1st Waste Decree (1982)
- the environment passes through Confindustria
- their ISO 14000
- in the early 2000s high demand for recycled, cheaper than gravel, more expensive
- price analysis for the tender for the demolition of the Fiera di Trieste, right scale
- there is a question of scale: no sense deconstructing for small buildings
- there is the problem of the “black economy”

construction company operating on a regional scale (*iii.*)

- must be profitable or, at least, not loss-making
- their suppliers/subcontractors
- they outsource: it is the breaker who takes care of dismantling and waste management
- they enter the chain for site waste management and landfill disposal
- the D4D is still not taken into account, it is the designers', not the builders'
- coatings used recently for energy efficiency are irreversible
- demolition of 1970s buildings better suited to selective demolition
- problem of material storage in sheds
- problem of widespread undergrounding
- skills are lacking or unknown
- procedures that slow down processes must be simplified (e.g., for the disposal of Eternit)
- CAM is talked about, but not very popular
- DNHS applied for an auditorium in Sacile, but it is a subcontracted task
- good a qualified network

- new BIM challenges
- problems with deconstruction of certain components, such as underfloor heating
- it is necessary to focus on new buildings

01 06 2023: one to one insight

The dialogue has been moderated by Anna Frangipane and Fabio Millevoi, allowing a more detailed speech:

company in the technical systems engineering sector (iv.)

- interest in the third sector
- where there is complexity, there is opportunity, even if hidden
- possible role of young people
- in the PNRR call for schools in FVG rewarding the presence of young people and women
- in old construction sites nails were straightened by young people
- in the past removable installations
- cost-effectiveness of intervention to be assessed
- reasoning on autonomous mobile units

05 06 2023: one to one insight

The dialogue has been moderated by Anna Frangipane and Fabio Millevoi, allowing a more detailed speech:

international General Contractor (i.)

- he shares the general reasoning
- interesting building inventory for circularity, but also the design itself
- dissociation between General Contractor/Contractor/Public Administration
- their increasing emphasis in the pre-construction phase in schemes of involvement with designer in the selection of materials and construction methods
- abroad (pe in Norway for a bridge) and generally in Northern Europe, the general approach contributes to the process from the beginning
- in the hospital in Trieste modularity starts with Covid, but also in Ancona and Denmark
- focus on reuse and surplus centres
- useful incentives for reuse with points
- in less wealthy economies, recycling is pushed
- construction company operating in the North-East and Central Italy area (ii.)
- does not know the UNI 75_2020 standard
- in general, the impact of the sector is favourable, I personally support the idea of the circular economy
- recycling for renovation is good: it decreases land use and safeguards assets
- regeneration is fundamental for architectural coherence
- on selective demolition/deconstruction we are behind: the basic idea of design must be changed
- useful life of buildings > 20 years for return on investment
- flexibility is important

- prefabricated construction reduces waste and increases the efficiency of the construction phases
- the Qatar stadium is a good example
- impact to date in Triveneto to be verified
- aspects not at the centre of PNRR calls for tenders
- BIM useful for circular economy, but still a problem for the contracting authority
- PNRR: role of disability/pink quotas, CAM only as a choice
- eco-design: external professionals, need to train internal staff, but will only be done if all are obliged
- invest in human capital
- it would be useful to have reuse centres and a platform soon
- economic, but also social relevance
- reward with points in the tender for the virtuous enterprise with the younger generation

a personal company operating in the restoration sector (vi.)

- reuse in the monumental sector linked to the will
- 30-35 years ago, he visited in England 2 companies dismantling historical buildings to make the materials available to companies; very interesting large warehouses with handcrafted furniture and technological objects (chandeliers, ...)
- difficult to talk about reuse, there is a need for quality, like that of the 1950s
- lack of operators, restoration cannot have an industrial approach
- design and specifications do not allow companies to develop specific skills
- during the earthquake craftsmen made materials available, then the market closed down
- 3 important realities in Veneto
- In reuse, the guarantee is natural, the quality of the material is unsurpassed: the tiles of the tower of Santa Maria in Udine are about 300 years old
- human capital is fundamental, i.e., quality craftsmanship, as opposed to genericness
- the building site is the place of training

05 06 2023: one to one insight

The dialogue has been moderated by Anna Frangipane and Fabio Millevoi, allowing a more detailed speech:

company active in the waterproofing sector and in the removal of asbestos components (v.)

- identifying potential networks
- problem of disposal costs of roofing membranes and insulation panels
- recovery of membranes in the Waterproofers Association (ASI Livorno), grinding them for asphalts
- synthetic PVC sheeting: shrinkage problem (it weighs little) and work safety problem if disposed of in cement factories
- in the Udine Court I work in ATI with a Bologna company: 1500 m² of polyurethane panels to be disposed of, potentially usable if ground, but also recoverable in foundations
- big bag silicone tubes
- they recycle sheet metal
- glue (Vinavil) and paint bins are special waste
- there are potential supply chains, but not activated

31 07 2023: one to one insight

The dialogue has been moderated by Anna Frangipane and Fabio Millevoi, allowing a more detailed speech:

company active in the building site material collection and recycling (*viii.*)

- for 25 years in the waste as raw material sector
- started with the packaging problem
- processing 75,000 t/year from private individuals and members
- more actors
- producer: culture and awareness for recyclable products and containers, cost/opportunity problem, only for structured companies, too many laws, cultural problem, not just ideological
- supply chain consortia (COREPA, AIP, ...): pay millions, power centres, monopolies
- consumers: don't think about packaging, other interests are involved
- municipalised companies: monopolists who collect a lot for urban management, spending more or less well; collectors of personnel, waste of energy and money for the many taxes
- innovation is in central and northern Europe, in Italy the municipalised companies block processes
- the magic word is “will”
- coffee companies: capsule recovery: without a technical facility, nothing can be done; the way seems open, but problem of codes; pilot initiative to be exported, but 10 t/year makes no sense; there is a cost problem that has to be given by the producer
- there is a lot of potential economy, but too many blockages
- it would take a project to collect the right things
- it is a market subject to price swings, even senseless ones: plastics had increased, now at zero cost; the cost is conditioned by production and speculation; so for paper, cardboard is 7 times recyclable
- Italy is first in Eu for recycling
- all actors must have their convenience were the first to produce alternative fuel, but today only solar is in use, a mini-plant has no permission
- return to a circular economy with closer dimensions: space-time and transport problems
- things can be done, but there is a lot of work
- battle over TARI (local tax) with UNIRIMA, the trade association of the municipalised companies: the municipalised companies should only deal with urban waste, today there is a choice; with the municipalised companies there is no definite timeframe
- him from builder to entrepreneur
- for deconstruction there are no solutions
- the builder must change the way of building with an open mind
- the problem is twofold: old constructions (what is there) and new constructions
- in 2018 new photovoltaic system, 25 years of life, panel recycling to date is only experimental (aluminium, silicon, glass and problematic films), it's a world that will explode in a few years, it's a problem to be solved, 2 small recycling companies in Italy, authorisation problems (waste code and EoW)
- going from prototype to large scale
- EoW of paper: at the border it becomes waste: need for new authorisation

- problem of electronic invoicing, which only exists in Italy
- need to focus on segments
- eco-bonus problem: processing waste has never been delivered, it is probably collected by municipalities and sent to incinerators, things done without thinking
- he dismantles the reusable, cost problems on materials that are too old (asbestos, sheaths with high oil values, ...)
- a local company experimented with a polystyrene recovery chain, managed independently
- to own a system, you have to close the supply chain
- plasterboard: simple mirror code, but no collection
- if there is a large quantity, the solution is found
- the process should not go through municipalised companies
- the Ronchi Decree, 20 years after its enactment, has not seen the use of recycled material
- there is the study of the industrial symbiosis area, but there is a lack of sensitivity
- for PVC contaminants problem, there are distant plants
- for plasterboard, there are industries that clean it up like cardboard.



ANNEXE 2 - ZOOMED FIGURES

Chapter 1
(no Figures)

Chapter 2



Figure 2.1 - The Waste hierarchy, as introduced by the Water Framework Directive, 1998 [EC Environment, 2023].

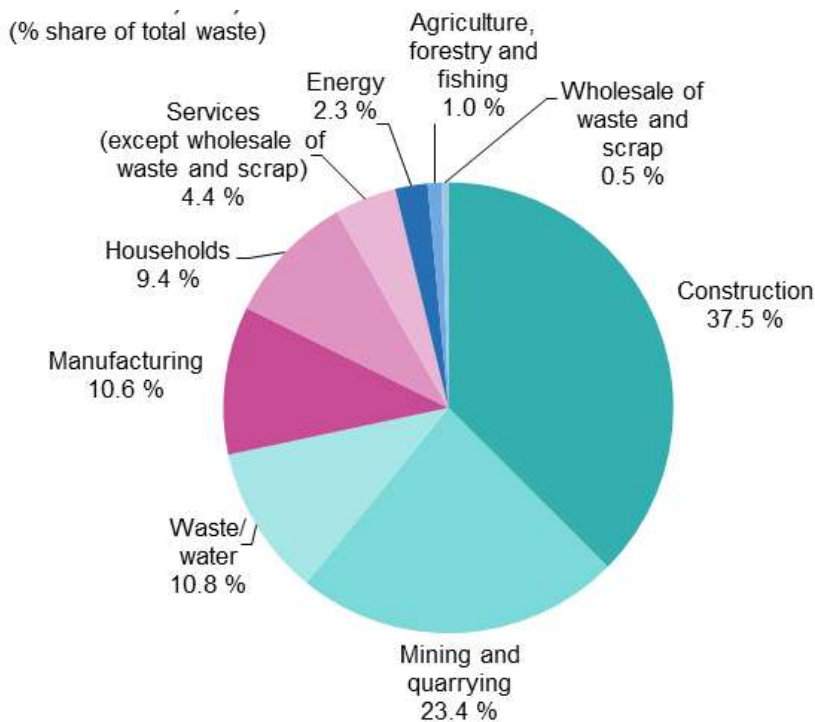


Figure 2.2 - Waste generation by economic activities and households, EU, 2020 (% share of total waste) [Eurostat, 2023].

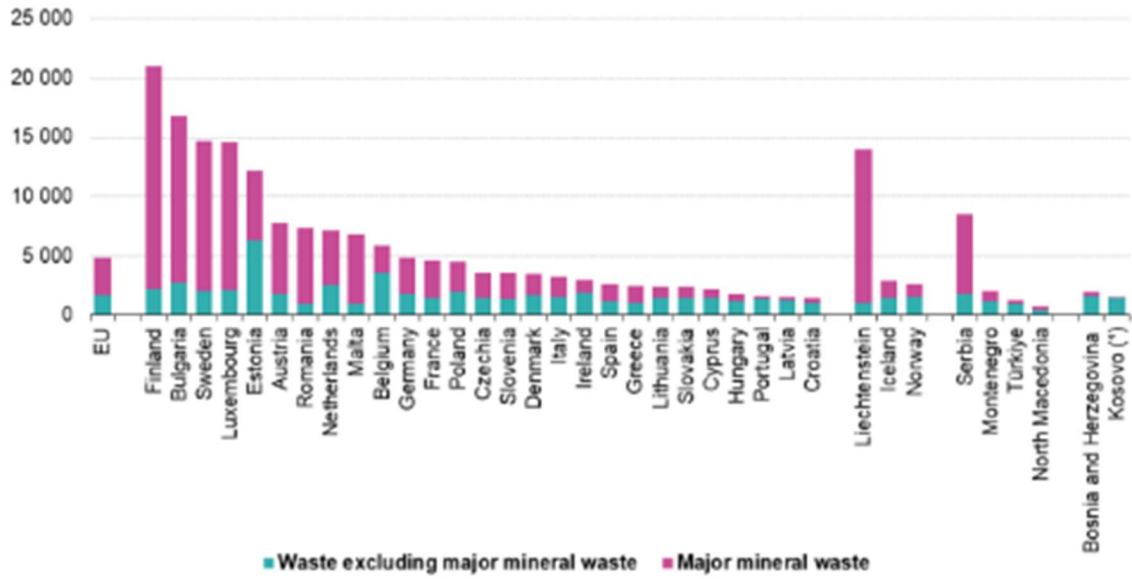
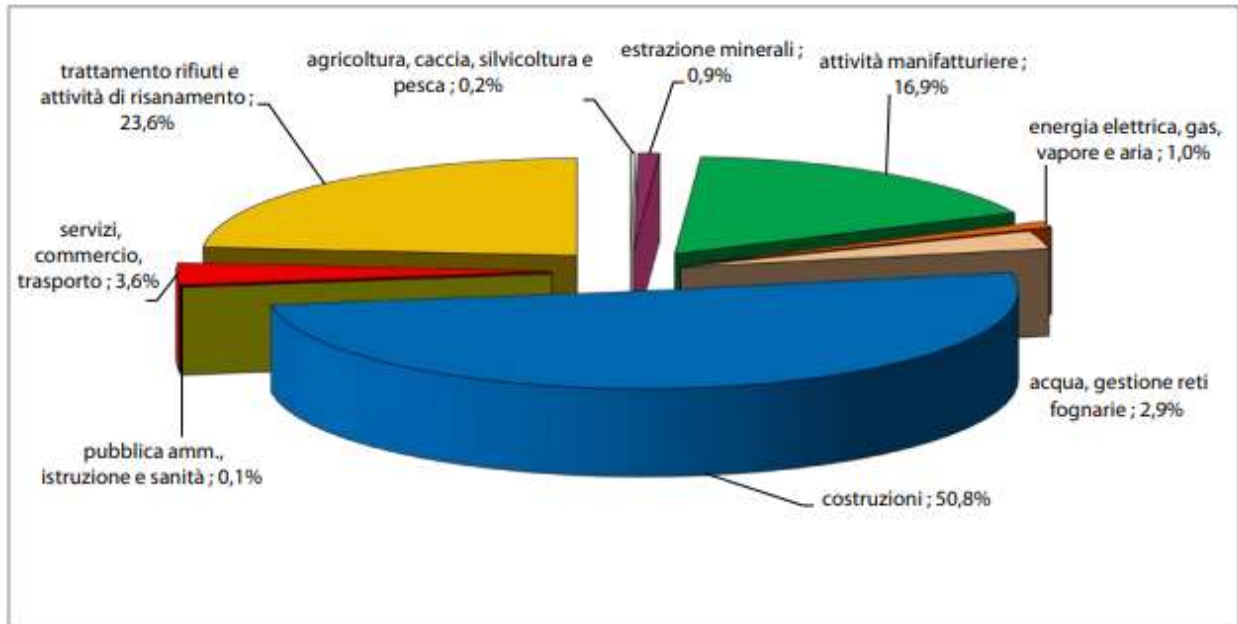


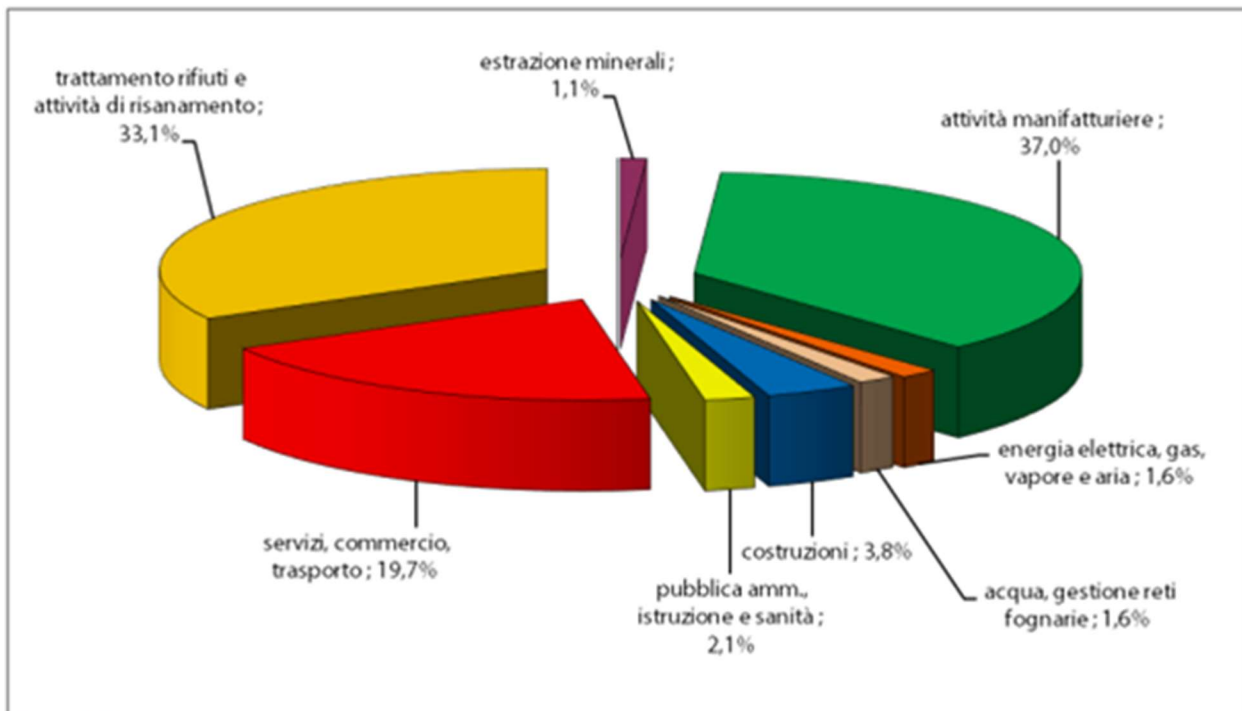
Figure 2.3 - Waste generation in EU, 2020 (kg per capita) [Eurostat, 2023].



Figure 2.4 - Percentage of recycled packaging materials: steel, aluminium, paper, wood, plastic and bio-plastic, glass [CONAI, 2022]



Fonte: ISPRA

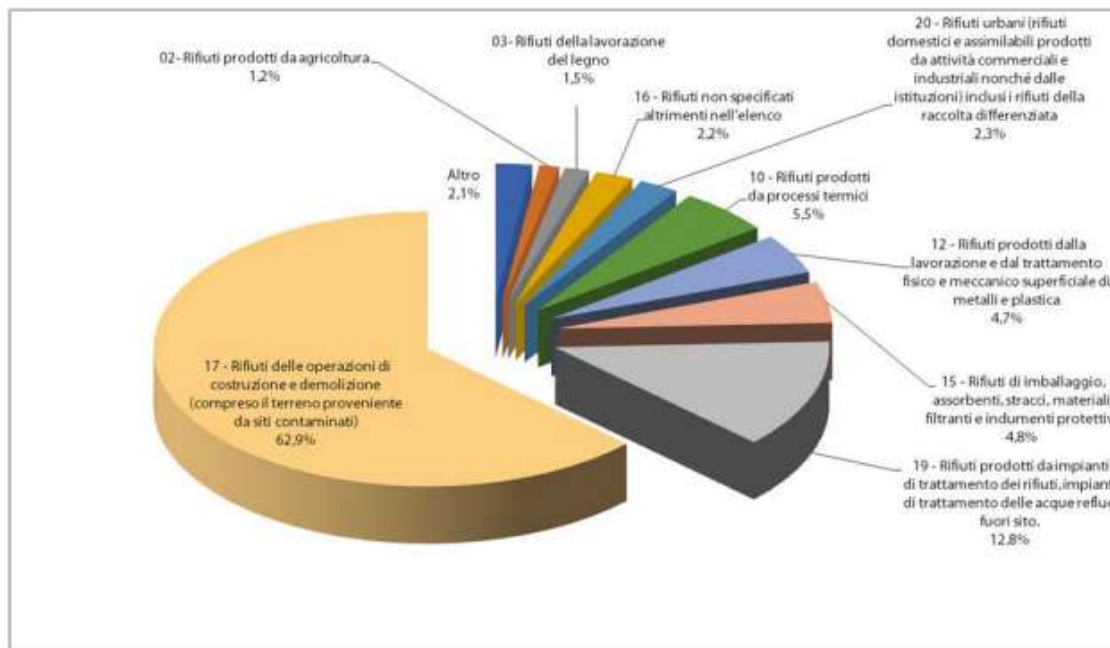


Fonte: ISPRA

Figure 2.5 - Rates of C&D Waste as compared to the total not hazardous and hazardous wastes, in blue [ISPRA Centro Nazionale dei Rifiuti e dell'Economia Circolare, 2023, 17, 19]



Figure 2.6 - Trends in the rate of preparation for re-use, recycling and other material recovery, excluding back-filling, of construction and demolition waste, years 2017-2020 [ISPRA Centro Nazionale dei Rifiuti e dell'Economia Circolare, 2023, 215]



Fonte: ISPRA

Figure 2.7 - Rates of C&D Recycled non Hazardous Waste as compared to the total, in yellow [ISPRA Centro Nazionale dei Rifiuti e dell'Economia Circolare, 2023, 17, 19]

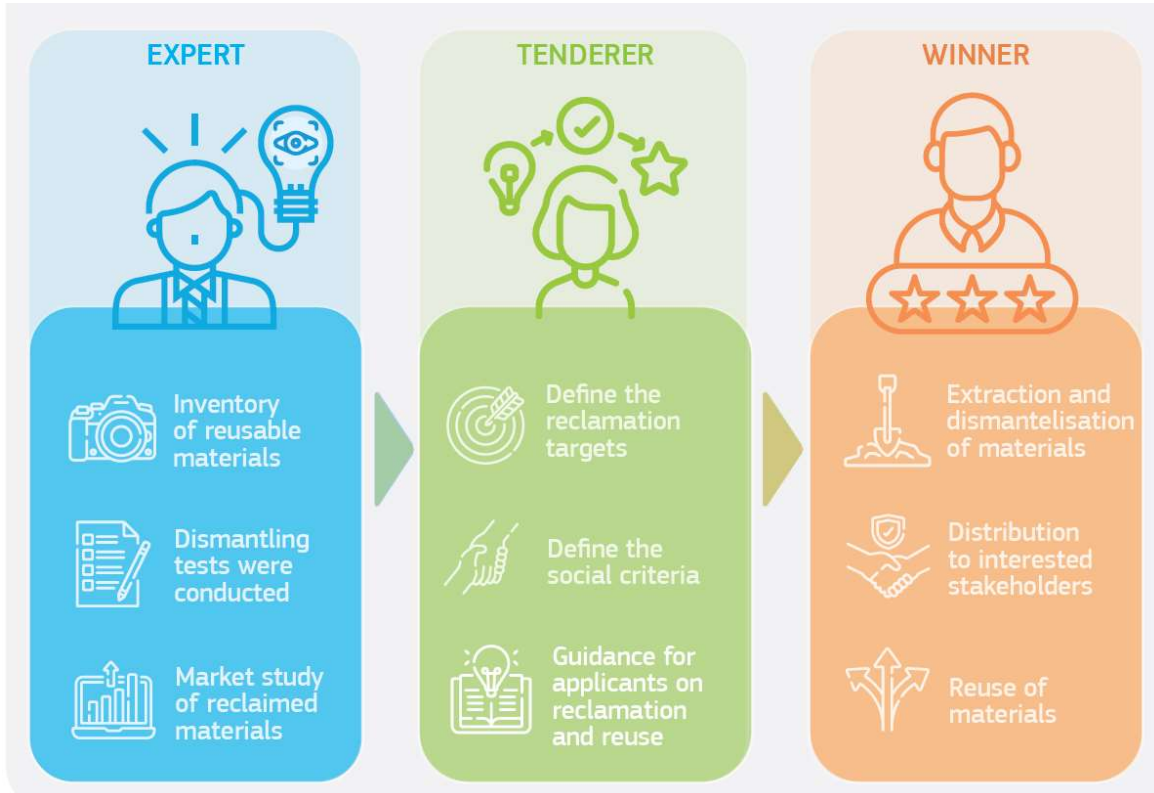


Figure 2.8 - Agents involved in a Green Public Procurement process of circular economy: experts, tenders, winners [Bruxer, 2022]

Chapter 3



Figure 3.1 - Framework Programmes for Research and Technological Development Milestones [sfe.lnl.infn.it].



EVOLUTION OF INTERREG 1990-2020

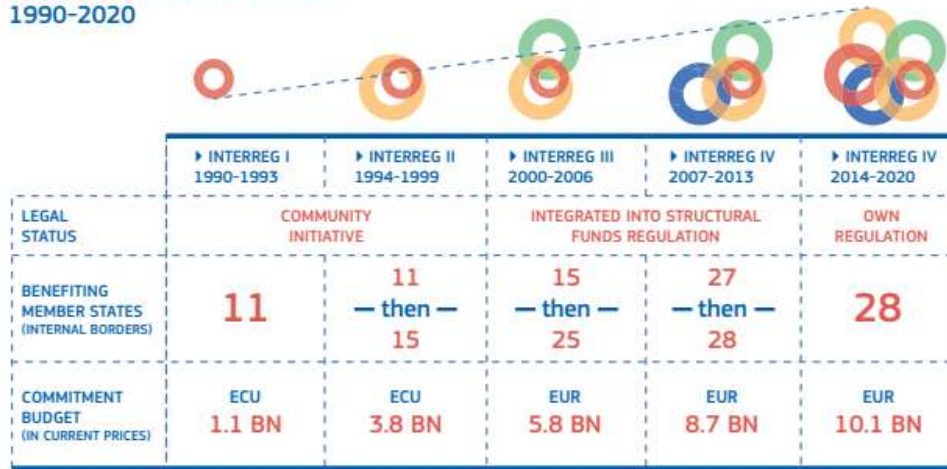


Figure 3.2 - Evolution of INTERREG 1990-2020 [ec.europa.eu].

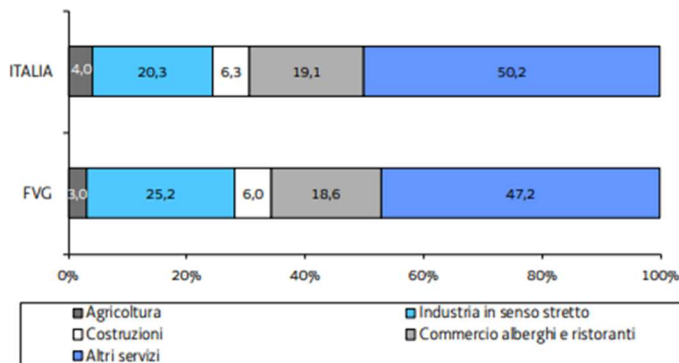


Figure 3.3 - LIFE Programme numbers [cinea.europa.eu].

Chapter 4
(no Figures)

Chapter 5

Graf. 11.1 - FVG ITALIA OCCUPATI PER SETTORE DI ATTIVITÀ ECONOMICA (valori %) - Anno 2021



Fonte: ISTAT, Rilevazione sulle forze di lavoro

Figure 5.1 - Employment percentages in Italy and FVG for different economic activities: Agriculture, Industry, Constructions, Trades/Hotels/Restaurants in 2021 [RFVG, 2022, 161].

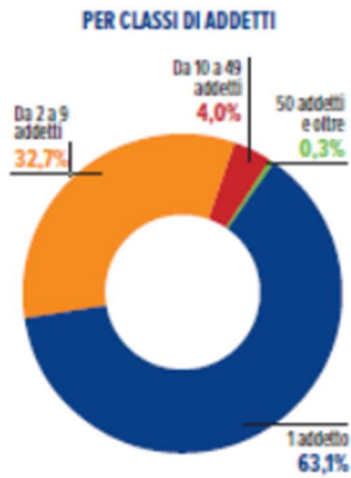


Figure 5.2 - Percentage of employees in the construction sector, as related to the company size [ANCE, 2022, 46].

Role of the Company



Figure 5.3 - Activity of the interviewed Companies



Figure 5.4 - Focus on critical issues in FVG building sector.



Chapter 6

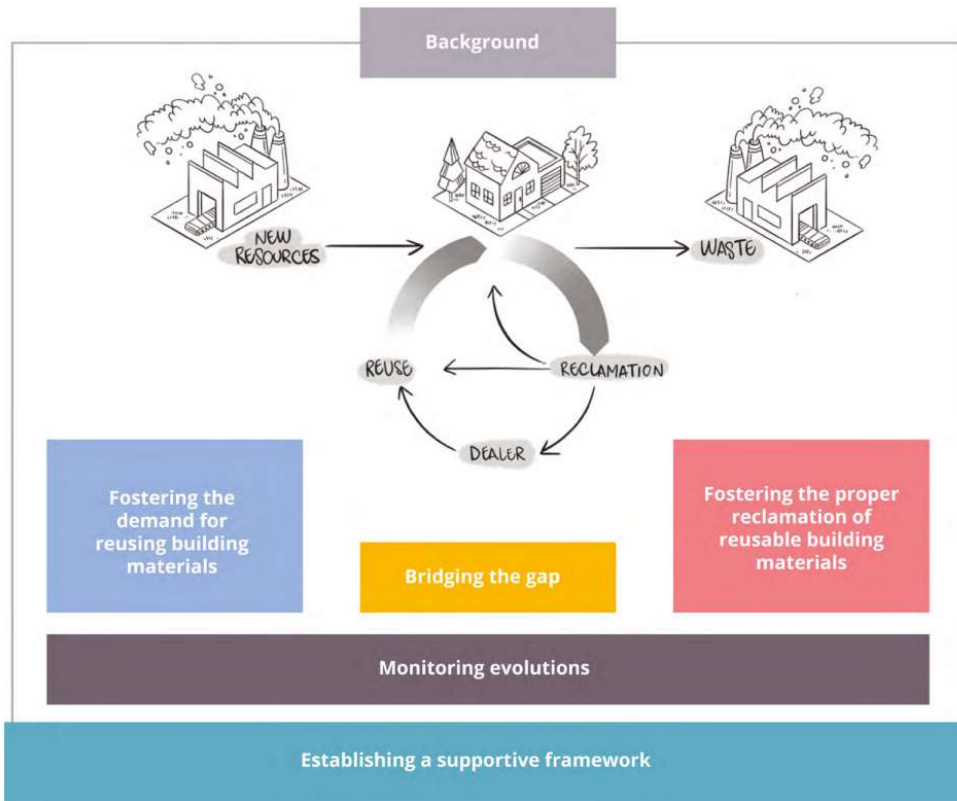


Figure 6.1 - Actions toward reuse practices [FCRBE, 2022].

6.1 FOSTERING THE DEMAND FOR REUSING BUILDING MATERIALS	6.2 FOSTERING THE PROPER RECLAMATION OF REUSABLE BUILDING MATERIALS	6.3 BRIDGING THE GAP	6.4 ESTABLISHING A SUPPORTIVE FRAMEWORK	6.5 MONITORING EVOLUTIONS
6.1.1 Encouraging and supporting specifiers and contractors to adopt reuse practices	6.2.1 Raising private owners' awareness of reclamation procedures	6.3.1 Documenting the reclamation trade	6.4.1 Integrating reuse in Green Building Rating Systems	6.5.1 Surveying the reclamation trade
6.1.2 Assisting and supporting building commissioners to adopt reuse practices	6.2.2 Raising demolition contractors' awareness of possible reclamation pathways	6.3.2 Analysing existing reuse practices	6.4.2 Developing LCA and EPD for reclaimed materials	6.5.2 Monitoring reuse in building projects
6.1.3 Setting reuse objectives in public tenders	6.2.3 Raising DIYers' awareness of possible reclamation pathways	6.3.3 Fostering collaborative dynamics	6.4.3 Integrating reuse in environmental impact assessment tools	6.5.3 Surveying future material flows
6.1.4 Giving visibility to active enterprises and available reclaimed materials stocks	6.2.4 Conducting systematic reclamation audits	6.3.4 Supporting enterprises that adopt reuse practices	6.4.4 Developing labels for reclaimed products	
	6.2.5 Specifying dismantling for reuse	6.3.5 Developing synergies between the social economy and salvage activities	6.4.5 Ensuring a common approach regarding the fitness for reuse	
	6.2.6 Establishing a list of 'protected materials'	6.3.6 Federating the actors of the sector	6.4.6 Developing adapted insurance schemes	
	6.2.7 Developing material passports for reclaimed building elements	6.3.7 Fostering urban salvage yards	6.4.7 Facilitating the access to the technical documentation for past, present and future building materials	
		6.3.8 Facilitating the access to land and storage spaces	6.4.8 Clarifying CE-marking	
		6.3.9 Dealing with logistics issues	6.4.9 Clarifying the conditions of application for the end-of-waste status	
		6.3.10 Adapting education and training programmes	6.4.10 Internalising environmental costs of new products	
			6.4.11 Adapting fiscalty for reclaimed products	

Figure 6.2 - Subtasks toward reuse practices [FCRBE, 2022].

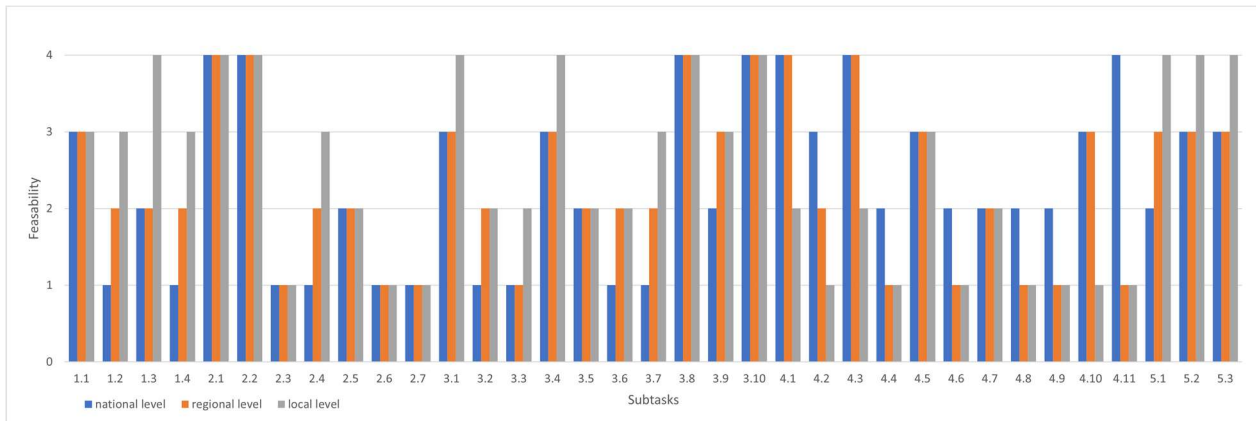


Figure 6.3 - Feasibility of the FCRBE roadmap subtasks at different levels of interventions, as referred to FVG Region: 1= Very Difficult; 2= Difficult; 3= Easy; 4= Very Easy.

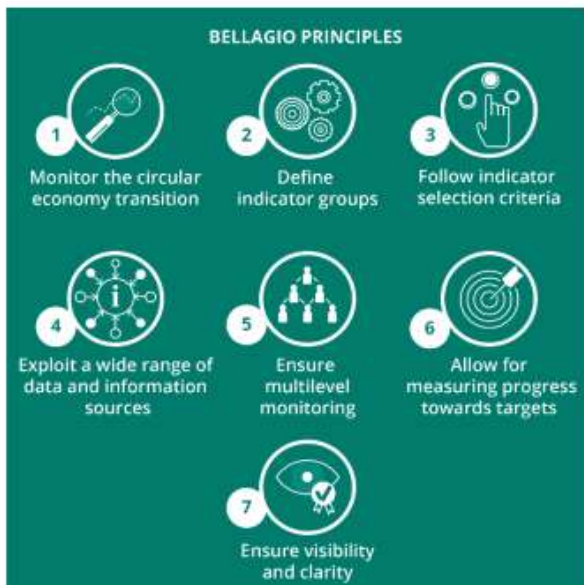


Figure 6.4 - Principles for monitoring the evolution to a Circular Economy [Bellagio Declaration (2020)]

Chapter 7
(no Figures)

Chapter 8
(no Figures)

Chapter 9
(no Figures)