



**SECTORAL STRATEGIC
APPROACH TO COOPERATE
ON SKILLS IN THE
CONSTRUCTION INDUSTRY
WP2
STATUS QUO AND SECTORAL
SKILLS STRATEGY**

**Deliverable 2.4.
Skills needs analysis**



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Skills Blueprint for the Construction Industry

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COOPERATION FOR INNOVATION AND THE EXCHANGE OF GOOD PRACTICES
SECTOR SKILLS ALLIANCES FOR IMPLEMENTING A NEW STRATEGIC APPROACH
("BLUEPRINT") TO SECTORAL COOPERATION ON SKILLS

Project number:

600885-EPP-1-2018-1-ES-EPPKA2-SSA-B

PARTNERSHIP		
VET PROVIDERS	SECTORAL REPRESENTATIVES	COUNTRY
FLC (COORDINATOR)	CNC	SPAIN
IFAPME	EMBUILD	BELGIUM
SATAEDU	--	FINLAND
CCCA-BTP	FFB	FRANCE
BZB	ZDB	GERMANY
BFW-NRW		
AKMI	PEDMEDE	GREECE
TUS	--	IRELAND
FORMEDIL	ANCE	ITALY
VSRC	LSA	LITHUANIA
CENFIC	--	PORTUGAL
SCKR	CCIS CCBMIS	SLOVENIA
	BUDOWLANI (TRADE UNION)	POLAND
	FIEC	EU
	EFBWW	EU
	EBC	EU

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1. Introduction

The Construction Industry represents 9% of the GDP in the EU and employs around 5% of European workers (nearly 18 million jobs)¹. It is a complex sector that includes a wide range of economic activities: extraction of raw materials, manufacturing and distribution of construction products, design and construction of buildings and infrastructures, maintenance, renovation and demolition, waste recycling, etc. It is also characterised by being a highly SME-based sector, where around 95% of companies have less than 20 employees.

In the current context of the EU, the construction industry holds a high potential for creating new jobs, contributing to the economic growth and providing key elements to face the current challenges in terms of climate, energy, sustainability and circular economy. The EC launched the initiative Strategy for the sustainable competitiveness of the construction sector and its enterprises², as a reference framework stressing the role that the construction industry will need to play in the coming years regarding these aspects.

The transformation of the construction industry is demanding a new set of skills to be acquired by the workers, to be able to face the mentioned challenges. According to Skills Panorama³, the growing need for higher-level skills in the sector is attributed to a series of key drivers:

- **Technological advances.** Workers will need to own a suitable qualification and take up professional development opportunities to use new IT-based or automated equipment. One digital technology that is expanding its influence in the sector is the Building Information Modelling (BIM), that is to be used to design and manage construction projects at all stages of the production process. Other technologies, such as 3D printing, simulation or cloud computing are gaining strong positions in the industry.
- **Off-site manufacturing.** Currently, some parts of a building structure can be built in construction factories before being transported, meaning that there is less need for some professionals on-site; they will need to adapt their ways of working to factory situations with new qualifications. **Technical skills** are also very important in off-site building and construction roles, such as computer aided design or computer aided manufacturing.
- **Climate change challenges and the need for greater energy efficiency.** New practices have already been implemented because of technological advances, and in response to regulatory changes related to waste management and pollutant emissions. As the reduction pollutants in construction processes becomes a greater priority, new materials, methods, and technologies will be introduced. Workers will need to have proper skills to work with new and “green” material and techniques.
- **The energy sector** will also be a major driver of demand for specific skill sets of construction workers.
- Increasing levels of **urbanisation**. This involves a variety of challenges as population density increases and demand for space and resources follows suit. As a result, retrofitting and building renovation will become a more and more common practice; workers will need technical expertise both in retrofitting and renovation, along with skills in new practices and methods, including off-site production and prefabricated building elements.

¹ https://ec.europa.eu/growth/sectors/construction_en

² <https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:52012DC0433>

³ <https://www.cedefop.europa.eu/en/data-insights/construction-workers-skills-opportunities-and-challenges-2019-update>

- Workers will also be required to have **collaborative skills** and the ability to work in better-connected interdisciplinary teams.

The EU has established a variety of initiatives on upgrading the workers' skills. In 2020, the EC launched the European Skills Agenda for sustainable competitiveness, social fairness and resilience⁴, which sets objectives for upskilling (improving existing skills) and reskilling (training in new skills) to be achieved in the next years in the framework of a transition towards a neutral-climate Europe, supported by the digital transformation that is rapidly changing the working and learning ways for the European society.

2. Energy Efficiency

A systematic transition to renewable energy systems, clean technologies and energy-efficiency is of key relevance to achieving the European Union's climate targets. In this context, the Construction Industry plays a predominant role.

Derived from this, employment in construction is projected to be significantly increased (an estimation of 4 million between 2018 and 2030, according to CEDEFOP). However, the scarcity of skilled workers and trained professionals somehow hinders the achievement of the EU's climate aim. It is, therefore, necessary to invest in upskilling and reskilling the labour force, as the only way to deal with the green transformation, as stressed by the European Green Deal⁵.

To deal with this situation, the EC has prepared the ground for the transformations that lie ahead through the adoption of a number of policy instruments:

The Renovation Wave⁶

Adopted in October 2020, this initiative seeks to double renovation rates up to 2030 and ensure that renovations lead to higher energy and resource efficiency. According to the estimation by the European Commission, it could lead to the renovation of 35 million buildings and to the creation of up to 160,000 additional green jobs in the construction sector. The initiative acknowledges that a climate-neutral building stock is only achievable by integrating green and circular skills in existing jobs and by the emergence of new job profiles (for example, deep renovation specialists). The Renovation Wave pursues skills-related objectives and calls for more inclusiveness and an increased share of women in the construction sector to improve the availability of skills and qualified professionals, and for better access to information for SMEs on training and apprenticeship programmes.

The Pact for Skills⁷

Launched on 10 November 2020, the Pact for Skills is the first flagship action of the European Skills Agenda⁸. Through the Pact the EC calls upon public and private organisations to join with the aim of promoting upskilling and reskilling of people to support a fair recovery as well as the green and digital transformations envisaged by the European Green Deal. One of the sectors identified in this initiative is construction. The European Commission highlights how difficult is to attract young and qualified workers in the sector and recommends closing the skill gaps - in a pool of 12 million workers - by focusing on upskilling for energy and resource efficiency, decentralised energy solutions and renovation of existing constructions, among others.

4 https://ec.europa.eu/commission/presscorner/detail/en/ip_20_1196

5 https://ec.europa.eu/info/publications/communication-european-green-deal_en

6 https://ec.europa.eu/commission/presscorner/detail/en/IP_20_1835

7 <https://ec.europa.eu/social/main.jsp?catId=1517&langId=en>

8 <https://ec.europa.eu/social/main.jsp?catId=1223&langId=en>

The European Climate Pact⁹

This initiative was launched by the Commission last December 2020, aiming at engaging EU citizens in the achievement of the climate targets. The Climate Pact will support skills for the energy transition in the context of 'green skills' which, together with 'green areas', 'green mobility' and 'green buildings' constitutes one of its four priority areas. The Pact will also support educational and training institutions to improve the development of and accessibility to green skills development programmes.

Investing in new skills for workers on energy-efficient and climate-friendly solutions through life-long learning/continuous training, education and training must become a target of all policy-makers and businesses.

All this was already analysed by the Build Up Skills initiative¹⁰, focused on continuous education and training of construction workers, in order to increase the number of qualified workers across Europe to deliver building renovations which offer high-energy performance as well as new, nearly zero-energy buildings. It covers skills in relation to energy efficiency and renewable energy systems and measures in the building stock.

3. Circular Economy

The European Commission adopted in 2020 a new Circular Economy Action Plan¹¹, one of the main components of the European Green Deal, the new European agenda for sustainable growth. The EU's transition to a circular economy will reduce pressure on natural resources and will create sustainable growth and jobs. It is also a prerequisite to achieve the EU's 2050 climate neutrality target and to halt biodiversity loss. The Plan aims to make the economy fit for a green future, with measures across the entire life cycle of products, and to strengthen competitiveness as well as protect the environment and give new rights to consumers.

Among other issues, it includes a comprehensive strategy to promote circularity in the building sector in an environment of sustainable construction, aiming at reusing resources and maximise their use. In a circular economy, the aim is to ensure that resources remain in the process for as long as possible, moving from a linear economy ('use- and-throw- away') to a circular economy.

The construction industry has one of the highest resource consumptions and, at the same time, is one of the sectors that generates most waste (wood-related products, used cement or scrap metal). Construction and demolition waste (CDW) accounts for 1/3 of the total waste generated in the EU (which is hundreds of thousands of tonnes), including concrete, bricks, plaster, wood, glass, metals, plastics, asbestos and excavated soil. This reveals the real importance of applying a circular economy in construction and moving towards a higher sustainability.

The transition to a circular economy requires the creation and design of new models and approaches, and the acquisition of new skill and competences. Education, initial and continuing vocational training, as well as lifelong learning, have a key role to play in providing and updating the necessary skills, both for the workers as well as for the trainers themselves.

⁹ https://ec.europa.eu/clima/policies/eu-climate-action/pact_en

¹⁰ <https://www.buildup.eu/en/skills/about-build-skills>

¹¹ https://ec.europa.eu/environment/strategy/circular-economy-action-plan_en

4. Digitalisation

At the beginning of 2020 the European Commission published the European Digital Strategy¹² as well as the European strategy for data, focusing on the digital transformation. The Commission will focus on three key objectives:

- Technology that works for people: Development, deployment and uptake of technology that makes a real difference to people's daily lives. A strong and competitive economy that masters and shapes technology in a way that respects European values.
- A fair and competitive economy: A frictionless single market, where companies of all sizes and in any sector can compete on equal terms, and can develop, market and use digital technologies, products and services at a scale that boosts their productivity and global competitiveness, and consumers can be confident that their rights are respected.
- An open, democratic and sustainable society: A trustworthy environment in which citizens are empowered in how they act and interact, and of the data they provide both online and offline. A European way to digital transformation which enhances our democratic values, respects our fundamental rights, and contributes to a sustainable, climate-neutral and resource-efficient economy.

In fact, due to the COVID-19 sanitary crisis, this strategy has been even more relevant, since digital work and interaction has been central during the pandemic. States, individuals and companies have been forced to rapidly adapt to digital connectivity and remote working where possible, due to imposed lockdowns in practically all the countries and the closing down of non-essential businesses.

Clearly, the crisis has greatly increased the demand for digital skills, which, on the other hand, were already necessary before it appeared; it is therefore crucial for workers to acquire the skills necessary to adapt to the new environment.

It is intended that the digital transformation will benefit people but also businesses, opening new opportunities for them, driving the development of reliable technologies, enabling a dynamic and sustainable economy, and helping to fight against climate change and complete the green transition described in the Green Deal.

However, when talking about the construction industry in terms of digital activity, the sector is placed among the lowest digitalised economic sectors in Europe -although currently in its way towards digital transformation-, as indicated in the last Analytical Report published in April 2021 by the European Construction Sector Observatory (ECSO)¹³. This Report presents the state of play of the most relevant digital technologies in the construction sector in terms of data acquisition, automating processes and digital information and analysis, and the current levels of maturity of the related technologies.

¹² https://ec.europa.eu/info/sites/default/files/communication-shaping-europes-digital-future-feb2020_en_3.pdf
¹³ <https://ec.europa.eu/docsroom/documents/45547>

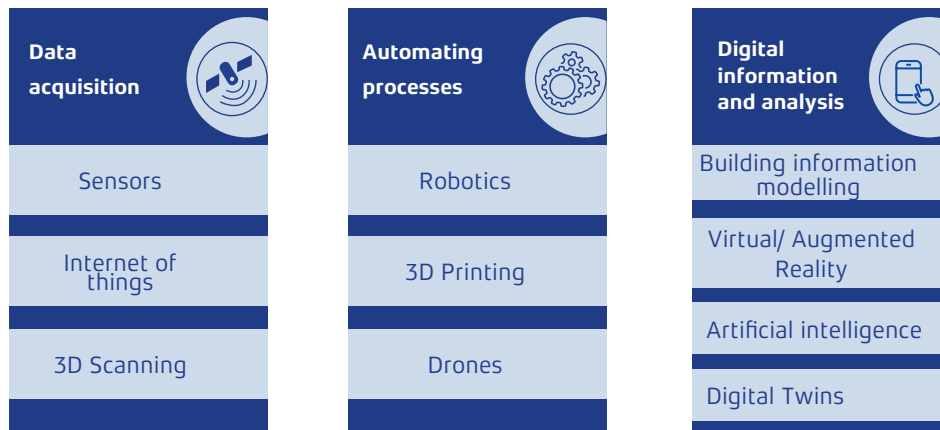


Figure 1. Technologies related to the data acquisition, automation and digital information/analysis. Source: ECSO

In many EU Member States there are policies covering or specifically targeting the digitalisation of the construction sector, by developing Digital construction platforms, or by including BIM requirements in the public procurement processes, among other initiatives.

In this context, the lack of skilled workforce, is, according to ECSO, one of the main factors hindering digitalisation of the European construction industry, together with the cost of equipment and software, and lack of awareness and understanding of digital technologies.

5.Blueprint for sectoral cooperation on skills. Responding to skills mismatches at sectoral level

Resulting from the need of counting on workers owning the needed qualification to face the new challenges derived from the European policies about the green transition and the digitalisation, the EC launched the Blueprint initiative (Blueprint for Sectoral Cooperation on Skills)¹⁴, as a part of the Skills Agenda for Europe 2016¹⁵, and constitutes a framework for strategic cooperation to address skills needs in a particular economic sector. It outlines how stakeholders (businesses, trade unions, public authorities, research, education and training institutions, etc.) can address sectoral challenges, describing the steps towards delivering sector-specific skills solutions through sectoral partnerships.

Several sectors have benefitted from this initiative, the Construction Industry among them. In January 2019, the Construction Blueprint project¹⁶ was launched, with the main objective of developing a new sectoral strategic approach to cooperate on skills in the sector and support a better matching between skills need of companies and skills provided by training centres, especially in the topics of Energy Efficiency, Circular Economy and Digitalisation.

¹⁴ <https://ec.europa.eu/social/main.jsp?catId=1415&langId=en>
¹⁵ <https://ec.europa.eu/social/main.jsp?langId=en&catId=1223>
¹⁶ www.constructionblueprint.eu

6. Skills needs in the Construction Industry

6.1. Methodology

During the project lifespan, the Construction Blueprint consortium will develop several phases and activities to achieve the objectives, and to obtain outcomes that support the main aim: a new sectoral strategic approach to cooperate on skills in the Construction industry.

The first phase has consisted of the analysis of the current state of the European construction sector, which determines the current scenario regarding several factors that are likely impelling the appearance of skills needs, influencing the current status of the qualification frameworks as well as affecting the Vocational Education and Training (VET) offered in each country. This first phase aims to provide valuable information to serve as a fundamental basis for defining the key elements through the creation of a Roadmap and an Action Plan, which will shape the first approach concerning the setting up of the Sectoral Skills Strategy.

The methodology for this phase included a series of stages, the first one being the analysis of different external factors that may affect the construction industry and its evolution in terms of professional skills and competences. These factors are: Political, Economic, Social, Technological, Legal and Environmental, which constitute what is known as PESTLE analysis.

The first step for the analysis of these factors was the completion of a series of national factsheets where the main trends and topics per factor were analysed. These national factsheets included a specific section where partners analysed the skills needs identified in their countries in each of the main topics of the Construction Blueprint project (i.e., Energy Efficiency, Circular Economy and Digitalisation). Also, other skills have been identified not belonging to the three main topics.

The following information has been partly extracted from these national factsheets and constitute the first approach to the skills needs identified for the construction industry. The information is presented in the form of tables, ordered per topic and per country. It includes:

- Denomination of the skill
- Current situation in the country
- Barriers
- Measures to be undertaken

In order to provide a more complete information, an analysis of other documents elaborated in the project (**Status Quo** and **Pestle Analysis**, that can be consulted [here](#), and provide a lot of complementary information related to skills needs) have been carried out, as a complement to better understand the current situation of the selected topics in the Construction Blueprint countries and the need of upskill/reskill construction workers. Besides, information from the European Construction Sector Observatory (ECSO)¹⁷ and other EC documents has been considered when relevant.

Please note that most of this information was developed before the COVID-19 pandemic, therefore this circumstance is scarcely mentioned in the current document. However, updated information about skills needs for the construction industry will be provided in subsequent stages of the project (mainly through the Observatory -Watchtower- of skills needs and the Analysis of occupational profiles to be updated).

17 https://ec.europa.eu/growth/sectors/construction/observatory_en

The current document is to be read as a complement to the already mentioned Status Quo report and PESTLE analysis, both available on the Construction Blueprint website: www.constructionblueprint.eu. This is an approximation to some of the current and future skills identified by the Construction Blueprint partners, that will potentially be necessary by companies and workers in order to comply with the European requirements regarding climate change, sustainability or digital transformation.

The last step in the elaboration of the present document has been a revision made by members of the National Advisory Groups (NAGs) conformed in each country of the Construction Blueprint consortium. These NAGs are external groups composed of experts that contribute to the project, in accordance with their area of expertise, with the aim of adding value to the project outcomes and results.

Each NAG collects experts from different disciplines and subjects related to the construction industry, and are distributed in different fields, in line with what is known as Quintuple Helix model: Education, Social, Political, Economic, Environmental and Technological perspectives. This way, multiple viewpoints are ensured, and the quality of the results is guaranteed.

6.2. Topic 1. Energy efficiency

It is one of the main drivers of skills development in the sector. The European Commission agreed to decarbonise the European building stock by 2050, which will force 3-4 million workers to be trained in this area. In this sense, it is of paramount importance to carry out efforts to qualify and increase the number of construction workers in the field of energy efficiency and renewable energy systems in the buildings.

Belgium

Each Belgian region has its own approach towards improving the energy performance of buildings: the Flemish government launched in 2015 the Renovation Pact 2050 in cooperation with the construction sector to make buildings energy efficient by 2050 by increasing the renovation rate of the housing stock¹⁸; the Walloon government adopted a new Decree on the energy efficiency of buildings (PEB) in January 2016, and a new one in December 2020, introducing an amendment to the calculation method for the energy performance of non-residential buildings and enforcing new energy efficiency standards for new constructions and system requirements for renovation¹⁹; also, the Renovation Strategy in response to the European Directive on EE (2012/27/EU)²⁰; in the Brussels Capital Region, the Energy Premium scheme is also in place, focused on three categories of priority measures for energy efficiency in buildings, namely audits, insulation and heat (heating and solar water heating)²¹.

In the Walloon region, to be able to benefit from the new housing bonus scheme (home improvement work and / or energy saving work) which came into force on June 1, 2019, it is necessary to call on a housing auditor, certified to carry out a preliminary audit of the accommodation. The Walloon region has therefore organized a new housing auditor training course which also incorporates safety, health, and sanitation criteria into the auditor's analysis of housing²². This new training has been active since May 2021²³.

18 *Energie Sparen, Renovatie Pact 2050*, <https://www.energiesparen.be/renovatiepact>

19 *Since January 1, 2021, buildings to be constructed in Wallonia must meet the NZEB (Nearly Zero Energy Building) or Q-ZEN (Quasi Zero Energy Building) standard. The requirements are therefore reinforced for new constructions. In renovation, the requirements applicable did not change. More information at: SPW Wallonie, Réglementation PEB*, <https://energie.wallonie.be/fr/reglementation-wallonne-sur-la-peb.html?IDC=7224>

20 <https://energie.wallonie.be/fr/strategie-de-renovation.html?IDC=9580>

21 *Brussels Environnement, Primes d'Energie 2021*, <https://environnement.brussels/thematiques/batiment-et-energie/primes-et-incitants/les-primes-energie-2021>

22 *The auditor also has to develop a renovation roadmap for the dwelling, aiming at an A level on the EPB certification scale for 2050...*

23 *SPW Wallonie*, <https://energie.wallonie.be/fr/index.html?IDC=6018>

In the last years, a series of professional profiles and occupations have been updated in terms of qualification in order to meet the current requirements related to energy efficiency and renewable energy systems.

The country did not provide specific skills needs related to energy efficiency in the national factsheets.

Finland

All new construction takes into account the latest energy efficiency regulations which in practice means buildings' nZEB rating. There are good skills, methods, know-how and training materials for energy-efficient new construction. Build Up Skills training materials for home builders are very up-to-date and will be partly updated later. It is clear, however, that the availability of a skilled workforce is a big challenge and needs to address by all various means.

The challenge in Finland is the building stock, which was mainly built after the Second World War. The amount of renovation will therefore increase dramatically over the next few years. The construction industry has identified the need for developing expertise in repair renovation at all levels. Based on the experience and good practices of the Build Up Skills Finland project it is considered necessary to carry out a site-specific competence update. One of the best practices developed was a "construction site ambassador" who brings the know-how straight to the sites with the support of training material supplemented with pragmatic guidance. One key finding is that training in energy efficiency and moisture protection should be offered in addition to electricians, HVAC installers and building automation installers.

Regarding skills needs related to energy efficiency, the following table shows those identified by the country in the national factsheets:

Future skill needed	Energy efficiency – Variation in the quality of construction
Target group/population	This is a matter of all possible target groups. In eyes of a VET provider, upskilling the existing workforce and people acquiring additional competence. Reskilling adults and the young primary vocational education. Responsibility of client who orders the construction work.
Current situation	Construction project schedules have accelerated, causing haste in the implementation of practical work. Construction projects consist of long subcontracting chains and numerous independent actors on construction sites. Obsolete quality of work is particularly evident in the energy efficiency of buildings.
Barriers	<ul style="list-style-type: none"> • There is no time to check the quality of the work thoroughly and well enough. • Insufficient attention is paid to the control and communication of construction projects throughout the subcontracting chain.
Measures to be undertaken	Construction sites need the guidance of experts specialising in ensuring energy efficiency. Electronic project management should also be considered in small businesses.

Table 1. Energy Efficiency. Finland

France

In France, compliance with environmental standards has been a condition for public support for energy renovation projects since 2016. Households wishing to undertake energy renovation work in their homes and benefit from public support (such as a zero-rate loan, less taxes, etc.) must use a company that holds a "Recognized Environmental Guarantor" (RGE) certification scheme.

Following the Covid-19 crisis, a national investment plan of more than 7 billion euros was set up for the French building sector, to facilitate, among other things, the energy transition. In addition, the National Assembly voted on 4 May 2021 on the Climate and Resilience Bill, which is the faithful translation of a very large part of the citizens' proposals for the climate. This law, if adopted, will also bring new perspectives for the building sector. For example, from 2025 onwards, it will no longer be possible to rent energy-intensive housing. In addition, 20 articles of the bill deal with the renovation of buildings, including energy renovation.

Controlling the energy performance of new and existing buildings is a priority, with the aim of reducing the average consumption of the building stock and having, by 2050, a stock of buildings that have been renovated to the level of the "Bâtiment Basse Consommation (BBC)" - renovation or similar label. In this context, the entire social housing stock will have to be renovated. In addition, all private residential buildings with a primary energy consumption of more than 330 kWh/(m²/year) will have to be renovated before 2025.

Regarding skills needs related to energy efficiency, the following tables show those identified by the country:

Future skill needed	Management of constraining environmental and energetic performance regulations
Target group/ population	Managers, company leading staff, worksite supervisors, team leaders.
Current situation	<p>The regulatory framework enforces new requirements in terms of energetic performance, which impact the companies' internal organization. The managers (company leading staff, worksite supervisors and, to a certain extent, team leaders) have to anticipate problematics and technical constraints on construction sites to respect regulations related to energy efficiency.</p> <p>A database of skills required for the energy transition has also been developed in France.</p>
Barriers	<p>Few existing training programmes intended to managers propose a global vision where energy efficiency is not tackled as a separate topic, but where it would be considered as a component of a global construction approach where it influences and modifies all the other aspects (organisational, technological, human and financial), through mutual interactions.</p>
Measures to be undertaken	<p>Promote a global approach of the projects related to energy efficiency in order to determine and implement appropriate organisational, technical, human and financial solutions and processes.</p> <p>Analyse the characteristics of the buildings in order to adapt the solutions provided.</p>

Future skill needed		Preparation of site managers and team leaders for the coordination of works aiming at energy efficiency improvements in the renovation of buildings	
Target group/ population		Site managers and team leaders	
Current situation		Building renovation is a specific challenge for site managers and team leaders, where new energy efficiency regulations must be applied by respecting specific building structures and their technical constraints. These publics need not only purely technical knowledge, but also specific competence enabling them to face complex professional contexts where acceptable compromises must be found between legal requirements and reality.	
Barriers		Many French companies declare that they have difficulties to recruit site managers and team leaders mastering sufficiently the organisation of works aiming at the implementation of energy efficiency in the renovated buildings. There is also a lack of appropriate training paths.	
Measures to be undertaken		Promote work-based learning to create stronger links between legal requirements in terms of energy efficiency and their concrete implementation conditions. Propose specific training aiming at energy efficiency implementation to the workers potentially able to become site managers or team leaders through internal promotion	

Table 2. Energy Efficiency. France

Germany

The annual report 2018/2019 carried out by BauInfoConsult showed that energy efficiency is one of the three most important trends for the construction sector in Germany, according to technicians for sanitation, heating and climate (accessibility 46 %, energy efficiency 40%, increasing construction costs 28%). The German government published a guideline about sustainable construction which is binding for federal buildings considering ecological, economic, sociocultural and technical aspects and should serve as an example for companies in the construction industry. Moreover, the government promotes energy consultancy.

Training centres and chambers of crafts organise courses about energy efficiency and energy-saving advice for professionals in the construction industry. However, an increased knowledge of materials and products of energy efficient building is necessary. Also, the procedures on how to adapt these products properly in the construction process should be trained earlier and be more explicit in trainings. A crucial role here is that practitioners on-site consider cross-crafts aspects, i.e. avoiding energy efficiency losses at the interfaces of two or more crafts, which work together in parallel or after another.

The country did not provide specific skills needs related to energy efficiency in the national factsheets.

Greece

Buildings account for roughly 40.0 percent of energy use in Greece, according to the National Energy and Climate Plan (NECP), published in 2019. As a result, the requirement is primarily focused on increasing building energy efficiency.

Renovation, NZEB and modernisation, as well as the adoption of matching measures for renewing the stock of end-of-lifecycle structures, are used to achieve this goal.

One of the key national priorities is the repair or construction of smarter buildings with superior insulating materials that are completely consistent with the concepts of circular economy.

Greece has set targets to reduce greenhouse gas emissions by more than 56% by 2030 compared to 2005 and to have a climate neutral economy by 2050.

Regarding skills needs related to energy efficiency, the following table shows those identified by the country in the national factsheets:

Future skill needed	a. BIM Expert b. Skills relative to NZEB & Renovation The main goal is to acquire the necessary technical and practical background for the design and implementation - installation of "smart" systems in building facilities.
Target group/ population	Construction professionals. Experts in renovation & energy efficiency. Technical workers.
Current situation	The country has been facing the phenomenon of brain drain and therefore, a scarcity in terms of its workforce. Furthermore, when it comes to energy efficiency, Greek buildings trail far behind. The adoption of BIM and training related to renovation and NZEB is beset by an overall skills deficit.
Barriers	Legal restructure is needed regarding the use of new technologies. Specifically for BIM, while it may be used in public construction project plans in Greece, there are still no standards or guidelines in place to guarantee that it is used in practice.
Measures to be undertaken	Specialised VET Training programmes should be designed. Moreover, economic incentives should be given to trainees for them to enjoy the benefits of moving to the new energy model as well as recognise the modern energy management technologies in "smart" system applications

Table 3. Energy Efficiency. Greece

Ireland

The EU Energy Performance of Buildings Directive (EPBD) was adopted in Ireland in 2006, amendments in 2010 and further updates in 2018. The Energy Efficiency Directive (EED) 2012 also set out improvements of energy efficiency in buildings. The Government in 2019 approved NZEB specifications and the National VET providers Education Training Boards, ETBs, have rolled out NZEB short programs across the country. Whilst energy efficiency skills are now recognised, it is still early days for the recognition of skills in green and sustainability.

The Programme for Government and the Climate Action Plan have set goals to reduce emissions from buildings and has set a target to retrofit 500,000 homes to a Building Energy Rating of B2 and to install 400,000 heat pumps in existing buildings by 2030.

The number of green buildings has increased significantly in Ireland over the last years thanks to the substantial social and economic impacts of going green (more productive workplace for occupants, mitigation of climate change, etc). Despite these encouraging results, the lack of educated green building professionals identified as a key obstacle to more green energy efficient building in Ireland.

There are several emerging occupations developed from the evolution of sustainable needs and the enforcement of energy efficient building pushed by the Government and by a number of public funded bodies such as Sustainable Energy Authority Ireland, SEAI.

In addition to lack of green skill, encouraging people into the construction sector continues to be an issue. The Department of Skills have set out a new 5-year action plan for apprenticeships to entice young people and females to take up apprenticeships with a new CAO system being implemented in 2022 and new incentives for employers. The new Human Capital Initiative project DASBE is also formed to collate the fragmented offers of training at NQF levels 4-9 using micro-credits with the endeavour to provide a streamlined training access and progression for everyone with a one-stop shop model.

Regarding skills needs related to energy efficiency, the following table shows those identified by the country in the national factsheets:

Future skill needed NSAI ²⁴ approved air permeability tester	
Target group/population	Construction Professionals, Technical energy experts, Craftworkers, BER Assessors
Current situation	Limited number of fully qualified testers nationally.
Barriers	Monitoring of their work is limited.
Measures to be undertaken	Require auditing on a regular basis by a regulatory body such as: NSAI or SEAI.
Future skill needed Green Building Assessors/Coordinators/Advisors	
Target group/population	Construction Professionals, Experts in renovation & energy efficiency; renewable energy experts, green and circular economy experts, BER Assessors
Current situation	Not existing
Barriers	Requires specific training criteria, an energy efficiency accreditation scheme for building professionals and energy efficient mortgages ²⁵ . Legislation may be required.
Measures to be undertaken	Introducing an environmental certification system for building professionals in Ireland. Develop a user-friendly holistic energy efficiency accreditation scheme for building professionals and energy efficient mortgages as stated in the Irish Green Building Council Build Upon recommendations. Require a fully accredited sustainable course covering green and NZEB Construction, high levels of IT literacy to transfer knowledge, communication Skills and systems thinking. The DASBE project will develop all these areas but will require extensive input from public bodies and industry.
Future skill needed Registered Technical Advisors on heat pumps (ASHP)	
Target group/population	Construction Professionals, Technical energy experts, Plumbing and Electrical Craftworkers
Current situation	SEAI have recently set up a list of registered technical advisors, however a huge increase in demand for heat pump installation is expected. Criteria includes currently registered as a domestic BER assessor and attendance at SEAI technical workshop.
Barriers	Limited access to obtain training in this area. Limited requirements on technical expertise in the field of heat pump installation.
Measures to be undertaken	Increase provision of quality in depth training nationally. This training can also be incorporated in a number of existing HEI programmes. Additional short SPA modules are to be developed with collaboration with the Engineers Ireland and LIT addressing the gap and need for certified advisors following the new code of practice series of the NSAI SR50 and especially the (S.R.) 50-4:2021 - Building Services – Part 4: Heat pump systems for dwellings.

²⁴ National Standards Authority of Ireland <https://www.nsai.ie/>

²⁵ An energy efficient mortgage (EEM) (or "green mortgage") is a loan product that allows borrowers to reduce their utility bill costs by allowing them to finance the cost of incorporating energy-efficient features into a new housing purchase or the refinancing of existing housing.

NZEB qualified craftworkers (plumbers, electricians, carpenters, plasterers, bricklayers)	
Target group/population	Apprentices, Craftworkers, Technical Experts and Workers, Site Supervisors, Young people interested in Apprentices
Current situation	NZEB Specifications were approved by the Government in August 2018. NZEB accredited programmes developed in 2019 are provided alongside existing apprenticeships for all VETs and HEIs usage. These 2- or 3-day courses (depending on the target group) are delivered in a blended format using online theory and 1 day practical. This is being further advanced with the use of a mobile VR training unit. Trainers are also being upskilled by LIT with accreditation NQF level 7 program to be rolled out for next 2 years.
Barriers	Uptake may be slow due to increase in the construction activity nationally. Input from CIF, Public Bodies (SOLAS) and Green tender procurement process is crucial to ensure roll out and sustainability.
Measures to be undertaken	Strategic plan to be developed by public bodies, VET and HEIs and approved by the Government to roll out nationally in 6 ETBs. Future apprenticeships need to incorporate the short modules into the apprenticeship programme. Trainers are to be continuously upskilled.

Table 4. Energy Efficiency. Ireland

Italy

With the transposition of European directives on energy efficiency and renewable energy sources and with targets to reduce fossil fuel consumption and CO2 emissions (carbon dioxide), Italian regulatory framework has provided specific objectives in training and qualification of some figures that are involved in the building process, both for new buildings and for the renovation of existing buildings. In particular, were set:

- requirements that technicians who issue the Energy Performance Certificates of buildings must have, providing in some cases mandatory training courses to register in regional registers;
- requirements for technicians that perform energy audits of buildings;
- requirements for technicians who install renewable heat or electricity production plants, in addition to legal existing requirements for all plant installers.

As for the other figures involved in the construction/renovation phases, given the increasingly high levels of energy performance, indications about correct execution of the thermal insulation by means of "coat insulation" solutions and correct installation of windows including fixtures have been codified in the UNI standards (the voluntary standardization body in Italy). On the basis of the Uni standards, it is possible to certify, voluntarily, the competence of operators to perform relative machining.

A lot of training and retraining courses about these subjects are carried out by the system of building schools throughout the country and these have been particularly required after the entry into force of energy requirements for NZEB buildings (Near Zero Energy Building), introduced by Directive 2010/31/EU.

Another figure, provided by the voluntary systems of "environmental sustainability of buildings", is the certifier of environmental sustainability. This figure is regulated by individual systems, and it hasn't public recognition since it refers to a plurality of requirements not merely energy-related.

Regarding skills needs related to energy efficiency, the following tables show those identified by the country:

Skill needed		Energy certifier
Target group/population	Information not available.	
Current situation	It is regulated by law.	
Barriers	rTo access you must have certain qualifications, in some cases it is required an additional training.	
Measures to be undertaken	Information not available.	
Skill needed		Expert in energy diagnostics
Target group/population	Information not available.	
Current situation	It is regulated by law.	
Barriers	Energy audits can be drawn up by a qualified professional. In some cases the expert must be certified in according to UNI standards.	
Measures to be undertaken	Information not available.	
Skill needed		Installer of renewable source plants
Target group/population	Information not available.	
Current situation	Qualification required by law.	
Barriers	In addition to the titles required for the registration to the list of local installers of plants, it is necessary following a specific course held by the Regions.	
Measures to be undertaken	Information not available.	
Skill needed		Installation of insulation systems
Target group/population	Information not available.	
Current situation	Voluntary qualification on the basis of UNI standards.	
Barriers	Participate in specific training course. Possible certification following final examination.	
Measures to be undertaken	Information not available.	
Skill needed		Installation of fixtures and doors
Target group/population	Information not available.	
Current situation	Voluntary qualification on the basis of UNI standards.	
Barriers	Participate in specific training course. Possible certification following final examination.	
Measures to be undertaken	Information not available.	
Future skill needed		Green Building Assessor
Target group/population	Information not available.	
Current situation	Voluntary qualification based on the requirements of the various voluntary certification schemes for the energy-environmental sustainability of buildings.	
Barriers	Participate in specific training course. Possible certification following final examination.	
Measures to be undertaken	The diversity of requirements in the different sustainability protocols doesn't favour the correct perception by users the real level of the building environmental performance. A standardisation of requirements and uniformity of assessment criteria/ methods used it would be necessary.	

Table 5. Energy Efficiency. Italy

Lithuania

The efficient use of energy resources and energy is one of Lithuania's key long-term strategic objectives in the energy sector. One of the objectives set in The National Energy Independence Strategy (approved in 2018) is Energy efficiency improvement.

The construction sector is expected to need 35,000 to 40,000 workers to be trained in energy-efficiency of buildings, even though no official data is available on the number of already trained workers. Nevertheless, according to a survey conducted among construction companies, it is reported that about 40% of workers have received training in energy efficient construction of buildings, while 30% have been skilled in renewable energy.

Regarding skills needs related to energy efficiency, the following table shows those identified by the country in the national factsheets:

Future skill needed	
Facade installers for energy efficient buildings	
Target group/population	Young people who want to gain a qualification, working people who want to improve their qualification.
Current situation	The construction sector is affected by both skilled and unskilled labour shortages, mainly for building construction workers. Modernization of buildings and a start of the construction of nearly zero-energy buildings have increased demand for facade installers.
Barriers	The shortage of construction workers, as well as other skilled manual workers is affected also by a limited amount of young people undertaking VET and as a consequence of emigration of skilled manual workers to countries offering considerably higher salaries.
Measures to be undertaken	There is a need to: <ul style="list-style-type: none"> ➤ improve VET quality, attractiveness and responsiveness to labour market needs; ➤ implement measures to stop emigration of skilled workers; ➤ implement training courses in order to gain new competences, qualifications. ➤ Upgrade skills and competences of VET trainers in order to provide them with the knowledge of new know how.
Future skill needed	
Thermal insulators: Thermo bridge skills (preventing thermal bridges)	
Target group/population	Young people who want to gain a qualification, working people who want to improve their qualification.
Current situation	Due to implementation of the Directive on the energy efficiency of buildings, the new technologies have to be deployed. Construction industry faces a variety of structural problems: many companies lack skilled workforce, young people are not particularly attracted to the working conditions in this sector.
Barriers	A limited amount of young people undertaking VET and as a consequence of emigration of skilled manual workers to countries offering considerably higher salaries. There is a lack of highly qualified teachers.
Measures to be undertaken	There is a need to improve VET quality, attractiveness and responsiveness to labour market needs. Implement measures to stop emigration of skilled workers. To implement training courses in order to gain new competences, qualifications as well as BIM competency. Improvement of VET trainers' skills through implementation of teacher training programs.

Future skill needed	
Windows Installer for A+, A++ energy efficiency class buildings	
Target group/population	Working people who want to improve their qualification
Current situation	Due to implementation of the Directive on the energy efficiency of buildings, the new technologies have to be deployed. Construction industry faces a variety of structural problems: many companies lack skilled workforce, young people are not particularly attracted to the working conditions in this sector.
Barriers	A limited amount of young people undertaking VET and as a consequence of emigration of skilled manual workers to countries offering considerably higher salaries. There is a lack of highly qualified teachers.
Measures to be undertaken	There is a need to improve VET quality, attractiveness and responsiveness to labour market needs. Implement measures to stop emigration of skilled workers. To implement training courses in order to gain new competences, qualifications as well as BIM competency. Improvement of VET trainers' skills through implementation of teacher training programs.
Future skill needed	
Ventilation and air conditioning systems installer for A+, A++ energy efficiency class buildings	
Target group/population	Young people who want to gain a qualification, working people who want to improve their qualification.
Current situation	Due to implementation of the Directive on the energy efficiency of buildings, the new technologies must be deployed. Construction industry faces a variety of structural problems: many companies lack skilled workforce; young people are not particularly attracted to the working conditions in this sector.
Barriers	A limited amount of young people undertaking VET and as a consequence of emigration of skilled manual workers to countries offering considerably higher salaries. There is a lack of highly qualified teachers.
Measures to be undertaken	There is a need to improve VET quality, attractiveness and responsiveness to labour market needs. Implement measures to stop emigration of skilled workers. To implement training courses in order to gain new competences, qualifications as well as BIM competency. Improvement of VET trainers' skills through implementation of teacher training programs.

Table 6. Energy Efficiency. Lithuania

Poland

Over last years, Poland has made significant improvements in energy efficiency, a topic which benefits from a strong governmental commitment. As a result, energy efficiency has improved in the main industry sectors in recent years, and Poland managed to reduce their energy intensity faster than the EU-28 average until 2015. The number of certified green buildings in Poland has increased over the years. A voluntary building certification program has also been developing in the last years; it should be emphasized, however, that many buildings that meet the certification standards do not have them, because the owners see no need to incur additional costs.

On the other hand, there is a shortage of employees in the field of low-energy construction, project managers in this field, construction managers and employees using BIM, specialists dealing with the recovery of building materials and waste management.

Regarding skills needs related to energy efficiency, the following table shows those identified by the country in the national factsheets:

Future skill needed	Skills in a digitalised energy efficiency construction sector
Target group/population	Information not available.
Current situation	The number of construction investments that take into account energy efficiency is growing, although it is still insufficient. All new investments require energy efficiency certificates. More and more buildings are applying for LEED and BREEAM certificates. Many modernizations and renovations of existing buildings are underway. The use of BIM is developing. New building materials (cement and other nanoelements) are being used more and more often.
Barriers	Lack of systemic education in new technologies and materials in the formal path No quality control of training in the non-formal system.
Measures to be undertaken	The need to broadly integrate new technologies into the core curricula in the formal path. The need to develop new market qualifications in the Integrated Qualifications System. The need to provide quality control tools for training in the non-formal path.

Table 7. Energy Efficiency. Poland

Portugal

In Portugal only a third of the buildings built after 1990 meet the requirements for energy efficiency, thus being one of the EU countries where the greatest thermal discomfort is experienced. The National Energy and Climate Plan (PNEC)²⁶ has improvement objectives, regarding the energy efficiency of buildings, to be implemented by 2030. Among the objectives of this Plan is a 35% reduction in primary energy consumption, but for that it has equip buildings with greater energy efficiency.

Civil construction is a sector with strong contrasts, low levels of qualification, strong tenacity of professions, low salary levels and a high number of precarious work situations. Qualified Personnel represents only 30% of total employees and Highly Qualified Personnel represents less than 3%. There is currently a shortage of around 70,000 skilled workers in the sector; energy efficiency skills should be integrated in the education and training programmes.

The country did not provide specific skills needs related to energy efficiency in the national factsheets.

Slovenia

The Slovenian government has published a Strategy for Improving the Energy Efficiency of Buildings. This document clearly reflects the approach that the Slovenian National Housing Fund is taking to decarbonisation. The strategy is linked to the objectives of the European Green Deal and promotes the implementation of measures to achieve zero emissions in new buildings as well as the sustainable renovation of old buildings.

In the long term, the country aims to gradually transform the entire stock of existing housing in the country so that it complies with the requirements. The renovation of old buildings includes measures to improve their thermal insulation, to reduce water consumption or the installation of renewable energy sources, among others. Among them, the objective of incorporating centralised heating systems in all buildings in use by 2050 stands out.

26 https://ec.europa.eu/energy/sites/default/files/documents/necp_factsheet_pt_final.pdf

The country did not provide specific skills needs related to energy efficiency in the national factsheets.

Spain

In relation with the current status of the energy efficiency in Spain referred to buildings, it is necessary to mention the so-called ERESEE 2020, Long-term strategy for Energy Rehabilitation in the Spanish Building Sector. This strategy has been very positively valued by the European Commission, and has been assessed by the BPIE Buildings Performance Institute Europe as the best of the national strategies submitted to the EU as mandated by Directive 2010/31/EU .

On the other hand, Spain has implemented the directive 2018/844/EU which aims to accelerate the cost-effective renovation of existing buildings and, more specifically, introduces building automation and control systems as an alternative to physical inspections, encourages the deployment of the necessary infrastructure for e-mobility, and introduces an intelligence indicator to assess the technological aspects of the building. With regards to nearly zero energy buildings (nZEB), there are also applicable regulations which are already being amended to adapt them to the new directives.

In addition, the Integrated National Energy and Climate Plan defines what Spain must do until 2030 to achieve the energy efficiency (32.5%) and Renewable Energy (40%) targets in line with the European Union's commitments. This is the first time that a Plan has been drawn up and integrates energy and environmental issues or the fight against climate change.

Regarding skills needs related to energy efficiency, the following table shows those identified by the country in the national factsheets:

Future skill needed	Global energy efficiency skills
Target group/population	All construction workers irrespective the sub-sector or activity they work in.
Current situation	Isolated training, designed for each trade, without taking into account the decisive interactions to achieve efficient energy performance. Thermal losses, poor finishes, loss of potential improvements. Economic impact.
Barriers	Lack of holistic and integral vision of the necessary interaction between trades and crafts involved in energy efficiency renovations.
Measures to be undertaken	Incorporate a general training of awareness and understanding of the elements and the existing interactions between trades to achieve adequate energy efficiency ratios.

Table 8. Energy Efficiency. Spain

6.3. Topic 2. Circular economy

Numerous studies have confirmed that climate change is a global threat. Experts agree that the best option for the future is to protect nature and biodiversity. In this context, the construction sector has a great challenge and a great opportunity to position itself as a driver of change by working and providing sustainable solutions. Given the volume of natural resources it mobilises and the fact that it is a key sector of the economy, embracing the circular economy can make a significant difference. To be prepared for this purpose, the suitable qualification of all those involved in the sector is currently of paramount importance.

Belgium

At the end of 2011, the principles of sustainable materials management and circular economy were anchored in the Flemish legislation through the adoption of the Materials Decree²⁸. To facilitate the transition towards a circular economy, OVAM launched the Flanders' Materials Programme (FMP) in 2012²⁹.

In March 2016, Brussels Capital Region has adopted a Regional Program for Circular Economy. It aims to turn environmental objectives into economic opportunities, to optimize resource and territorial use while creating added value locally, and to create more jobs.

This plan identifies Construction as one of the priority sectors. The needs are to increase the lifecycle of buildings (maintenance, monitoring, and renovation) and to use construction resources in an efficient way (notably re-using construction materials). New cooperation models and new business models applied to the construction sector are also of interest (sharing economy, functionality economy)³⁰.

CDR Construction, the Brussels Professional Reference Centre for the construction sector, commissioned in 2021 a preliminary study on the impact of the emergence of the circular economy on the construction trades in the Brussels-Capital Region. This study identified several skills necessary in the context of the circular economy:

- knowledge of regulations
- the drafting of specifications clauses
- knowledge of materials
- knowledge of deconstruction
- knowledge of innovative technologies

In 2020, the Walloon government defined a development strategy for the circular economy: "Circular Wallonia". Several skills needs have been identified. Training has been set up, in particular in taking the circular economy into account in specifications, drafting social clauses, anti-dumping measures and waste management .

²⁸ *Decreet betreffende het duurzaam beheer van materiaalkringlopen en afvalstoffen*, 23 December 2011,

https://www.ejustice.just.fgov.be/cgi_loi/change_lg.pl?language=nl&la=N&table_name=wet&cn=2011122333

²⁹ OVAM, *Materiaalbewust bouwen in kringlopen*, <https://www.ovam.be/sites/default/files/atoms/files/Milieuverantwoord-milieugebruik-bouw.pdf> (page consulted on the 20th of May 2021)

³⁰ *Be Circular, Programme Régional en Economie Circulaire 2016-2020*, https://document.environnement.brussels/opac_css/elecfile/PROG_160308_PREC_DEF_FR

Regarding skills needs related to circular economy, the following table shows those identified by the country in the national factsheets:

Future skill needed	Waste management & circular economy
Target group/population	All actors of the construction value chain, both in first-degree courses and continuing education
Current situation	Not enough awareness, current behaviours, fear of increased costs
Barriers	Difference in waste policy among the three regions, new requirements in the three regions, distrust in recycled products performances
Measures to be undertaken	Awareness campaign and training actions, stimulate creativity of architects, monitoring of field work

Table 9. Circular Economy. Belgium

Finland

The first circular economy road map was published in 2016 in Finland. Its continuation updates Finland's steps to sustainable success and change the financial scenario.

Sustainability has already become a key part of some advanced business operations and competitiveness. The change has taken place in a very short time. However, the construction industry is not among the first to put the principles into practice, but it is only a matter of time when a business based on the principles of sustainable development is also commonplace in construction. Big companies bringing solutions are to be the first in practice.

It is generally accepted that circular economy expertise should be increased at all levels meaning expert work, management designing and planning, leadership, and production work itself. The Finnish Innovation Fund Sitra has designed and implemented educational material for all school levels; it is ready for use but must be tailored and implemented in vocational training separately.

Regarding skills needs related to circular economy, the following table shows those identified by the country in the national factsheets:

Future skill needed	Circular Economy - understanding of sustainability (circularity, waste management)
Target group/population	Upskilling the existing workforce and people acquiring additional competence. Reskilling adults and the young primary vocational education.
Current situation	Sustainability is not seen as a sufficiently important theme in relation to basic construction skills. Only little attention is paid to the recycling of materials in teaching.
Barriers	<ul style="list-style-type: none"> ➤ Attitudes change very slowly even though there is an understanding of the issue. ➤ The topic is not considered particularly important in vocational training.
Measures to be undertaken	<p>Developing curricula so that new phenomena, such as sustainable development, are also taken into account.</p> <p>Deepening cooperation between vocational training and expert organizations.</p>

Table 10. Circular Economy. Finland

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- 31 Circular Wallonia, Stratégie de développement de l'économie circulaire, https://developpementdurable.wallonie.be/sites/default/files/2020-07/Circular_Wallonia.pdf
- 32 Be Circular, Roadmap 2019, https://www.circulareconomy.brussels/wp-content/uploads/2019/06/BE_beCircular_feuille-de-route-CD_def_FR1.pdf

France

The transition to the circular economy is recognised in France as one of the objectives of the energy and ecological transition. This concept was introduced in the Energy Transition for Green Growth Act of 2015. The aim is to produce using less material, and to promote the reuse of raw materials by recovering them. In this context, waste management takes on a new dimension. In addition, the law provides for a drastic limitation of plastic production, penalization of programmed obsolescence, fight against food waste, etc.

It also provides objectives in terms of waste management: reducing the quantity of household waste by 10% by 2025, stabilising the quantity of industrial waste, reaching 65% by 2025 for recycling so-called non-hazardous waste. The construction sector is largely concerned by these ambitions. In this context, the year 2021 sees a wave of new standards and rules applying to construction. This is the case, for example, for waste management on the construction sites, with an increase from five to seven streams to be sorted.

Regarding skills needs related to circular economy, the following tables show those identified by the country:

Disassembling/dismantling constructions	
Future skill needed	
Target group/population	Construction company managers
Current situation	Increasing scarcity of resources and higher costs of demolition/rebuilt.
Barriers	Slow awareness of the increasing scarcity of raw materials and natural resources (water, energy and others).
Measures to be undertaken	Implication of various crafts in the processes of disassembling and dismantling. Identifying reusable products and sort them adequately. Develop new processes for deconstruction.
Management of environmental aspects, waste collection and recycling on worksite	
Future skill needed	
Target group/population	Site managers, team leaders
Current situation	Workers are still not sufficiently aware of environmental aspects, especially the collection and recycling of construction waste. Site managers and team leaders have a role to play in improving the situation.
Barriers	Specific conditions on renovation sites which do not always allow for compliance with all waste collection and recycling standards, for organisational and financial reasons.
Measures to be undertaken	Strengthen training provision to enable site managers and team leaders to better communicate with workers, company leading staff and other partners to find appropriate solutions to implement proper waste management on worksite.

Table 11. Circular Economy. France

Germany

Although Germany has a Circular Economy Law (Kreislaufwirtschaftsgesetz) and construction processes have to be adapted along this, it does not cover a big part in the formal VET for apprentices. Special courses dealing with circular economy aspects are booked by companies and practitioners occasionally. Circular Economy should receive a bigger part in future initial VET curricula. Hence, so called Standard Vocational Training Positions have been adjusted recently and came into force end of 2020. These have to be considered when VET regulations are revised, one of these VET

regulations deals with environmental protection, sustainability and circular economy. Thus, circular economy will be considered more in VET curricula.

Regarding skills needs related to circular economy, the following table shows those identified by the country in the national factsheets:

Future skill needed	Recycling economy
Target group/population	All (individual) persons and corporate bodies in Germany that are in a position to implement measures for recycling economy or train people in circular economy such VET centers.
Current situation	VET regulations are in force on the national level. VET curricular on the regional level must reflect VET curriculars.
Barriers	Cost increases in the disposal area of mineral construction waste counteract.
Measures to be undertaken	Building industry demands construction waste utilization law (Mantelverordnung) which passed the Federal Parliament in May 2021. Co legislators (Bundesrat) also have to sign, after that the regulation will come into force two years later.

Table 12. Circular Economy. Germany

Greece

Along with the National Energy and Climate Plan (NECP), in September 2020, the Hellenic government adopted the National Waste Management Plans, which will lead operations in circular economy through 2030.

The challenge lies in achieving the planned objectives and recycling quotas by 2030 and reducing the greenhouse gas transmissions from the waste sector as a whole.

Regarding skills needs related to circular economy, the following table shows those identified by the country in the national factsheets:

Future skill needed	Skills related to Construction and Demolition Waste
Target group/population	Construction professionals. Experts in renovation & CD Waste. Technical workers.
Current situation	In Greece, there are some operating systems for alternative CDW administration. However, the country lacks suitable locations for temporarily storing CDW until they are processed.
Barriers	Incentives for recycling are lacking, as is awareness of the need to adjust behaviours toward resource sustainability and green growth.
Measures to be undertaken	Enhancement of the Greek construction industry's capacity to respond to the skills requirements arising from the transition to a circular economy. This should be achieved by adequate restructure of the VET system in order to become equipped to meet such training requirements.

Table 13. Circular Economy. Greece

Ireland

The Waste Action Plan for a Circular Economy is Ireland's new roadmap for waste planning and management (2020) and will inform and give direction to waste planning and management in Ireland over the coming years. This is followed by an All Government Circular Economy Strategy (2021) which is to include reducing waste, shrinking our carbon footprint, supporting local and regional economic development, growing new business models and providing skilled employment opportunities.

In the report "Towards circular economy in construction", the Irish Green Building Council (IGBC) emphasises the urgency to assess low carbon, healthy, responsible products for the construction sector. The key initial step is to raise awareness amongst policy makers of the importance of embodied carbon in new construction and infrastructure as a part of Ireland's carbon mitigation strategy. This should be accompanied by, for example, a capacity building strategy amongst construction professionals on building level life cycle assessment; better quality Life Cycle Assessment data on products encouraging Irish producers to develop Environmental Product Declaration and generic data for Ireland's construction products to fill the gaps and embodied carbon benchmarks to allow better comparison of buildings similar to the current BER for operational energy. It could be necessary to develop standards or material passports to provide confidence as to composition and performance, allowing materials to be reused in future and to develop capacity amongst professionals to design for deconstruction.

Although Ireland did not provide specific skill needs related to circular economy in the national factsheets, the new emerging requirements to acknowledge and initiate the action of recycling, waste prevention and reusing materials (lean construction) is required at all levels in the construction chain with reference to the Climate Action Plan 2019, waste action plan (2020) and the circular economy plan (2020). Circular Economy Checklists for the Construction have been developed for each phase of construction (clients, designers, contractors, product manufacturers and quantity surveyors).

Future skill needed	Recycling economy
Target group/population	Construction Workers, Site Supervisors, Project Managers, Construction Professionals, Green and energy experts, Clients
Current situation	Circular economy Checklist Construction for all phases are to be considered at national level and although not mandatory many companies are addressing these areas especially within the green public procurement requirements.
Barriers	No existing training is available to address the new policies, although there is progress in training at design and coordination levels in the form of LCA/LCC and lean management short modules and webinars.
Measures to be undertaken	Building industry demands construction waste management and further training to be provided for the construction industry for all phases of the construction chain. DASBE is to implement a number of short modules to address this gap and need.

Table 14. Circular Economy. Ireland

Italy

Italy is among the reference markets in Europe in the field of the circular economy, according to a recent study carried out at the request of Conai (National Consortium for Packaging Recycling). Italy recycles almost twice the total waste compared to the European community, with a rate almost 30% higher than the rest of Europe. In particular, according to the National Recovery and

Resilience Plan (PNRR), Italy ranks above the EU average for investment in the circular economy and resource productivity. However, there are a lot of disparities between regions, and above all, a national strategy for the circular economy is lacking.

Italy's project proposals on the circular economy within the PNRR aim to address structural gaps that hinder the development of the sector through:

- Improving waste management,
- Modernization and development by implementing waste treatment facilities,
- Overcoming the gap between northern and central-southern regions.

In addition, the new national strategy for the circular economy will be adopted by June 2022, in line with the Circular Economy Action Plan and the EU regulatory framework. The new strategy will address eco-design, eco-products, blue economy, bio-economy, critical raw materials, and will focus on tools, indicators, and monitoring systems to assess progress in achieving set goals.

The new waste traceability system (RENTRI), which is in an experimental phase, will also be part of the national strategy.

Regarding skills needs related to circular economy, the following table shows those identified by the country in the national factsheets:

Future skill needed	Circular economy
Target group/population	Environmental experts (technician EQF 5)
Current situation	<ul style="list-style-type: none"> ➤ Scarcity of waste collection and treatment facilities ➤ Insufficient planning capacity of regions ➤ Weakness of governance ➤ Still difficult also if there is the law
Barriers	No existing training is available to address the new policies, although there is progress in training at design and coordination levels in the form of LCA/LCC and lean management short modules and webinars.
Measures to be undertaken	Building industry demands construction waste management and further training to be provided for the construction industry for all phases of the construction chain. DASBE is to implement a number of short modules to address this gap and need.

Table 15. Circular Economy. Italy

Lithuania

Circular Economy in Lithuania has been lacking wider appreciation among policy makers and traditional business sectors. EU's Circular Economy Strategy requests Lithuania to establish the full waste management cycle, with proper collecting, sorting and recycling. Lithuanian civil society organizations have been playing an active role in involving the population in the process towards zero waste and helping to reduce the per capita production of residual waste.

According to Eurostat data, in 2016 Lithuania had a very high recovery rate of 97 % (EU-28 average was 89 %). In contrast, Lithuania performs above the EU-28 average in terms of the number of people employed in the circular economy (2.71 % of total employment in 2016, EU-28 average is 1.73 %). Lithuania supports the EU circular economy package and the shift to the circular economy in general, however, it needs to take further steps in this area. As of 2018, there is no national strategy or roadmap on the circular economy. New circular economy targets on waste will be integrated into the National Waste Prevention and Management Plan for the period 2021–2027.

The country did not provide specific skills needs related to circular economy in the national factsheets.

Poland

The aim of Poland's Roadmap towards the Transition to the Circular Economy, adopted in 2019, is twofold: first, to identify cross-cutting measures capable of having the broadest possible impact in Poland, both socially and economically; and second, to prioritise areas that will enable Poland to take advantage of its current opportunities, and to deal with existing or future challenges.

Circular Economy generates a new area of necessary competences in Poland: according to the recommendations of the European Commission, 70% of demolition materials are to be recovered in the EU in 2023. However, employers point to insufficient practical preparation of school graduates and to too slow adaptation of education programs to the changing needs of the sector, new techniques and technologies appearing in particular in the following processes: construction and assembly, technical maintenance of a building as well as demolition of a building and reuse of materials construction in a circular economy.

The country did not provide specific skills needs related to circular economy in the national factsheets.

Portugal

The Circular Economy Action Plan (PAEC) was approved in December 2017 and identifies some priority areas and sectors to encourage projects in circular economy. Civil Construction is one of the sectors that most consumes the raw materials and, at the same time, the most produces waste (RCD) from construction and demolition, representing the largest waste stream in the EU.

The country did not provide specific skills needs related to circular economy in the national factsheets.

Slovenia

The Slovenian parliament approved at the end of 2019 an initiative to adopt a proposal led by EIT Climate-KIC, called "Deep Demonstration on Circular and Regenerative and Low Carbon Economy in Slovenia".

Thus, the Slovenian Government has defined the abandonment of traditional linear economic models and the transition to circular economy systems as one of the country's strategic development priorities and as an important building block of the carbon-neutral future.

The country did not provide specific skills needs related to circular economy in the national factsheets.

Spain

In 2015, the generation of construction and demolition waste (CDW) represented 54% of the CDW sent to landfill in Spain. The construction of buildings produced 71% of the CDW, compared to 29% of the civil works. Although there is no system of indicators to assess the circularity of the construction sector it could be observed that currently only 40.9% of construction and demolition waste declared are recovered in some way, when the aim established at EU level for 2020 is 70%. In this sense, it is estimated that 24% of the CDW is deposited in landfill and 30% is still an uncontrolled landfill.

Education, training and awareness-raising has been widely understood as an important global challenge to be applied to the entire value chain. It is necessary to act in the education and training of all the professionals who participate in the construction sector with the principles of the circular economy. To this extent, it is considered essential to influence the different training programs to include this type of criteria, principles and concepts and also the need to organise specialised recycling courses adapted to each professional.

Regarding skills needs related to circular economy, the following table shows those identified by the country:

Future skill needed	Ensuring proper management of construction and demolition waste
Target group/population	On-site environmental management technicians and site management profiles with specific CDW management functions that enable the revaluation of waste and its integration into the value chain.
Current situation	The generation of construction and demolition waste (CDW) represents more than 50% of the CDW sent to landfills in Spain, mostly derived from the construction of buildings.
Barriers	Cultural acceptance, lack of awareness among suppliers and customers. Lack of knowledge about the benefits. Difficulty of access to financing and economic barriers. Technological obstacles and lack of technical skills.
Measures to be undertaken	Awareness-raising and training measures need to be implemented, which are key to initiating change processes. In addition, changes in policy and legislation need to be put in place.

Table 16. Circular Economy. Spain

6.4. Topic 3. Digitalisation

Digitalisation in the construction sector can bring significant opportunities for the whole value chain not only by improving existing practices, but also by integrating disruptive technologies and tools that can lead to new processes, business models, materials, and solutions. They also can be applied not only throughout all phases of the construction process, but also at any point of the building's lifecycle.

Belgium

According to a survey conducted by the Confederation Construction³⁴, digital technologies are not well integrated within the Belgian construction sector. Only large companies are familiar with such technologies and use them within building processes in an efficient manner.

As a result of the survey, it was stated by the majority of respondents that do not have access to those technologies, that the use of digital technologies is not necessary in order to fulfil their task properly. However, respondents who use them on a daily basis affirm that it is a matter of time that digitalisation becomes a key element for the construction industry.

Regarding skills needs related to digitalisation, the following table shows those identified by the country in the national factsheets:

Future skill needed	Digitalisation
Target group/population	Carpenter, joiner, road worker and installer of joinery closures ³⁵ More generally, construction companies with less than 20 workers ³⁶
Current situation	Fear that digitalisation could be synonym to less employment
Barriers	Reluctance to change, lack of young workers, education programmes lagging behind
Measures to be undertaken	Awareness-raising campaigns, training courses, social networks, training actions, smart cities

Table 17. Digitalisation. Belgium

Constructiv, the training fund for the construction sector in Belgium, was invited in 2021 to respond to the Forem (Walloon public office for vocational training and employment) questionnaire on occupations under recruitment pressure for the construction sector. This analysis makes it possible to establish the list of trades subject to recruitment tension(s), to identify the tensions linked to these trades, to take stock of the recruitment channels used by construction and construction companies and to locate companies in the sector in relation to the training of candidates. This analysis reviews among other things the lack of digital skills by profession. The professions identified as lacking digital skills are, in the Walloon Region, those of carpenter, joiner, road worker and installer of joinery closures³⁷.

³⁴ Survey conducted within the Forum Construction 2017

³⁵ "Sector analysis of jobs under recruitment pressure in 2021", Constructiv, April 2021

³⁶ Confédération Construction, Rapport annuel 2017, La construction numérique, balise pour une transition réussie, https://embuild.be/sites/default/files/files/2021-06/Rapport%20Annuel_Confederation%20Construction_2016_2017_FR_WEB-190617.pdf

³⁷ "Sector analysis of jobs under recruitment pressure in 2021", Constructiv, April 2021

Finland

The fluent use of professional technical equipment and applications requires both good basic skills and application-specific training.

Training in the use of special professional tools is justified in basic vocational training when the use of this technology is sufficiently general, and the skills are widely used in the profession. Schools can play a certain role in the training of special techniques and applications but because the field of needed skills is so fragmented, training is planned on a case-by-case basis.

Studies and pestle analysis show clearly that the use of building data model (BIM) based applications on construction sites will become more common. This would seem to be a major challenge for VET in the near future.

In addition, there is a clear need for input for the professional use of mobile devices and applications.

Regarding skills needs related to digitalisation, the following table shows those identified by the country in the national factsheets:

Future skill needed		Digitization - knowledge of construction specific application programs
Target group/population		Upskilling the existing workforce or people acquiring additional competence. Reskilling adults and the young primary vocational education.
Current situation		The ability of employees to use application programs is limited.
Barriers		<ul style="list-style-type: none"> ➤ There is a conservative view in the industry of the importance of the skills required. ➤ General perception is that especially young people master digitization and know how to use application programs. ➤ Teaching emphasizes craftsmanship.
Measures to be undertaken		Training in the construction industry should include the teaching of application programs typical of the industry. Working life cooperation practices must be developed taking into account electronic practices
Future skill needed		Digitization - building automation
Target group/population		Upskilling the existing workforce and people acquiring additional competence. Reskilling adults and the young primary vocational education.
Current situation		Building automation is taught separately from construction skills. However, construction skills should be seen as a whole from primary vocational education onwards.
Barriers		<ul style="list-style-type: none"> ➤ Pedagogical arrangements within VET schools consist of resources not necessarily in terms of areas of expertise. ➤ Teaching emphasizes craftsmanship.
Measures to be undertaken		Invest in management skills of VET schools and especially in development in cooperation of sectoral based working life.

Table 18. Digitalisation. Finland

France

Digital skills would be essential to decompartmentalise crafts and to elaborate long-term development strategies that would include ever more energy audit, circular economy or specific industrial programs for any kind of professionals. Digital methods and instruments can also be learned "playfully" and easily to overcome the fear of them. Thus, virtual, augmented & mixed reality could be a way, especially on construction sites. Scenarios of different options of "building evolution in a changing urban landscape" could be helpful to imagine desirable and feasible futures, if both end-users, manufacturers and R&D actors could play interactively to feel pros and cons and forge consensus.

Regarding skills needs related to digitalisation, the following table shows those identified by the country in the national factsheets:

Future skill needed	Digital skills to combine technological changes in the construction sector and company performance (all crafts and functions)
Target group/population	Company owners and managers. Quality assurance officers. Worksite supervisors.
Current situation	The ability to combine skills to integrate all evolutions (technological, organisational, normative, financial, etc.) is not always well taken into account by training organisations. Digitisation is not always understood as a complement to human innovation, but as a replacement of man. Nevertheless, many workers and managers are good professionals, even if they do not master digital skills sufficiently.
Barriers	It is easier to learn each technique separately than to see the combination of techniques to deal with a complex situation on site. There are still natural barriers to digital skills in companies (not only workers, but also other staff): cultural, apprehension and fear of doing it wrong, etc.
Measures to be undertaken	Introduce more complexity and work-based approach to digital skills. The improvement of digital skills should be done at all levels in the company, in a circular way, with a gradual build-up: for example, it is possible to teach BIM from level 3 (EQF) and go up to level 8, introducing more complexity at each stage.
Future skill needed	Digitisation: an approach at the service of human innovation for any staff category
Target group/population	Company owners and managers. Engineering officers. Worksite supervisors
Current situation	Building automation is taught separately from construction skills. However, construction skills should be seen as a whole from primary vocational education onwards.
Barriers	Reduced vision of digitalisation: BIM, for instance, cannot be seen as an autonomous goal, but as a means to produce other results, within a framework of a more global system managed by humans.
Measures to be undertaken	Position digitalization in a system where there is a whole: interconnection, transversality, smart city, combination of data at the heart of this system, with digitalization of media and portability of courses. Clarification of the relationship between artificial intelligence and emotional and situational intelligence in future professionalization schemes, which are increasingly individualized. Introduce into training tools that learners use every day (e.g. mobile phones) and rely on them as vehicles for the digitalisation of processes and procedures in company.

Table 19. Digitalisation. France

Germany

Digital tools improve transparency and efficiency of work processes and visualize data of construction projects before and during the contract phase and enable the access to all information to all parties involved. Training seminars to introduce Building Information Modelling (BIM) are organized. These courses explain how information about a construction project can be accessed during the stages of planning and construction as well as the operating phase. BIM-tools and best-practise examples show how work processes can be improved.

Regarding skills needs related to digitalisation, the following table shows those identified by the country in the national factsheets:

Future skill needed	Automation of construction activities, construction robots
Target group/population	Entrepreneurs, lecturers, trainers, trainees, continuing education providers, universities, etc.
Current situation	Less than 6% of construction companies fully use digital planning tools
Barriers	Currently, there is not much demand. This could change in the future if, for example, public tenders demand BIM.
Measures to be undertaken	Training and qualification of professionals for the introduction and handling of BIM.

Table 20. Digitalisation. Germany

Greece

There are two tendencies in terms of digital skills in the construction sector in Greece. From the one hand, the country suffers a shortage of fundamental digital skills among its low-skilled workers. As a result, the economy's skills shortfall has worsened even further. On the other hand, technological advances bring about several emerging new practices, in the sector. Workers in building and related trades must possess sufficient qualifications and take up professional development opportunities to use new IT-based, or automated, equipment, such as remote-controlled vehicles and smart tools. One key IT –based technology that is expanding its influence throughout the industry is Building Information Modelling (BIM).

Aside from mastering new technologies, building and related trades workers will require collaborative skills and the ability to work in better – connected interdisciplinary teams. Technical skills are also very important in off-site building and construction roles, such as computer aided design or computer aided manufacturing.

Regarding skills needs related to digitalisation, the following table shows those identified by the country in the national factsheets:

Future skill needed	a. BIM Expert b. Basic & advanced digital skills
Target group/population	Construction professionals; Technical workers of the construction sector;
Current situation	a. The Greek Ministry of Environment and Energy took the initiative of forming a "Interministerial Group for the Promotion of the Modelisation of BIM Construction Information" to bolster interest in utilizing BIM. b. The "Digital skills for digital Greece" programme was launched in February 2019 and aims to further promote innovation and digital skills in Greece
Barriers	a. As listed in Topic 1 b. Greece has a digital skills gap, even though 90.0 percent of employment require them. In 2019, only 23.0 percent of persons had digital abilities that were above the basic level.
Measures to be undertaken	Seminars for workers, but mostly for businesses, are part of the training activities. Need for re-skilling and up-skilling of workforce Increase demand by using effective outreach, coaching, and motivation tactics that will assist low-skilled or low-qualified persons to improve their literacy, numeracy, and digital capabilities in all levels applicable to their job requirements and technological progress.

Table 21. Digitalisation. Greece

Ireland

The article "BIM: Time to tap into its full potential" (2019) confirms that there is no doubt that the Irish construction industry has embraced information technology to improve efficiency and productivity of processes during planning, design, construction and operation of assets. New techniques such as lean construction and integrated project delivery are well developed and there is a genuine willingness to innovate.

In this context, the skills shortages that Ireland is likely to experience up to the year 2025 were set out in the 2014 National Skills Strategy, this report identified the requirement for specific skill-sets within the construction sector: chartered surveyors; internationalisation and management capability; ICT, Building Information Modelling (BIM) systems and Green Economy skills. Since this report a taskforce - Innovation and Digital Adoption by the Construction Sector Group (CSG) is established (2021) to ensure regular and open dialogue between Government and the construction sector and identify areas for action. It is these digital technologies that are becoming critical in future-proofing the construction industry against skills gaps. As well as enabling the existing workforce to develop their skills, digitalisation of our industry will undoubtedly prove attractive to the next generation of engineers, surveyors and architects (a tech savvy and digital hungry generation)

Regarding skills needs related to digitalisation, the following table shows those identified by the country:

Future skill needed	a. BIM Expert b. Basic & advanced digital skills
Target group/population	Construction Professionals, Construction workers, BIM experts, Craftworkers, young school leavers
Current situation	The main workforce is slow to uptake training in BIM and other digital tools. However, the Erasmus+ BIMzeED learning units are adopted by the VET centres (grouping 3 LUs together to create an accredited course), the Technological Universities/Institutes (integrating the LUs into existing programs or creating new modules) and rolled out to the SMEs with huge success and interest (as stand-alone LUs or taking a number of LUs to obtain recognised credits). The VET centres are also developing a mobile VR Training unit, which initially will attend events and training centres nationally, but with further funding and development will outreach to construction sites. The use of Drones and 3D printing on site is becoming increasing popular especially for the larger sites.

Future skill needed	
a. BIM Expert b. Basic & advanced digital skills	
Barriers	Providing more BIM and Digital training with access to everyone requires organisation and currently the training available is fragmented, and along with the overstretched workload by many companies time to complete and attend training is very difficult. Poor Wi-Fi is also another major issue in rural Ireland, adding to the difficulty for many workers to access these online courses.
Measures to be undertaken	Construction studies and architectural engineering courses at EQF level 7-8 (4-6 modules) are oversubscribed and Technological Universities/Institutes need to deliver single modules online to supply the demand to enable the industry to upskill. Online modules allow the workforce to upskill gradually and choose the most relevant modules to their work needs. DASBE is to assist with collating all the fragmented training and enable the workforce to find suitable training with the one-stop shop BUILD Up Skills Training App.

Future skill needed	
BIM Coordinator and Manager	
Target group/population	Construction Professionals, Construction Manager, project coordinator
Current situation	A growing number of digital approaches in Training is available for engineers, surveyors and architects and BIM is becoming a strong force especially at design and management phase. CitA provides significant financial support through the springboard initiative.
Barriers	Providing more BIM and Digital training suitable for the role of a BIM coordinator requires not only digital skills but also management, communication and life cycle costing and assessment skills
Measures to be undertaken	Technological Universities/Institutes are acutely aware of the need for training in the BIM areas, however many managers and coordinators are already working and providing training will require flexible specific modules to be developed. Online modules allow the workforce to upskill gradually and choose the most relevant modules to their work needs. DASBE is to assist with developing and collating relevant modules to address the need and gaps. The increase in demand although addressed through the Higher education system will still need to work with the industry to stay up to date and adopt flexible additional add on modules in the future.

Table 22. Digitalisation. Ireland

Italy

Italy has a medium-low level of digitalisation awareness related to construction industry. BIM has a wide use for designing, especially for infrastructures. The current legal framework has made mandatory BIM for all public constructions where the cost is over 15M€, and in the next four years will be extended to all the projects.

The National Standardization Institute (UNI) has created a structured framework for BIM professional qualifications, helping the creation of a competent market. But there is an overall lack of “digital cultures” regarding other technologies (3D printing, Virtual Reality, IoT, Artificial Intelligence and Automation) and the BIM use in project phases distinct from designing (i.e. planning, construction and maintenance). It is essential to have a market able to react at the increasing demand of innovation technology. The digitalisation has a central role in the European policies related to sustainability and Recovery Plan, therefore a full understanding of its potentials is mandatory in order to be competitive in a continental market increasingly based on a digital ecosystem.

Regarding skills needs related to digitalisation, the following table shows those identified by the country:

Future skill needed	Awareness of a “fully-digital data workflow” for the construction value chain
Target group/population	Information not available.
Current situation	Stakeholders have not a consistent level of awareness
Barriers	<ul style="list-style-type: none"> ↳ Lack of a national common development vision ↳ Scarce economical resources for R&I and R&D of stakeholders (mainly SMEs) ↳ Low quality knowledge of digitalisation potentiality especially in clients and public organisations
Measures to be undertaken	Disseminate digital cultures and potential benefits following a common perspective (Digital Construction Roadmap)

Future skill needed	Understanding of the BIM at different level of the construction process
Target group/population	Information not available.
Current situation	BIM skills are mostly developed among designer and poor for other components of the construction process such as clients, constructors and building maintenance operators
Barriers	Benefits of a complete BIM process are not appreciated, especially at the early stages of the process (planning)
Measures to be undertaken	Develop a training BIM scheme devoted to process phases different from design and modelling, i.e. : planning, construction and maintenance

Future skill needed	Common use of Virtual Reality and Augmented Reality
Target group/population	Information not available.
Current situation	Both technologies, VR and AR, are scarce used in construction industry, except for architectural visualization. They would be very helpful for training (especially regarding Health&Safety) and support during construction operations on site
Barriers	General unawareness regarding extensive use of these technologies
Measures to be undertaken	Disseminate typological workflows where AR and VR are used: <ul style="list-style-type: none"> ↳ Health&Safety simulations ↳ Building data visualisation on site Allow the creation of new professional profiles specialized in construction VR (in other countries is already common, a.k.a. VDC – Virtual Design and Construction)

Future skill needed	Additive manufacturing use for buildings
Target group/population	Information not available.
Current situation	3D printing is very common for mechanical industry and industrial design. There are few cases of concrete-based printers, and their use is currently rare
Barriers	Lack of R&D regarding additive manufacturing applied to building construction
Measures to be undertaken	Improve the research and discussion regarding 3D printing in the construction industry, especially applied to refurbishment and conservation (through workshops, events and university spin-off)

Future skill needed	IoT and AI
Target group/population	Information not available.
Current situation	IoT (Internet of Things) and AI (Artificial Intelligence) are only used in some cases of building operation (building automation / smart living), while they could have an enormous potential in other branches of the industry
Barriers	Lack of R&D and technical expertise
Measures to be undertaken	Promote the creation of joint-ventures between experts (or faculties) of Computer Science and Building Construction in order to highlight innovative usage of data analysis applied to building design and construction

Future skill needed	Facility Management
Target group/population	Information not available.
Current situation	National construction economy is mostly based on existing building maintenance. Every year the business of FM (Facility Management) and Building Operation is gaining importance. But there is scarce use of digital technology as supporting tool
Barriers	People involved in this industry doesn't know or can't use innovative digital tools
Measures to be undertaken	Disseminate best practices devoted to "digital Facility Management" especially using specialized platform and Digital Twin. Arrange training for specific software related to this industry.

Future skill needed	Integrate skills in the new technological changes in the site
Target group/population	Site manager and team leader (EQF 3-4)
Technical workers (EQF 4-5)	National construction economy is mostly based on existing building maintenance. Every year the business of FM (Facility Management) and Building Operation is gaining importance. But there is scarce use of digital technology as supporting tool
Current situation	The designers of training are not able to think in this new way
Barriers	The training organization not always prepared to do this
Measures to be undertaken	From the sector- introduce the integrate skills in the training paths and (Formedil can drive for the sector)

Future skill needed	Digital competence _ plus BIM
Target group/population	Technical workers (EQF 4-5)
Current situation	Still difficult to professionalize towards digitization
Barriers	Resistance to change and to understand the importance of digitization
Measures to be undertaken	Training actions – seminar to the workers but mainly to the enterprises
Measures to be undertaken	From the sector- introduce the integrate skills in the training paths and (Formedil can drive for the sector)

Future skill needed	Digital competence _ plus BIM
Target group/population	Technical workers (EQF 4-5)
Current situation	Still difficult to professionalize towards digitization
Barriers	Resistance to change and to understand the importance of digitization
Measures to be undertaken	Training actions – seminar to the workers but mainly to the enterprises

Table 23. Digitalisation. Italy

Lithuania

The Public institution “Skaitmenine statyba” (“Digital Construction”) was established in 2014. It is an organization that gathers associations of Lithuanian construction sector and coordinates the digitalization process of Lithuanian construction industry. “Digital Construction” is in the process of the creation and promotion of the unified requirements for BIM.

This institution “Digital Construction” together with Lithuanian Builders Association are creating and developing documents, such as BIM Guides, EIR (Employer’s Information Requirements), BEP (BIM execution plan), BIM protocols, Building passes, BIM use stages, BIM competencies roles, etc that are available for construction markets participants.

The country did not provide specific skills needs related to digitalisation in the national factsheets.

Poland

Poland is at an early stage of BIM adoption. The Polish government has recently introduced policies and instruments supporting BIM implementation in its construction industry. The BIM adoption rate is relatively low, with only 12% of construction companies using BIM in their daily work. They do so mainly for activities relating to visualization, 3D models, and to a lesser extent for collision detection and use of schedules or optimization-40. This low adoption rate is partly explained by the lack of knowledge, the absence of (systematic) BIM requirements in public procurement law, and the high cost of BIM initial implementation.

Regarding skills needs related to digitalisation, the following table shows those identified by the country in the national factsheets:

Future skill needed	Skills in a digitalised energy efficiency construction sector
Target group/population	Information not available.
Current situation	The number of construction investments that take into account energy efficiency is growing, although it is still insufficient. All new investments require energy efficiency certificates. More and more buildings are applying for LEED and BREEAM certificates. Many modernizations and renovations of existing buildings are underway. The use of BIM is developing. New building materials (cement and other nanoelements) are being used more and more often
Barriers	Lack of systemic education in new technologies and materials in the formal path t No quality control of training in the non-formal system
Measures to be undertaken	The need to broadly integrate new technologies into the core curricula in the formal path. The need to develop new market qualifications in the Integrated Qualifications System. The need to provide quality control tools for training in the non-formal path

Table 24. Digitalisation. Italy

Portugal

In order to increase the attractiveness of the sector's professions, namely in professional training, the Portuguese government launched a political initiative “Portugal InCode 2020 - National Initiative for Digital Skills and 2030”, with the objective of introducing digital skills, in the sector's professions and making them more attractive to the general public.

New technological advances are improving the construction industry in Portugal. Tools such as mobile apps, drones or Virtual Reality are already incorporated in the construction sector. Some of the latest technological trends applied to the construction sector include the increased use of prefabricated parts, the use of tools to design buildings and the use of green technology to build environmentally friendly structures.

The country did not provide specific skills needs related to digitalisation in the national factsheets.

Slovenia

Nowadays, there is a need to digitize construction activities, increase productivity and improve the quality of works and services. Large construction companies and architects have been working in the BIM environment for few years now. However, for small companies nothing has been done to trigger BIM approach with the exemption of Architectural Chamber of Slovenia (ZAPS) which in the end of the 2019 organized Group purchase of thousands of BIM software licenses for its members. Moreover, the government has issued few BIM based project tenders for construction services so far (for large infrastructure projects), to develop BIM model for public infrastructure.

On VET schools, BIM and digitalization pace is in general slower and pedagogic staff less prone to use (how to use) advanced technology and due to not having appropriate software licences to train the students in their premises.

Regarding skills needs related to digitalisation, the following table shows those identified by the country in the national factsheets:

Target group/population	Information not available.
Current situation	At VET school, students (3-6 EQF level) do not get to know and use BIM.
Barriers	Using BIM is too difficult for this level of education, the inexperience of teachers is at a high level. Teachers do not have access to expensive software, many software licences have to be paid, even for schools. Many things also have to be first standardized in the BIM, before different users will understand each other and exchange the data via ifc via in the same way (attributes give to the objects).
Measures to be undertaken	Teacher training to improve understanding of new technology and improve teaching of BIM. Purchasing software licences for VET school lessons. Teachers working for industry also or acquiring practices in the companies who uses BIM. Creation of free public BIM libraries in the country, accessible for all stakeholders.
Future skill needed	Digital skills
Target group/population	Information not available.
Current situation	Limited digital skills acquired by adult workforce, especially older workers.
Barriers	No funds available for investment in life long sectoral learning and training, too low added value in the construction industry in Slovenia. Absent regulation of learning and training policy for adult workers, no obligation, no paritarian funds established, no public procurement support. Lack of requirements and public funds available for initial digital literacy and change of business model used in the construction business
Measures to be undertaken	Basis and advances digital skills being accelerated and encouraged by public funds and special calls. There were few such calls but to little funds available. Change of methodologies used for training and learning in education organizations (schools, VET schools, faculties...)-start of implementation of digital based lessons

Table 25. Digitalisation. Slovenia

Spain

The new tendencies force an efficient and flexible response for training on diverse fields such as the BIM methodology, industrialized construction or sustainable construction. BIM technology offers a more effective possibility, easy to carry out and manage the different activities in a Project, however, the starting of the use of BIM is quite complex. In 2018, 55% of the companies in Spain have rolled-out a BIM project, but it has to be stressed that only 15% use BIM as a generalised method for all the projects.

On the other hand, BIM, IoT, the use of drones, automation, etc. all have the concept of "data" in common, which means that an essential skill for the agents in the construction process will be the processing and analysis of these data. The environmental and social demands will be increasingly higher until we reach the decarbonisation target, which will require continuous monitoring measurements of the performance of the building stock and immediate proposals for action in order not to deviate from the target.

Regarding skills needs related to digitalisation, the following table shows those identified by the country:

Future skill needed	Digital competence
Target group/population	All the parties in the construction process, especially those with lower qualifications and those of older ages and most resistant to change.
Current situation	Construction is among the less digitalised sectors, together with Agriculture.
Barriers	Resistance to change, lack of knowledge, traditionalism of the sector
Measures to be undertaken	Awareness-raising campaigns Training actions

Future skill needed	Data processing and analysis
Target group/population	Construction management and lead technicians in the homeowners' associations
Current situation	There is no evidence of a widespread practice (especially in the private residential sector) of measuring continuous environmental and/or social performance values to have a real map of the state of buildings at any given moment. Already in the various amendments to the main regulations, such as the 2018 Directive, automation, and control systems, which are based on data systems and for which there must be technicians who know how to analyse them properly and make proactive decisions, are being given prominence.
Barriers	Total lack of monitoring of key variables in most buildings. Lack of control of the continuous performance of the building once it has been constructed. Lack of interest on the part of the user.
Measures to be undertaken	Specific training for technicians in the analysis of environmental and social data in buildings. Awareness-raising among citizens to integrate and become accustomed to this type of system.

Table 26. Digitalisation. Spain

6.5. Other skills identified

In their national factsheets, some countries have identified also other skills, not related to the main 3 topics of the project (i.e., energy efficiency, circular economy or digitalisation). The following tables show these other skills selected by some countries.

Belgium

Constructiv's analysis of jobs under recruitment pressure for the construction sector, carried out in 2021 for the Walloon Region, further revealed a lack of technical knowledge for a large number of professions. However, this specific knowledge was not detailed during the study.

The study also highlights a lack of skills acquired during basic training.³⁸

France

Future skill needed	Ability to reason and act systemically (especially for managerial training), considering environmental change ³⁹ (urban planning, taxation, housing policy, etc.)
Target group/population	Company owners and managers. Quality assurance officers. Worksite supervisors. Team leaders.
Current situation	Clustered approaches. Not enough culture of shared approaches.
Barriers	It is much easier to operate in silos, do not analyse interactions.
Measures to be undertaken	Develop work-based trainings, with round trips between analyses and practical applications.
Future skill needed	Systemic, constructive and evolutive customer approach: put the need at the heart of the system
Target group/population	Company owners and managers. Sales managers. Quality assurance officers. Worksite supervisors.
Current situation	The training courses specific to the customer approach in the construction sector are not sufficiently individualised.
Barriers	It is much easier to standard training paths, without enough interactions considering all the complexity of different (individual and collective customers, including institutional).
Measures to be undertaken	Modify teaching methods and include more interactivity based on concrete situation analysis.

Table 27. Other skills. France

³⁸ "Sector analysis of jobs under recruitment pressure in 2021", Constructiv, April 2021

³⁹ Energy renovation training modules: www.feebat.org

Germany

Future skill needed	Skilled workers
Target group/population	Entrepreneurs, lecturers, trainers, trainees, continuing education providers, universities, etc.
Current situation	Demographic problem
Barriers	<ul style="list-style-type: none"> ➤ Increasing academisation. Proportion of students is growing while the demand for apprenticeships is decreasing. ➤ Image and attractiveness of apprenticeships is low. The perceived attractiveness of training is very low in some cases
Measures to be undertaken	<ul style="list-style-type: none"> ➤ The skilled labour immigration law must be applied more consistently. ➤ Image campaigns are needed to improve the reputation of education.
Future skill needed	Harmonisation of data protection at European level
Target group/population	All (individual) persons and corporate bodies that are in a position to implement measures for data protection or train people such as VET centres
Current situation	Demographic problem Different data protection regulations existing side by side Personal protection is important, but more and more data protection regulations make surveys difficult, e.g. in projects.
Barriers	National laws
Measures to be undertaken	Simplification of data protection rules

Table 28. Other skills. Germany

Greece

Future skill needed	Up-to-date skilled workforce
Target group/population	Construction professionals; Technical workers.
Current situation	Greek workforce suffers skills scarcity in various levels. The country's education policy focuses on bridging these gaps in all sectors.
Barriers	Outdated VET system
Measures to be undertaken	Need for up-skilling and re-skilling of the construction workforce VET system should include verifiable validation and certification procedures, as well as validation of prior learning.

Table 29. Other skills. Greece

Italy

Future skill needed	Up-to-date skilled workforce
Target group/population	The image depends on all company staff including the employer. In addition, VET centres also have the role of presenting an innovative image of the sector with programmes which can attract new workers to the sector.
Current situation	Small enterprises have difficulties in promote their image
Barriers	companies, especially small ones, are not aware of their influence on the labour market, especially they do not know and do not care about making work more attractive for young people
Measures to be undertaken	To involve the small enterprises in training action for them

Table 39. Other skills. Italy

Poland

Future skill needed	Narrow ranges of skills ⁴⁰
Target group/population	Information not available.
Current situation	Competency needs are defined differently by large and small companies. Large companies are looking for highly specialized employees who perform a limited number of professional tasks. Small companies are more often looking for universal employees with skills from several areas of professional competence. In the future, construction in Poland will need specialized workers. Small companies will mainly deal with finishing, renovation and installation works. It seems, therefore, that the direction of development is the acquisition of skills in a modular way, whereby the modules should at least correspond to one or several professional tasks. number of professional tasks. Small companies are more often looking for universal employees with skills from several areas of professional competence. In the future, construction in Poland will need specialized workers. Small companies will mainly deal with finishing, renovation and installation works. It seems, therefore, that the direction of development is the acquisition of skills in a modular way, whereby the modules should at least correspond to one or several professional tasks.
Barriers	Formal education in construction lasts too long (3 years minimum) and is not very popular. It poorly absorbs innovation in the sector. Non-formal education does not have training quality control mechanisms in the system. Modular education is not popular in the formal path. There are no mechanisms confirming the qualifications acquired in the work process.
Measures to be undertaken	Introduction of coherent, verifiable validation and certification mechanisms in non-formal education and validation and prior learning certification mechanisms. Introduce a system of education in a formal path based on modules, corresponding to the skills necessary to perform professional tasks.

Future skill needed	Skills related to the safe use of new materials and new technologies
Target group/population	Information not available.
Current situation	Specialized companies are currently working on the use of new technologies and materials. Most construction workers do not have adequate knowledge and skills to work safely with new materials and do not know the risks associated with their use ⁴¹ .
Barriers	The formal education and non-formal training system has not yet implemented the relevant training programs. Standards for the use of new materials and new technologies are being implemented late. There are no information campaigns.
Measures to be undertaken	Introduction of appropriate content to the core curricula in formal education and programs for non-formal training. Wider information on standards and potential threats - information campaigns.

⁴⁰ Skills needs in Poland 2020: <https://www.oecd.org/employment/emp/Skills-strategy-poland-report-summary-EN.pdf>

⁴¹ See VET4LEC project (country report Poland) on: <https://www.fiec.eu/our-projects/completed-projects/vet4lec>

Future skill needed	Basic skills in construction at EQF level 1 and 2
Target group/population	Information not available.
Current situation	There is a lack of employees in construction, to a large extent, those who perform simple works in construction. Despite the digitization, the need to employ workers for simple work will persist. There is a need to train employees at EQF 1 and 2 levels, especially when large numbers of third-country migrants are on the market.
Barriers	Lack of system and programs for basic training of unskilled workers. No training offer for migrant workers. There is no financing system for such training.
Measures to be undertaken	Preparation of the training offer in the non-formal path. Training programs addressed to migrant workers. Preparation of training programs for companies (basic training in the workplace).

Table 31. Other skills. Poland

Portugal

Future skills needed	Adaptation to new technologies. Concern for the environment and the sustainability of the planet. Implementation of recycling, the circular economy concept and highlighting the use of renewable energies. Strengthening behavioural skills and adapting to new challenges.
Target group/population	The trainees will be adults with a minimum of 9th year of schooling and with experience in Civil Construction Professions.
Current situation	Over the past six years there has been an evolution in the Civil Construction and Public Works sector and industry trend to reduce bureaucracy procedures. Materials, equipment and methodologies have a very high technological nature, facilitating many activities.
Barriers	People with low qualifications due to new materials, new equipment and new construction methodologies. Low salaries. Because there are many immigrants, communication is difficult. Language.
Measures to be undertaken	More and greater incentive for the entry of qualified personnel and young people. Attractiveness of the sector that goes through more concrete social measures, compatible salaries with the activities developed. Improve the social image of the sector. That is, promoting it as a set of activities technologically adapted to the current reality and already implemented in other sectors.

Table 32. Other skills. Portugal

Slovenia

Future skills needed	Knowledge of traditional natural materials and products and their proper use
Target group/population	Information not available.
Current situation	Preparation of the curriculum and learning outcomes; Several national key stakeholders active in their specific domain are not willing to share their experiences and knowledge in organization of vocational training as they see other actors as potential competitors. Talk – inform - listen – ask - be proactive in cross-linking the Build up skills stakeholders, this approach is necessary to mitigate the doubts and fears of some core actors. The building industry and suppliers as well as craftsmen, installers and on-site workers are extremely interested in development of accreditation and certification of non-formal VET. Sustainability of the NQP is therefore realistic.
Barriers	Too little knowledge/skills in these areas. Knowledge and skills are hidden (not revealed to young person enrolled in education), because of the potential economic benefits in the future.
Measures to be undertaken	Connecting VET school with businesses and craftsman via win-win model.

Future skill needed	Motivation for lifelong learning and acquiring skills
Target group/population	Information not available.
Current situation	Knowledge and skills acquired via education process are not fully sufficient for actual work in companies. Companies in this sector are usually not investing in lifelong learning.
Barriers	No special funds available for an investment in the lifelong sectoral learning and training, too low added value in the construction industry in Slovenia. Absent regulation of learning and training policy for adult workers, no obligation, no paritarian funds established, no public procurement support.
Measures to be undertaken	Support of lifelong learning and training via public procurement tenders and their selection criteria. Establishment of special sectoral organization for lifelong learning and training (paritarian funds....)

Table 33. Other skills. Slovenia

Spain

Future skill needed	Health & Safety skills in a digitalised sector
Target group/population	All parties of the construction process, especially those working with (new) digital tools.
Current situation	There is a progressive increase of work supported by digital tools that will imply new emergent risks, mainly those related with Ergonomics (especially musculoskeletal disorders) and Psychosocial factors.
Barriers	Currently there is a lack of knowledge about the potential negative effects on workers' health and safety in an increasingly digital environment.
Measures to be undertaken	Risk assessments associated with digitalisation for each trade. Propose appropriate preventive measures. Updating the regulatory framework. Training update.

Future skill needed	Safe and correct use of bio-based materials and nanomaterials
Target group/population	All parties of the construction process, especially those working with new materials, irrespective of their occupation.
Current situation	Limited introduction of emerging risk factors and OSH training.
Barriers	There is no awareness of emerging risks. Many effects are not yet known.
Measures to be undertaken	Upgrading of current VET training. Better labelling. Awareness campaign

Table 34. Other skills. Spain

7. Process of revision by members of the National Advisory Groups (NAGs)

As the last step for the finalisation of the present document, a draft version was submitted to the members of the National Advisory Groups conformed in the project countries, with the intention of having an expert revision of the document and the skills needs proposed in the tables, and when relevant, their proposals for improvement (structure of the report, quality of the content, missing skills, etc.).

A total of 25 members have revised the document, guided by a brief questionnaire with a series of key questions. Results are shown in the table below (the figure in each box indicates the number of persons who have marked that option):

7.1. General evaluation

	Very unsatisfied	Unsatisfied	Satisfied	Very Satisfied
Visual presentation			19	6
General quality of contents		1	16	8
Relevance of the topics addressed		1	11	13

Figure 2. General evaluation

7.2. Specific evaluation (sections of the report)

	Very unsatisfied	Unsatisfied	Satisfied	Very Satisfied
Introduction			12	13
Energy Efficiency			16	9
Circular Economy		1	17	7
Digitalisation			17	8
Blueprint for sectoral cooperation on skills. Responding to skills mismatches at sectoral level			15	10
Skills needs in the construction industry: energy efficiency		1	15	8
Skills needs in the construction industry: circular economy		1	18	6
Skills needs in the construction industry: digitalisation		1	14	10
Skills needs in the construction industry: other skills needs			17	8
Conclusions		1	12	12

Figure 3. Specific evaluation

As it is shown in the table, most of the NAG members who have revised the document are satisfied or very satisfied with the different aspects shown in the report. However, in order to allow them to improve the content, the respondents have had the opportunity of providing further information about the skills that, in their opinion, should be added.

7.3. NAG members' feedback

Below, concrete information about the number and profile of experts who have revised the document in the countries of the project is indicated, as well as their proposals of skills to be added.

Belgium

In Belgium, the document has been revised by two NAG members, with the following profile:

1. Researcher from the University of Liege.
2. Manager of Constructiv.

- **ADDITIONAL SKILLS PROPOSED BY NAG MEMBERS:**

- Environmental performance (materials, notably).
- Sustainable buildings (there is a clear link with circularity and environmental performance, but with added parameters).

Finland

In Finland, three experts, part of the NAG have revised the document. Their profile is:

1. Senior Research Fellow, Faculty of Management and Business. Industrial Engineering and Management. University of Tampere
2. Regional Administrator of the Finnish Construction Trade Union (Rakennusliitto).
3. Health promotion liaison, ward nurse (counselling work). Central Satakunta Health Care Consortium.

- **ADDITIONAL SKILLS PROPOSED BY NAG MEMBERS:**

- In addition to digitalization an information search, for example, BIM and chemical search (makes work faster and less risks), quick reporting (for example, incident report).
- Wood construction is a growing sector and affects to Circular Economy.

France

No information provided.

Germany

The report was revised by two NAG members in Germany, with the following profile:

1. Energy research GmbH & Co. KG.
2. Representation of the German crafts sector, Zentralverband des Deutschen Handwerks, with the focus on education.

- ADDITIONAL SKILLS PROPOSED BY NAG MEMBERS:

The experts have not provided additional skills to be added to the document.

Greece

In Greece, two members of the NAG have revised and evaluated the document. Their profiles:

1. Professor at the National Technical University of Athens.
2. Civil Works Contractor at Panourgias Civil Works Office.

- ADDITIONAL SKILLS PROPOSED BY NAG MEMBERS:

- A possible suggestion for addition would be a more detailed approach on renovation – materials recycling issues which are going to be introduced through European legislation in the coming years.

Ireland

No information provided.

Italy

In Italy, two members of the NAG have revised and evaluated the document. Their profiles are the following:

1. Researcher at Censis.
2. Researcher at INAPP.

- ADDITIONAL SKILLS PROPOSED BY NAG MEMBERS:

- Soft skills: In recent years, key competences play an increasingly role in the employment prospects of young and adult people. As a matter of fact, entrepreneurs look for staff with a good level of technical-professional skills but also require good transversal skills, the so-called soft skills.

Key competences are defined as a combination of knowledge, skills, and attitudes appropriate to the context, and are those which all individuals need for their personal fulfilment and development, in order to perform tasks and solve problems. These skills strongly affect job performance. They concern the ability of learning to learn, to cooperate, to be autonomous, proactive, and identify working roles and integrate themselves into a business context and work processes. The key competences deal with the attitudes and personal aspects of the

individual. Consequently, while some technical skills may be also acquired in the first period within the company, these skills are difficult to be acquired ex post, and are often crucial in the recruitment process.

The importance of key competences led the European Council to draft a proper Recommendation (on 22 May 2018) in order to redefine the 8 key competences for lifelong learning, by updating the framework set in the previous 2006 Recommendation and so encouraging Member States to adopt them as strategic factors in the educational process.

Lithuania

The report has been revised by three NAG members, with the following profile:

1. Head of Urban Economy and Transport department of Vilnius City Municipality Administration.
2. Construction Production Certification Centre, Head of SE.
3. Dean, professor, doctor.

- **ADDITIONAL SKILLS PROPOSED BY NAG MEMBERS:**

The experts have not provided additional skills to be added to the document.

Poland

Three NAG members have revised the report in Poland. Experts' profiles:

1. Head of Centre for the Research and Development of Vocational Education at Łukasiewicz - Institute for Sustainable Technologies.
2. Senior Researcher at Łukasiewicz - Institute for Sustainable Technologies.
3. President of Confederation of Building and Real Estate (KBiN, employers' organization).

- **ADDITIONAL SKILLS PROPOSED BY NAG MEMBERS:**

- In the case of Poland, the expert from KBiN indicates that in June 2021, the first Industry Research of Human Capital in Construction in Poland was announced. As part of this study, the professions/jobs at which employers intend to hire employees in construction companies within the next 12 months were identified. Also, the perspective of hiring in the coming 5 years was also indicated (see Appendix for further information).
- On the other hand, the experts from Łukasiewicz have mentioned a series of relevant studies prepared by their organisations dealing with recommendations of competences and new qualifications that are needed in the Polish construction industry, including smart specialisations. The Polish Sectoral Competence Council in Construction, therefore, provides a list of 44 identified potential new qualifications/areas of competence, some of them already identified in the present document (see Appendix for further information).
- All qualifications / skills from the 3 areas apply to all phases of the building's life.

Portugal

In Portugal, two NAG members have revised the document. Their profiles correspond to:

1. General Director.
2. Senior Officer.

- **ADDITIONAL SKILLS PROPOSED BY NAG MEMBERS:**

- In the future, construction will undergo the very rapid evolution of prefabrication systems and the application of modular systems. The specific competence of working in this area, in design, production and installation, should have a greater investment in skills because the sector will not advance without these skills.

Slovenia

The document has been revised by one NAG member, who develops his professional activity in a Building and Civil Engineering Institute.

- **ADDITIONAL SKILLS PROPOSED BY NAG MEMBERS:**

The expert has not provided additional skills to be added to the document.

Spain

Finally, in the case of Spain, the document has been revised by five NAGs, whose profiles correspond to:

1. ANETVA (National Association of Vertical Work Companies). Business association.
2. National Reference Centre for vocational training in Building and Civil Engineering.
3. ANDIMAC (National Association of Ceramic and Building Materials Distributors).
4. INCUAL (National Qualifications Institute).
5. CGATE (General Council of Technical Architecture of Spain).

- **ADDITIONAL SKILLS PROPOSED BY NAG MEMBERS:**

Several additional skills have been proposed by the NAG members who have revised the document, indicated below:

- In all trades (bricklayers, fitters, installers, machine operators, structural workers, etc.) there is a need to raise awareness of the importance of planning and execution according to quality criteria to ensure efficiency and circular economy and to make them aware of the contribution of ICT in the performance of their trade. In general, it is at these trade levels that the fields of study are largely unknown.
- Renovation and refurbishment management skills. These activities represent, and even more so from 2022 onwards, the biggest driver of activity in the sector, in the residential building

segment. They are activities in which the operational management of the worksite merges with the management of relations with clients and users. The lack of skills integrated in the concept of "customer experience" in this area is a trigger for complaints, doubts and potential conflicts that could be minimised by improving customer experience skills in refurbishment and renovation, while at the same time improving the image and reputation of the sector and its guilds.

- Given the nature of the building stock, where noise is also the main source of discomfort and energy insulation in enclosures can often be easily complemented by acoustic insulation, the competence in acoustic efficiency skills should be integrated in these future necessary competences in a complementary way to the main competence (energy efficiency).
- Regarding the ERESEE⁴², it is interesting to note measure 8.2 on the figure of the Head Technician or the Energy Rehabilitation Management Agent, who will have to have specific knowledge of energy efficiency and be proactive in proposing measures to the owners' associations.
- Following the high user awareness of the sanitary crisis (Covid19), it is important that professionals are trained, not only in competences to make buildings more sustainable, but also healthier and more user-friendly. Therefore, we propose as a necessary future competence the knowledge of the relevant aspects affecting the health of users within their dwellings, and of the possible solutions to be implemented to ensure sustainable and healthy buildings. The target group, being of a decision-making nature, could be technicians in construction management and companies in the sector that could carry out consultancy in new building works and building renovations. Currently, there is public awareness and various initiatives are taking place to raise awareness and train technicians, but it is still a second or third priority, with environmental or aesthetic criteria taking precedence. There is a lack of knowledge of how users are really affected by their stay inside buildings (more than 85% of their time). So, it is necessary to train technicians, firstly on the synergies between environmental criteria and healthy criteria and, finally, on healthy and unhealthy solutions (so that they can be identified and avoided).

⁴² Long-term-strategy-for-energy-rehabilitation-in-the-building-sector-in-Spain. <https://www.mitma.gob.es/el-ministerio/planes-estrategicos/estrategia-a-largo-plazo-para-la-rehabilitacion-energetica-en-el-sector-de-la-edificacion-en-espana>

8. Focus Group

The final step has been the organisation of a virtual Focus Group (via MS Teams), aiming at receiving final feedback from different experts about the contents of the document and the skills needs identified in the construction industry.

The event was held on 28th of September, organised by Fundación Laboral de la Construcción (FLC), as project coordinator. Apart from FLC team, there were eight participants from six countries of the consortium: Germany, Ireland, Portugal, Slovenia, Greece and Spain.

Profile of participants corresponded to members of the National Advisory Groups of these countries:

- Gertrud Hirtreiter. Confederation of Skilled Crafts (ZDH). Germany.
- Dermot Carey. Construction Industry Federation. Ireland.
- Thomas Panourgias. Civil Engineer. Greece.
- Joaquim Nogueira de Almeida. Anakim Products 4U Lda. Area Technology. Portugal.
- Duarte Veiga Lopes. FAP. Area Technology. Portugal.
- Aleksander Srdic. Faculty for Civil engineering-FGG. Slovenia.
- Tomo Cerovsek. Faculty for Civil engineering-FGG. Slovenia.
- Rodrigo Burgos. Burgos Construction Employers Federation (FECBU). Spain.

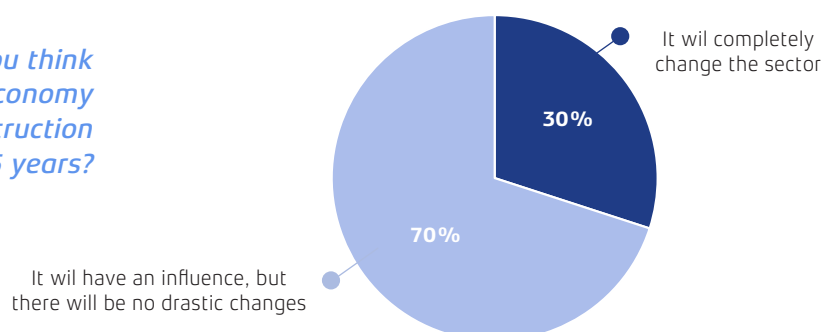
After a brief introduction of the participants, the FLC team carried out a presentation of the Construction Blueprint project, stressing the main deliverables and milestones. Also, a presentation of the Skills needs analysis report was carried out, describing the working methodology, the structure and the main skills identified and conclusions.

In order to create a more participative event where attendees could provide their opinion on different aspects related to the skills needs linked to the main topics of the project (energy efficiency, circular economy and digitalisation), a series of key questions were made through the interactive tool Mentimeter. This tool allows the organiser of the event to obtain immediate live results to the different questions asked, and a subsequent discussion to comment about these results.

Some of the main results and opinions expressed are detailed below:

Circular economy

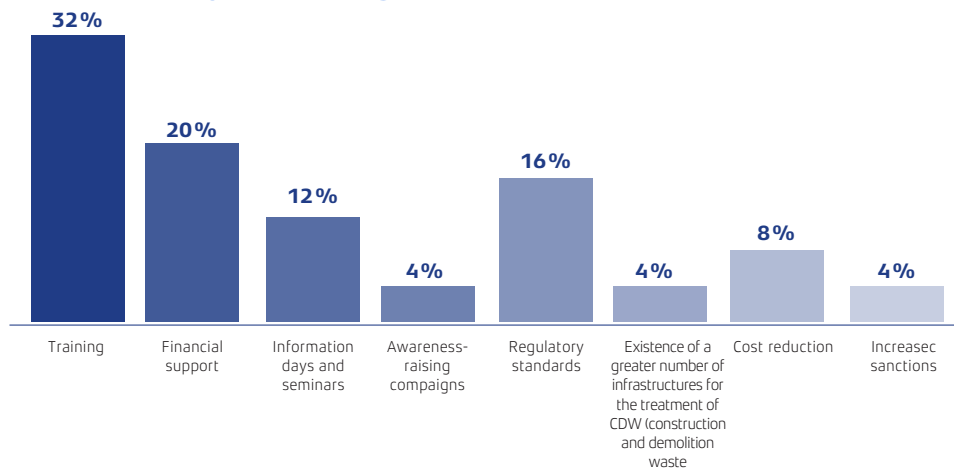
To what extent do you think that the circular economy will impact the construction industry in the next 5 years?



At this respect, participants believe that Changes mainly depends on regulations and strategies by different countries. Therefore, 10-15 years seem to be a more realistic timeline. Changes will not happen until there are clear obligations.

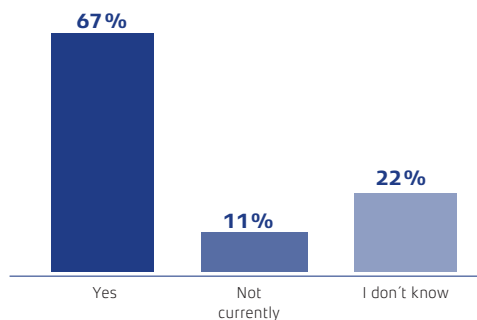
Also cost has a clear influence on the transition to circularity in construction, and also, those problems derived from the supply chain and improvisation that somehow affects the industry.

How can the implementation of circular economy practices or initiatives in the construction industry be encouraged?

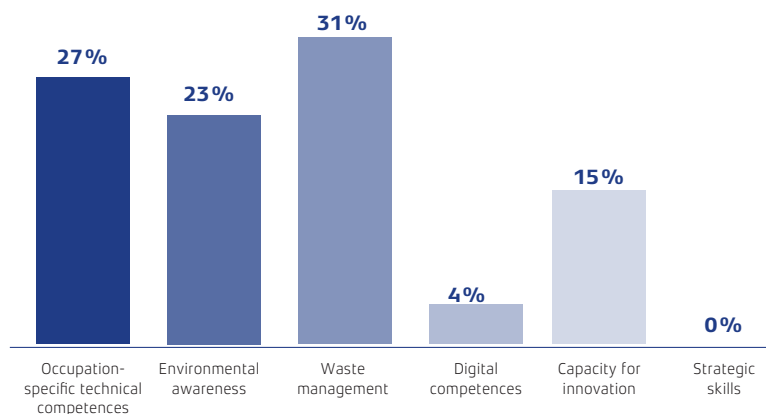


As it is shown in the image, 32% of the participants believe that the main action to be carried out in the construction industry towards circularity is training. Also, financial support and regulatory standards are considered as greatly important to achieve this aim in the sector, as it was confirmed in the following question, where almost 70% of participants think that there is a need of more regulation.

Do you think more regulation of certain aspects is needed to advance towards an environmental transition in the sector?

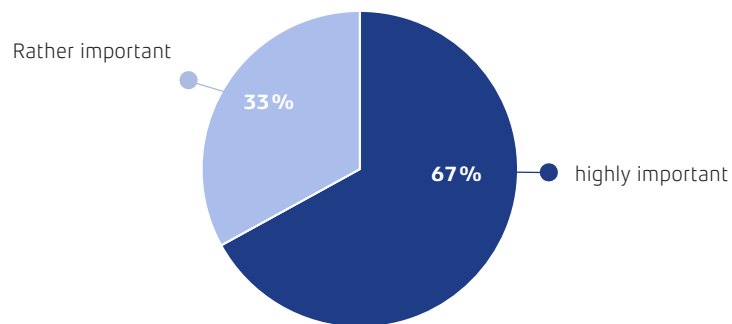


Please, indicate the competences needed to improve the performance of workers with regards to the transition to a circular economy.



When discussing about these results, participants indicated that even if society in general is more and more interested on environmental issues, most workers of the sector are not young and/or have a low qualification, which may somehow explain their lack of knowledge and awareness on these aspects.

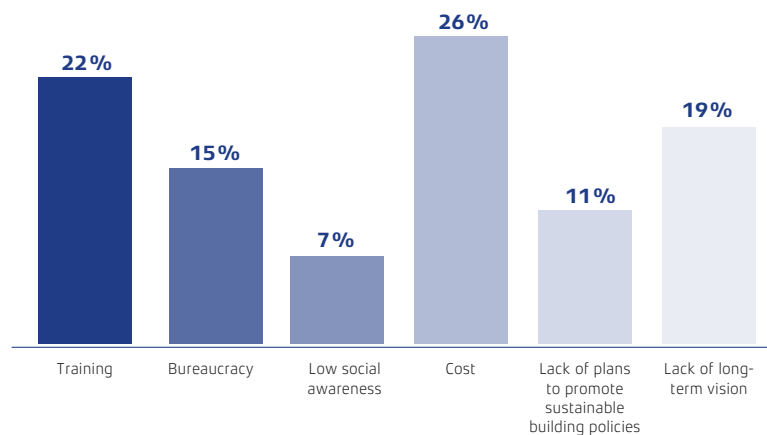
What is the role of vocational training in driving the circular economy in the construction industry?



In the subsequent discussion related to this result, which stresses the importance of vocational training, some partners agreed that like other related aspects, training is essential but, in the end, workers are not the decision-makers, so they do what they are asked to be done, also in terms of training

Energy Efficiency

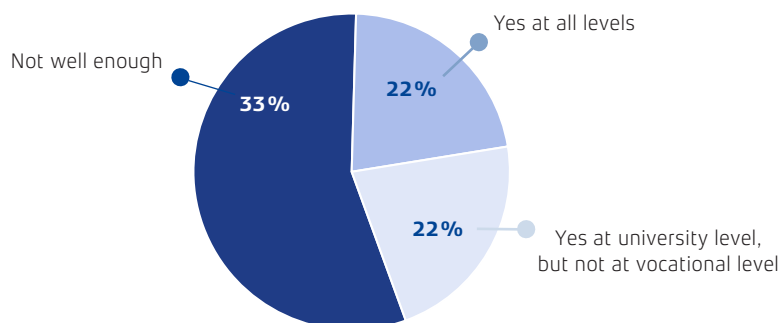
Please indicate the barriers that the sector faces in the field of energy efficiency in order to achieve sustainable construction.



Most participants agreed that cost is the main barrier to make the construction industry more inclined towards sustainability in the sector. It is necessary to take into account that construction companies and contractors are businesses and work for profit, therefore, it is reasonable that cost is the main concern. Usually, they are not completely involved in energy efficiency issues unless there is a legal requirement that forces them to incorporate sustainable principles.

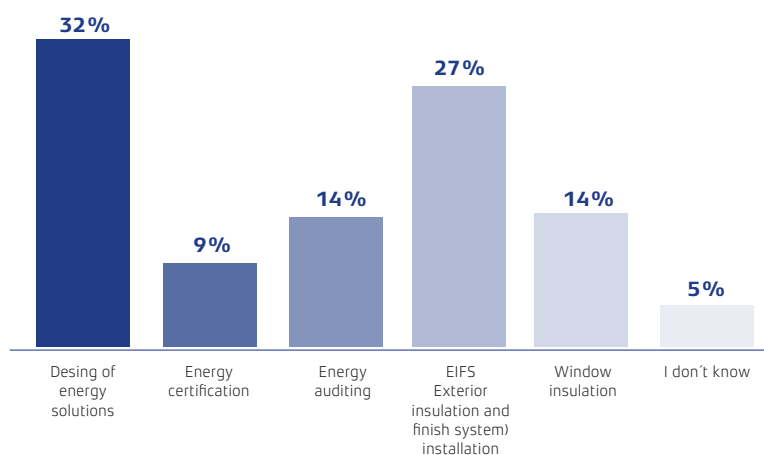
It is also to be noted that for 22% of participants, training is selected as a barrier, mainly because many companies do not feel it is necessary and because it is related to cost also (costs in finance and costs time). A question arose: What is the incentive for the company to training their workers?

Do you think that training in energy efficiency is being adequately addressed in the educational system?



According to some partners, one problem is that not all the persons who talk about EE in construction (for example, politicians...) really knows what it is exactly. It seems that there is a really poor communication addressed to let society know what energy efficiency is exactly.

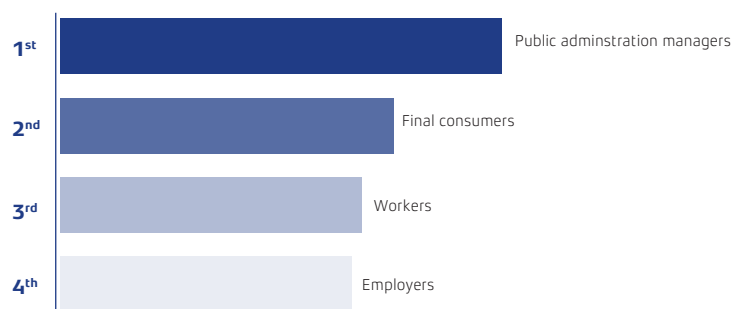
From the following list, which energy efficiency competences are most needed currently?



For new buildings, everything starts in the design phase, therefore workers do not have big influence. The design of energy solutions depends therefore on the qualification of the designers and the regulatory standards.

On the other hand, in renovation works, many times there are no architects or engineers involved, so other skills more addressed to the workers are needed.

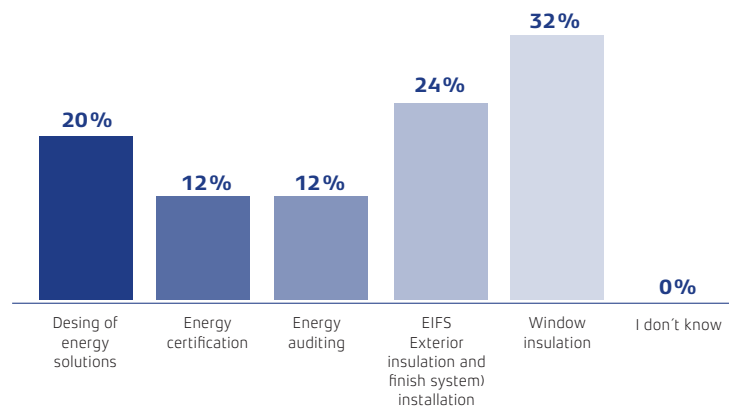
Rate in order of importance who is a priority to train in relation to energy efficiency



Participants agreed that the first to be trained are those managers from the Public Administration, who are involved in the regulatory aspects, followed by the final consumers, as the ones who should have more awareness on the topic.

Workers and employers would go next; the impact of training is increased when it derives from regulatory needs applicable to different scopes (local, regional, national, European). Regulation is a lever that drives and forces employers and workers to enrol in training actions as well as the implementation of measures addressed to improve the energy efficiency in the different assets.

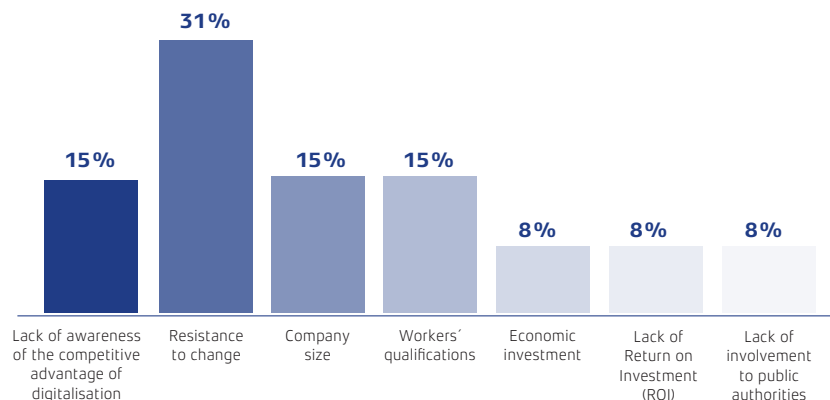
In which activities of the construction industry will the qualification of workers in energy efficiency have the most impact?



As shown in the graphic, renovation activities are agreed by the participants to be the ones where training in energy efficiency will have the highest impact.

Digitalisation

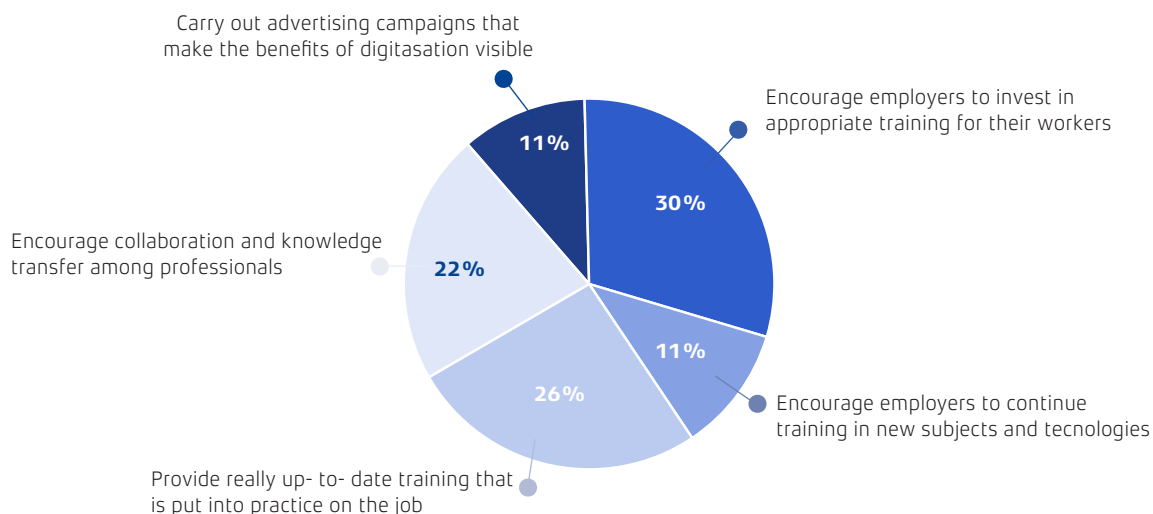
What are the barriers to qualify construction workers in the field of digitalisation?



Construction industry is very conservative and changes slowly. Also, most companies employ less than 20 persons, they do not see the need to rely on digitalisation to carry out the work. On the other hand, big companies seem to be the ones that better adapt, mainly because of the nature of the projects they are involved in and the type of client they deal with.

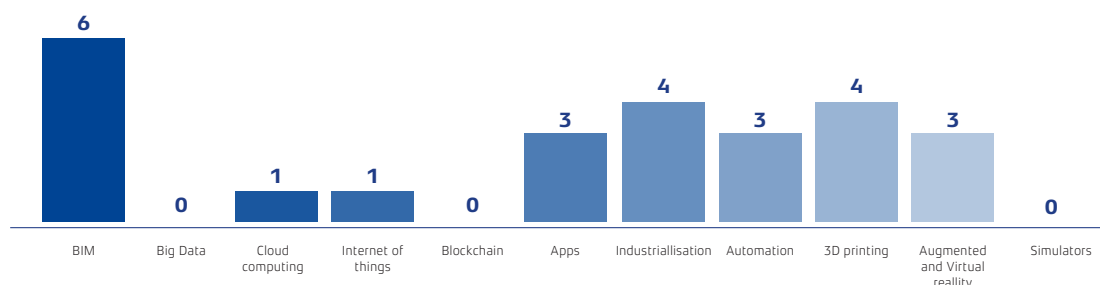
Regarding workers themselves (ex. mason), they don't need digital resources to do their work.

Some workers do not perceive digitalisation as a benefit in their daily work. How can this vision be improved?



In the opinion of most participants, it is important to invest in training, but, above all, it is essential that benefits of digitalisation need to be demonstrated to the people, otherwise, workers/companies won't see the need to adapt to it.

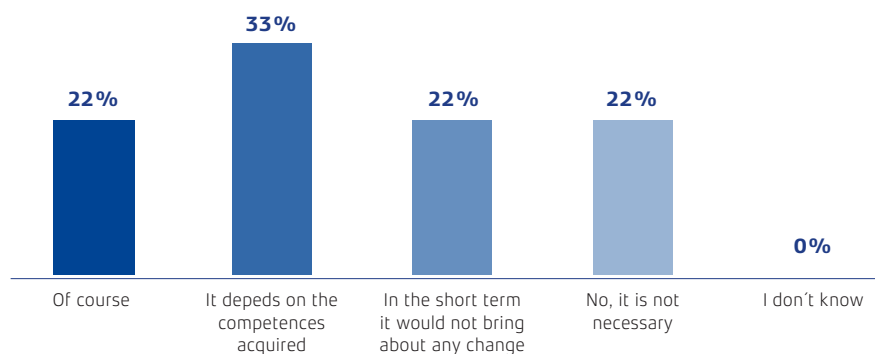
From the following options, which do you think would be most easily adopted by workers in the sector in the mid-term?



Although digitalisation goes far beyond just BIM, most participants believe that this methodology will be the one that is potentially the one that companies and workers will adopt more easily. Regulation will also have a relevant role to play in this aspect.

Other digital methods, such as 3D printing (or Additive Manufacturing) and Industrialisation of the constructive process will become increasingly important in the medium term.

Do you think that the acquisition of skills in the use of BIM on site is essential in the short term for workers in the sector?



Participants shown different visions about this question. It has to be taken into account that BIM is a quite sophisticated tool, therefore if the user does not own good necessary skills to use it, BIM would be useless.

Majority of low-level workers will never use BIM, due to the nature of their work; however, they must at least be aware of its existence and utility. Currently there are some practices on site where workers do not need to know how BIM works but they are capable of seeing/reading the results of BIM in the project they are working on.

9. Conclusions

Energy efficiency is an extremely relevant skills-driver in the construction industry. Several European initiatives are being developed stressing the need of continue education and training on energy efficiency and renewable energy in buildings.

As described in the Pestle Analysis and in the Status Quo Report, all partner countries have already implemented European energy efficiency regulations: Directive 2010/31/EU and 2018/844/EU. Moreover, all have issued laws and regulations in their respective countries.

It is already needed to point out that in most countries, courses are being organised and carried out for consultants, technicians and workers in the construction of nZEB and energy efficiency; equally, most countries have identified a lack of professionals, consultants and workers qualified on this topic.

Circular economy is considered also as one the main drivers that should lead the national action plans designed for the construction industry. National initiatives have been taken to tackle the issue at national level although reliable data is not always available in the countries in terms of production of wastes.

In some countries, there are evidence of the right steps already taken. However, there is a common acknowledgement of lack of specific skills on circular economy within the construction sector. Training on the performance of management of waste should be introduced in the national VET systems as well as specific information on the impact of construction products on the environment.

As regards with digitalisation, mostly experts and countries focused the digital transformation of the construction industry on BIM, however, it goes beyond that, covering other digital technologies such as robots, drones, automation, 3D printers and scanners, etc. A successful digitalization of the industry could be achieved by combining BIM with the other technologies already mentioned.

As a summary, the following comparative table shows the skills provided by the countries.

APPENDIX 1. COMPARATIVE TABLE OF SKILLS

COUNTRY	SKILLS ON ENERGY EFFICIENCY	SKILLS ON CIRCULAR ECONOMY	SKILLS ON DIGITALISATION	OTHER SKILLS	SKILLS PROPOSED BY THE NAGS
BELGIUM	--	Waste management & circular economy	Digitalisation	--	Environmental performance (materials, notably)
					Sustainable buildings
FINLAND	Energy efficiency– Variation in the quality of construction	Circular Economy- understanding of sustainability (circularity, waste management)	Digitization - knowledge of construction specific application programs	--	Information search, for example, BIM and chemical search and quick reporting
			Digitization - building automation		Wood construction
FRANCE	Management of constraining environmental and energetic performance regulations	Disassembling/ dismantling constructions	Digital skills to combine technological changes in the construction sector and company performance (all crafts and functions)	Ability to reason and act systemically (especially for managerial training), considering environmental change (urban planning, taxation, housing policy, etc.)	--
	Preparation of site managers and team leaders for the coordination of works aiming at energy efficiency improvements in the renovation of buildings	Management of environmental aspects, waste collection and recycling on worksite	Digitisation: an approach at the service of human innovation for any staff category	Systemic, constructive and evolutive customer approach: put the need at the heart of the system	
GERMANY	--	Recycling economy	Automation of construction activities, construction robots	Skilled workers	--
				Harmonisation of data protection at European level	
GREECE	BIM Expert	Skills related to Construction and Demolition Waste	BIM Expert	Up-to-date skilled workforce	A more detailed approach on renovation – materials recycling issues
	Skills relative to NZEB & Renovation		Basic & advanced digital skills		
IRELAND	NSAI approved air permeability tester	Recycling economy	Integrate BIM and Digital skills in the Construction Phases	--	--
	Green Building Assessors/ Coordinators/ Advisors				
	Registered Technical Advisors on heat pumps (ASHP)		BIM Coordinator and Manager		
	NZEB qualified craftworkers (plumbers, electricians, carpenters, plasterers, bricklayers)				

APPENDIX 1. COMPARATIVE TABLE OF SKILLS

COUNTRY	SKILLS ON ENERGY EFFICIENCY	SKILLS ON CIRCULAR ECONOMY	SKILLS ON DIGITALISATION	OTHER SKILLS	SKILLS PROPOSED BY THE NAGS
ITALY	Energy certifier	Circular economy	Awareness of a “fully-digital data workflow” for the construction value chain	Employer – social and economic (market) skills	Soft skills / transversal skills / key competences
			Understanding of the BIM at different level of the construction process		
	Expert in energy diagnostics		Common use of Virtual Reality and Augmented Reality		
			Additive manufacturing use for buildings		
	Installer of renewable source plants		IoT and AI		
	Installation of insulation systems		Facility Management		
	Green Building Assessor		Integrate skills in the new technological changes in the site		
LITHUANIA	Façade installers for energy efficient buildings	--	--	--	--
	Thermal insulators: Thermo bridge skills (preventing thermal bridges)				
	Windows Installer for A+, A++ energy efficiency class buildings				
	Ventilation and air conditioning systems installer for A+, A++ energy efficiency class buildings				
POLAND	Skills in a digitalised energy efficiency construction sector	--	Skills in a digitalised energy efficiency construction sector	Narrow ranges of skills	All qualifications / skills from the 3 areas to be applied to all phases of the building's life
				Skills related to the safe use of new materials and new technologies	
				Basic skills in construction at EQF level 1 and 2	See Appendix for further skills derived from national documents

APPENDIX 1. COMPARATIVE TABLE OF SKILLS					
COUNTRY	SKILLS ON ENERGY EFFICIENCY	SKILLS ON CIRCULAR ECONOMY	SKILLS ON DIGITALISATION	OTHER SKILLS	SKILLS PROPOSED BY THE NAGS
PORTUGAL	--	--	--	Adaptation to new technologies	Skills in design, production and installation of prefabrication systems and the application of modular systems
				Concern for the environment and the sustainability of the planet	
				Implementation of recycling, the circular economy concept and highlighting the use of renewable energies	
				Strengthening behavioural skills and adapting to new challenges	
SLOVENIA	--	--	Using the BIM	Knowledge of traditional natural materials and products and their proper use	--
			Digital skills	Motivation for lifelong learning and acquiring skills	
SPAIN	Global energy efficiency skills	Ensuring proper management of construction and demolition waste	Digital competence	Health & Safety skills in a digitalised sector	Awareness raising in all topics for all trades
			Data processing and analysis	Safe and correct use of bio-based materials and nanomaterials	Renovation and refurbishment management skills
					Acoustic efficiency skills (acoustic insulation)
					Skills to make the building not only more sustainable but also healthier and more user-friendly. knowledge of the relevant aspects affecting the health of users within their dwellings, and of the possible solutions to be implemented to ensure sustainable and healthy buildings

Appendix 2. New qualifications/areas of competence in Poland

The following information has been provided by the Polish experts who have revised the document; due to the extension and its eminently geographical nature and scope (although may be applicable in many countries), it has been treated in this separate section.

In June 2021, the first Industry Research of Human Capital in Construction in Poland was announced. As part of this study, the professions/jobs at which employers intend to hire employees in construction companies within the next 12 months were identified. Most responses concerned:

- Specialist for renewable energy sources.
- Ventilation/recuperation/air conditioning designer.
- Environmental protection specialist.

In turn, in the perspective of 5 years, employers intend to hire (most often indicated):

- 3D visualization designers.
- BIM engineers.
- Environmental protection specialists.
- Service technicians of new technology machines.
- Specialists in renewable energy sources.
- IT specialists/automation specialists.
- Ventilation/recuperation/air conditioning designers.

At the request of the Sectoral Competence Council in Construction, in 2020 it was prepared the following studies: Recommendation concerning particularly needed market qualifications in construction, including smart specializations, requiring descriptions in accordance with the Integrated Qualifications System in Poland.

Market qualifications in this system are to result from the real needs of the labor market. A limited study of Polish construction stakeholders was conducted. Below is a list of identified potential new qualifications/areas of competence recommended by the Council (the first 11 did not directly deal with the topics covered by the project, therefore they are not included in the table below).

NEW QUALIFICATIONS/AREAS OF COMPETENCE

12	Management of construction waste on the construction site.
13	The use of innovative materials and technologies for the revitalization of buildings, including historic buildings.
14	The use of innovative materials and technologies for thermo-modernization of buildings on the existing thermal insulation requiring improvement of insulation.
15	The use of innovative coatings with improved parameters in construction, which hinder the development of fungi, bacteria and algae.
16	The use of innovative materials and technologies that protect buildings against overheating and / or reduce heat losses.
17	Management of the building and a group of intelligent buildings using energy from renewable sources and local accumulation systems integrated with the building.
18	The use of machines and devices that reduce energy and labour consumption in the construction process and increase work safety.
19	Operation of devices integrated with the building and systems for conversion, storage and use of renewable and waste energy.
20	Application in construction of devices and systems for rationalization of the use, acquisition, purification and treatment of water.
21	The use of waste-free and low-waste technologies and technological lines increasing the efficiency in the production of materials, construction products, and the implementation of construction investments.
22	The use of computer simulation techniques, BIM (Building Information Modelling) techniques in all phases of designing buildings and structures.
23	Planning and organizing sustainable construction (energy-saving architectural design, high comfort and fictionality of the building, minimal environmental impact).
24	The use of technologies for the re-use of materials, construction, and insulation elements (recovery, including recycling) in construction.
25	Conducting construction waste management in a closed cycle.
26	The use of technologies for the production of materials and products for the construction industry with the use of accompanying raw materials, by-products and waste.
27	Supervising the construction and operation of scaffolding (application from the Polish Chamber of Commerce for Scaffolding).
28	Assembling prefabricated building elements.
29	Installing partition walls in plasterboard technology.

NEW QUALIFICATIONS/AREAS OF COMPETENCE

30	Using IT software used to assess the energy performance of buildings and drawing up energy performance certificates for buildings.
31	Performing the inspection of the heating system and air-conditioning system.
32	Carrying out and developing an energy audit of a building used for the implementation of a thermomodernization and / or renovation project.
33	Performing thermographic analysis of a building (commentary).
34	Preparation of design documentation related to thermo-modernization works.
35	Insulating building partitions, balcony slabs or foundations.
36	Mounting of non-openable transparent surfaces.
37	Installing internal heating installations or hot water preparation installations.
38	Mounting the gas condensing boiler.
39	Installing the condensing oil boiler.
40	Installing the heat pump.
41	Mounting the solar collector.
42	Installation of a mechanical ventilation system with heat recovery from the exhaust air.
43	Assembly and operation of a photovoltaic installation.
44	Conducting selection and storage of building materials from the demolition of buildings.

Table 35. New qualifications. Poland

Appendix 3. Focus Group Agenda



Establishing a new Strategy on Construction Skills in Europe

Focus Group

Organised by:



On-line event (through Microsoft Teams):

Date: September 28th, 2021

Time: 11:00 h. a 12:30 h CET

[Click here to join the meeting](#) through MS TEAMS

AGENDA

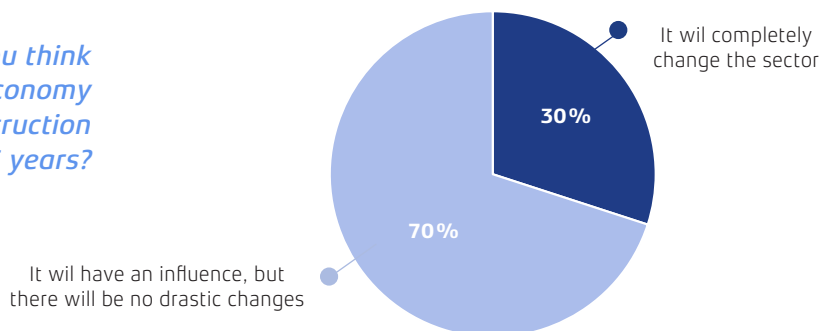
11:00 – 11:15	Welcome and brief introduction of participants
11:15 – 11.30	Presentation of the “Construction Blueprint” project and Skills needs analysis
11:30 – 12:00	Interactive activity by participants: Mentimeter
12:00 – 12:30	Debate and conclusions

Appendix 4. Focus Group Mentimeter results

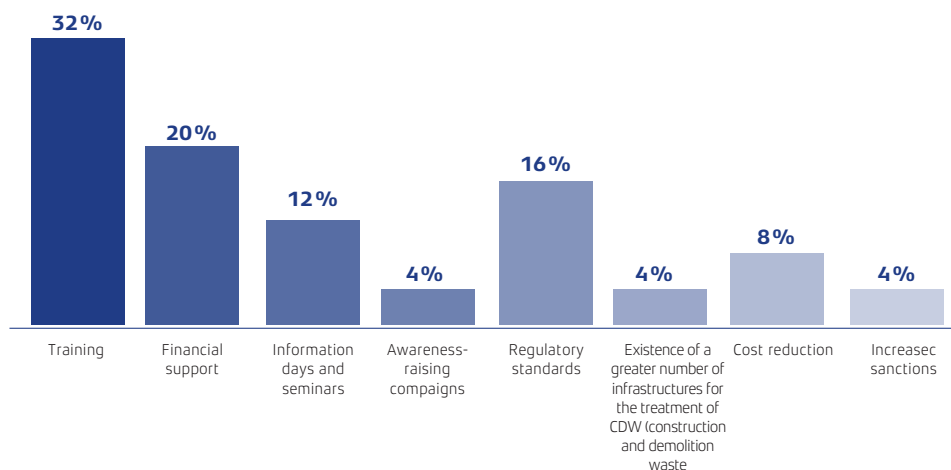


CIRCULAR ECONOMY

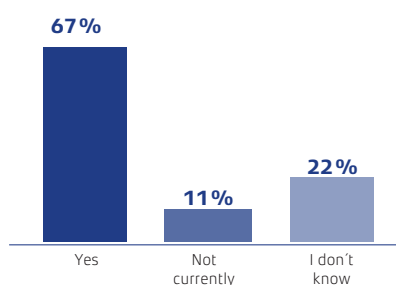
To what extent do you think that the circular economy will impact the construction industry in the next 5 years?



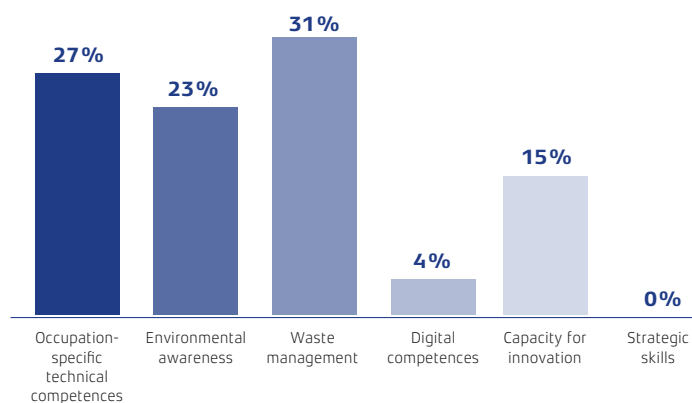
How can the implementation of circular economy practices or initiatives in the construction industry be encouraged?



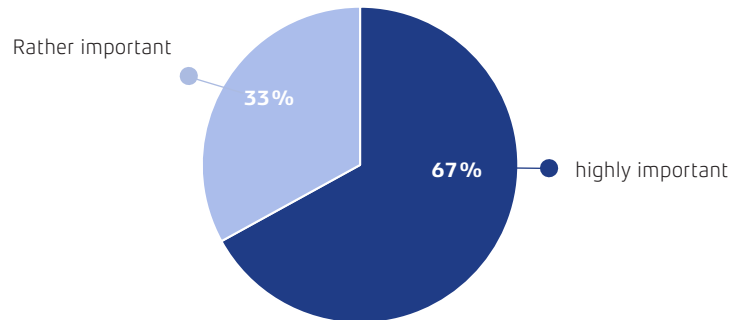
Do you think more regulation of certain aspects is needed to advance towards an environmental transition in the sector?



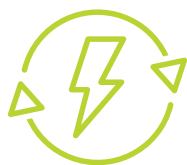
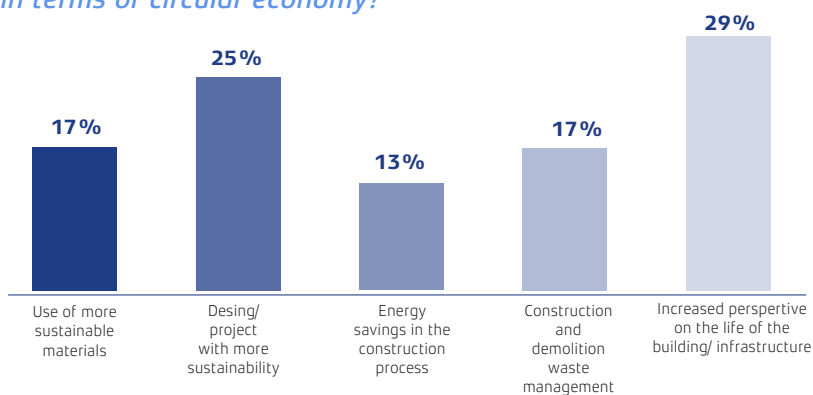
Please, indicate the competences needed to improve the performance of workers with regards to the transition to a circular economy.



What is the role of vocational training in driving the circular economy in the construction industry?

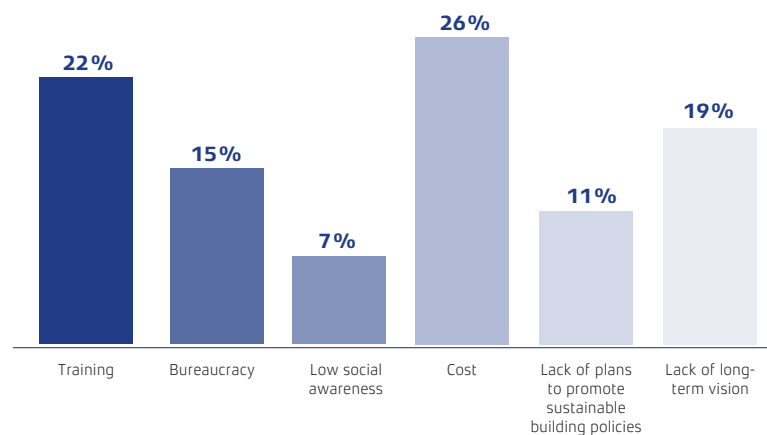


Regarding construction activities, which areas require the highest qualification of workers in terms of circular economy?

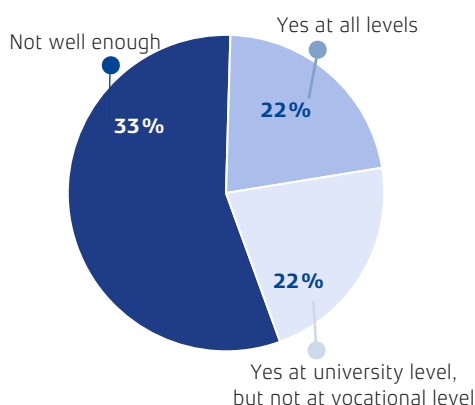


ENERGY EFFICIENCY

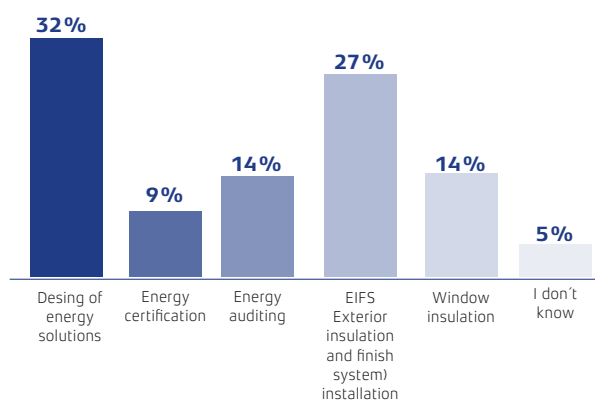
Please indicate the barriers that the sector faces in the field of energy efficiency in order to achieve sustainable construction.



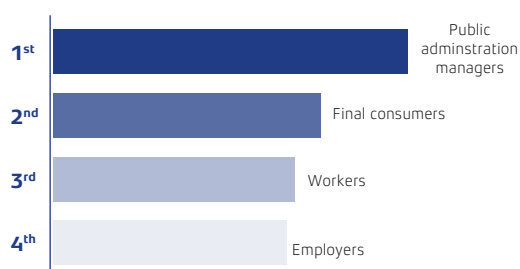
Do you think that training in energy efficiency is being adequately addressed in the educational system?



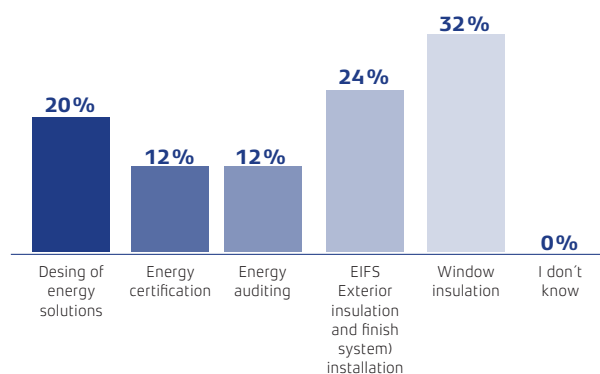
From the following list, which energy efficiency competences are most needed currently?



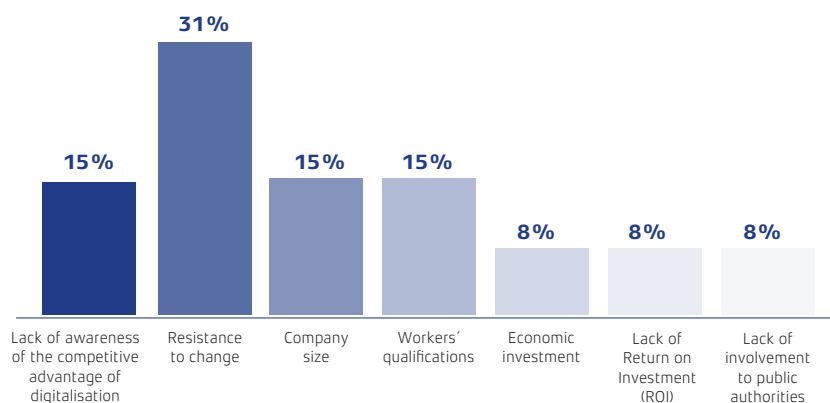
Rate in order of importance who is a priority to train in relation to energy efficiency



In which activities of the construction industry will the qualification of workers in energy efficiency have the most impact?



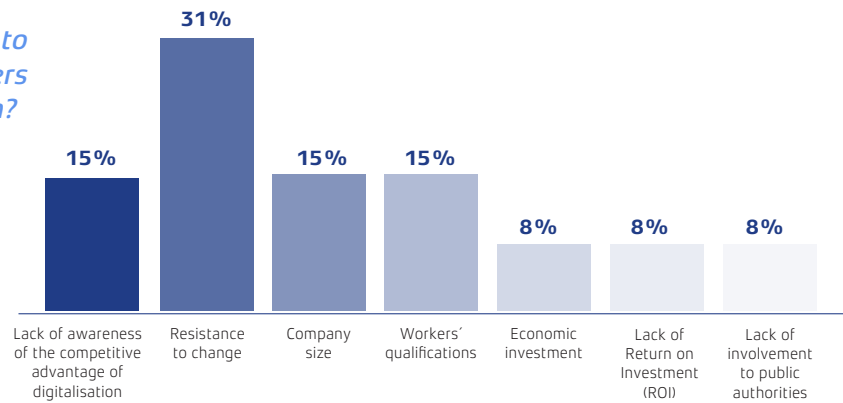
In which activities of the construction industry will the qualification of workers in energy efficiency have the most impact?



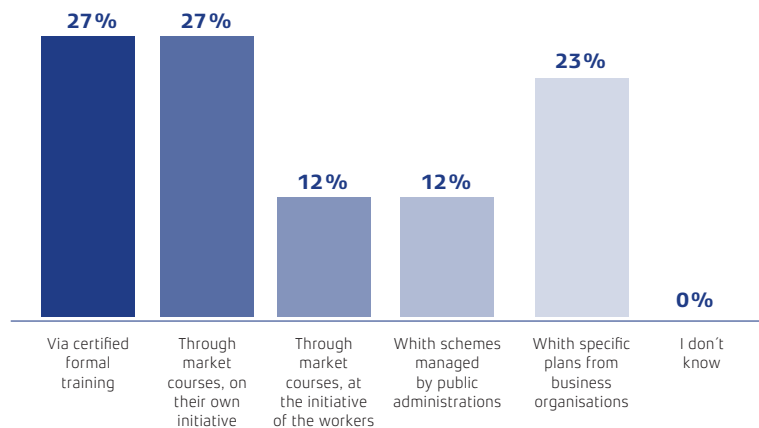


DIGITALISATION

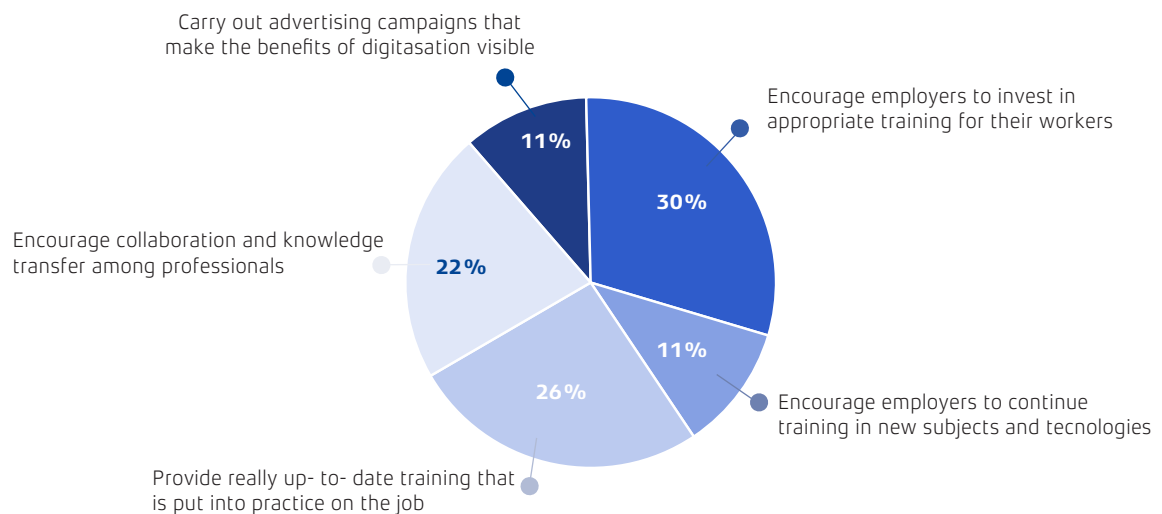
What are the barriers to qualify construction workers in the field of digitalisation?



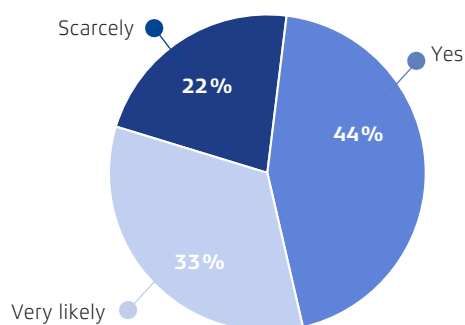
In what ways do you see the majority of companies becoming qualified to adapt to digitalisation?



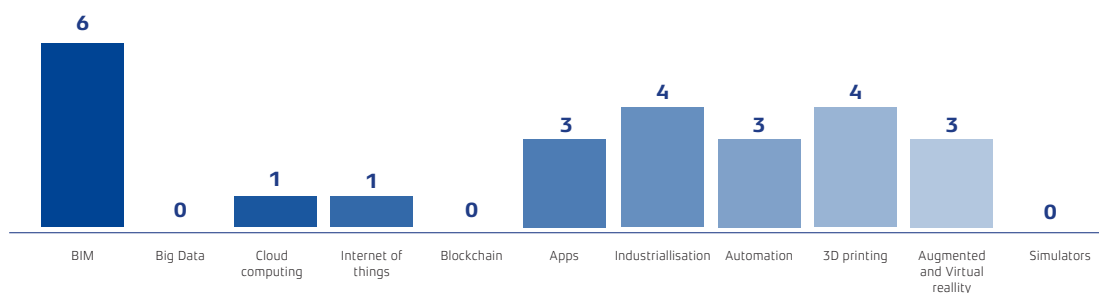
Some workers do not perceive digitalisation as a benefit in their daily work. How can this vision be improved?



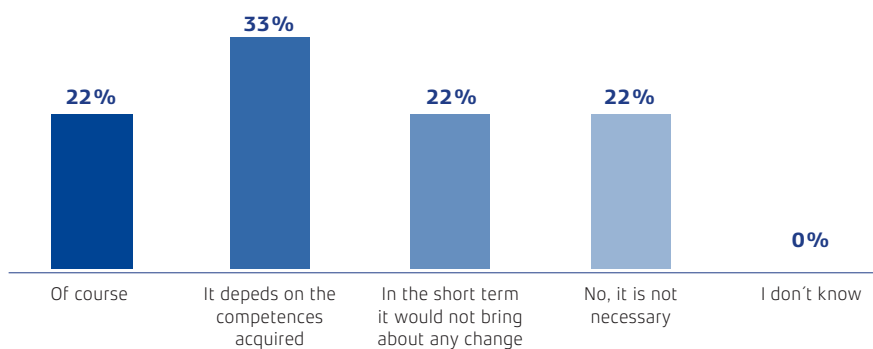
Would improving workers' skills in the use of tools increase the impact of the training they receive (e.g. in H&S)?



From the following options, which do you think would be most easily adopted by workers in the sector in the mid-term?



Do you think that the acquisition of skills in the use of BIM on site is essential in the short term for workers in the sector?



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