



INNOVATIVE QUALIFICATIONS FOR TECHNOLOGICAL AND
ORGANIZATIONAL INNOVATION IN BUILDING SECTOR

D2.3 – EU POLICIES AND DIRECTIVES IN THE CONSTRUCTION SYSTEM: WHICH INNOVATION IS NEEDED?

WP2 – Framing the innovation: GAP analysis of the existing qualification
and identification of the needs in the building sector

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LEADER
FORMEDIL (Italy)

PARTNERS
FLC Madrid, FLC Asturias (Spain), VSRC Vilnius, Panevezys CCIC (Lithuania),
Conseil des Architectes d'Europe (Belgium), Alma Mater Studiorum UNIBO, IIPLE Bologna (Italy)



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Project Coordinator	Rossella Martino	Email	rossella.martino@formedil.it
Partner	FORMEDIL	Phone	+39 0685261797

Authors (Partner)	Simona Tondelli, Angela Santangelo, Alice Panciroli (UNIBO)		
Responsible partner	Simona Tondelli	Email	simona.tondelli@unibo.it
	Organisation	UNIBO	Phone

Description of the deliverable (3-5 lines)	This report will provide an overview of the most relevant policies and directives in the construction sector at EU level, highlighting the demand for innovation in the construction industry deriving from the directive. This deliverable, together with deliverables 2.1 and 2.2 will allow project partners to tailor the new curricula based on the innovation needed.
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DEFINITIONS & ACRONYMS

CnS	Construction Sector
EUR	EU Regulations
EUD	EU Directives
oEUA	Other EU Acts
IFI	Impact Fields of Innovation

EXECUTIVE SUMMARY

WP2 aims to frame the innovation in the building and construction sector through two main activities: the analysis of the existing professional training system (T2.1) and the review of the innovative factors requested by EU directives and policies in the construction industry (T2.3). These two activities will be accompanied by a survey within at least 150 construction companies to understand technological and organizational innovation needs (T2.2).

The report presents the results of the Task 2.3: an overview of the most relevant policies and directives in the construction sector at EU level is provided, with a particular focus on the demand for innovation in the construction industry deriving from the EU directives.

The final goal of this report, together with the deliverables 2.1 and 2.2, is to allow project partners to tailor the new vocational trainings curricula for the construction sector technicians based on the innovation needed. The ambition is to make clear and more accessible the framework of EU policies and directives in terms of R&D. The EU directives implemented by the Member States introduce and regulate new skills and management innovations that must be acquired by construction companies to improve competitive quality and in response to calls for tenders and/or contracts.

To conduct such analysis of the existing policy framework and related innovations introduced, the UNIBO team has defined few steps to follow:

1. The first step is understanding, between all **types of legal acts available at the EU level** (Strategies, Policies, Directives, Regulations, Decisions, Recommendations, Opinions, etc.) which are the relevant ones for the present analysis.
2. Once detected which documents to look into, it occurs to set a list of the ones concerning in some ways the building and construction sector and then the related innovations they introduced.
3. All the innovations introduced are then summarized into main **‘Innovation Thematic Areas’ (ITAs)** to better visualize the relevant directions taken by the EU normative framework in the sector.
4. The innovations introduced under each ITAs are finally classified in terms of **‘Impacts’ Fields of Innovation’ (IFI)** to have a better understanding of which aspects of the construction sector are expected to be affected by the existing policy framework.

In conclusion, the aim of the whole exercise is to provide a clear image of the current status of the EU policy framework relating to the construction sector, by specifying the innovations introduced and in which fields they have had significant impacts. The outcome will be a state-of-the-art investigation where innovations and effects are highlighted in order to help identifying the actual needs of the construction sector to develop a combined qualification of “Construction Site Technician” that is in step with the times.

1. BASIC UNDERSTANDING

1.1. THE CONSTRUCTION SECTOR NOWADAYS

According to the European Commission¹ **the construction industry is very important to the EU economy** since the sector provides 18 million direct jobs and contributes to about 9% of the EU's GDP. It also creates new jobs, drives economic growth, delivers the buildings and infrastructure needed and provides solutions for social, climate and energy challenges. The construction value chain includes a wide range of economic activities, going from the extraction of raw materials, the manufacturing and distribution of construction products up to the design, construction, management and control of construction works, their maintenance, renovation and demolition, as well as the recycling of construction and demolition waste (EC, 2016). Moreover, the construction sector has a direct impact on the safety of workers and on the quality of life; while buildings, infrastructure and construction products have an important impact on energy and resource efficiency, the fight against climate change and in the environment in general. As such, **the construction sector plays an important role in the delivery of the European Union's 'Europe 2020'² goals for smart, sustainable and inclusive growth.**

The financial and economic crisis has hit particularly hard this sector and now **the challenges to face are many**: stimulating efficiency improvements and renovation in the existing buildings, improving specialised training, making the sector more attractive, up-taking the new technologies and digital innovations and reducing buildings' energy consumption and greenhouse emissions.

Against this background, the goal of the EC is to help the sector become more competitive, resource efficient and sustainable by defining the objectives and then developing a common regulation framework that each Member State must follow. With these aims, **the European Union has put in place a comprehensive legislative and regulatory framework concerning the construction sector**, including corresponding European standards as well as financial tools, information platforms, labelling schemes and other instruments. The objective of the present report is **to review the main directives and policies belonging to this EU regulatory framework and then analyze the effects of the introduced innovations in the construction sector.**

1.2. EU NORMATIVE FRAMEWORK

Before starting to review the innovative factors requested by the EU normative framework it is necessary to understand how this framework is structured, and especially to detect which are the more relevant types of documents that should be processed.

At the EU level we can find several types of legal act. Some are binding, others are not. Some apply to all EU countries, others to just a few. In particular, EU legislation consists of:

- **binding legal instruments** (regulations, directives and decisions)
- **non-binding instruments** (resolutions, opinions)
- **other instruments** (EU institutions' internal regulations, EU action programmes, etc.)

The ICARO project, in order to see which innovations are promoted by the EU in the construction sector, has decided to mainly focus on the **binding instruments**, which are briefly described below³:

- **Regulation**: it is an instrument of general scope that is binding in its entirety and directly applicable in all Member States. Regulations can be adopted under the EC Treaty by the European Parliament and the Council or by the Council or by the Commission. Regulations are often used in the field of judicial cooperation in civil matters. They are directly applicable, so they require no transposal into the Member States' domestic law and directly confer rights or impose obligations.

¹ <http://ec.europa.eu/growth/sectors/construction/>

² https://ec.europa.eu/info/business-economy-euro/economic-and-fiscal-policy-coordination/eu-economic-governance-monitoring-prevention-correction/european-semester/framework/europe-2020-strategy_en

³ Sources: https://europa.eu/european-union/eu-law/legal-acts_en#directives
http://ec.europa.eu/civiljustice/glossary/glossary_en.htm

- **Directive:** it is a legislative act that sets out a goal that all EU countries must achieve. However, it is up to the individual countries to devise their own laws on how to reach these goals. Directives may be adopted under the EC Treaty either by the European Parliament and the Council or by the Council or by the Commission. The Community institutions use Regulations more often than Directives in judicial cooperation in civil matters. Once adopted, Community Directives still have to be transposed by each of the Member States, that is to say they must be implemented by national law.
- **Decision:** it is binding in its entirety on those to whom it is addressed (e.g. an EU country or an individual company) and is directly applicable. A decision may be adopted under the EC Treaty either by the European Parliament and the Council or by the Council or by the Commission. Decisions are rarely used in the field of judicial cooperation in civil matters. The European Judicial Network in Civil Matters was established by a Council Decision.

Moreover, the ICARO project wants to pay special attention on the binding instruments which **always refer to all the Member States** in order to establish a clear framework of the innovations introduced at a global scale in whole Europe. Against this background, we will consider as relevant just the **EU Regulations and Directives** related to the construction sector in some way. Other types of documents will be added to the review only if considered to be very relevant to understand which the current needs of the construction sector are.

With the objective of understanding the expected directions and needs of the construction sector, not only normative acts such as regulations and directives must be reviewed. In order to have a broader picture of the current situation a preliminary analysis of the present strategic policies is required. In fact, **at the basis of the EU normative framework we found the EU strategy** which has a main role in setting priorities and then implement them through **EU policies**. The EU strategy seeks to promote peace and well-being, and the values of human dignity, freedom, democracy, equality, rule of law and respect for human rights. The strategy is articulated in different topics and then translated into policy actions. Therefore, a review of the main objectives and needs at the root of the EU policies that are somehow relevant for the construction sector will be given too during this report.

2. OVERVIEW OF THE LATEST EU LAWS RELATED TO THE CONSTRUCTION SECTOR

2.1. EU POLICIES

The review of the EU Policies⁴ helps the ICARO project to understand which are the main goals of the EU involving the construction sector (CnS) and to find out the directions that the EU wants to take on a range of specific issues.

⁴ Source: https://ec.europa.eu/info/policies_en

In **Table 1** are listed the main **EU Policies** whose **objectives** affect somehow the CnS. Each of these policies, along with its specific objectives, can be placed under one or more **macro-category**⁵, made explicit in the last column.

Table 1: Overview of the main EU Policies affecting the CnS and their objectives

EU policy		Main objectives	Macro-categories
1	Energy-efficient buildings - Energy performance of buildings	<ul style="list-style-type: none"> - To help consumers to make informed choices, allowing them to save both energy and money doing improvements for their health and well-being, promoting the use of smart technologies. - To build "a resilient Energy Union and a forward-looking climate change policy". Guide EU countries to establish stronger long-term renovation strategies, targets and achievements required to reach it and financial measures to support it. EU countries have to collaborate to set a scheme for rating the smart readiness of buildings, to make energy efficient renovations, NZEB and to promote e-mobility. 	ENERGY – CLIMATE ACTION
2	Energy-efficient products - Energy label and ecodesign	<ul style="list-style-type: none"> - Energy labels help consumers choosing products which are more energy efficient to save money on their household energy bills, while saving energy and encourage manufacturers to drive innovation by using more energy efficient technologies. - Ecodesign improves the environmental performance of products by setting mandatory minimum standards for their energy efficiency and support industrial competitiveness and innovation by promoting better environmental performance of products. 	ENERGY – CLIMATE ACTION
3	renewable energy - moving towards a low carbon economy	<ul style="list-style-type: none"> - To keep EU a global leader in renewables and help the EU to meet its emissions reduction commitments under the Paris Agreement, making the countries outlining targets, action plans and periodical reports for renewable energy and for energy efficiency. The aim is reached through cooperation with statistical transfers, joint renewable energy projects and support schemes. - Biofuels and bioliquids are instrumental in helping EU countries meet their renewables target in transport. 	ENERGY - CLIMATE ACTION
4	Urban environment	<ul style="list-style-type: none"> - To enhance the sustainability of EU cities through common legislation and criteria in order to assess the environmental performance and to protect nature and biodiversity, while considering economic, social and territorial impacts. A key aspect is the improvement of green infrastructures. - To bring the cities to use new tools for collaboration that will allow to benchmark the environmental performance, assessing progress, sharing best practices and tracking improvement over time. 	ENVIRONMENT
5	Sustainable development	<ul style="list-style-type: none"> - To identify and develop actions to enable the EU to achieve a continuous long-term improvement of quality of life, linking more closely EU and national strategies. This is possible by creating sustainable communities able to manage and use resources efficiently, able to tap the ecological and social innovation potential of the economy and able to ensure prosperity, environmental protection and social cohesion, that are linked one to the others through smart monitoring and best practice sharing. 	ENVIRONMENT

⁵ See the section “Policies by topics” at the end of this webpage: https://ec.europa.eu/info/strategy_en

		<ul style="list-style-type: none"> - To propose objectives and policy measures to guide sustainable development to gradually change our current unsustainable consumption and production patterns and move towards a better integrated approach, focusing on the translation into substantial concrete action. - To use Impact Assessments to submit new major policy proposals in a way that the economic, social and environmental policies mutually reinforce each other. 	
6	Waste and recycling	<ul style="list-style-type: none"> - To turn waste into a resource as 'secondary raw materials', key point for a circular economy. - To reduce the amount of waste generated, improve waste management, stimulate innovation in recycling, limit the use of landfilling, create incentives to change consumer behaviour and ensure full implementation of the waste policy targets in all Member States. 	ENVIRONMENT
7	Circular economy	<ul style="list-style-type: none"> - To reduce pressure on natural and freshwater resources as well as ecosystem, protect the environment and human health, make products more energy and resource efficient and empower consumers to choose better products. Assess how the rules on waste, products and chemicals relate to each other and collaborate to transform the way plastics and plastics products are designed, produced, used and recycled are key elements in the Circular Economy Package. 	ENVIRONMENT – CONSUMERS
8	European standards	<ul style="list-style-type: none"> - Following principles as consensus, openness, transparency and non-discrimination, it improves efficiency of European policies with influences in most areas of public concern, it reduces obstacles stemming from national standards and certification schemes, and it improves information to service providers. It ensures interoperability and safety, reduces costs and facilitates companies' integration in the value chain and trade. 	SINGLE MARKET
9	Digital economy – digital single market	<ul style="list-style-type: none"> - To enable the best possible use of the potential of digital data to benefit the economy and society unlocking the re-use potential of different types of data and facilitating its free flow across borders to achieve a European digital single market. - To ensure fair and competitive markets for Internet of Things (IoT) objects and for products and services that rely on non-personal machine-generated data created by such objects. - To assist public bodies in accessing and re-using private sector data, guiding policy decisions or improving public services. 	DIGITAL ECONOMY AND SOCIETY
10	Rights at work	<ul style="list-style-type: none"> - To improve health and safety at work, guarantee equal opportunities for women and men, protect against discrimination and inform workers and employers on their rights and obligations. 	EMPLOYMENT AND SOCIAL AFFAIRS
11	Skills and qualification	<ul style="list-style-type: none"> - To increase skills and abilities to match supply with demand in order to reduce poverty, unemployment and social exclusion 	EMPLOYMENT AND SOCIAL AFFAIRS
12	Moving and working in Europe	<ul style="list-style-type: none"> - To simplify working in another EU country for EU citizens and protect social security rights when moving within Europe 	EMPLOYMENT AND SOCIAL AFFAIRS
13	Vocational education and training (VET)	<ul style="list-style-type: none"> - To equip people with knowledge, know-how, skills and/or competences required in particular occupations or more broadly on the labour market. It responds to the needs of the economy but also provides learners with skills for personal development and active citizenship. It contributes to enterprise performance, competitiveness, 	EDUCATION AND TRAINING

		research and innovation and is central to employment and social policy.	
14	International cooperation and policy dialogue	<ul style="list-style-type: none"> - Cooperation in education and training with non-EU countries enhances the quality of education and training in the EU and beyond through mutual learning, comparison and exchange of good practices, it boosts innovation and job creation through mobility and offers to the participants opportunities to broader horizons. 	EDUCATION AND TRAINING
15	Industry competitiveness and innovation	<ul style="list-style-type: none"> - To promote industrial competitiveness, empower citizens by providing skills for industry, revitalise regions through the development of clusters and the Smart Specialisation Platform, and have the best technologies by supporting the digital transformation of industry and Key Enabling Technologies, and promoting ICT standards. - To implement policies and programmes that support the development of innovation to increase investment in research and development, and to better convert research into improved goods, services, or processes for the market. 	BUSINESS AND INDUSTRY

2.2. EU REGULATIONS

EU Regulations are very relevant instruments to be investigated in order to establish a clear and accessible knowledge about the EU normative framework of the construction system since they are binding and also directly applicable to all the Member States.

A review of the main EU Regulations affecting the construction sector (CnS) is given in **Table 2**. Differently to what it was pointed out in the previous table (Table 1), not the objectives but the actual **innovations** introduced by the Regulations are shown. This is because EU Regulations are not strategic instrument as EU Policies are, but they are effectively legal acts introducing some changes and statements to the current situation. The Regulations are listed with their **name** and the **date** of the publication. The Regulations regarding the same **main topics** (which are explained by keywords) are listed together from the oldest to the most recent one, in order to better visualize the framework of interest of the specific Regulation and view immediately the innovation in that field.

Table 2: Overview of the main EU Regulations (EUR) affecting the CnS and their innovations.

EU Regulat. (EUR)	Date	Main topics	Innovations
1 Regulation No 305/2011 laying down harmonised conditions for the marketing of construction products (Construction Products Regulation – CPR) It replaces the Council Directive 89/106/EEC (Construction Products Directive - CPD)	03/2011	CONSTRUCTION PRODUCTS, PERFORMANCE, MARKET	<ul style="list-style-type: none"> - The CPR provides a common technical language to assess the performance of construction products through the Declaration of Performance. This ensures that reliable information is available to professionals, public authorities, and consumers, so they can compare the performance of products from different manufacturers in different countries. - It ensures free movement of products and basic requirements for construction works through the affixing of CE marking to construction products. - It defines clear rules for the assessment and verification of constancy of performance (AVCP) systems applicable to construction products (former Attestation of Conformity AoC). - It defines the role and responsibilities of manufacturers, distributors, importers, notified bodies, technical assessment bodies, market surveillance and Member States' authorities as regards the application of this EU regulation.

				<ul style="list-style-type: none"> - It introduces simplified procedures enabling cost reductions for businesses, especially SMEs. - It provides a clear framework for the harmonised technical specifications (harmonised standards and European Assessment Documents). - It confirms the 6 essential requirements of the CPD: mechanical resistance and stability, safety in case of fire, hygiene, health and environment, safety in use, protection against noise and energy economy and heat retention.
2	Regulation No 66/2010 on the EU Ecolabel (EU ecolabel Regulation)	11/2009	ECOLABEL, ENVIRONMENTAL EXCELLENCE LABEL FOR PRODUCTS AND SERVICES, CIRCULAR ECONOMY	<ul style="list-style-type: none"> - The EU Ecolabel helps identify products and services that have a reduced environmental impact throughout their life cycle, from the extraction of raw materials to production, use and disposal. Greener, more environmentally friendly, products of high quality available around the world are listed in the Ecolabel catalogue. - It establishes a European Union Ecolabelling Board (EUEB) consisting of the representatives of the competent bodies of all the Member State to contribute to the development and revision of EU Ecolabel criteria, to any review of the implementation of the EU Ecolabel scheme and to decide upon minimum environmental performance requirements.
3	Regulation No 1907/2006 concerning the registration, evaluation, authorisation and restriction of chemicals (REACH Regulation)	12/2006	CONSTRUCTION PRODUCTS, HUMAN HEALTH AND ENVIRONMENT PROTECTION, INNOVATION, COMPETITIVENESS, CIRCULAR ECONOMY	<ul style="list-style-type: none"> - The REACH Regulation is relevant for construction products that use recovered substances, such as metals, aggregates and glass since its main objectives are: <ol style="list-style-type: none"> 1. to ensure a high level of protection of human health and the environment from the risks that can be posed by chemicals, allowing the free circulation of substances on the internal market 2. to promote alternative methods for the substances' risks evaluation instead of tests on vertebrate animals 3. to enhance competitiveness and innovation.
4	Regulation No 1293/2013 on the establishment of a Programme for the Environment and Climate Action (LIFE Regulation)	12/2011	ENVIRONMENT, HEALTH, RESOURCE-EFFICIENCY, CLIMATE ACTION, RESILIENCE	<ul style="list-style-type: none"> - It establishes of a programme for the Environment and Climate Action, covering the period from 2014 to 2020, which follows four general objectives: <ol style="list-style-type: none"> 1. Help move towards a resource-efficient, low carbon and climate resilient economy, improve the quality of the environment and halt and reverse biodiversity loss; 2. Improve the development, implementation and enforcement of EU environmental and climate policy and legislation, and act as a catalyst for, and promote, the mainstreaming of environmental and climate objectives into other policies and practices; 3. Support better environmental and climate governance at all levels, including better involvement of civil society, NGOs and local actors; 4. Support the implementation of the 7th environmental action plan.

2.3. EU DIRECTIVES

Finally, an overview of the main **EU Directives** in force related to the construction sector gives us a complete image of the EU normative framework in terms of innovations and impacts.

In **Table 3** are summarized the most innovative EU Directives for the construction sector (CnS) in Europe. The **name** of the Directive is provided along with the **publishing date**. As for the Table 2, it is also included a list of keywords explaining the **main topics** of the Directive and the description of **the innovations** introduced with it.

Table 3: Overview of the main EU Directives (EUD) affecting the CnS and their innovations.

EU Directive (EUD)		Date	Main topics	Innovations
1	Directive 2010/31/EU on the energy performance of buildings (Energy Performance of Building Directive – EPBD)	19/05/2010	ENERGY EFFICIENCY, ENERGY PERFORMANCE, NZEBs, BUILDING ENERGY CONSUMPTION	<ul style="list-style-type: none"> - The EPBD promotes the energy performance of buildings taking into account outdoor climatic and local conditions, as well as indoor climate requirements and cost-effectiveness. - It applies both to new buildings and old ones undergoing renovation. - It lays down minimum requirements for energy performance, requirements for related framework methodologies and it strengthens the role of energy performance certificates and inspections. - It requires that all new buildings shall be nearly zero-energy buildings by 31 December 2020, and 2 years earlier for buildings occupied and owned by public authorities.
2	Directive 2012/27/EU on energy efficiency (Energy Efficiency Directive – EED)	25/10/2012	ENERGY EFFICIENCY, ENERGY PERFORMANCE	<ul style="list-style-type: none"> - The EED requires 20% energy savings target by 2020. - It has set minimum energy efficiency standards and labelling for many products, supporting ecodesign and it has compelled energy efficiency certificates accompanying the sale and rental of buildings. - It requires that Public EU authorities should set the example by renovating each year 3% of central government buildings with insufficient energy performances but also asking to large companies to conduct energy audits at least every four years.
3	Directive 2018/844/EU amending Directive 2010/31/EU on the energy performance of buildings and Directive 2012/27/EU on energy efficiency	30/06/2018	ENERGY EFFICIENCY, ENERGY PERFORMANCE, NZEBs, BUILDING ENERGY CONSUMPTION	<ul style="list-style-type: none"> - It introduces an indicator of intelligence for buildings, calculated to adapt its working to the needs of the occupant and the network and to improve its energy efficiency and general performance through more interconnected and intelligent devices. - It simplifies inspections of heating and air conditioning system. - It promotes economically efficient renovations with the aim to improve the energy efficiency of buildings and to encourage the renovation of buildings. In fact, one of its long-term goals is to decarbonise the current European building stock, highly inefficient. - It promotes electromobility by establishing a framework for parking spaces to serve electric vehicles.
4	Directive 2018/2001 revising the 2009/28/EC on the promotion of the use of energy from renewable sources (Renewables Energy Directive)	11/12/2018	ENERGY, RENEWABLE SOURCES	<ul style="list-style-type: none"> - The Directive revises the previous EU's original Renewable energy directive (2009/28/EC) which sets a binding target of 20% final energy consumption from renewable sources by 2020. The first Renewables Energy Directive establishes a common framework for the promotion of energy from renewable sources introducing National Action Plans, to establish national targets for the share of energy from renewable sources consumed in transport, electricity and heating and cooling by 2020. - This Directive establishes a common framework for the promotion of energy from renewable sources, with the goal that the Union's gross final consumption of energy from renewable sources will be 32% at least by 2030, ruling the EU financial support too. - It asks to Member States to develop suitable information, awareness-raising, guidance or training programmes for consumers and gives the guidelines for certifications. - It also establishes sustainability and greenhouse gas emissions saving criteria for biofuels, bioliquids and biomass fuels.
5	Directive 1999/31/EC on the landfill of waste (amended by	26/04/1999	WASTE, LANDFILLS, TECHNICAL	<ul style="list-style-type: none"> - It is one of the first EU waste policies to deal with construction and demolition waste by stating that where waste needs to be landfilled, it must be sent to landfills

	Directive 2018/850/EC)		REQUIREMENTS	<p>which comply with the requirements established by the Directive.</p> <ul style="list-style-type: none"> - Its objective is to prevent or reduce, as far as possible, negative effects on the environment by introducing stringent technical requirements for waste and landfills.
6	Directive 2008/98/EC on waste and repealing certain Directives (Waste Framework Directive)	19/11/2008	WASTE, RESOURCE EFFICIENCY, RECYCLE, RECYCLING PRODUCTS	<ul style="list-style-type: none"> - The Waste Framework Directive aims to provide a framework for moving towards a European recycling society with a high level of resource efficiency. - It sets economic measures such as incentives for good supply chain and green products or penalties for landfilling (in accord with the waste hierarchy on which lays down the current EU waste policy) to reach the goals of reaching 70% of prevention, preparation for reuse, recycling and other forms of material recovery of construction and demolition waste and discouraging landfilling targeting the maximum at 10% for municipalities by 2030. - It contributes significantly to the European policy towards increased resource efficiency in the construction sector, which components have a high resource value, boosting EU economic and building sectors.
7	Directive 2009/125/EC establishing a framework for the setting of ecodesign requirements for energy-related products (Ecodesign Directive)	21/10/2009	ECODESIGN, QUALITY OF PRODUCTS, ENVIRONMENTAL IMPACTS OF CONSTRUCTION PRODUCTS	<ul style="list-style-type: none"> - The Ecodesign Directive provides a coherent framework of requirements for taking into account all the environmental impacts of a product, targeting harmonised standards for their energy efficiency. - Ecodesign measures enhance product quality and environmental protection and facilitate the industrial competitiveness and free movement of goods."
8	Directive 2014/52/EU amending Directive 2011/92/EU on the assessment of the effects of certain public and private projects on the environment	16/04/2014	ENVIRONMENTAL IMPACTS OF CONSTRUCTION WORKS	<ul style="list-style-type: none"> - The Directive gives the guidelines for the assessment of the environmental effects of projects, both public and private, which have significant effects on the environment. The environmental impact assessment has to be site-specific and it has to be referred to tangible and non-tangible heritage.
9	Directive 2008/50/EC on ambient air quality and cleaner air for Europe	21/05/2008	AMBIENT AIR QUALITY	<ul style="list-style-type: none"> - The Directive sets objectives and provides shared methods and criteria for ambient air quality aiming to a cooperation between Member States for air pollution reduction. - It encourages measuring and monitoring the air quality to maintain or improve it and recommends transparent information.
10	Directive 2005/36/EC on the recognition of professional qualifications	07/09/2005	PROFESSIONAL QUALIFICATIONS	<ul style="list-style-type: none"> - The Directive establishes rules that allow to compare professional qualifications and to recognize professional experience for the access to and pursuit of that profession across all EU Member States. This increases the mobility and aims to reduce unemployment.
11	Council Directive 92/57/EEC on the implementation of minimum safety and health requirements at temporary or mobile construction sites	24/06/1992	SAFETY AT WORK, HEALTH AT WORK, CONSTRUCTION SITES, PREVENTION	<ul style="list-style-type: none"> - The Directive aims to prevent risks by establishing a chain of responsibility, linking all parties involved. - It lays down minimum safety and health requirements and maximum level of exposure to risk factors for temporary or mobile construction sites, focusing on the prevention. -
12	Council Directive 89/656/EEC on the minimum health and safety requirements for the use by workers	30/11/1989	SAFETY AT WORK, HEALTH AT WORK, CONSTRUCTION	<ul style="list-style-type: none"> - The Directive lays down minimum requirements for personal protective equipment used by workers at work.

	of personal protective equipment at the workplace		N SITES, PREVENTION	
13	Directive 2006/25/EC on the minimum health and safety requirements regarding the exposure of workers to risks arising from physical agents (artificial optical radiation)	05/04/2006	HEALTH FROM PHYSICAL AGENTS OF WORKERS, ARTIFICIAL OPTICAL RADIATION	- The Directive lays down minimum requirements for the protection of workers from risks to their health and safety arising or likely to arise from exposure to artificial optical radiation during their work.
14	Directive 2013/35/EU on the minimum health and safety requirements regarding the exposure of workers to the risks arising from physical agents (electromagnetic fields)	26/06/2013	HEALTH FROM PHYSICAL AGENTS OF WORKERS, ELECTROMAGNETIC FIELDS	- The Directive lays down minimum requirements for the protection of workers from risks to their health and safety arising or likely to arise from exposure to electromagnetic fields during their work.
15	Council Directive 89/391/EEC on the introduction of measures to encourage improvements in the safety and health of workers at work (OSH Framework Directive)	12/06/1989	SAFETY AT WORK, HEALTH AT WORK, PREVENTION, PROTECTION, TRAINING FOR WORKERS	- The OSH Framework Directive introduces measures to encourage improvements in the safety and health of workers at work. - It contains general principles concerning the prevention of occupational risks, the protection of safety and health, the elimination of risk and accident factors, the informing, consultation, balanced participation in accordance with national laws and/or practices and training of workers and their representatives, as well as general guidelines for the implementation of the said principles.
16	Directive 2014/24/EU on public procurement and repealing Directive 2004/18/EC (EU Public Procurement Directive)	26/02/2014	PROCEDURES FOR PROCUREMENT, CONTRACTS, BIM, DIGITALIZATION	- The Directive establishes rules on the procedures for procurement by contracting authorities with respect to public contracts as well as design contests. Every Member State is free to define what it considers to be services of general economic interest, their organisation and financing system and what specific obligations they should be subject to. - The Directive encourage the use of BIM (Building Information Modeling) as reference standard for all publicly funded projects and works
17	Directive 2006/123/EC on Services in the Internal Market	12/12/2006	SINGLE MARKET FOR SERVICES, QUALITY, TRANSPARENCY, PROCEDURES SIMPLIFICATION	- The Directive aims at establishing a single market for services within the European Union. - The Directive helps businesses establish themselves, facilitates the cross-border provision services, enhances the rights for service recipients and aims to establish administrative cooperation between European countries. - The construction services and craft are covered by the Directive, as well as the training and educational services.

2.4. OTHER EU ACTS

As explained in the section 1.2., to build the EU normative framework of the construction sector (CnS) we paid our attention just on Policies, Regulations and Directives. All the other types of EU acts on the topic are

not considered as fundamental, but it was deemed significant to add the following documents to the framework in order to not lose other important guidelines given by the EU regarding the CnS.

Table 4: Other EU Acts (oEUA) affecting the CnS and their innovations.

Name of act		Under the framework of	Date	Main topics (keywords)	Innovations (description)
1	EN Eurocodes 2 (EN 1990 – EN 1999)	Regulation No 305/2011	07/09/2018	CONCRETE STRUCTURAL DESIGN, SAFETY, SERVICEABILITY	- The Eurocodes 2 establish a set of common technical rules for the design of concrete buildings and civil engineering works which will ultimately replace the different rules in the various Member States.
2	Communication (2014) 445 on Resource Efficiency Opportunities in the Building Sector	EU circular economy package	01/07/2014	WASTE, RECYCLE, BUILDING MATERIALS, CONSTRUCTION PRODUCTS, EFFICIENCY, ENVIRONMENT, RECYCLE	- The main objectives are to enhance the use of building materials in more efficient way and to reduce the total environmental impacts throughout the full life cycle of buildings - The communication aims at improving design, construction, demolition and recycling of construction products, as well as simplify data in the use of resources to reduce waste.
3	Communication (2015) 614 Closing the Loop - An EU Action Plan for the Circular Economy	EU Circular Economy Package	02/12/2015	CIRCULAR ECONOMY, PRODUCTS LIFECYCLE, RECYCLING, PRODUCTION, WASTE MANAGEMENT	- The Action Plan for the Circular Economy establishes a concrete and ambitious programme of action, with measures covering the whole cycle, from production and consumption to waste management and the market for secondary raw materials. - The annex to the action plan sets out the timeline when the actions will be completed. The proposed actions will contribute to “closing the loop” of product lifecycles through greater recycling and re-use, and bring benefits for both the environment and the economy. - In addition, revised legislative proposals on waste introduced as part of the plan will include ‘concrete measures to promote re-use and stimulate industrial symbiosis - turning one industry's by-product into another industry's raw material’.
4	Construction and Demolition Waste Management Protocol	Directive 2008/98/EC	18/09/2018	WASTE, RESOURCE EFFICIENCY, RECYCLE, RECYCLING PRODUCTS	- It increases confidence in the C&D waste management process and the trust in the quality of C&D recycled materials by improving waste identification, source separation and collection, waste logistics, processing and quality management and by giving appropriate policy and framework conditions.
5	Communication (2014) 14. For a European Industrial Renaissance	Directive 2014/24/EU	22/01/2014	INDUSTRY 4.0, DIGITALIZATION, INDUSTRIAL RENAISSANCE, TECHNOLOGIES, BIM, ICT	- It stated that digital technologies (including cloud computing, big data, new industrial internet applications, smart factories, robotics and 3D printing) are essential to increase European productivity through redefining business models and creating new products and services.
6	Communication (2012) 433 Strategy for	Europe 2020 initiative	31/07/2012	SUSTAINABLE COMPETITIVENES	- - The strategy focuses on five objectives: stimulating favorable investment conditions; improving the

	the sustainable competitiveness of the construction sector and its enterprises	(COM/2011/0021)		S, CONSTRUCTION SECTOR	human-capital basis; improving resource efficiency, environmental performance and business opportunities; strengthening the EU internal market and fostering the global competitiveness of enterprises.
7	EU Strategic Framework on Health and Safety at Work 2014 – 2020 (OSH strategy)	Council Directive 89/391/EEC	06/06/2014	OCCUPATIONAL SAFETY AND HEALTH, PREVENTION, PROTECTION, TRAINING FOR WORKERS	- It provides a comprehensive body of EU simplified legislation as common framework to facilitate risk assessment and to support principally SMEs also making available a common database with OSH best practices. It offers financial and technical support and Action Programmes for coordinating national policies and promote the information base for prevention but also for costs and benefits. It tackles demographic change, mostly with ageing of the working population.
8	Communication (2018) 773 A Clean Planet for all - A European strategic long-term vision for a prosperous, modern, competitive and climate neutral economy	EU Energy and Climate future policies	28/11/2018	CLIMATE, ENERGY, FUTURE SCENARIOS, CLIMATE NEUTRALITY, LOCAL AUTHORITIES	- The communication proposes complex and ambitious scenarios which will have cross-cutting impacts on all sector of the EU policies, creating the new framework for the upcoming policies in the field of energy and climate and beyond. - The main objectives are: to express the importance of aiming at the most ambitious scenario towards 2050 and set the objective of achieving climate neutrality; to stress the central role of Local and Regional Authorities in the definition of concrete roadmap towards climate neutrality; to stress the need for a systematic territorial impact assessment of climate and energy policies with a view to detecting vulnerable regions and support them in the transition.

3. IDENTIFICATION OF THE INNOVATION THEMATIC AREAS AND CLASSIFICATION OF THEIR IMPACT FIELDS.

Thanks to the EU normative framework overview performed in the previous section (Section 2), we are able to identify in which directions the EU is oriented to promote changes and improvements in the construction sector (CnS).

To help the ICARO project identifying the EU guidelines of innovations for the CnS, all the innovations introduced by EU Regulations and Directives (see Table 2 and 3) are summarized into main thematic categories that we have called ‘**Innovation Thematic Areas**’ (ITAs).

In **Table 5** is shown the list of ITAs identified as far. Each ITAs includes a series of EU Regulations (EUR), EU Directives (EUD) and other EU Acts (oEUA) that are specified in the columns beside.

Table 5: Innovation Thematic Areas (ITAs)

ITAs	EUR	EUD	oEUA
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a	ENERGY PERFORMANCE/EFFICIENCY OF BUILDINGS		2018/844/EU 2012/27/EU 2010/31/EU 2018/2001/EU	
b	QUALITY/PERFORMANCE/ECODESIGN/EFFICIENCY OF CONSTRUCTION PRODUCTS		2009/125/EC	
c	STRUCTURAL REQUIREMENTS (PERFORMANCE AND SECURITY) OF CONSTRUCTIONS	No 305/2011		EN Eurocodes 2
d	WASTE MANAGEMENT AND RECYCLE OF CONSTRUCTION PRODUCTS		1999/31/EC 2008/98/EC	COM (2014) 445 COM (2015) 614 Construction and Demolition Waste Management Protocol
e	ENVIRONMENTAL IMPACT AND SUSTAINABILITY OF CONSTRUCTION WORKS	No 66/2010 No 1293/2013	2014/52/EU 2008/50/EC	COM (2018) 773
f	HEALTH, SAFETY AND RIGHTS FOR WORKERS IN BUILDING SECTOR		92/57/EEC 89/656/EEC 2006/25/EC 2013/35/EU 89/391/EEC	OSH strategy
g	DIGITALIZATION OF THE CONSTRUCTION PROCESS		2014/24/EU	COM (2014) 14
h	COMPETITIVENESS OF CONSTRUCTION SECTOR	No 1907/2006	2006/123/EC	COM (2012) 433
i	PROFESSIONAL QUALIFICATIONS / EMPLOYMENT IN THE CONSTRUCTION INDUSTRY		2005/36/EC	

Moreover, we can observe that the innovative factors requested by EU laws (see Table 2, 3 and 4), along with the main objectives of the EU Policies listed in Table 1, have consequences, or effects, on different aspects of the construction sector. We can summarize these aspects into **6 different types** that we can call ‘**Impact Fields of Innovation**’ (IFI):

1. Technological field

Innovations in technologies, techniques, materials, equipments, devices. Progress in scientific and technical knowledge.

2. Social field

Social impact: effects on the community, improvements of the welfare/social state of the workers in the sector, increase of the social acceptance.

3. Process field

Innovations in construction procedures and processes. Improvements in legal procedures, contractual procedures, enforcement procedures, etc.

4. Economic field

Improvements for the economic sphere of the construction sector: reduction of costs, establishment of a circular economy and of a fair market, etc.

5. Environmental / Health-related field

Environmental and health benefits, reduction of pollution, positive innovations for the environment care and protection and for the human health and well-being.

6. Educational field

Specific amendments to the qualifications and skills requested to each grades of the construction site technicians, special requirements in their curricula, changes in the VET qualification system, etc.

Finally, we are able to put together the ITAs and the IFI (in **Table 6**) to actually see the relationship between the latest innovations introduced by European Union and their impact on the construction sector.

Table 6: Relationship between innovations and impact fields

ITAs	1. Tech.	2. Soc.	3. Proc.	4.Econ.	5.Env/H.	6.Edu.
a ENERGY PERFORMANCE/EFFICIENCY OF BUILDINGS	x	x	x	x	x	
b QUALITY/PERFORMANCE/ECODESIGN/EFFICIENCY OF CONSTRUCTION PRODUCTS	x		x	x	x	
c STRUCTURAL REQUIREMENTS (PERFORMANCE AND SECURITY) OF CONSTRUCTIONS	x		x	x		
d WASTE MANAGEMENT AND RECYCLE OF CONSTRUCTION PRODUCTS		x	x	x	x	
e ENVIRONMENTAL IMPACT AND		x	x	x	x	

	SUSTAINABILITY OF CONSTRUCTION WORKS						
f	HEALTH, SAFETY AND RIGHTS FOR WORKERS IN BUILDING SECTOR		x	x		x	x
g	DIGITALIZATION OF THE CONSTRUCTION PROCESS	x		x	x		x
h	COMPETITIVENESS OF CONSTRUCTION SECTOR	x	x	x	x		x
i	PROFESSIONAL QUALIFICATIONS / EMPLOYMENT IN THE CONSTRUCTION INDUSTRY		x	x	x		x

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