European Commission

Transition pathway for Construction









EUROPEAN COMMISSION
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Introduction

Vision: why a transition pathway for construction

The **updated EU Industrial Strategy**[1] emphasises a swift green and digital transition of EU industry and its ecosystems. It foresees cooperation with industry, public authorities, social partners and stakeholders to navigate each ecosystem's transition. Each industrial ecosystem must transform its business models and value chains to become the foundation of a green, digital and resilient European economy. But such transitions require **concrete and actionable plans (transition pathways)** developed for each of the industrial ecosystems.

Construction is the **second largest industrial ecosystem** in the European Union in economic terms, employing around 25 million people. As a result, it offers enormous potential to contribute to the European Green Deal[2] and the Digital Decade[3]. However, this large ecosystem also faces numerous challenges. These include current crises such as the aftermath of the Covid-19 pandemic and the Russian invasion of Ukraine, as well as the climate emergency[4], rapid digital transformation, and the transition from a linear to a circular economy[5].

Planning the future of construction is not only about setting new actions and commitments, but also about aligning efforts and identifying and closing critical gaps. It also requires attention to the coherence, enforcement, and success of previously announced policies. During recent years the Commission and national governments launched numerous initiatives that impact construction and the built environment. Among those are the Renovation Wave[6], the proposed Emission Trading System for Buildings (and Road Transport)[7], the New European Bauhaus[8], the Climate Adaptation Strategy[9], and proposals to revise key legislation such as the Construction Products Regulation and the Energy Performance of Buildings Directive. **Many targets exist on how the built environment should transform in the future, but far fewer indicators exist on how the construction ecosystem should evolve to deliver on these objectives.** The construction ecosystem is called to deliver building renovations faster than ever before and install renewable energy generation and management systems to help Europe use energy sustainably. In addition, the industry must continually provide monitoring and maintenance services, repair to critical infrastructure, and efforts to make buildings safer and more accessible. Construction works also involve administrative processes via public authorities that are moving from cumbersome paper-based to fully digitalised procedures. Construction must also play its part in the general effort to reach climate neutrality by 2050 and other environmental goals. Construction activities and buildings must prevent, reduce re-use

1 COM/2021/350 final
2 COM/2019/640 final
3 Decision (EU) 2022/2481 of the European Parliament and of the Council of 14 December 2022 establishing the Digital Decade Policy Programme 2030
4 SWD(2020) 176 final
5 COM/2020/98 final
6 COM(2020) 662 final
7 COM(2021) 551 final
8 https://new-european-bauhaus.europa.eu/index_en
9 COM/2021/82 final

and recycle waste, increase the use of secondary raw materials and decrease greenhouse gas emissions[10] and even help remove carbon dioxide from the atmosphere by storing it[11].

The built environment, the result of the construction ecosystem's activities, is omnipresent in citizens' lives. Europeans spend, on average, 85-90% of their time in buildings. Policymakers need to take into account the challenges faced by companies in the ecosystem, of which over 90% are micro-enterprises, to navigate a complex policy and regulatory framework.

This transition pathway describes the conditions and the necessary actions to achieve a resilient, competitive, greener, and more digital construction ecosystem. In addition, it proposes actions that support the transition towards safer buildings and affordable housing for all Europeans.

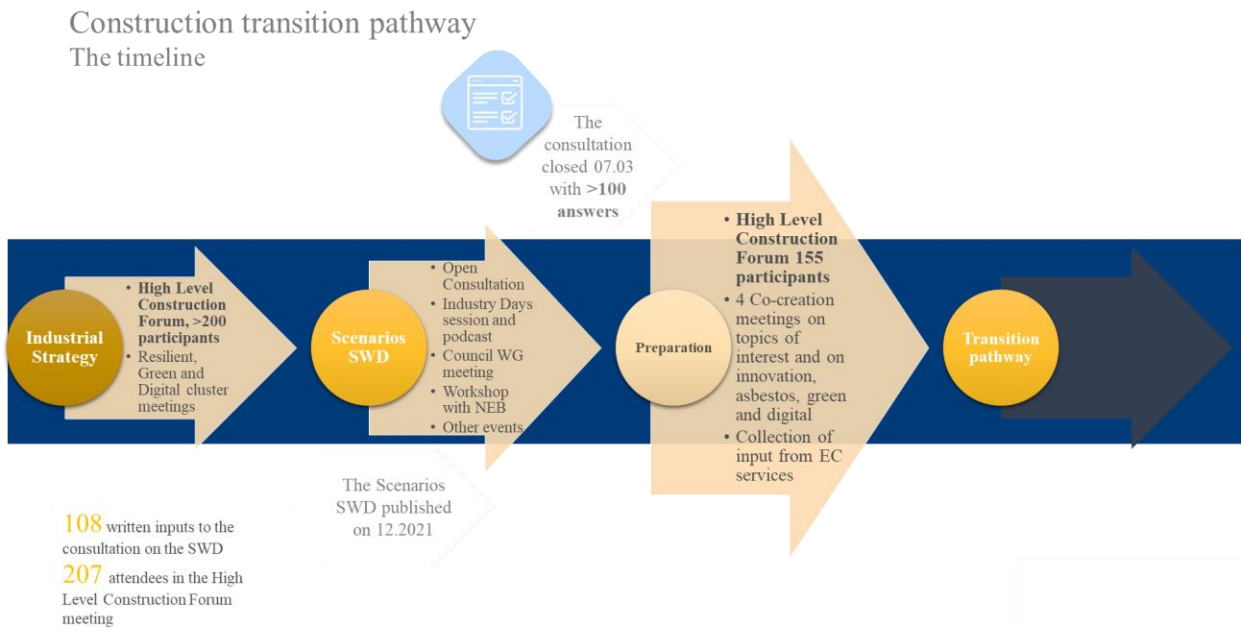
The process: delivering the transition pathway through co-creation

The European Commission and the **EU's Industrial Forum[12] developed a blueprint[13]** for the transition pathways of industrial ecosystems, including construction. Accordingly, the transition pathway for construction aims to offer a bottom-up understanding of the scale, cost, and conditions for resilience, competitiveness, the green and digital transition. These conditions are translated into an actionable plan whose success depends on the EU, its Member States, regional and local governments, industry, academia, and citizens.

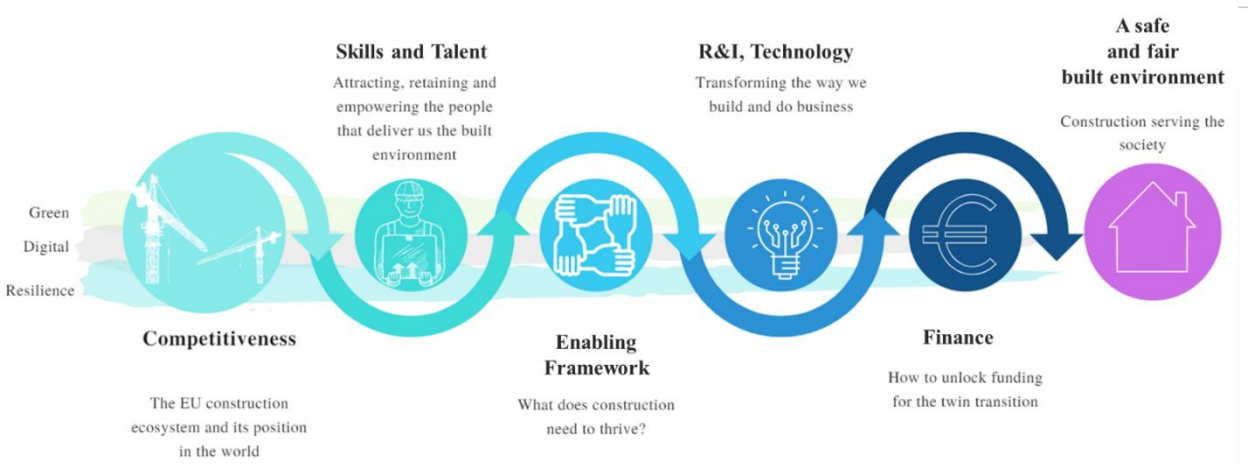
The High Level Construction Forum (HLCF) is the vehicle for the co-creation of the transition pathway. It includes over 700 members (companies, industry associations, Member States, academia and other stakeholders). The HLCF plenary meetings and focused thematic sessions are open to all interested parties, and as a result this is a growing community. The presence of the Commission services ensures that the construction industry is informed and appropriately consulted in all relevant policy areas that might affect their operations.

The December 2021 publication of the Commission Staff Working Document **"Scenarios for the transition pathway for a resilient, greener, and more digital construction ecosystem"**[14] was an important milestone in the transition pathway's co-creation. It described the main challenges and opportunities for the ecosystem, and the relevant policy, economic, and innovation landscape. It proposed scenarios, as potential actions for the Commission, Member States, and other stakeholders.

10 The Commission is developing a Roadmap to reduce life cycle emissions of buildings by 2050. The work is expected to be carried out during 2023, in a co-creation process with stakeholders, Member States and the High Level Construction Forum.
11 On 30 November 2022 the Commission adopted a proposal for a voluntary framework to reliably certify high-quality carbon removals. https://ec.europa.eu/commission/presscorner/detail/en/IP_22_7156
12 https://single-market-economy.ec.europa.eu/industry/strategy/industrial-policy-dialogue-and-expert-advice_en
13 Blueprint for the development of transition pathways for industrial ecosystems.
https://ec.europa.eu/docsroom/documents/49407
14 https://ec.europa.eu/docsroom/documents/47996



Over 100 organisations (Member States, industrial associations, companies, trade unions, researchers, standardisation bodies) provided written responses to the open consultation. These included comments on the scenarios as well as pledges of action. The document was presented at numerous Commission events and with the New European Bauhaus Community in dedicated workshops. It was also discussed with the Council Working Party on Technical Harmonisation (Construction Products). All of this input was analysed and presented in the **consultation report**[15]**,** which forms an important background for this document.



Above: Structure of the Transition Pathway for construction, with the six Building Blocks and the cross-cutting horizontal themes

15 https://ec.europa.eu/docsroom/documents/51254

The Commission invited stakeholders to discuss, organise and chair at total of nine dedicated sessions of the High Level Construction Forum[16] for the most prominent challenges and opportunities facing the ecosystem. The following sessions were organised in the first half of 2022:

- Enabling collection, interoperability and sharing of data
- Expanding and reinforcing digital tools to serve the green transition
- Calculating whole lifecycle GHG emissions in construction
- Stabilising the supply of materials and increasing resilience to external shocks, including through circularity

Additional meetings took place later in 2022 on the following subjects:

- Digital building logbooks: Existing national initiatives and linking of databases
- Innovation in construction: new ways of building, new ways of collecting and using data
- Green transition in construction and announcement of EU roadmap for the reduction of whole life carbon of buildings
- Asbestos in buildings: announcing a new EU initiative for scanning and addressing
- BIM and Public Procurement: two allies

The Commission has now considered all of the input provided since the beginning of the exercise in 2021. The result is this policy report, **the transition pathway for construction.**

16 Minutes and recordings of sessions and webinars can be found at https://single-market-economy.ec.europa.eu/sectors/construction/construction-transition-pathway_en

Building block 1: Competitiveness

This building block describes the construction ecosystem and critical factors affecting its competitiveness. It assesses how the ecosystem is performing in relation to other industrial ecosystems and with third countries. It also explores the dynamics of SMEs and of the start-up community that are contributing to the twin transition and resilience. Available networks, communities and platforms that support the competitiveness and resilience of construction enterprises are listed.

A **series of recommended actions** follows the analysis. These actions derive from the ecosystem's strengths and opportunities. The actions resulted from the co-creation process with stakeholders, and they are to be carried out by the Industry, the Member States, and the European Institutions over a short, medium or long-term period.

Construction: principal challenges and opportunities

The EU's construction ecosystem employs 24.9 million people and provides a value added of EUR 1 158 billion (9.6% of the EU total). These two make construction in economic terms the **second most important of the 14 identified ecosystems**, with retail being the only ecosystem with higher employment (29.8 million) and value added (11.5%)[17].

At the national level, the focus of public sector initiatives reflects the economic importance of the sector in each economy. Italy for example has numerous construction-specific programmes and an industrial focus, while Denmark and the Netherlands address construction more indirectly, as a contributor to sustainability.

Skills

Construction is labour intensive and currently lacking in skilled labour due to ageing workers retiring and challenges in attracting younger workers. The ecosystem suffers overall from a poor image, low uptake of innovation and low productivity. These factors overshadow creative and technological construction-related profiles that could be attractive to talent. The demand for **new skills** and roles to carry out the green and digital transition is rising and could be an opportunity for the ecosystem's future sustainable competitiveness. Industrial stakeholders who took part in the consultation confirmed the need to build the skills of the current construction workforce, attract new workers and improve diversity as perquisites for achieving the twin transition.

The European Union supports the development of the ecosystem in various ways: funding pilot training modules at the EU level; incentivising partnership creation and capacity building; and provide means to Member States for mass-scale training. However, funding available to Member States is not always earmarked specifically for construction, therefore it is up to national initiatives to prioritise support and training in the right way.

17 COMMISSION STAFF WORKING DOCUMENT Ares(2021)7679109 final: Scenarios for a transition pathway for a resilient, greener and more digital construction ecosystem. https://ec.europa.eu/docsroom/documents/47996

The green transition and the life cycle of construction works

Construction represents the biggest source of Europe's waste, with 37.5% of the total generated in 2020 by mass[18]. The recovery rate for construction and demolition waste stands at 89% across the EU27 with significant differences across Member States, but this has improved very little over recent years and much of it consists of backfilling[19]. The actual substitution of primary material by re-use and recycling remains low. If current practices in the EU 27 continue in a business-as-usual scenario, the renovation of buildings alone will consume 918 million tonnes of virgin materials from 2022-2050[20]. Buildings are also responsible for about 40% of Europe's energy consumption, but the ageing building stock suffers from a low rate of renovation, around 1% per year[21]. This is insufficient to meet Europe's climate and energy goals, as well as the transition to a circular economy. Construction, renovation, maintenance, and demolition activities generate greenhouse gas emissions. Data regarding whole life cycle emissions of construction works at the EU level is limited. However, Eurostat has estimated the carbon footprint of construction and demolition works[22] and several Member States have estimated construction-related emissions at the national level[23]. Several Commission studies are expected to provide better data on whole life cycle emissions associated with the EU building stock. Efforts in this direction must also take into account how climate impacts are likely to affect built assets in the future, a risk that is also recognised in the **EU Climate Adaptation Strategy**[24].

There is an opportunity for construction to operate in a more resource efficient way and make greater use of secondary materials, while avoiding the use of hazardous materials. Material use for buildings could potentially decrease by 30% if used more efficiently[25]. Some materials commonly used in construction, such as metals, gypsum and asphalt, are in theory fully recyclable. The carbon neutrality roadmaps published by the main construction products manufacturers show a great interest in this topic. Moreover, there remains great potential for construction to adopt industrialised techniques as a way of increasing productivity as well as resource efficiency. **Overall, the most effective single action to reduce material**

18 Eurostat, 2020. https://ec.europa.eu/eurostat/statistics-explained/index.php?title=Waste_statistics#Total_waste_generation The proportion has increased from 2018 when it stood at 35.9%.
19 Eurostat, 2022. https://ec.europa.eu/eurostat/databrowser/view/CEI_WM040/default/table?lang=en
20 European Environment Agency, 2022. Modelling the Renovation of Buildings in Europe from a Circular Economy and Climate Perspective. https://www.eea.europa.eu/publications/building-renovation-where-circular-economy/modelling-the-renovation-of-buildings/view
21 Renovation Wave communication COM(202) 662 final. https://energy.ec.europa.eu/topics/energy-efficiency/energy-efficient-buildings/renovation-wave_en
22 See https://ec.europa.eu/eurostat/statistics-explained/index.php?title=Greenhouse_gas_emission_statistics_-_carbon_footprints
23 For example, Denmark has calculated CO_2 limit values for new buildings as part of its National Strategy for Sustainable Construction.
https://im.dk/Media/637602217765946554/National_Strategy_for_Sustainable_Construktion.pdf Ongoing Commission studies are expected to supply new and better data on this subject at the EU level.
24 COM(2021) 82 final.
25 Material Economics, 2018. 'Circular Economy – A Powerful Force for Climate Mitigation'. See https://materialeconomics.com/publications/the-circular-economy-a-powerful-force-for-climate-mitigation-1

consumption in building works would be to extend the lifespan of existing assets[26]. The Renovation Wave[27] highlighted the importance of combining improved energy efficiency with circularity and resource efficiency. This will further contribute to the Green Deal Industrial Plan[28] and REPowerEU objectives.

Digitalisation

In terms of **digitalisation**, construction bears the negative reputation of a slow adopter of technology and innovation. This can be traced to the traditional nature of construction activities and the industrial ecosystem's fragmentation: a building needs dozens of different professionals to be involved to its delivery, with most of these professionals being self-employed or employed by micro-enterprises. It is challenging for micro and small enterprises to digitalise and innovate while often struggling for their survival.

At the same time, we cannot ignore that **the way we build, manage, and intervene in the built environment is being transformed** with numerous applications of BIM (Building Information Modelling), IoT (Internet of Things), sensors, robots, drones, scanning tools and even earth observation. The public sector is contributing to the digital transition with an accelerated transformation of procurement, building permits, platforms, digitalisation of building archives and information and by setting requirements for transparency and trust. As digital technologies can accurately record, assess, simulate, measure, track and cut emissions over the entire life cycle of a building, further digitalisation has the strong potential to support a sustainable built environment[29].

Crises challenging ecosystem functioning

The **COVID-19 pandemic, the war in Ukraine and the current energy crisis** had all a clear impact on these supply chains, including for steel, copper, aluminum, and wood as well as recently for clay materials (e.g., bricks, tiles), mineral products (gravel, cement, and concrete), glass and certain chemical products. This demonstrates that their robustness and resilience is vital for the resilience of the construction sector itself.

The output of the construction ecosystem suffered a decline during 2020 because of lockdowns, with a turnover loss of about 5% compared to 2019. However, in terms compared to some other ecosystems, the decline was rather short and much less severe. As a result of the pandemic and the lockdowns, confidence levels in the construction ecosystem dropped by almost 30% between February and April 2020. However, in May 2020 the confidence levels started to recover slowly, stabilising in October 2020.

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26 European Environment Agency, 2022. Modelling the Renovation of Buildings in Europe from a Circular Economy and Climate Perspective. https://www.eea.europa.eu/publications/building-renovation-where-circular-economy/modelling-the-renovation-of-buildings/view

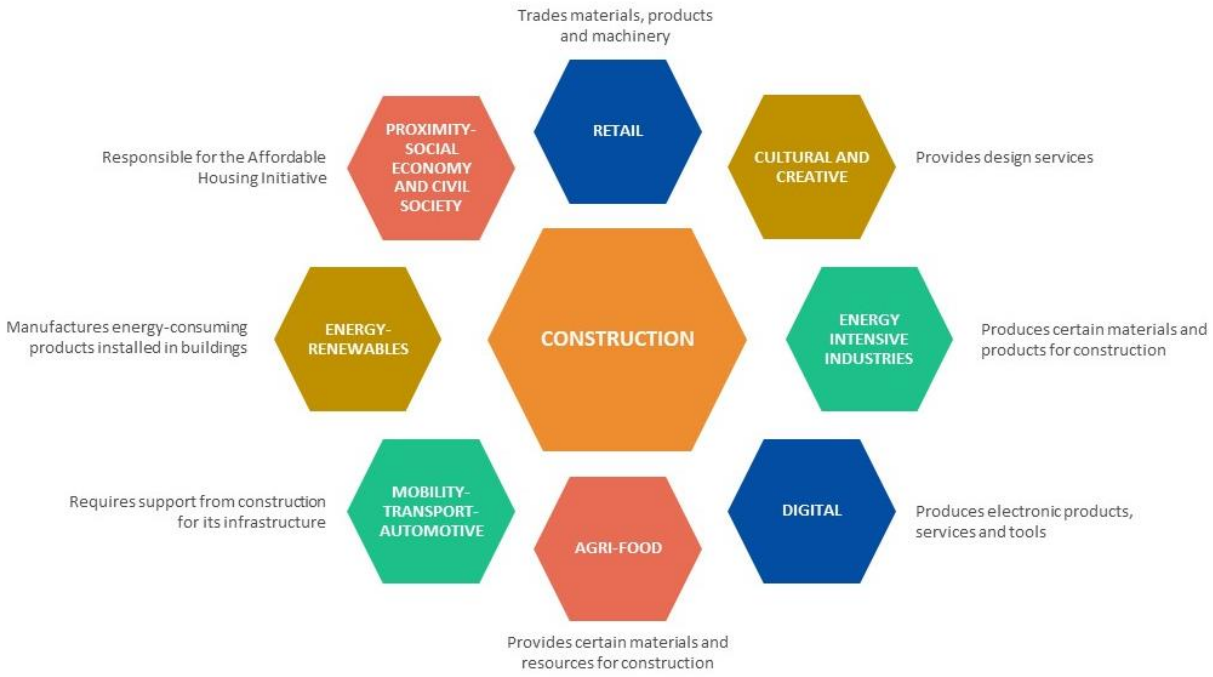
27 COM(2020) 662 final. See also https://energy.ec.europa.eu/topics/energy-efficiency/energy-efficient-buildings/renovation-wave_en

28 See https://ec.europa.eu/commission/presscorner/detail/en/ip_23_510

29 DIGITALEUROPE, Paving the way towards a sustainable and digitalised European building sector, https://www.digitaleurope.org/resources/paving-the-way-towards-a-sustainable-and-digitalised-european-building-sector-digitaleuropes-views-on-the-revision-of-the-epbd

From February 2021, confidence started to rise more clearly, and reached pre-pandemic levels in April 2021[30].

In addition to the general indicators such as turnover and confidence, the pandemic had a substantial effect on the construction ecosystem, providing shifts in supply and demand for materials, finished products and workforce. Another looming crisis that is likely to threaten the functioning of the ecosystem in various ways is the ongoing change in the Earth's climate. For instance, the supply of biobased materials for construction may be compromised by drought and heat induced wildfires and by the proliferation of tree pests and diseases under the changing climate conditions.



Above: the EU's industrial ecosystems are not isolated from each other. Due to its complexity, construciton is interconnected with other industrial ecosystems.

Construction and other industrial ecosystems

Construction supply chains are generally complex as they rely on inputs and services from various sources. For this reason, the construction ecosystem depends largely on other ecosystems, with the **Energy Intensive Industries (EIIs)** being a major provider of essential construction products, such as steel, glass, aluminum, mineral products (cement, concrete, and concrete products), chemical products (asphalt, paint, varnish) and clay products (bricks and tiles). Indirectly, but importantly, the construction ecosystem is dependent on the availability of specific raw materials, often sourced via trade with third countries. Some of these issues are treated in the second stage of in-depth reviews of EU strategic dependencies[31] and mostly concern the importance of securing access to critical raw materials for EU industries, the need

30 EC analysis based on survey by ECFIN
31 https://ec.europa.eu/docsroom/documents/48878

to diversify the supply chains and facilitate EU projects through permitting and clear regulatory framework.

All **wholesale trade,** including the wholesale of building materials and machinery, is included in the **Retail Ecosystem**. As a transport intensive industry, the construction ecosystem obviously has strong links with the **Mobility-Transport-Automotive Ecosystem**. For example, e-mobility charging stations for both bikes and vehicles are being deployed in the building stock, including innovations like solar vehicle-to-grid (V2G).

To ensure the availability of sufficient building materials, the ecosystem is very dependent on supplies **from the primary sector** to produce building materials. The following activities are important in this regard:

- The mining of metal ores (iron, zinc, copper), quarrying of stone, sand and clay, and extraction of crude petroleum. The extraction of these raw materials mainly feeds the EII ecosystem which in turn feeds the construction industry.
- Harvesting of raw wood for industrial use within the sector of 'Agriculture, forestry and fishing'[12] as part of the **Agri-Food Ecosystem**.

With respect to the twin transition of the construction ecosystem, including the renovation and digitalization of the built environment, there are strong links to:

- **The Digital Ecosystem:** not only the production of electronic products or robots used in construction, but also the telecommunication and information activities to digitalize the construction industry and the built environment.
- **The Energy-Renewables Ecosystem** covers manufacture of products that are installed in buildings by actors of the construction ecosystem, for example renewable energy sources like solar panels and heat pumps, equipment destined for buildings and infrastructure, and construction machinery. It also enables decarbonizing the manufacturing of construction products.

The Affordable Housing Initiative reinforces the links of construction with the **Social Economy and Proximity** ecosystem, particularly in action related to the Renovation Wave. Additionally, the **Cultural and Creative Industries e**cosystem includes aspects of architectural and engineering activities, technical testing and analysis as well as specialised design services.

The European construction ecosystem in the world

A Commission study from 2019[32] suggested that **SMEs should not rush into international markets unprepared**. This is particularly the case with parts of the construction sector where companies work on the spot and often must rely on local staff, materials, and work to local regulations. The consensus was that foreign markets can be a useful source of profit if the SME gets it right. If not, they can lose a lot.

The time scales of construction projects and related payment schedules often create problems for **internationalising construction SMEs**. A local EU based bank might provide short-term credit for a local

32 European Commission, Executive Agency for Small and Medium-sized Enterprises, Internationalisation of SMEs from the European construction sector in third markets : drivers, challenges and policy examples : final report, Publications Office, 2020, https://data.europa.eu/doi/10.2826/99446 https://op.europa.eu/en/publication-detail/-/publication/6be10d2b-722c-11ea-a07e-01aa75ed71a1/language-en/format-PDF/source-221969706

SME with whom it has a long-term banking relationship while the SME is waiting for large, staged payments by customers. However, such short-terms credit might not be as readily forthcoming in foreign markets. If such payments are further affected by delays related to exchange rates and currency availability, it can have negative cash flow consequences for otherwise profitable projects[33].

There is an increasing presence of **Chinese** (state) **companies**[34] in the European market for large-scale construction projects. This is especially the case for large-scale infrastructure projects such as the construction of railways and bridges, notably the construction of the Pelješac Bridge in Croatia by a consortium led by the China Road and Bridge Corporation. The total share of works performed by Chinese companies is still relatively low for the time being and internationalisation of the competition is to be encouraged. However, great care must be taken that the rules of competition are not broken by allowing companies on the European market that are subsidized from their own country or that do not meet the social preconditions that European companies must meet. To ensure a level playing field, more **scrutiny on subsidies given by third countries to companies competing in the European market**[35] appears to be in order, as well as scrutiny into the quality of materials and social conditions for employees deployed during implementation.

In the other direction, **there are often substantial thresholds for European construction companies to enter foreign markets**. For example, in the **United States**, the recently agreed "Infrastructure and Investments Jobs Act" (IIJA) will deliver USD 550 billion of new federal investments over the next five years. The IIJA focuses on updating the outdated infrastructure and create new networks. In general, many of these projects represent important opportunities for European companies. However, public procurement rules in the US are quite strict, including the "Build America Buy America" (BABA) Act. BABA makes it difficult for European companies to access this market, and yet they need a strong foothold in the US as part of broader consortia.

Enforcing a European identity in construction

The construction industry and the way we construct is in the centre of this pathway. However, we cannot ignore the impact that the completed buildings and infrastructure have in raising the status and competitiveness of the European construction.

Strong policy directions and a tradition in valuing **architecture**, aesthetics and quality are also factors that elevate the position of the European construction ecosystem in the world. The **New European Bauhaus** (NEB) positions principles such as sustainability, beauty, and inclusiveness in equal footing to efficiency. The EU is developing an integrated and people-centered approach to a sustainable built environment, where architecture has a major role to play to design buildings, public space and urban landscapes that contribute to citizens' quality of life[36].

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33 https://ec.europa.eu/docsroom/documents/38521
34 https://www.fiec.eu/priorities/China-Challenge article
35 On 12 January 2023 The Foreign Subsidies Regulation (FSR) entered into force, addressing distortions caused by foreign subsidies. The FSR addresses these distortions and closes a regulatory gap, whereby subsidies granted by non-EU governments go currently unchecked, while subsidies granted by Member States are subject to close scrutiny. It proposes new tools to effectively tackle foreign subsidies that cause distortions and undermine the level playing field in the internal market. https://competition-policy.ec.europa.eu/foreign-subsidies-regulation_en
36 https://culture.ec.europa.eu/cultural-and-creative-sectors/architecture

The Mies Van der Rohe award, the EU award for architecture, is mainstreaming exceptional architecture that is serving communities and at the same time climate goals. An excellent example of what quality architecture can help us achieve is the Emerging winner of the **EU Mies Awards 2022**[37]: *La Borda cooperative housing.* This is a self-organized development to access decent, non-speculative housing, including several community spaces.

Higher environmental standards can help EU companies win tenders within the EU and internationally. The EUR 300 billion Global Gateway[38] initiative for investments in physical infrastructure is values driven and based on the EU's high social, environmental, fiscal, and labour standards.

Above: La Borda nominated for the Mies 2022 awards. Image source : http://www.laborda.coop/en/2021/02/21/la-borda-nominated-for-the-mies-2022-awards/

The twin transition of construction internationally

In terms of the **digital transformation** of industry and processes related to construction, the EU is not always the frontrunner. Gulf and other **Asian countries** have long been using BIM and digital permits to automate processes and administration. For example, in **South Korea**, BIM has been compulsory for all large public projects since 2011 and for all public construction projects since 2016. BIM can help optimise energy usage by presenting and visualising system components and consumption, by predictive maintenance and by enabling real-time facility management. For this reason, it has the potential to support the EU in reaching its climate goals.

37 https://miesarch.com/work/4554
38 Global Gateway https://commission.europa.eu/strategy-and-policy/priorities-2019-2024/stronger-europe-world/global-gateway_en

However, Europe is leading in other technologies such as construction-related 3D printing and prefabrication[39]. Although robotics started being used in construction in **Japan** several decades ago due to a booming real estate market, Europe is also well positioned to deploy innovations in this area.

The European Union is not alone in pursuing policies supporting the **green transition** of industry, including construction. For example, **China** has been developing a green finance taxonomy that shares similarities with the EU Taxonomy for Sustainable Activities. The EU-China Common Ground Taxonomy[40] has named construction as one of the areas where commonalities occur, in the context of climate change mitigation. Japan is pursuing policies supporting decarbonization of industry and climate neutrality, an ambition that was formalized in 2021 through EU-Japan Green Alliance[41]. Various third countries have developed policies supporting circular approaches to construction, including at regional or city level[42].

The global stock of **buildings emitted 12 gigatonnes of CO_2 equivalent greenhouse gas emissions during 2019, or 21% of the world's total**[43]. This breaks down to 57% indirect emissions from offsite generation of electricity and heat, 24% emissions produced directly onsite, and 18% embodied emissions from the use of cement and steel. Although life cycle emissions from buildings fell to 11.7 gigatonnes by 2020, this decline is mostly explained by the COVID-19 pandemic, and underlying progress to decarbonise construction remained limited. Indeed, global emissions from construction and buildings rebounded in 2021[44]. The decade 2020-2030 is critical to realise a sustainable pathway for construction and buildings[45]. One of the tools to help this process would be consistency in measuring and reporting on life cycle emissions. A global coalition of organisations has developed the voluntary International Cost Management Standard (ICMS)[46] to support consistent reporting of life cycle costs and carbon emissions of construction works. This is largely based on the same standards as the Commission's Level(s) framework[47] in this area.

39 The High Level Construction Forum heard from businesses working on innovative technologies at an event it hosted on 19 October 2022. Details available here: https://single-market-economy.ec.europa.eu/sectors/construction/construction-transition-pathway_en

40 International Platform for Sustainable Finance https://finance.ec.europa.eu/sustainable-finance/international-platform-sustainable-finance_en For the comparison of construction-related activities see 'Common Ground Taxonomy Table of Activities'.

41 https://climate.ec.europa.eu/news-your-voice/news/eu-and-japan-commit-new-green-alliance-work-towards-climate-neutrality-2021-05-27_en

42 The Commission's 2021 'study on circular economy principles for buildings' design' featured numerous case studies https://op.europa.eu/en/publication-detail/-/publication/86c67cd0-0f83-11ec-9151-01aa75ed71a1/language-en/format-PDF/source-230073893

43 Intergovernmental Panel on Climate Change (IPCC) 6th Assessment Report 2022, Chapter 9 'Buildings'. Doi: 10.1017/9781009157926.011

44 Global Alliance for Buildings and Construction: 2022 Global Status Report for Buildings and Construction. See https://wedocs.unep.org/20.500.11822/41133

45 IPCC 6th assessment report 2022, as before.

International Cost Management Standard | International standards and data for a global construction industry (icms-coalition.org)

47 Level(s) https://environment.ec.europa.eu/topics/circular-economy/levels_en

Construction start-ups

> *" Technology innovators and entrepreneurs across Europe are increasingly eyeing the construction industry. It helps that construction is a mega market of almost €2tn on the continent alone. But founders, and their investors, aren't attracted only by market size. They're betting on the impact of digital transformation in an industry that has been, so far, a sleeping giant.''*
>
> M. Amwad and K. Gillet, Sifted.eu, 2021[48]

Construction start-ups, so-called "construction tech", translate high tech innovation to products and services that are financially and technically useful for construction. In addition, start-ups typically monetise by offering digital transformation as an operational expense rather than a capital expense. In other words, construction companies pay a subscription to start-ups to use their services (see example in the box below). These subscriptions are an important level, given limited profit margins and ability to invest in digital technologies[49]. The European Innovation Council has recently set up a dedicated programme for management support for innovations in architecture, engineering and construction[50].

It is interesting to note the interest of industry leaders and venture capitalist to start-ups. Cemex Ventures is looking at solutions in the green construction and productivity increase. Dysruptek by Haskell, Ferrovial, GS Futures, Hilti, VINCI Group´s Leonard, NOVA by Saint Gobain, Procore, and Zacua Ventures they organise the Construction Start Up Competition[51].

AISTI[52], a Finish start-up is developing wood fibre-based acoustic tiles that are easy to recycle and plastic-free. Founded in 2019, AISTI is bringing a practical choice to the construction industry to help the goal of reaching a reduced carbon footprint. In April 2020 it was announced that EUR 1.6 million was raised by a group of investors assembled by Valve Ventures[53].

Flexcavo[54] is a Berlin based start-up that received around EUR 7 million in 2022. The start-up aims to accelerate the digitalization of construction by pursuing two core business models. On one side, it leases construction equipment from well-known manufacturers to construction companies of all sizes. On the other, it develops software solutions for digital fleet management. [55]

48 Tech disrupts the €2trn construction market. https://sifted.eu/articles/construction-tech/
49 Digitalisation in Construction, Analytical Report, European Construction Sector Observatory (2021)
50 https://eic.ec.europa.eu/eic-communities/eic-programme-managers_en
51 Construction Startup Competition 2022 https://www.cemexventures.com/constructionstartupcompetition/
52 http://aisti.com/
53 EU-Startups https://www.eu-startups.com/2022/04/finnish-startup-aisti-scores-e1-6-million-to-revolutionize-construction-material-industry-with-sustainable-acoustic-tiles/
54 http://www.flexcavo.de/
55 EU-Startups https://www.eu-startups.com/2022/02/berlin-based-flexcavo-picks-up-around-e7-million-to-digitise-the-construction-industry/

Vizcab, a French construction tech startup founded in 2020, allows construction and real estate players to reduce their carbon footprint with the help of data calculating, reporting and visualisation tools. It has three main tools: The Vizcab Explo tool (which allows project owners to build secure and competitive carbon energy strategies); The Vizcab Eval (a Life Cycle Assessment calculation software used by engineering and general contractors), and the Vizcab Dashboard (capitalisation and reporting platform). Vizcab closed its first funding round of EUR 1.6 million with the support of Banque des Territoires and A / O Proptech, as well as the Unibail-Rodamco-Westfield group.

BuildSafe is a Stockholm-based company that provides a safety management cloud service for construction. The tool helps construction companies and builders with reporting, documenting, and monitoring risks in their projects. Founded in 2015, Buildsafe already has major clients such as Skanska and Fabege and EUR 1 million in funding to bring more transparency in the sector.[56]

Accelerating growth and competitiveness through networks

Cluster organisations offer co-ordination and support as well as access to EU programmes and networks. They also allow SMEs to internationalise, which can be difficult for them to achieve on their own. Other support for internationalisation and competitiveness to the construction industry is delivered through **European, national and regional level organisations.**

Several **EU initiatives and networks** aim to strengthen the competitiveness and sustainability of Europe's economy and industry, particularly SMEs, and improve their performance in terms of productivity, resource efficiency, innovation, and international competitiveness.

- The **European Resource Efficiency Knowledge Centre** (EREK)[57] is one of the tools deployed by the European Commission to achieve the ambitions of the EU Green Deal. It is here to help European companies, especially SMEs, save resources (water, energy, waste) and engage in circular economy and industrial symbiosis. EREK supplies tools, information and business opportunities proving new and better ways to be resource efficient and benefit from circular economy business models which turn waste into assets. EREK also supports industrial clusters, national, regional, and local organisations across Europe that work with SMEs to improve their environmental performance, helping them to become more resource efficient.
- The **Enterprise Europe Network**[58], has a dedicated **Sector Group on Construction** with 38 members. Its work kicked off in May 2022. Since then, the members have co-decided the structure of the group and a work plan for the upcoming year. To maximise impact, the group met in Porto, Portugal, on 13-14 October 2022 in parallel to the CONCRETA fair[59].

56 EU Startups (2019). 10 European startups shaping the future of the construction industry. https://www.eu-startups.com/2019/09/10-europeanstartups-shaping-the-future-of-the-construction-sector/
57 European Cluster Collaboration Platform https://clustercollaboration.eu/
58 Enterprise Europe Network https://een.ec.europa.eu/about-enterprise-europe-network
59 Concreta: the largest Architecture, Construction, Design and Engineering Fair of the future returns to Exponor - Concreta

- **Digital Innovation Hubs (DIHs)** play a key role in supporting companies to take advantage of digital opportunities. Companies that want to go digital have the choice between a wide range of digital technologies and software and may need support in finding the best solution to their needs. In addition, the challenges start once the technologies are acquired – meaning that businesses need to invest human and financial resources to familiarise themselves with the technology, adapt their routines accordingly, train staff etc. The DIHs tackle such a gap by supplying a range of services that could be assimilated to "technical assistance". Moving forward, the DIHs are expected to play a key role in supporting the uptake of e.g., digital technologies, including in the construction sector. About 124 fully operational DIHs offer services that can be relevant for the construction sector, while 69 DIHs specifically focus on supporting the digital transformation of construction. These are spread over 23 Member States, with countries such as France, the Netherlands, Spain, and Italy having more than 10 DIH related to the construction sector, including over 50% in average specialised in construction[60].
- The **European Cluster Collaboration Platform**[61] is a comprehensive online platform, providing support offers, such as maps and matching to and of clusters; is a growing community of and around clusters; and acts as a service facility aiming to provide cluster organisations, cluster partnerships, initiatives and networks, cluster associations and resource efficiency support actors (EREK) public authorities and decision makers, benefitting companies and other stakeholders with a variety of modern tools for cross-industry and cross-sectoral cooperation, capacity building and others. There are 75 Cluster Organisations[62] active in the construction ecosystem that is also part of the ECCP network.
- **Euroclusters**[63] (or Joint Cluster Initiatives, JCI) is a new initiative following the updated EU Industrial Strategy. With a budget of EUR 42 million, Euroclusters will contribute to building resilience and accelerating the transition to a green and digital economy. There are 4 Euroclusters strongly related to the Construction Ecosystem: AEC (Architecture, Engineering and Construction) Eurocluster, Polrec, Sustain and xBuild-EU.
- Supporting the uptake of BIM is still a priority of the Commission[64]. This is done, for example, by convincing and empowering public authorities to use BIM in the procurement process of construction and infrastructure projects. Many national, regional, and local procurers have already adopted the use of BIM and digital technologies, mainly for infrastructure and large-scale construction projects. However, there is still a lot of room for improvement. For this reason, a new initiative[65] has been launched to collect insights into the state of play through a new multi-dimensional categorization, and with the added aim of describing many use cases linked to BIM. A community of practice is also being developed as part of an on-line platform called the Public Buyers Community. This platform is promoting collective intelligence and joint action among contracting authorities and will host a digital community on how to apply BIM in public

60 Digitalisation in construction, Analytical Report, European Construction Sector Observatory (2021) https://single-market-economy.ec.europa.eu/document/download/3ae8a41e-4b82-4150-968c-1fc73d1e2f61_en
61 European Cluster Collaboration Platform https://clustercollaboration.eu/
62 ECCP Visual Reporting Site (clustercollaboration.eu)
63 https://clustercollaboration.eu/euroclusters
64 See for example this cost-benefit analysis: http://www.eubim.eu/cost-benefits/
65 Support of the Digitalisation of the Built Environment, Public Procurement and SMEs in Construction - https://etendering.ted.europa.eu/cft/cft-display.html?cftId=10352

procurement., as part of the already existing **Big Buyers Community**[66]. All these tasks will be performed in close consultation with stakeholders, from the High Level Construction Forum and the **EU BIM Task Group**[67] which has been representing and coordinating efforts of public buyers since 2016.

- The **Construction 2050 Alliance**[68] is a partnership set up in 2020 made up of more than 50 European organisations representing the actors of the built environment working together to advance the needs and priorities of the wider construction and built-environment sector at the European level. The Construction 2050 Alliance has been set up to coordinate common political messages of the construction value chain and raise the political importance of the sector at the European level and is initiated by the European Builders Confederation (EBC), the European Construction Industry Federation (FIEC), CECE (Committee for European Construction Equipment) and Construction Products Europe (CPE).
- The **Intelligent Cities Challenge**[69] initiative is supporting EU cities make the transition to a net-zero economic model, through Local Green Deals[70]. These are integrated, multi-disciplinary action plans to lead the green and digital transition across sectors, including the built environment and construction sector. This initiative helps cities harness the power of cutting-edge technologies and clean tech, while improving their competitiveness, social resilience and the European citizens' quality of life. For instance, the Amsterdam Metropolitan Area has launched a Local Green Deal on timber construction, mandating that 20 per cent of all new housing projects in the Dutch capital must be constructed with wood or other biobased materials from 2025. This has been signed by all 32 municipalities in the Metropolitan Region of Amsterdam (MRA) region.

Euroclusters are opening new markets for construction SMEs

The AEC Eurocluster project[71] focuses on mapping the ecosystem, showing potential causes for the disruptions it is experiencing, showing involved actors along the value chains and interlinkages between them. Building on elaborated business continuity plans that prepare for future challenges, a cluster-to-cluster learning program enhances cluster managers skills on problem identification and risk-minimized product creation processes. It allows them to put this expertise promptly into practice by enriching their service portfolio for business support. Moreover, companies can also benefit directly from upskilling activities by teaming up with certificated open innovation trainers and learn how to become aware of needs and deliver solutions related to digital and transition.

The consortium members have extensive experience in EU project development and implementation, with references as DESALPS (INTERREG) to support SMEs in adopting design thinking practices and MOVECO (INTERREG) for mobilizing institutional learning for better R&I exploitation in circular economy. The consortium is composed of the Construction Cluster of

66 https://bigbuyers.eu/
67 http://www.eubim.eu/
68 https://euconstruction2050.eu/about/
69 https://www.intelligentcitieschallenge.eu/
70 https://www.intelligentcitieschallenge.eu/sites/default/files/2021-06/Local%20Green%20Deals-8.pdf
71 https://profile.clustercollaboration.eu/profile/cluster-partnership-initiative/7325860f-becd-4918-bd40-a7ad4c120a2d

Slovenia (CCS), the Furniture & Timber Construction Cluster at Business Upper Austria (BIZUP), the Technological Cluster on Interiors and Design, Italy (DID), the Southern European Cluster in Photonics and Optics, Spain (SECPHO), the Technology Enabled Construction Cluster in Romania (TEC) and Black Sea Energy Cluster, Bulgaria (BSEC).

Strategic dependencies challenging construction resilience

Several product groups that are integrated in buildings and handled by construction professionals experience important import concentration. Among these are heating and cooling products, with large import shares from China, Turkey and the United Kingdom, also copper wire, with large import shares from Turkey, and plastics for sanitary use, with large shares from the United Kingdom and China. Although these kinds of products sometimes fall under the Energy and Renewables ecosystem rather than construction, they are essential for the modernisation and decarbonisation of buildings' energy consumption. The importance of this import concentration should not be overestimated. Previous research has shown that very few construction products have a high net import concentration. The only outlier in this area is air conditioning systems, with more than half of EU demand being met by net imports.

The **main strategic dependencies** for construction products occur at the beginning of the value chains, at the level of raw materials. Some examples of main constituents are iron ore for steelmaking and bauxite for aluminum production. Several strong dependencies exist for materials that are not the main constituent but are an essential element for production: magnesia for clay products, molybdenum and nickel for steel, fluorspar for aluminum and feldspar for glass.

The general move towards digitally powered smart buildings creates a dependence on electronic components. A shortage of chips has recently caused problems in the production of solar panels (inverters), home automation and automatic window screens. In February 2022, the Commission proposed the **European Chips Act[72],** aimed at ensuring the EU has the necessary tools, skills, and technological capabilities to become a leader in the field. The EU has the ambition not only to be leading in research and technology but also in design, manufacturing, and packaging of advanced chips, to secure its supply of semiconductors and to reduce its dependencies.

Companies in the construction ecosystem must often make capital-intensive investments to innovate or expand capacity. This is the case, for example, with wood processing companies that use roundwood to make all kinds of products for construction and industry. To make the necessary investments, external financing is required, but such investments are often labelled as ''high risk'' on the supply and the demand side. On the demand side, this can be due to uncertainty on the continuation of uptake of the innovative product by construction companies. On the supply side, regulatory uncertainty or other political and economic factors can lead, for example, to a poorly guaranteed supply of timber.

Sharply rising energy prices, as now being seen since the Russian invasion, have a strong influence on the prices of these products. This in turn has led to significant implications for the construction industry, facing

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high input prices and uncertain delivery times, which in turn leads to delays, and projects being postponed by clients.

This also leads to a new problem: manufacturers of construction products in these energy intensive industries are already downsizing their output temporarily or even permanently. In case of an ongoing energy crisis, with uncompetitive energy prices in the EU, some production may move outside the EU. This would not only mean a loss of jobs in these industrial sectors, but also an increasing dependence on inputs from third countries for construction.

However, this problem cannot be solved within the ecosystem, as it needs an EU-wide and cross sector approach. Examples of measures already taken, are:

- the **REPowerEU Plan**[73], aimed at saving energy, accelerating production and deployment of clean energy and diversifying energy supply.
- The **Temporary Crisis Framework**[74] that enables Member States to grant limited aid to companies affected directly by the Russian invasion in Ukraine

Among Commission proposals we find:

- a **temporary revenue cap** on companies producing energy at low cost.
- an emergency regulation to address high gas prices and ensure security of supply.
- a **targeted flexible use of Cohesion Policy funding** to tackle the impact of the energy crisis on citizens and businesses.

1. Competitiveness		
Recommended action	**Actors**	**Timeframe**
1.1 To ensure a level playing field, apply more **scrutiny regarding non-EU state aid** for companies competing in the European market, in line of the recent FSR Regulation[75], including scrutiny for the quality of materials used, and the social conditions of the employees involved.	EU/MS	M
1.2 Invest in **technologies that increase efficiency** such as on-site automation, pre-fabricating or 3D-printing modular building elements and automation of building process related procedures.	Industry	S/M

73 Communication from the Commission Temporary Crisis Framework for State Aid measures to support the economy following the aggression against Ukraine by Russia, OJ C 131I, 24.03.2022, p. 1, https://ec.europa.eu/commission/presscorner/detail/en/statement_22_1949
74 https://ec.europa.eu/commission/presscorner/detail/en/IP_22_3131
75 Regulation (EU) 2022/2560 https://competition-policy.ec.europa.eu/foreign-subsidies-regulation_en

1.3 **Increase the number of start-ups** for better innovation uptake. Unlock the benefits of StartUp Europe[76], StartUp Europe Partnership[77] and InvestEU[78].	MS	M
1.4 Develop strategies and roadmaps promoting **resilient value chains** against shocks and shortage of resources.	Industry	S
1.5 Support **long-term contracts** between construction companies and suppliers of material to avoid short term price spikes and delays.	Industry	S/M
1.6 **Diversify** suppliers, materials, and products.	Industry	S
1.7 Allow **adequate indexation of material prices** in public tendering for construction projects.	MS	S
1.8 Propose **compensation schemes** at national/regional/local level for companies affected by exceptional price spikes in fixed-price public contracts.	MS	S
1.9 Support **local availability of materials, products and building techniques** to assure easier repairability, promotion of crafts	Industry	S/M
1.10 Support i**nternational standardisation** and mainstream EU Standards (revise and implement)	EU/MS	M
1.11 Promote the use of **harmonised standards** under the Construction Products Regulation in third countries through existing bilateral and multilateral fora.	EU	S/M
1.12 Support evidence building and **public-private partnerships** to foster agile building design that allows to replace construction materials and products easily in case of shortages.	EU/MS	S/M
1.13 Elevate the position of the European construction ecosystem in the world through policies valuing **architecture** and high quality design. Promote design competitions and awards, such as the **Mies Van der Rohe** award for contemporary architecture.	EU/MS/ local authorities	S

76 Startup Europe | Shaping Europe's digital future (europa.eu)
77 Startup Europe Partnership (SEP) - Home
78 https://digital-strategy.ec.europa.eu/en/policies/startup-europe

1.14 Follow the **NEB compass**[79] and the **New European Bauhaus** principles when intervening in buildings, infrastructure, and public spaces.	MS/local authorities	M

79 https://new-european-bauhaus.europa.eu/index_en

Building Block 2: Skills and talent

The world of work is changing due to technological advancement, demographic and climate change, and geopolitical developments. Automation is replacing some labour-intensive tasks, the population is ageing, workers migrate, and industry is required to reduce its environmental impacts. Construction faces all of these challenges.

The **talent pool** of the construction ecosystem is shrinking with ageing workers retiring and young people being reluctant to consider construction as their career choice. At the same time, the needs for upgrading skills and abilities of the current labour force are immense. Industrial stakeholders often stress the need to **invest in lifelong learning and digital working practices**, in **better working conditions and social protection**, in a **healthier and safer** working environment and in better promotion of career opportunities. All of these would also improve the attractiveness of a career in construction.

CSR label for construction worker cooperatives (France)

They are thousands of worker cooperatives in the construction sector across EU. They are characterized by the fact that they are owned and managed by the workers and they reinvest mainly the profits in the enterprise. Being worker owned, quality working conditions, which include health and safety at work and upskilling and life-long training, are at core of their interest.

The French federation of construction worker cooperatives (SCOP BTP) and Afnor certification, a body specialised in Corporate Social Responsibility (CSR) related initiatives, have launched in 2015 the CSR label. It's a voluntary process and the cooperative applying are required to achieve an expected CSR level based on such as: governance and decision-making processes, dialogue with stakeholders, leadership, internal communication, responsible value chains, human rights, sustainable consumption and construction, health and safety at work. The labelling committee is composed of representatives from the entire BTP branch: public and private clients, banks, insurance companies, prevention bodies, associations etc. The recognition granted by the label allows to raise awareness of the public construction sector about responsibility-related issues, green and social. It acts as a recognition and commitment to improve the environmental practices and to implement high social standards for workers and human resource management practices. In 2023, 103 French worker cooperatives have been awarded the CSR label.

CSR label - rse.scopbtp.org/decouvrez-label-rse-scop-btp

Afnor certification - www.afnor.org

Addressing skills gaps and anticipating future skills needs in construction will mean providing more, better, and safer jobs. Construction faces challenges with technology transfer, dispersed workplaces, and low innovation rates. It has trouble attracting young and diverse workers including women. Upskilling professionals and modernising/digitalising construction techniques and processes are key to improving working conditions and the reputation of construction as an employer.

While white collar professionals, such as architects and engineers, propose innovative solutions to design challenges, their visions must be realised by other professionals during construction, renovation or

demolition works. The skills of the whole workforce are therefore crucial for the resilience and productivity of the ecosystem and the sustainability of buildings and infrastructures.

A coordinated effort to upskill construction professionals

Several important EU policy initiatives including the Renovation Wave and the Resilience and Recovery Facility (RRF)[80] aim to support upskilling and reskilling of the construction workforce for the renovation of buildings. This also presents an opportunity to address other challenges in the ecosystem, to boost the inclusion of women in this sector, as well as other marginalised groups.

The construction ecosystem is highly fragmented, given that 99.9% of its 5.3 million companies are SMEs, which represent 71.2% of the employment. Around 90% of construction companies are microenterprises, representing 36.5% of the employment. Small companies may not have the right abilities to sufficiently develop the skills of their workers.

The Commission launched the **Blueprint for Sectoral Cooperation on Skills** initiative to improve skills intelligence and address short and medium-term skills needs. In this context, the Construction Blueprint project (2019-2023) focused on digital skills, as well as skills in energy efficiency and circular economy. The Blueprint was implemented by a consortium of 24 partners from twelve European countries[81]. It mapped current and future skills needs, training schemes, and developed new curricula and a Sectoral Skills Strategy.

The **Pact for Skills** in construction[82] is a large-scale partnership that plans to upskill and reskill overall at least 25% of the workforce of the construction industry in the next 5 years, to reach a target of 3 million workers. The initiative was launched in 2022 by the EU social partners FIEC and EFBWW (European Construction Industry Federation and European Federation of Building and Woodworkers) in cooperation with EBC (European Builders Confederation)[83]. Detailed activities are under preparation. Any construction stakeholder can join the Pact with its own commitment.

In 2015, the Commission launched the European Alliance for Apprenticeships (EAfA)[84] to strengthen the quality, supply, and overall image of apprenticeships across Europe, while also promoting the mobility of apprentices. EAfA is implemented through national commitments and voluntary pledges from stakeholders. Construction stakeholders have been encouraged to take part and promote apprenticeship schemes and improve the image of the sector for youth. In an early EAfA stage, the construction pledges made up about a third of all pledges and more than 90% of the pledges from industrial SMEs.

Since 2011, the Commission has been supporting the upskilling of construction professionals on energy efficiency and sustainability as part of the **BUILD UP Skills** initiative[85]. Support has been granted through open calls under the Intelligent Energy Europe, Horizon 2020 and currently LIFE Clean Energy Transition

80 https://commission.europa.eu/business-economy-euro/economic-recovery/recovery-and-resilience-facility_en
81 http://constructionblueprint.eu/
82 https://ec.europa.eu/social/main.jsp?catId=89&furtherNews=yes&newsId=10160&langId=en
83 https://ec.europa.eu/social/BlobServlet?docId=25235&langid=en
84 https://single-market-economy.ec.europa.eu/sectors/construction/apprenticeships-construction-industry-tomorrow_en
85 https://www.buildup.eu/en/skills/about-build-skills

programme for close to EUR 50 million. As part of the Green Deal Industrial Plan[86], the Commission is planning to establish a **Heat Pumps skills partnership**, as well as a **Net Zero Industry Academy** to offer on-and offline trainings for sustainable construction with a focus on the use of biobased materials, circularity and digital technologies.

In general, the European Union supports EU wide partnership creation and skills development at EU level, via stakeholders' consortia covering several Member States. These projects may serve as pilots or models. Member States are provided with resources/means for skills development at national level and skills deployment at a mass scale. These means are generally not ecosystem earmarked for education and training. Member States can use them for an ecosystem of their choice but prioritising the construction ecosystem will create more benefits as the construction ecosystem is a key enabler in achieving the EU climate targets and the stimulation of investments in many other ecosystems. The investments in education and training in the construction ecosystem present multifactorial benefits for Member States.

Skills for digitalisation

Digitalisation, automatisation and innovative technologies in construction can have several positive effects on the workforce. Construction workers often suffer from musculoskeletal disorders and high incidence of other **occupational diseases and accidents**, what means that many workers are unable to work up to the normal retirement age. Technological changes in equipment and digitalisation of working processes can improve working conditions and prolong working life of workers. It may also improve employee well-being and morale and decrease absenteeism. Innovative technologies may attract women and young talent to the sector.

According to The **Future of Jobs** Report (2020)[87] automation, in tandem with the COVID-19 recession, is "creating a double-disruption scenario for workers". Consequently, the idea that robots destroy human jobs leads to emphasising the need for certain human work skills, such as the use and development of technology, self-management, working with people, problem solving, critical thinking and analysis, the management of communication tools and activities[88]. Furthermore, the World Economic Forum estimated that by 2025, 85 million jobs may be displaced by a shift in the division of labour between humans and machines, while 97 million new roles may emerge that are more adapted to the new division of labor between humans, machines, and algorithms. Nevertheless, automation also has the potential to improve productivity to the levels that are necessary to meet climate targets, as well as taking over hazardous tasks and thereby improving health and safety of workers.

Diversity and attraction of talent

The construction ecosystem suffers from an overall poor public perception connected to low job security, tough working conditions and health and safety concerns. In part, the negative image of the industry derives from its structural characteristics, yet the sector is also plagued by negative stereotypes and an overall poor reputation depicted in popular culture, with construction still being seen as a "man's job".

86 COM(2023) 62 final
87 Chapter 2. Forecasts for Labour Market Evolution in 2020-2025 - The Future of Jobs Report 2020 | World Economic Forum (weforum.org)
88 The Future of Jobs Report, October 2020, World Economic Forum

Women rarely view the construction sector as a potential and attractive employer, while studies find that an important share of female engineers leave the sector in the beginning of their careers discouraged from their early work experiences. There are often objective barriers related to the sector, including the physical aspect of certain works in the construction sites. But this results in many construction-related professions that are not physically demanding to be overlooked. At the same time, as construction is digitalised and automated, tasks that require physical work will fade out, making other technical and soft skills more desirable.

An analysis of the composition of the construction workforce shows that women represented 10.0% in 2018, a slight increase compared to the 2010 share (9.6%). According to Eurostat, in 2018, women made up 12.0% of the workforce in civil engineering, 10.5% in construction of buildings and 9.4% in specialised construction activities. On the positive side, in some other construction-related areas the share of women was considerably higher. In real estate activities women were the majority in 2018 (50.3%), while in architectural and engineering activities women represented 30.3% of the workforce. There is however a lack of females in managerial positions, which is also why the construction ecosystem is often reported as having a significant gender pay gap.

Indeed, amidst the well-recognised shortage of skills in the sector, several Member States and industrial stakeholders have launched initiatives to attract more women at construction, as well as to help female workers advance in their construction careers. In Belgium, the online portal "Femmes de métier" is dedicated to the recruitment of women who are interested in a career in the construction sector. The portal offers information on specific trainings and includes testimonials of women working in construction. In Ireland, #BuildingEquality campaign is committed to achieve a more diverse and inclusive workforce that drives innovation as well as attracting and retaining key talent.

The lack of women in the sector is reflected on poor representation in the heads of companies, national and European associations as well as public administrations. It is pertinent that in a sector like construction female participation is assured in the policy and public dialogue, with a minimum required presence in panels and conferences. The European initiative **''Women on boards''** requires that a 40% of non-executive director posts or 33% of all director posts are occupied by the under-represented sex by June 2026. Although this does not currently concern SMEs, it is important that all companies reflect on their diversity strategies. In such a complex global context and with an overall shortage of workers, companies that strive for a diverse workforce can thrive and assure their resilience.

2. Skills		
Recommended action	**Actors**	**Timeframe**
2.1 Promote **partnerships creation**, sharing of good practices and development of skill-needs responses through European partnerships.	EU/MS	S
2.2 Continue and increase in scale initiatives for upskilling and re-skilling, such as **BUILD UP Skills**	EU/MS	M

2.3 Facilitate cross-border **professional services** and reduce administrative burdens related to posting of workers by streamlining the requirements suggested by the Single Market Enforcement Taskforce (SMET) and through introduction of a common electronic format for the declaration of posting of workers.	MS/Regions	M
2.4 Provide an enabling framework (e.g., curricula, funding) for skills deployment and exploit the possibilities of the **Cohesion Policy and the Recovery and Resilience Facility** on the skills development and deployment.	MS	M
2.5 Foster **public procurement** contracts through open tenders supporting the **upskilling** of professionals and promotion of **apprenticeships**	MS/public buyers	S
2.6 Improve through awareness raising and structural changes (e.g., use of digital collaboration and working methods) the **attractiveness of the ecosystem as an employer.**	Industry	S/M
2.7 Join the **Pact for Skills / Succeed** in the commitments made in the Pact for Skills.	Industry	S
2.8 Deliver the Blueprint for Sectoral Cooperation on Skills.	Industry	S
2.9 **Train public sector employees** dealing with procurement, permits and management of buildings and infrastructure to the use of BIM and other digital technologies and tools.	MS	S
2.10 Set up a **New European Bauhaus Academy** to support upskilling of construction professionals in circular economy, digitalisation and use of bio-based materials.	EU/Industry	S
2.11 Commit to **gender balanced** and **diverse panels** when construction policy and initiatives are discussed in EU, local or industrial level.	EU/MS/ Industry	S

Building Block 3: Enabling framework

The construction ecosystem requires an enabling framework to be resilient, competitive, and innovative as well as to achieve the green and digital transition. **By enabling framework, we refer to the regulatory and policy framework**, as well as necessary **infrastructure (digital and physical)**. The EU contributes to an enabling legal framework for construction notably through the single market and especially the Construction Products Regulation (CPR). In addition, the European Commission is trying to set the direction, enable collaboration and help fund the digital and green transition.

Setting requirements for buildings and civil engineering works is a competence of Member States, or of the regions in countries with federal structures. In this way, specific needs which do not apply to the whole EU can be addressed specifically. These needs refer to safety (e.g., seismic resistance, snow or wind loads, risks for flooding), but also specific needs for energy efficiency, accessibility, or sustainability. As a result, national and local governments have a significant role to play in creating an enabling framework for construction.

The EU is responsible for the rules relating to access of construction products to the single market (the marketing of construction products). Therefore, the CPR mainly sets harmonised rules on how to express the performance of construction products in relation to their essential characteristics (e.g., reaction to fire, thermal conductivity, or sound insulation) and provides harmonised rules on the CE marking of these products. Using these rules Member States define which construction products can be incorporated in buildings.

Enabling a greener construction ecosystem

Circular economy and sustainable products

The transition to a **circular construction ecosystem** could be further accelerated, and it is still hampered by a variety of barriers[89]. These include:

- a lack of regulatory requirements which would drive demand for circular approaches.
- a lack of standards for secondary materials and agreement on end-of-waste status.
- unfavourable market conditions and a lack of financial incentives.
- difficulties comparing construction products using environmental criteria.

Innovative construction products are in constant development. They are often quickly marketable with high performance and quality, in addition to having a lower environmental impact compared to already existing products. This is the case, for example, for products based on novel, hybrid or secondary materials, or products manufactured from energy and resource-efficient processes. There is also potential for wood based innovative construction products, in line with the EU bioeconomy and circularity policies. However, there is also competition for biomass use and a potential biomass availability gap[90]. These developments in some cases clash with regulations, are subject to conflicting policies (energy use versus

89 European Commission, 2021. Circular Economy Principles for Buildings Design. https://op.europa.eu/en/publication-detail/-/publication/86c67cd0-0f83-11ec-9151-01aa75ed71a1/language-en/format-PDF/source-230073893

90 EU Bioeconomy Strategy Progress Report 2022 https://data.europa.eu/doi/10.2777/997651

material use of biomaterials and residues, for instance) or lead to situations where **compliance** with different regulations leads to significant delays in bringing the product to market. And as a result, the green transition can be delayed.

When extending the life span and reuse are not possible, remanufacturing and recycling is the preferable circularity option, but **an effective use of secondary materials requires a well-functioning market**. The Commission launched numerous initiatives on this field, and the development of EU-wide end-of-waste and by-product criteria could support a level playing field for the marketing of products using secondary raw materials. A recent Commission study[91] identified construction and demolition waste as one of the priority waste streams for EU end-of-waste criteria alongside plastics and textiles. The development of standards related to recycling and waste characterization would be an important enabler for the secondary materials market. Other initiatives that could support these aims include preparing for re-use and recycling targets for specific waste streams, recycled content requirements, and innovative sorting systems[92]. However, questions remain about who is responsible and pays for the storage and processing of demolition materials that are destined for re-use and recycling, and where such materials can be temporarily stored.

The **Construction Products Regulation (CPR)**, which is currently under revision, is expected to address some of these barriers[93]:

- The current regulatory framework offers innovative products a reliable way to compete (providing the same level of information) with traditional products through **European Assessment Documents**. This instrument offers the chance to voluntarily CE mark the product and deliver a declaration of performance able to satisfy customers' demands.
- As regards environmental sustainability information, the need for **harmonisation** at the European level will be satisfied with their inclusion in harmonised standards following the principle of a single declaration to satisfy the needs across Europe. The process started under the current CPR and will be enhanced with more tools provided by the new CPR[94] including improved access to environmental information from suppliers and the possibility to recognize assessments under other regulations e.g., Ecodesign for Sustainable Products Regulation[95].
- The new CPR will also promote the marketing of **reused products** by setting up a flexible framework for the **declaration of performance** of these products depending on their future use. The approach is expected to deliver enough information to ease the reuse of the products but prevents overburden the companies performing these practices.
- The new CPR will improve the functioning of the single market for construction products, through better functioning standardisation, better market surveillance and enforcement.

91 Scoping possible further EU-wide end-of-waste and by-product criteria - Publications Office of the EU (europa.eu)
92 EEA, 2022. Investigating Europe's secondary raw material markets.
https://www.eea.europa.eu/publications/investigating-europes-secondary-raw-material
93 EUR-Lex - 32011R0305 - EN - EUR-Lex (europa.eu)
94 EUR-Lex - 52022PC0142 - EN - EUR-Lex (europa.eu)
95 EUR-Lex - 52022PC0142 - EN - EUR-Lex (europa.eu)

- In line with the ambitions of the **Ecodesign for Sustainable Products Regulation**, the new CPR offers more instruments to ensure the effective transmission of environmental information and the possibility to set up thresholds and binding classification systems.

Under the CPR the environmental performance of products is declared following a harmonised and reliable approach. A unique declaration at European level must satisfy regulatory and market demands as regards this type of data. The regulation is flexible enough to ease the burden for SMEs through simplified provisions and supplies certainty by setting up third-party verification of the assessments.

Renovating Europe's stock of buildings

Taken as a whole, the stock of Europe's buildings is the single largest energy consumer in Europe. Around three quarters of the EU's buildings are energy inefficient, and 35% are over 50 years old. At the same time, only about 1% of the building stock is renovated each year. The impact of Russia's invasion of Ukraine on energy prices has added to the urgency of improving buildings' energy performance. The Commission adopted the **Renovation Wave**[96] with a dual ambition of energy gains and economic growth. It foresees 35 million building units renovated this decade at double the current rate, and an even faster rate thereafter until 2050, creating 12-18 local jobs per million euro invested[97]. **This is a huge practical challenge for the construction ecosystem.** A shift of emphasis from new construction to renovation is likely to be required, accompanied by greater use of innovative tools and techniques to boost productivity.

Under the proposal to revise the **Energy Efficiency Directive**[98], Member States would be required to renovate each year at least 3% of the total floor area of buildings owned by public bodies. In its proposal to recast the **Energy Performance of Buildings Directive**[99] the Commission set out how Europe can achieve a zero-emission and fully decarbonised building stock by 2050. The Commission also proposed strengthened targets for renewable energy in the building stock as part of the **Renewable Energy Directive** revision proposal[100] and this was further strengthened as part of **REpowerEU**[101]. The construction ecosystem stands to benefit from the increased renovation activity foreseen in this legislation, but action will be needed to ensure the availability of skilled labour for the necessary works and installations.

Addressing climate change

The EU has adopted an **Emission Trading System for Buildings** (and Road Transport), in addition to Member States' greenhouse gas reduction obligations under the **Effort Sharing Regulation**[102], that also covers emissions from buildings. The Commission is developing a **2050 roadmap to reduce whole life cycle emissions of buildings**, as part of the Renovation Wave. Better quality information and data is

96 COM(2020) 662 final. See https://energy.ec.europa.eu/topics/energy-efficiency/energy-efficient-buildings/renovation-wave_en
97 International Energy Agency, 2020. Sustainable Recovery: World Energy Outlook Special Report. https://www.iea.org/reports/sustainable-recovery
98 COM(2022) 222 final
99 COM(2021) 802 final
100 COM(2021) 557 final
101 COM(2022) 230 final
102 Regulation (EU) 2018/842

needed to benchmark individual buildings' whole life cycle emissions, as well as emissions of the construction ecosystem at national and EU levels. Several ongoing Commission studies are expected to fill some of these data gaps. As part of the **revision of the Construction Products Regulation**[103], it is expected that all construction products entering the single market will include data on their carbon footprint. This will facilitate calculations of life cycle emissions at the level of the works. For buildings, such calculations would be carried out using tools aligned with the Level(s) framework[104] and for new buildings they would be regulated under the **Energy Performance of Buildings Directive** recast proposal[105]. Some Member States have already implemented requirements to disclose life cycle emissions, and in some cases maximum limit values also apply. For the construction ecosystem, **a push to address life cycle emissions should help to stimulate innovation** in products, processes, design and construction practices and tools. Construction has a major role to play in the fight against climate change, not only by mitigating emissions but also by contributing to climate adaptation[106].

Construction sites in the green transition

Construction sites need **water** for technical and hygiene purposes and to clean the site and construction machinery. Water for technical purposes must fulfill strict criteria. Usually, the easiest solution is to use drinking water for all the purposes mentioned above. New buildings will need to be connected to drinking water, therefore existing or newly built pipes can be used temporarily for that purpose during the construction process. Considering increasingly frequent dry periods, these may lead to restrictions of using of water by industry in general, construction included. As water in technological processes is irreplaceable for the moment, the construction ecosystem will also need to develop solutions on how to deal with a possible scarcity of this resource, e.g., via diminishing the consumption or using harvested rain- or graywater where possible.

Reducing emissions at the construction site is a commitment shared by different stakeholders. Machinery and equipment manufacturers work on the use of low or net-zero emission energy carriers, efficiency improvements and reductions in consumption. As part of the Big Buyers' Initiative, several cities have pledged to require fossil-free construction machinery in their procurement contracts, with a target of 20% emission free machinery by 2025 and 50% by 2030[107]. As well as helping to reduce emissions, electrified construction machinery can also reduce pollution and noise around the building site.

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103 COM(2022) 144 final

104 Level(s): European framework for sustainable buildings. https://environment.ec.europa.eu/topics/circular-economy/levels_en For life cycle GHG emissions, see indicator 1.2 Life Cycle Global Warming Potential: https://susproc.jrc.ec.europa.eu/product-bureau/product-groups/412/documents

105 Proposal for a revision of the Energy Performance of Buildings (COM(2021) 802 final), https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A52021PC0802&qid=1641802763889

106 In September 2021 the Commission published 'Technical guidance on the climate proofing of infrastructure in the period 2021-2027'. See https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=uriserv%3AOJ.C_.2021.373.01.0001.01.ENG

107 Bigbuyers.eu 2022 Joint Statement of Demand for Emission-free Construction Site Machinery, signed by the cities of Oslo, Copenhagen, Helsinki, Barcelona, and Vantaa.

Enabling the digital transition as lever of resilience

The construction ecosystem is rapidly digitalising in various areas. Construction companies are increasingly working with Building Information Models, while building permits are increasingly handled digitally by local governments. Building owners, tenants and facility managers are increasingly using smart metering to optimise water consumption, energy consumption, air quality and comfort. Member States and regions are developing Digital Building Logbooks to track information on construction, renovations, material use and safety aspects. Digital technologies generating substantial amounts of data are increasingly used in construction, such as robots, drones, 3D printing and 3D-scanning. In addition, there are initiatives at European level that (will) contribute to the construction of building-related datasets, such as the Energy Performance for Buildings Directive, the Construction Products Regulation, and the Digital Product Passport of the ESPR.

Members of the High Level Construction Forum expressed **cyber-security** as a significant concern for SMEs to digitalise in some areas. There is a fear that incorporating certain technologies will make them more vulnerable to outside attacks. Examples are the use of BIM of digital logbooks, or even the use of smart meters in their own buildings. General data security is also important for SMEs, because they often fear a loss of intellectual rights or commercial data when digitizing processes or digitally communicating with clients, partners, and other companies up or down the value chain. Both elements often lead to a certain reluctance in the uptake of digital technologies.

The **Data Services Act package**[108] is the framework to guarantee data security, privacy and sustainable governance. The Commission proposal constitutes the last major building block of the Commission's 2020 Data Strategy. It is linked to the Data Governance Act and common European Data Spaces. It supplies fair, clear, and balanced rules for data use and sharing (B2C, B2B and B2G) personal and non-personal data and aims at maximizing the value of data in the economy by ensuring that a wider range of stakeholders gain control over their data and that more data is available for innovative use, also in the construction ecosystem.

The Commission's proposal for a Regulation laying down harmonised rules on artificial intelligence (**Artificial Intelligence Act**)[109] is also essential. Indeed, in the construction ecosystem, AI has the potential to help players realize value throughout project lifecycles, including design, bidding, and financing; procurement and construction; operations and asset management; and business model transformation. In this context, the Commission's AI Act aims at setting up a balanced approach towards AI systems, among others, for the construction professionals, as users of AI systems located within the Union. In particular, the aspects of major concern for the construction ecosystem are the harmonised rules for 'AI systems' in the Union, the Specific requirements for high-risk AI systems and obligations for operators of such systems, AI resilience, and the introduction of measures in support of innovation.

A Construction **Data Space** would unleash the enormous potential of data-driven innovation. This position is fully endorsed in the Commission Staff Working Document on Data Spaces[110]. However, no budget became available in the latest Digital Europe Work Programmes, which given the crises of the last years,

108 https://digital-strategy.ec.europa.eu/en/policies/digital-services-act-package
109 https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=celex%3A52021PC0206
110 https://digital-strategy.ec.europa.eu/en/library/staff-working-document-data-spaces

prioritised sectors such as health, agri-food, and finance. Given the lack of funding from the principal European Programme for digitalisation, the Commission will still assess if a Data Space can be financed from different resources, its potential governance structure and its role in supporting interoperability, trust and data sharing. This analysis and proposals for future actions will be carried as part of an initiative for the ''Digitalisation of the built environment'' launched in January 2023. Enabling collection, interoperability and sharing of data in the construction ecosystem is an important priority.

Actors in the construction ecosystem acknowledge that this does not provide, by nature, the most straightforward environment to implement this. Different stakeholders have vastly distinct competencies and roles (all levels of public authorities, architects and engineers, product manufacturers, construction companies, building owners) and different interests and abilities when implementing digitalisation. According to views expressed at the High Level Construction Forum, SMEs face specific challenges and we must ensure that data is available to them, costs are bearable, regulations reasonable to follow and that the interoperability of various systems is a major condition for any innovative development.

The Commission proposal for the Construction Products Regulation (CPR) and the Ecodesign for Sustainable Products regulation (ESPR)[111] of March 2022 strongly support the **digitalisation of information from products**. The CPR proposes to create a European database or system to archive the information related to construction products. The ESPR defines the concept of Digital Product Passport (DPP) as the access gate for product data. Both approaches are running in parallel: the focus of the DPP is environmental and consumer information, the CPR database will deliver information on all characteristics of construct products such as safety and environmental information. The final implementation is expected to transform the European economy, however proper integration among initiatives requires attention. For example, the interoperability with BIM and building logbooks is a cornerstone for market utilisation.

In addition, the Commission proposal for the recast of the Energy Performance of Building Directive will facilitate the collection of and access to interested parties to building-related data by facilitating data exchange, including through interoperability, harmonising and strengthening indicators that are part of energy performance certificates (EPCs) and requiring Member States to set up national databases gathering data from the EPCs inspections, the building renovation passport, the smart readiness indicator and regularly transferring such data to the Building Stock Observatory EU database.

Digitalising construction permits and compliance

Many administrative procedures needed for construction are still paper- based, lengthy and prone to mistakes. The **digitalisation of building permit systems** is necessary for the digitalisation of the construction ecosystem, complementing logbooks and the introduction of BIM in public procurement. Digitalisation of the building permit systems accelerates processes and reduces administrative burdens. Digitalisation reduces the mistakes and fosters transparency. In parallel, public authorities that digitalise their permitting systems are also incentivising the use of digital technologies by the industry.

Digitalising the administration and unlocking the power of data in construction can only happen when processes, people and technical/digital infrastructure perform. The digitalisation of building permits should not refer to the use of static digital formats, such as using a non-machine-readable pdf instead of a paper. Digitalisation should result to automatic compliance checks based on machine readable rules. To

111 See https://ec.europa.eu/commission/presscorner/detail/en/ip_22_2013

achieve this digital transformation, tools that automate regulatory assessment processes are needed (e.g., to deliver required authorizations), as well as tools made available to construction stakeholders to check regulatory compliance at any stage of a project and even before its submission. In many cases such exercise would imply rationalisation and simplification but also improvement of existing building codes, that in certain EU Member States are several decades old.

Low digitalisation rates and lack of investment in construction enterprises are still two major challenges to resilience and competitiveness. With the ecosystem consisting mainly of SMEs the margins for initial investments in innovative technologies are generally low, and the need for support structures is high. It can be particularly challenging for architects to incorporate expensive digital and other innovative technologies if governments do not offer financial incentives.

The initiative **Digitalisation of construction SMEs** is funded by COSME. Its website[112] is the main repository and platform, offering a toolkit to support smaller companies: a self-assessment scan on digital maturity and adoption of BIM and other technologies, a handbook linked to the maturity scan and best practices shared from digitally advanced SMEs. As part of the same initiative, training sessions for SMEs aim at introducing specific digital technologies or guiding them in drawing up a digital strategy for the company.

Standardisation as enabler of digitalisation

Feedback from the High Level Construction Forum indicated that data standardisation would need to be widely supported as a strategic element of the green transition, including the concept of digital sobriety. One of the crucial issues would be the incompatibility of digital project management information systems between stakeholders. **OpenBIM** should allow the integration of a digital work assuring access and usability throughout its life cycle without depending on a specific proprietary tool. **Open standards** require a commitment and structural support from the public sector. To ensure access to and control over data, tools, and data processes open standards should remain in place to ensure data ownership.

The **Construction Products Regulation** provides the necessary instruments and will ensure the exchange of compatible data in BIM systems. To achieve this goal the current CPR allows the declaration using human and machine-readable information and the future CPR is expected to provide a database or system to be used as data source for the assessment of buildings. The publication of the international standard ISO 22057 on data templates of the use of environmental product declarations (EPDs) provides a clear signal of the importance of the worldwide markets in this field.

From a more global perspective, the work of **CEN/TC 442** dealing with BIM is another key element able to ensure a **homogeneous implementation across Europe**. Issues such as language, different construction traditions and terminology, process and regulatory approaches need to be taken into consideration for the development of European standards related to BIM. At the same time, the pressure of global players to impose their own solutions needs to be assessed to ensure a level playing field in the virtual world.

112 https://digital-construction.ec.europa.eu/

Creating a favourable environment for competitiveness and resilience

Stakeholders who took part in the consultation proposed a series of actions and priorities on which the Commission and the MS should focus to create an enabling and stable framework to support the resilience of the construction:

- Reduce administrative burden and support local construction SMEs to engage in public-private partnerships, specifically focusing on affordable, adequate, and accessible housing and infrastructure projects.
- Further optimise the processes for achieving compliance with EU, national and regional rules, as this can be challenging for SMEs. The cumulative impact of legislation is an important element for the sustainable competitiveness of the sector. It is therefore of continued importance to keep considering the resource and cost impact of any new or amended legislation, especially on SMEs[113].
- Monitor via the dedicated EU observatory late payments and propose measures to address late payments in the construction ecosystem.
- Take actions to lift remaining barriers to the Single Market with regards to the provisions of construction services.
- Further improve the Single Market for services in the construction ecosystem through possible introduction of harmonized standards or reinforcement of mutual recognition of national schemes.
- Use the support and recommendations of the European Labor Authority on promotion of cross-border service provision, in order not to compromise quality of jobs, safety, consumer protection.

Free movement of services and regulated professions in construction

Professions involved in the construction ecosystem are '**regulated professions**' in several Member States. When a Member State regulates a profession, it reserves access to certain professional activities by requiring specific qualifications and compliance with other conditions such as compulsory membership of a professional body. In addition, access to the construction ecosystem in Member States can be subject to authorisation requirements or schemes. These obstacles reduce competition, hamper the mobility of workforce, and balance the demand/offer for the trades at stake. The mutual recognition procedures for professional qualifications of Directive 2005/36/EC and the principles laid out in the Services Directive[114] aim at facilitating free movement of workers and the cross-border provision of construction services.

A 2021 Commission study[115] found that **the removal of barriers** over the years 2006-2017 in the services sector including construction **was slow and only led to a small decrease in the absolute level of barriers** despite the clear economic benefits associated with easing the regulatory restrictions. In the same year,

113 The SME Test analyses the possible effects of EU legislative proposals on SMEs. By assessing the costs and benefits of policy options, it helps implement the 'think small principle' and improve the business environment https://single-market-economy.ec.europa.eu/smes/sme-strategy/sme-test_en
114 Directive 2006/123/EC
115 Mapping and assessment of legal and administrative barriers in the services sector https://op.europa.eu/en/publication-detail/-/publication/6d8d8858-a756-11eb-9585-01aa75ed71a1/language-en

the Commission issued recommendations to the Member States with specific areas of regulation in seven professional services that would benefit from regulatory improvements on national reforms among which two professions from construction ecosystem: **Architects** and **Civil engineers.** The aim was to assist Member States in better targeting their regulatory reforms and achieving the highest economic payoffs from the reforms, and to provide additional political support needed to implement the reforms.

The case of Architects

Although most EU Member States regulate the architectural profession in such a way that it qualifies for automatic recognition under the Professional Qualifications Directive, there remain significant differences in the approach taken. Several countries assign the architecture activities to one regulated profession (e.g. Austria, Belgium, Bulgaria, Greece, France, Hungary, Ireland, Luxembourg, Malta), while others take a more fragmented approach to regulation (e.g. Poland, Lithuania, Latvia) with different activities reserved to closely related professions (e.g. architectural technologists, landscape architects, urban planners, interior architects) or carried out by more specialised/certified specialists (e.g. architects with additional attestations for specific fields of construction). Denmark, Estonia, Finland, and Sweden regulate specific modes of pursuit or use other forms of checks of competence specific to construction.

As part of the **Communication on taking stock of and updating the reform recommendations for regulation in professional services** of 2017, the Commission recommended to:

Austria, Belgium, Czechia, France, Germany, Italy, Romania, Slovakia, Spain and **Portugal** to consider the impact of the shareholding and/or company form restrictions they have, in addition to other requirements.

Austria to assess the proportionality of the restrictions it sets on multidisciplinary activities (pending adoption of the new law in response to the ECJ judgment).

Malta to review the requirement that 100% of the shares of a company must be held by professionals.

Member States with a fragmented system governing the profession or multiple certification requirements, like **Latvia, Lithuania, and Poland**, to reassess the impact of this system on the free movement of professionals and the obstacles caused.

Lithuania is invited to review and communicate the specific reasons for considering that attestations for 'structures of non-exceptional significance' are necessary and proportionate.

Member States with a wide scope of reserved activities to reassess the impact of these restrictions.

Member States that make professional certification mandatory for non-regulated professions or that use other forms of checks and balances, especially for the provision of specific services, to review the overall coherence and practical effects of this requirement to avoid it becoming a barrier to access to the profession.

Source: https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:52021DC0385&rid=1

The case of Civil Engineers

The overall situation in the regulation of the profession of civil engineer is broadly the same in 2021 as it was in 2017. As reported in 2017, there are many similarities across Member States, in the way they pursue the same general interests when regulating the profession. However, the regulatory approach still varies from one Member State to another.

Most Member States consider regulating the profession necessary to ensure the quality and safety of civil engineering services. However, Netherlands and Sweden have found other ways than regulating the profession *stricto sensu* to ensure quality or meet the objectives to safeguard the general interest. Differences between the two approaches may be less significant than might appear where countries that do not regulate the profession in the usual sense, for instance Finland and Sweden, use certification of competences of civil engineers or an ad hoc evaluation of competences or experience on a case-by-case basis as a condition for engineers to provide specific services (e.g., submission of building plans or applications for permits). Therefore in 2017, the Commission recommended to 'non-regulating' Member States to review this model to avoid it becoming a barrier for exercising these activities. The Commission has not noted any change in the legislation of 'non-regulating' countries in response to this recommendation and is not aware of any consultations carried out on the matter.

As part of the **Communication on taking stock of and updating the reform recommendations for regulation in professional services of 2017**, the Commission recommended to:

Member States with a wide scope of reserved activities should reconsider the impact of these restrictions.

Malta should clarify which activities are reserved to the 'Periti'.

Spain should reassess the requirement to obtain authorisation from the professional organisation for certain projects/works.

Malta needs to review the requirement that 100% of a company's shares must be held by professionals. Italy needs to review the requirement that the number of professional members and their participation in the share capital must constitute a two-thirds majority.

Member States that make professional certification mandatory for non-regulated professions or that use other checks, especially for the provision of specific engineering services, should review the overall coherence and practical effects of these requirements to avoid it becoming a barrier for access to the profession.

Member States with a fragmented system of the profession or that set multiple requirements depending on the specific activities to assess the impact of this system on the free movement of professionals and whether potential obstacles can be justified. They should also assess the efficiency and proportionality of rules spreading responsibility over different categories of professionals in the same area of activity. **Lithuania** is invited to review and communicate the specific reasons for considering that attestations for 'structures of non-exceptional significance' are necessary and proportionate.

Source: https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:52021DC0385&rid=1

Cross-border service provisions

To fill skills gaps, **temporary cross-border service provisions** shall be encouraged to improve flexibility and resilience of the construction ecosystem. The Member States shall facilitate posting of workers in the construction ecosystem, including temporary workforce. Cross-border exchange in construction supports adaptive and agile business models. The use of temporary workforce in the Single Market is especially beneficial for SMEs, if there is a larger contract or multiple urgent contracts. Hiring out workers seems to be an efficient way to supplement own workers and fulfil cross- border contracts. In addition, the posting of workers to different EU Member States, including temporary taskforce, has a large potential to contribute to sharing knowledge and skills across the EU construction ecosystem.

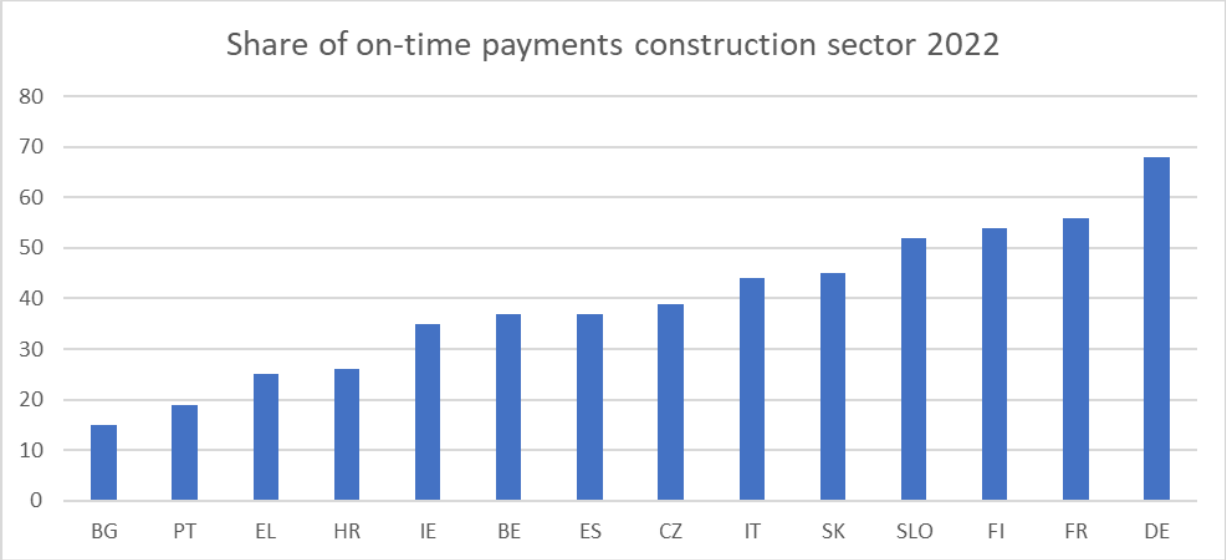
Late payments

Businesses face costs and delays when collecting payments and/or recovering debts in another Member State. The risk of **late payment** or non-payment is also the first major obstacle to the participation in public procurement of European SMEs. Late payments account for 1 out of 4 bankruptcies in the EU[116]. SMEs in the construction ecosystem are particularly affected by late payments. The specificities of the construction supply chain further aggravate the incidence of payment delays. Disputes on the quality of the work or of the materials, verification procedures at the interim and final stages of the projects, unfair retention provisions and the administrative payment processes are often used to artificially delay the payment[117].

According to the 2022 SAFE survey, 49% of SMEs in construction reported late payment problems[118.] On-time-payments are not satisfactory across the EU (with the exception of Denmark). The percentage of payments made by the agreed deadline in 2022 ranged from 15% in Bulgaria to 68% in Germany[119].

According to the JRC study "Assessing the economic impact of faster payments in B2B commercial transactions"[120], if payments in B2B transactions were carried out systematically at 30 days, the cash flow of businesses would increase by 66%. If payments were carried out regularly at 60 days, the cash flow would increase by 10%. For each day of reduction of payment duration, the cash flow liberated would be around EUR 3.7 million, almost 1% on average over a period of 4 years. The study suggests that long payment times affect the liquidity position of companies which can force companies to cut back on emp

116 Source: ECE (European Commission for Europe)
117 Late Payments in the Construction Sector, 2020.
https://ec.europa.eu/docsroom/documents/44789/attachments/5/translations/en/renditions/native
118 SAFE survey, 2022
119 D&B Payment Survey, 2022
120 https://op.europa.eu/en/publication-detail/-/publication/fa844000-356a-11ed-9c68-01aa75ed71a1



Source: DG GROW based on D&B Payment Study 2022

Against this background, the Commission announced a revision of Directive 2011/7/EU to combat late payments in commercial transactions ("the Late Payment Directive")[121]. A proposal for the revision is expected during 2023[122].

Liability and insurance

Despite the real accomplishments of the Single Market, businesses and consumers still report many hurdles. Controls imposed on construction service providers for accessing the market vary significantly in terms of restrictiveness among the Member States. Stringent regulations in the construction ecosystem or requirements imposed on companies active in cross-border service provision, access to public procurement and insurance requirements abroad may act as important hurdles when providing construction services abroad. There is an increasing discrepancy in the regulation of **liability and insurance**. While certain Member States impose a stringent and legally compulsory decennial insurance on a range of construction works and companies taking part in the construction process, in other Member States there is no legal obligation for construction parties in terms of insurance.

Some innovative products find difficulties to enter construction markets because of insurance barriers[123]. One reason for this is the uncertainty around long-term product performance. Additional research is necessary to overcome this problem.

The Construction Products Regulation offers the possibility to assess the performance of innovative products to facilitate their comparison with standardised products. This approach has the potential to

121 https://ec.europa.eu/info/law/better-regulation/have-your-say/initiatives/13665-Late-payments-update-of-EU-rules_en
122 https://commission.europa.eu/strategy-documents/commission-work-programme/commission-work-programme-2023_en
123 For example, some of the largest insurers of construction works contributed to the 2022 report 'Insurance barriers of massive timber construction' https://www.thefpa.co.uk/resource-download/401 Although the report is UK focused, the issues highlighted can be applicable to other countries.

mitigate increased insurance prices and satisfy regulatory demands, but it requires an initial investment from the manufacturer to request the assessment to a Technical Assessment Body which can be problematic for SMEs.

3. Enabling Framework		
Recommended action	**Actors**	**Timeframe**
3.1 Consider setting **preparing for re-use and recycling targets** for construction and demolition waste and its material-specific fractions, in the context of the Waste Framework Directive	EU/MS	M
3.2 Consider developing **EU-wide end-of-waste criteria** for selected streams of construction and demolition waste	EU	S
3.3 Deploy **innovative solutions on waste sorting** and recycling processes	Industry/ MS	S/M
3.4 **Prioritise renovation over demolition** and reconstruction in policies, programmes and developments	Industry and EU/MS	S/M
3.5 Develop a **European standard for reversible buildings and infrastructure works**, following the recommendations of the BAMB project[124]	Industry and EU/MS	S/M
3.6 Support the creation of **regional and cross-border marketplaces for secondary** construction products and materials	Industry and EU/MS	S/M
3.7 Strengthen requirements for **pre-demolition audits** and selective deconstruction in capital investment projects, in line with the EU Construction & Demolition Waste Management Protocol	EU/MS	M/L
3.8 Develop European **standards for the quality assessment of secondary materials**	Industry	S/M
3.9 Support the **large-scale roll-out** of resource-efficient industrialised techniques for construction and renovation	Industry and EU/MS	S/M
3.10 Revise the Construction Products Regulation to improve the functioning of Single Market for construction products and to **address the sustainability performance of construction products** with the same ambition as the Ecodesign for Sustainable Products Regulation. **Update all current standards** under the Construction Products Regulation in the CPR Acquis process.	EU	S

124 The BAMB project 'Buildings as Material Banks' developed a 'Reversible building design protocol' https://www.bamb2020.eu/topics/reversible-building-design/

3.11 Invest in continual and predictive **maintenance** of buildings and infrastructure works to extend their service life	MS/ owners	S/M/L
3.12 Require disclosure of **whole life cycle GHG emissions of buildings and infrastructure works** and consider the setting of maximum target values	EU/MS	S/M
3.13 Support the transition to **zero-emission construction sites** (including zero-emission machinery)	Industry and MS	S/M/L
3.14 Encourage **disclosure of buildings' environmental performance**, both designed and as built, to enable benchmarking according to Level(s)	Industry and MS	S
3.15 Facilitate consistency in calculation and disclosure of **whole life cycle greenhouse gas emissions** in buildings based on Level(s)	EU/MS	S/M
3.16 Consider developing an equivalent of Level(s) for **infrastructure** works	Industry and EU/MS	M
3.17 Facilitate the development of **SME friendly environmental assessment tools** for construction products in line with the Construction Products Regulation	Industry and EU	S/M
3.18 **Align national building assessment schemes to the EU framework**, in particular Level(s) and the information delivered in the context of the Construction Products Regulation and the revised EPBD.	MS/ Industry	S/M
3.19 Align **public procurement initiatives** to European Green Public Procurement criteria.	MS	S/M
3.20 Promote the **digitalisation of construction product information** under the Construction Products Regulation	Industry	M
3.21 Implement a **database or system for construction products** that is interoperable with other tools, in the context of the Construction Products Regulation revision	Industry and EU	M
3.22 Improve digitalised **traceability of construction products, materials and waste** through the value chain including their connection to databases (Construction Products Regulation or Digital Product Passport).	Industry and EU/MS	S/M
3.23 Develop **innovative applications** linked to the Construction Products Regulation-related information and to the Digital Product Passports for construction products.	Industry/ Research	S
3.24 Update national **regulations to be compatible with the Digital Decade** and propose user-friendly tools for industry, professionals and consumers	MS	M

3.25 Support SMEs on their digitalisation activities by creating **exchange platforms, hubs, and support services**	EU/MS	S/M
3.26 **Raise awareness of SMEs in digital technologies** and in the available supporting framework to increase innovation and competitiveness[125]	Industry (SMEs)	S
3.27 Mainstream the use of digital design tools that facilitate **analysis and disclosure of the performance and environmental impact** of construction projects	Industry	S/M
3.28 Develop **digital building logbooks** or improve existing national logbooks according to the Commission's forthcoming model and guidelines	MS	M
3.29 Use the guidelines for digital building logbooks as a basis for more **interoperable systems and databases** for construction projects and works	EU/MS	S/M
3.30 Demonstrate and experiment on applications of digital building logbooks for the creation of **new business models and innovative solutions.**	Academia / Industry	S/M
3.31 Build a **community of practice for public buyers** of construction, buildings and infrastructure focusing on BIM. Select and promote good practices for OpenBIM and resource savings (2023).	EU	S
3.32 Make **BIM a standard practice for collaboration** (from procurement to facility management) in public construction and infrastructure projects.	MS	M
3.33 Assess the state of digitalisation of **building permit systems** and deliver guidelines and trainings to public authorities to improve their systems.	EU	S/M
3.34 Facilitate free movement and the export of construction services **mutual recognition procedures** for professional qualifications of Directive 2005/36/EC and the principles laid out in the Services Directive[126].	MS	S
3.35 Encourage **temporary cross-border service provisions** to improve flexibility and resilience of the construction ecosystem. Facilitate posting of workers in the construction ecosystem, including temporary workforce.	MS	S
3.36 Provide incentives for SMEs to **participate in public procurement**	MS	S
3.37 Request the Commission's support through the **Technical Support Instrument** when challenged to introduce reforms and assure an enabling framework	MS	S

[125] For example, using digital-construction.ec.europa.eu
126 Directive 2006/123/EC

Building Block 4: Research, Innovation, Technology

Digital tools can accelerate the green transition at various stages of the life cycle of the works. During the design phase, architects and engineers can use new tools to test design choices, optimise resource efficiency, collaborate with other team members, simulate energy consumption, and optimize life cycle emissions. During the construction phase, contractors can simulate processes, share information between site and design offices, and use automated hardware to build faster and with fewer errors and waste. At the end of construction, a digital twin can be handed over to the owner and facility manager**,** who will benefit from the data during operation of the asset. By automating certain activities, not only does the final quality of the project increase, but workers are also less exposed to health and safety risks and new materials and techniques can be deployed[127]. The manufacture of construction products can also benefit from industrial symbiosis, whereby material flows are exchanged between industries. IT spending in construction does not exceed 1%, because of which, labor productivity has grown at only a quarter of the rate in manufacturing over the past two decades[128].

As a response to the Scenarios Staff Working Document, stakeholders showed **barriers to the uptake of R&I solutions**. The three most important barriers were: 1) high number of SMEs and the fragmentation of the ecosystem, 2) R&I not addressing the needs of the ecosystem and 3) regulatory barriers. Beyond these three, other barriers mentioned were a culture aversive to change; lack of awareness as well as lack of demand to drive innovation among companies; lack of skills to implement innovation; and in general, the costs of implementing innovative technologies.

In this building block we are presenting the assessment and proposals from construction stakeholders and experts received during consultations and two dedicated webinars that took place in November 2022. In addition, we describe the current EU level initiatives to improve R&I in construction.

R&I in a fragmented ecosystem

A key obstacle for innovation noted by many stakeholders during consultations is the lack of awareness and ability. Many SMEs run with low profit margins that prevent large scale investment in innovation, and it is difficult to disseminate research results across the ecosystem. Technology transfer is also time consuming for SMEs. According to stakeholders, public authorities could offer means to mitigate this risk.

The limited abilities of SMEs to innovate are often brought to the attention of the Commission. It was argued that SMEs would need dedicated training structures that could help them to understand the added value and the uptake of these technologies. Scale-up schemes would be needed to offer SMEs the opportunity to develop, promote and expand their innovations and technology transfer from research institutions to industry. Therefore, supporting R&D&I (Research, Development and Innovation) in SMEs and their collaboration with research institutions would be necessary.

Beyond the fragmentation from SMEs, some stakeholders noted fragmentation due to differences in national markets and language barriers, which would hinder scaleup. A European digital construction

127 Digitalisation in the construction sector. https://ec.europa.eu/docsroom/documents/45547
128 Integrating digital innovations in the construction sector. https://ec.europa.eu/docsroom/documents/34517

platform based on the recommendations of DigiPLACE[129] could offer solutions. In addition, the Horizon Results Booster service of the European Commission would also have potential but look only at project partners and not external companies who would like to bring research results into the market.

Stakeholders suggested that the EU should consider sectoral R&I funding with less restrictive criteria. They also referred to the need to focus on delivery, and practice-oriented and networked research and to reduce the gap between academic theory and industrial practice.

In addition to showing the **excessive costs** of innovative technologies, several stakeholders see also an issue with a **lack of demand from clients to encourage innovation**. Clients (including the public sector) can support demand for innovation and create a competitive advantage when incorporating innovative solutions.

In relative terms, micro-enterprises face the strongest barriers to make the green and digital transition. Their capital is limited to making investments in technology or to training employees. In most cases, they do not have experts in house. Yet micro and small enterprises do not have to give up on the green and digital transition, on the contrary. It is equally necessary for them to join the cause so as not to lose their competitiveness.

However, the small scale and agility can be an asset via:

- small-scale sustainability investments in their field of expertise
- short training courses to install a digital culture in the company
- temporary hiring of expertise (consultants and contract agents on BIM, 3D-printing, digital company culture,
- collaborations with larger companies that are already further along in their transition, whereby knowledge is gained about, for example, digital technologies

Certainly, to empower micro-enterprises to digitalise and innovate, Member States need to set up sectoral and local support centers that guide companies, offer expertise and on-demand services.

Research, innovation and technology as enablers of the twin transition

Although numerous technologies for circular and resource efficient construction exist or are under development (for example, 3D printing, automated and robotic off-site manufacturing and on-site assembly, drones), they should not be considered in isolation. Their maximum potential depends on their combined use, together with appropriate business models. For example, circular business models include products as a service (which can be effective especially for technical building systems), take-back schemes (for over-ordered products delivered to site), and platforms that match supply and demand for secondary materials. Furthermore, a descriptive 'digital twin' can be constructed which is an as-built representation of an asset connected to its operational data. It combines all relevant information for operations and upkeep in a digital format, contextualised by a 3D model.

Feedback from stakeholders named many areas of R&I that can support the twin transition of construction:

129 https://digiplaceproject.eu/

- **Design and collaboration tools** can improve resource efficiency and optimise design choices, including with artificial intelligence.
- **Robotics can be applied not only to manufacturing** and construction processes but also put to perform time-consuming activities such as logistics, deconstruction of works, recovery and sorting of waste for circular re-use and recycling[130]. There is a need for more research on sensing and positioning of robots for construction and a greater need for adaptivity, meaning system loops that integrate mass customisation of robots, and robots that can deal with both digital and physical information. In addition, human-robot collaboration including safety issues require further work.
- Factory or on-site **3D printing and additive manufacturing** delivers tailor-made solutions and can produce complex products at an affordable cost in a resource-efficient way. This can be especially useful where non-standard elements with complex shapes may be needed. In addition, the distances to transport construction products can be reduced by printing closer to the building site. Currently, **Europe and the USA are at the forefront of 3D-printing technology in construction** and drive innovation. There is a need to ensure that legislation and building codes adapt to take account of 3D printing innovation, notably for structural elements whether precast or stacked load-bearing components. Further research is also needed on low carbon, circular materials that can be 3D printed for construction works.
- **Innovations in processes that reduce errors and ensure quality** and compliance checks of the works, including use of augmented and virtual reality, machine learning and digital twins.
- Integration of 3D scanning with **manufacturing processes for prefabricated elements**, this approach has an added value for the renovation of existing buildings.
- **Mapping tools, Earth Observation** and other data for planning and preparation of works[131].
- Technologies and associated business models for **end-of-life of assets** including demolition, selective deconstruction, sorting of waste, and reducing waste generated on site.
- Stakeholders stressed the importance of **off-site construction and prefabrication** to enable best use of other technologies such as robots and drive process innovations for enhanced productivity and quality of the works. However, off-site construction implies different ways of working together, such as an earlier collaboration of design and construction teams, with consequent implications for design fees and allocation of risks.

In line with the **European Research Area (ERA)** communication[132], the Commission has developed the **ERA industrial technology roadmap for circular technologies and business models** in the textile, construction and energy-intensive industries[133]. This work shows the means to develop and adopt these technologies, which can help reduce the impact of these industries on climate and the environment. It finds a leading position of EU companies in circular technologies, but also looks at the substantial research & innovation investment needs at EU and national levels and necessary framework conditions to put in place.

130 For example, the Robeton project won the bauma innovation award 2022. See https://www.youtube.com/watch?v=qy5B9hQfIpo

131 For example, the Circularity Atlas under the Horizon 2020 project CIRCuIT. See https://www.circuit-project.eu/circularity-atlas

132 https://ec.europa.eu/commission/presscorner/detail/en/ip_20_1749

133 European Commission, 2023. ERA industrial technology roadmap for circular technologies and business models in the textile, construction and energy-intensive industries. https://data.europa.eu/doi/10.2777/188014

Under the **Horizon Europe** programme[134], Cluster 4 'Digital, Industry and Space' supports the twin transition of the construction ecosystem. Recent funding topics have focused on improving access to life cycle-related digital information, improving processes related to construction and demolition waste, and innovations supporting European technological sovereignty in construction. Additionally under Cluster 5 'Climate, Energy and Mobility, the Built4People co-programmed partnership for a people-centric sustainable built environment[135] takes a whole value chain approach to support innovations, working with regional innovation clusters. Several parts of Horizon Europe support the aims of the New European Bauhaus.

The **European Innovation Council** (EIC) supports entrepreneurs bridging the gap between scientific excellence and market adoption. It works with three funding schemes namely EIC Pathfinder, EIC Transition, and EIC Accelerator which aim to respectively find, develop, and scale up breakthrough technologies[136]. The EIC also offers business services such as access to coaches, mentors, and global partners. The EIC offers specialised support for architecture, engineering, and construction technologies with a dedicated programme manager.

4. Research, Innovation, Technology		
Recommended action	**Actors**	**Timeframe**
4.1. Support **research collaboration** between construction SMEs and academia, building on the work of the EIC and the Built4People partnership.	EU/MS	S
4.2. Support the **scaling up of innovation, innovative technologies, materials and business models** across the ecosystem and its value chains, including by aligning national support with Horizon Europe and the European Innovation Council.	EU/MS	S/M
4.3. Invest in circular technologies and business models for construction, in line with the **ERA** (European Research Area) **Roadmap.**	Industry and EU/MS	S
4.4. Ensure that **standards are rapidly developed** and revised to keep up with innovation and policy developments.	Industry and EU/MS	S/M
4.5 Foster synergies between different EU-funded and national programmes and projects for R&I in construction.	EU/MS	S/M
4.6. Support research and innovation in innovative technologies, techniques and high-performance construction products including those derived from secondary and biobased materials.	Industry and EU/MS	S/M

134 https://research-and-innovation.ec.europa.eu/funding/funding-opportunities/funding-programmes-and-open-calls/horizon-europe/horizon-europe-work-programmes_en
135 https://www.ectp.org/built4people/
136 https://eic.ec.europa.eu/index_en

4.7. **Raise awareness** among SMEs about secured digitalised systems, and specifically train SMEs' employees in the cyber-security field.	Industry and EU/MS	S/M
4.8. In the context of the **European Drone Strategy 2.0**, mainstream the use of drones and other data collection/earth observation tools in construction, buildings, and infrastructure.	Industry	S

Building Block 5: Funding

The microenterprises that comprise 90% of EU construction companies tend to have limited bargaining power for a favourable financing deal, due to lower working capital and higher perceived business risk. Furthermore, many microenterprises exhausted their reserves during the last three turbulent years, with a pandemic followed by rising energy prices and inflation.

According to members of the High Level Construction Forum, there is in many cases a **lack of easy-to-understand and tailored information on funding and financing possibilities**. Concrete funding programmes can be set up to match SMEs, to familiarize them with different financing options.

Regarding the **systemic barriers faced by construction SMEs**, stakeholders listed a series of priorities on which the Commission, Member States and industry should focus. These include:

- Providing SMEs with tailored support and training about finance and available funding
- Supporting SMEs in the purchase/rental/subscription of equipment, software and support services
- Making digitalisation affordable for SMEs (e.g. with project guarantees, providing tools for calculating Return on Investment)
- Using possibilities for Cohesion Policy funding for ICT uptake in SMEs, including infrastructures and services to support this (e.g. Digital Innovation Hubs, Living Labs)

High Level Construction Forum members also called for **more direct technical and financial support for the digital transition** of SMEs. This support could take the form of subsidies to small businesses through grants for the direct costs of introduction of certain IT systems, like IT infrastructure, software, or training and consultancy. They also suggested that the industry should use the available infrastructure for experimentation, training, and funding for innovative technologies. There is a significant role for industrial associations to encourage their larger players to set up collaborations with smaller players and thus propel them forward in digitalisation, as this will ultimately benefit the entire ecosystem.

The private investment environment

The world of construction and property development is interwoven by a variety of financing instruments. Private financial institutions provide several types of financing to developers, architects, construction companies, and property owners or investors. Each of these actors has its own risk profile and its own needs or requirements in terms of conditions and terms of financing. The types of loans range from large-scale long-term loans for investments in the purchase of land to specific, often small-scale, and tailored loans for renovation projects by private homeowners. Many companies in the construction ecosystem primarily rely on loans for working capital, for example to pay their equipment and workers in anticipation of payment from the sale of the construction project or from the developer. Many start-ups and growing companies take out specific loans, tailored towards their growth ambition and investment needs, and adapted to their risk profile.

Member States and other national public bodies support all these players, to the extent that they are aligned with their respective goals in areas such as sustainability and economic development, and as far as they are following EU regulations in the field of competition and state aid. The European Investment Bank also supports many SMEs.

Energy efficiency loans and mortgages are growing in popularity, such as loans linked to improving the energy performance of buildings. This is strongly linked to the business case of these investments, which has been greatly strengthened due to high energy prices, in combination with incentives from Member States to issue this type of loan. In some cases, there are officially supported large-scale schemes aimed at efficient renovation of the built environment.

The work on the **EU Green Taxonomy for Sustainable Financing** has a twofold aim. On the one hand, it aims at offering more transparency to financial institutions' loan portfolios, and especially the extent to which truly sustainable projects are supported. On the other hand, it also wants to supply an incentive for these institutions to invest more in these green projects.

Venture Capital (VC) funding in construction start-ups increased globally in the past few years, going from EUR 43 million in 2012 to EUR 1 199 million in 2018 (with a record increase of 177% between 2017 and 2018). However, VC investments are largely concentrated in the US and China, with the European digital start-ups accounting for only 4% of global VC funding in digital construction start-ups in 2017. France, Germany, and Sweden attracted most of these investments.

Concerning the investment initiatives to support the twin transition and strengthen the resilience of the ecosystem, stakeholders provided various ideas of private investment during the consultation. Among these, one of the central topics to support the green transition through investment was the EU Taxonomy, which was seen as a crucial tool by many. Indeed, the Taxonomy would channel private investment towards more sustainable technical building systems, and construction technologies and practice.

An accelerated rate of building renovation requires a mixture of **public support and private finance** to raise at least EUR 150 billion additional investments per year. The Energy Efficiency Financial Institutions Group (EEFIG) works to propose policy and market solutions to increase the scale of energy efficiency investments across Europe[137]. The Renovation Wave foresees at least doubling the annual rate of building renovation, and this has been made even more urgent by high energy prices. There is a need to scale up industrialised renovation techniques[138] and the deployment of energy efficiency and renewable energy technologies in buildings.[139.]

The proposals to recast both the Energy Efficiency Directive and the Energy Performance of Buildings Directive also include stronger provisions on the need to roll-out innovative financing instruments while targeting grants for renovations to homeowners and businesses with more limited financing capacities and worst-performing buildings where the potential for energy savings is the highest.

137 https://eefig.ec.europa.eu/index_en
138 The Interreg project INDU-ZERO has developed a blueprint for a factory capable of producing 15,000 prefabricated renovation packages per year. See https://www.induzeroblueprint.eu/
139 The 2022 Progress Report on Competitiveness of Clean Energy Technologies COM (2022) 643 final presents the current and projected state of play for key technologies used in buildings including heat pumps, solar PV and home energy management systems. See https://energy.ec.europa.eu/progress-competitiveness-clean-energy-technologies_en

EU funding schemes and national/regional programmes

The **Social Climate Fund**, sourced from revenues from the ETS for Buildings and Road Transport (ETS-BRT), will support households and micro-enterprises affected by the impact of the ETS-BRT, including via investments in energy efficiency and renovation of buildings, clean heating and cooling. It will start in 2026 before the entry into force of the ETS-BRT, with an estimated total of EUR 86.7 billion, financed by EUR 65 billion from the EU budget, in addition to 25% co-financing by Member States.

The **Modernisation Fund**[140], sourced from revenues from the EU ETS, supports investments in generation and use of energy from renewable sources, energy efficiency, energy storage, modernisation of energy networks, including district heating, and just transition in carbon-dependent regions (including re- and up-skilling of workers) in 10 lower-income EU Member States. The ETS **Innovation Fund**[141] provides funding for ETS installations including those producing energy intensive materials destined for construction works.

The **Green Deal Industrial Plan**[142] intends to enhance the competitiveness of Europe's net-zero industry and support the fast transition to climate neutrality. The Plan aims to provide a more supportive environment for the scaling up of the EU's manufacturing capacity for the net-zero technologies and products required to meet Europe's ambitious climate targets, including products used in the construction ecosystem such as heat pumps for buildings.

According to DG GROW analysis[143], all the **National Recovery and Resilience Plans** (NRRPs) have measures that are at least indirectly related to the construction ecosystem. Many of these measures concern economic and financial support for the ecosystem. Looking at the composition of national allocations, the share of value of NRRPs measures directly aimed at the construction ecosystem averages 12.7% across the 22 approved plans while the median is 9.7%. From the construction ecosystem's perspective, the NRRPs can stimulate an enabling framework that fosters investments and strengthens resilience as a prerequisite for the twin transition. The **Recovery and Resilience Facility** (RRF) Regulation defines resilience as the "ability to face economic, social and environmental shocks or persistent structural changes in a fair, sustainable and inclusive way". The main strategic dependencies addressed by the NRRPs concern the sourcing of construction and raw materials. To achieve such an enabling framework in the construction ecosystem, several challenges need to be addressed. Here follows a list of examples of how specific NRRPs measures tackle these challenges.

140 Modernisation Fund (europa.eu)
141 https://climate.ec.europa.eu/eu-action/funding-climate-action/innovation-fund_en
142 COM(2023) 62 final
143 https://single-market-economy.ec.europa.eu/industry/strategy/ecosystems_en

Main figures and findings:

Number of national RRPs analysed: 22 (approved plans); all of them have measures at least indirectly related to the construction ecosystem.

€186.6bn are devoted to measures related to construction, comprising 41% of the total RRF allocation. Out of this amount, **€56.4bn provide direct support to the ecosystem,** adding up to 12.7% of the total allocation for the 22 plans.

€50.8bn are devoted to the policy area for "building renovation and construction.[3]"

Please note that all figures on construction within this fiche are based on GROW tagging methodology and ecosystem definition and take into account the 22 plans approved by the Commission and endorsed by the Council in 2021.

A key challenge addressed in the plans is streamlining and evolving regulatory and administrative processes such as permits and procurement. The better collection, organisation and use of information and data from construction is key to modernise the ecosystem and increase transparency.

The NRRPs measures also seek to address a central challenge in the construction ecosystem to boost the confidence of property owners, public authorities, and investors to direct resources in the green and digital transition of the built environment. **The construction ecosystem can be supported via a larger set of tools: reforms** (national, implementation of EU initiatives) as well as **investments** (national funds, and EU resources such as Cohesion funds, React-EU, Just Transition Fund, InvestEU, Connecting Europe Facility, Technical Support Instrument).[144] Examples of countries utilising EU funding for increasing the resilience of construction and advancing in the twin transition are presented in a later chapter with the commitments**.**

The **ERASMUS+** 2021-2027 programme places a strong focus on social inclusion, the green and digital transitions, and on promoting young people's participation in democratic life. It supports priorities and activities set out in the European Education Area, Digital Education Action Plan, and the European Skills Agenda. Erasmus+ will increase the support for projects that foster cooperation and exchange of practices. It allows stakeholders to make better use of innovative technologies, develop innovative teaching, training, and learning methods, promote non-formal learning and develop common tools and activities. The platforms of Centers of Vocational Excellence will be fully rolled out and will supply high-quality vocational skills, support entrepreneurial activities, and foster inclusion and innovation. Forward-Looking Partnerships will promote projects that aim to find, develop, test and/or assess innovative approaches with the potential of becoming mainstream and improving education and training systems. Alliances for Sectoral Cooperation on Skills aim to create new strategic approaches and cooperation for concrete skills development solutions – both in the short and the medium term – in areas implementing

144 A list of sources of funding is available in the Commission Staff Working Document ''Scenarios for a transition pathway for a resilient, greener and digital construction ecosystem".
https://ec.europa.eu/docsroom/documents/47996 as well as the 2022 Annual Single Market Report.

a major action of the European Skills Agenda for sustainable competitiveness, social fairness and resilience, the Pact for Skills.

Creative Europe[145], the flagship programme for the culture and creative sectors, provides support to architecture and cultural heritage for a quality built environment. It does so through targeted actions for the mobility, capacity-building and internationalization of architecture and cultural heritage operators, the promotion of Baukultur, peer learning and audience engagement. The programme also supports the EU Prize for Contemporary Architecture, the Mies van der Rohe Award, to highlight and promote quality architecture in Europe, and help raise awareness on the benefits quality architecture can generate for sustainable growth, the circular economy, the environment and social cohesion.

Investment in key services and products to ensure supply continuity is a good approach to prevent value chain disruptions in the construction ecosystem. A long-lasting non-competitive situation within the EU in terms of energy dependency and material availability may push companies to allocate their factories outside the EU and due to transport issues or market interest may result in scarcity of these materials. While economic incentives to key European business seem the logical approach it is sometimes complex because the subsidies may end in the support of global players not interested per se in the European market.

The Commission is taking various initiatives aimed at alleviating the mentioned price hikes and guaranteeing a steady supply of construction materials. Initiatives are being taken on reducing energy prices for high intensity consumers, such as the **REPowerEU**[146] Communication aimed at saving energy, accelerating production and deployment of clean energy and diversifying energy supply. The Commission announced a **temporary revenue cap** on companies producing energy at low cost[147] so that Member States can re-channel these profits to help consumers reduce their bills, including SMEs. Furthermore, the Commission proposed an **emergency regulation to address high gas prices** and ensure security of supply[148]. This will be done through joint gas purchasing, price-limiting mechanisms, new measures on transparent infrastructure use and solidarity between Member States, and continuous efforts to reduce gas demand.

The **Temporary Crisis Framework for State Aid**[149] is aimed at supporting the economy specifically in the context of Russia's invasion of Ukraine. It enables Member States to use the flexibility foreseen under State aid rules to tackle this unprecedented situation, and support companies that can show their activities were specifically affected by the war in Ukraine and its direct consequences. In addition, the recently revised State aid guidelines on Climate, Environmental protection and Energy[150] provide additional flexibility for supporting building renovations and the deployment of renewable energy and energy efficient appliances in buildings. Similarly, the upcoming revised General Block Exemption Regulation will ensure that the same principles and flexibility are provided for block-exempted State aid measures.

145 https://culture.ec.europa.eu/creative-europe
146 https://ec.europa.eu/commission/presscorner/detail/en/IP_22_3131
147 https://ec.europa.eu/commission/presscorner/detail/en/ip_22_5489
148 https://ec.europa.eu/commission/presscorner/detail/en/IP_22_6225
149 https://ec.europa.eu/commission/presscorner/detail/en/ip_22_4622
150 https://competition-policy.ec.europa.eu/sectors/energy-environment/legislation_en

Matchmaking between supply side and consumer side of raw materials, notably in the supply chain of wood and other construction products, are being carried out, for example through the Cluster Collaboration Platform[151]. Through the Enterprise Europe Network the Commission has launched the Supply Chain Resilience platform[152] that helps companies tackle bottlenecks and discover partnerships to transport their products or source what they need. Many Member States are using the Resilience and Recovery Platform to resolve bottlenecks in value chains, such as sawmill capacity. Furthermore, initiatives are being taken on intra- and extra-EU import diversification.

Stakeholders also proposed that **public funding could be used to remove barriers to private investment**, for example by de-risking and supplying technical assistance, one-stop shops or roadmaps for cost-effective staged renovations such as building renovation passports. Therefore, the EU should ensure that Recovery Funds target renovation of the existing stock and that Member States have clear strategies to channel this funding to construction. According to many stakeholders, clients in partnership with consulting engineers should develop green finance strategies on project level and offer Design Build and Finance types of projects. Other aspects brought up as private investment suggestions concerned transparency, clarity and predictability of the market and the construction ecosystem, and a coherent legal framework (as coherence between EU tools would help make companies willing to invest in the twin transition). Examples of this include the EPBD, including the provisions in its recast proposal on minimum energy performance standards and zero-emission buildings, among other matters; the Emission Trading Scheme extension to buildings; the Energy Efficiency Directive, with provisions on energy efficiency financing and public buildings; and the Energy Taxation Directive. Furthermore, stakeholders suggested one-stop shops for private investments with the latter focusing on the provision of financial and technical support for energy renovation.

5. Financing		
Recommended action	**Actors**	**Timeframe**
5.1 Activate and utilise EU funding to support resilience, greening and digitalisation in the construction ecosystem	MS	S/M/L
5.2 Provide tailored information to SMEs and increase their awareness of **funding and financing** possibilities (grants, investment aid, guarantees) for investments to digitalise, take up innovative technologies, or increase working capital for growth and new hires.	EU/MS/ financial institutions	S
5.3 Increase the understanding of funding and financing possibilities for EU citizens (homeowners, business owners) for renovations, investments in renewables and others (e.g., solar panels, wind energy, heat pumps).	EU/MS/ financial institutions	S

151 https://clustercollaboration.eu/
152 https://supply-chain-resilience-platform.b2match.io/

5.4 Reduce systemic barriers to finance for SMEs and micro-enterprises.	EU/MS/ financial institutions	S/M
5.5 **Channel public investments towards bottlenecks** in the value chains. Monitor such bottlenecks.	EU/MS/ Industry	S/M
5.6 Increase the share of revenue that is used for **development and training** (digitalisation, automatisation, upskilling).	Industry	S/M
5.7 Develop and frequently update **investment criteria** for construction via the EU Taxonomy for Sustainable Activities	EU/MS/Industry	S
5.8 Increase synergies between green financing initiatives related to construction, to de-risk green investments, and without compromising access to finance, in particular for more vulnerable citizens and businesses.	EU/MS	S/M

Building Block 6: Towards a fair and safe built environment

This transition pathway focuses on supporting the industrial ecosystem of construction. However, the built environment that the construction industry delivers, is above all a service to society. Construction policies directly affect the lives of Europeans, the availability and quality of housing, and even their safety.

In this building block, we are describing initiatives supporting a fair, quality, and safe built environment, recognising though that we are entering the sphere of national competencies. Member States master their building codes and must implement the transformation strategy that is the Renovation Wave.

Fair housing

Since 2020 and with the Renovation Wave, the EU has worked to stimulate building renovations, something that has been very beneficial for the construction industry. However, renovation has many societal effects. In a world where energy is becoming more expensive, policies that focus on improving energy performance without offering adequate financial support, can drive households to energy poverty. The most vulnerable households are the ones that cannot afford energy renovations or face "renoviction" (i.e. when people occupying a dwelling are evicted because they cannot afford the rent prices following energy renovations). It is vital that measures to improve the built environment do not overburden the most vulnerable building owners and tenants.

In 2020, approximately 8% of the EU population were unable to keep their homes adequately warm[153]. The surge in energy prices that started in 2021 and worsened with the impact of the COVID-19 crisis and with Russia's invasion in Ukraine worsened an already difficult situation for many EU citizens. Deep energy renovations can be expensive, and owners may not have the means or proper incentives to finance them. Financial instruments provided by the EU and Member States can help solve this issue and address financial and investment gaps. However more support might be needed, either financial or in the form of guidance, particularly towards vulnerable groups and owners of smaller residential assets. Under the Energy Performance of Buildings Directive, Member States maintain a list of national measures for funding energy performance improvements as part of their long-term renovation strategies[154].

As part of their obligation to assess energy poverty in their National Energy and Climate Plans[155] (NECPs), several EU countries have integrated targeted measures in their national strategies and are developing their own definitions, measurement and monitoring methods and solutions to tackle energy poverty. In 2020 the Commission published a Recommendation on energy poverty[156]. This was issued as part of the Renovation Wave strategy and included a proposal for the Energy Poverty Advisory Hub (EPAH)[157].

To alleviate the socio-economic impact of the energy transition, the **Just Transition Mechanism** provides targeted support to mobilise around EUR 55 billion over the period 2021-2027 in the most affected regions. It focuses on territories the most affected by the transition (such as coal regions, heavy

153 https://ec.europa.eu/eurostat/web/products-eurostat-news/-/ddn-20211105-1
154 https://energy.ec.europa.eu/topics/energy-efficiency/energy-efficient-buildings/long-term-renovation-strategies_en
155 https://energy.ec.europa.eu/topics/energy-strategy/national-energy-and-climate-plans-necps_en
156 https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:32020H1563&qid=1606124119302
157 https://energy-poverty.ec.europa.eu/index_en

industrialised regions) and on financing projects fitting with their Territorial Just Transition Plans, ranging from the creation of new workplaces, adaption of business models, and re-skilling and assistance for job seekers, but also renovation of buildings and investments in renewable energy, district heating networks and sustainable transport.

As part of the Fit for 55 package, the Commission adopted in July 2021 a proposal to revise the **Emission Trading Scheme (ETS)**[158]. As well as speeding up emissions reductions, emissions trading for building fuels will stimulate investments in building renovation works. For the most vulnerable groups, the Social Climate Fund will complement the ETS by providing around EUR 72 billion of financial support[159]. Member States will set out their proposals for specific measures and investments in Social Climate Plans that they will submit to the Commission.

The **Affordable Housing Initiative** (AHI) aims to deliver on the objectives of the Green Deal and the Renovation Wave by putting people and innovation at the forefront. As a flagship of the New European Bauhaus, this initiative will pilot the renovation and construction of "100 lighthouse social and affordable housing districts" following a smart and integrated neighbourhood approach. It does this by providing support to local partnerships composed of SMEs active in the construction ecosystem, public authorities, social housing providers and other relevant stakeholders (e.g., impact investors, creative, cultural industry entities, business support centres) in affordable and social housing projects.

Safe buildings

Asbestos- free buildings

Asbestos has long been recognized as a danger to human health. The main threat to human health occurs when materials that contain asbestos are disturbed and fibers can be released into the air and inhaled. The deterioration over time of some asbestos products may also lead to fibers being released posing a risk to humans.

78% of cancers recognized as occupational cancer in the EU are related to asbestos. It is estimated that 4.1 to 7.3 million workers are currently exposed to asbestos, with 97% working in construction and 2% in waste management. To eliminate the risks stemming from asbestos, the EU has acted over the past 40 years to limit and then ban all use of asbestos in 2005. However, the use of products containing asbestos fibers, which had been installed before 1 January 2005, remains permitted in buildings until they are disposed of or reach the end of their service life. Given that over 220 million building units were built before the ban, many still contain asbestos and some may pose a health threat to residents and workers, mainly in construction. Therefore, addressing the health risks of exposure to asbestos is essential to protect people's health and the environment as well as ensure decent living and working conditions. This is even more urgent given the EU's ambition to double the annual rate of energy renovations of buildings by 2030, which are responsible for more than one third of energy-related greenhouse gas emissions.

On 20 October 2021, the European Parliament adopted a resolution calling for a European strategy for the removal of all asbestos[160] (2019/2182(INL)). The resolution calls on the Commission to present a

158 COM(2021) 551 final
159 COM(2021) 568 final
160 Procedure File: 2019/2182(INL) | Legislative Observatory | European Parliament (europa.eu)

European strategy for the removal of all asbestos, including a mandatory screening of asbestos in buildings and national asbestos registries. In its response of 19 January 2022, the Commission committed to follow up on the resolution by presenting a legislative proposal in 2023 on the screening and registration of asbestos in buildings. It confirmed this intention in the letter of intent[161] accompanying the State of the Union address 2022 and in the Commission "Communication on working towards an asbestos-free future: a European approach to addressing the health risks of asbestos"[162], adopted on 28 September 2022. Together with the Communication, the Commission adopted a proposal to amend Directive 2009/148/EC[163], the Asbestos at Work Directive, to lower the occupational exposure limit by ten times, from 0.1 fibres per cubic centimetre (f/cm^3) to 0.01 f/cm^3. The number of workers exposed to asbestos is expected to increase by 4% per year in the next 10 years, partly due to the foreseen increases in building renovations. The proposal is expected to prevent hundreds of cases of asbestos-related deaths over the next 40 years, thus affording a better protection to workers, while mitigating the impacts on businesses and creating a more level playing field.

A principal challenge is the lack of information on which buildings contain asbestos. The Asbestos at Work Directive obliges employers, in the case of any activity likely to involve a risk of exposure to asbestos, to assess the risk and to determine the nature and degree of exposure. Beyond that, mandatory asbestos screening exists only in few Member States. There is also a lack of coherent and useful tools to share the information about the presence of asbestos in buildings, as it is not standard practice to keep digital registries of it. The late identification of asbestos-containing materials may delay purchase or renovation, while discovering unexpected asbestos during renovation works could lead to the accidental release of asbestos fibres, posing a severe risk not only to workers, but also to inhabitants and neighbours.

The legislative proposal on the screening and registration of asbestos in buildings aims to contribute to a safe environment with positive impact on human health. The specific objectives are to (1) gain comprehensive evidence about the presence of asbestos in buildings, and (2) make this information available through registries that would be (3) the basis for the safe removal of asbestos considering the risks to air pollution.

The preparation of the proposal includes a broad consultation strategy to gather views and evidence from interested/affected parties such as owners of buildings, tenants, national authorities, businesses, academic experts, social partners, etc.

The wide public is now being consulted via a public consultation published on the Commission's central Have your Say web portal. This public consultation was launched in parallel with the Call for evidence [164] and ran until February 2023. Moreover, in 2022 a questionnaire was sent to Member States to gather initial information about their national legislation and strategies.

161 https://state-of-the-union.ec.europa.eu/system/files/2022-09/SOTEU_2022_Letter_of_Intent_EN_0.pdf
162 Communication on working towards an asbestos-free future: a European approach to addressing the health risks of asbestos
163 Directive 2009/148/EC of the European Parliament and of the Council of 30 November 2009 on the protection of workers from the risks related to exposure to asbestos at work
164 https://ec.europa.eu/info/law/better-regulation/have-your-say/initiatives/13543-Asbestos-screening-registering-and-monitoring_en

In November 2022 the High Level Construction Forum organised a webinar to inform stakeholders about the Commission's legislative proposal and to collect their feedback on challenges and best practices for designing and implementing a regulatory approach to reducing exposure to asbestos. The Chief Coordinator of the Polish Programme for Asbestos Abatement 2009-2032 presented the lessons learned and best practices. The President of the Belgian federation of asbestos laboratories and asbestos experts explained the process for asbestos screening. The webinar ended with a panel discussion that touched upon the financing of asbestos removal, the right training of asbestos experts, the question of the independence of certifying instances, the creation of new databases, and other important considerations for the implementation of asbestos policies and regulations.

Additional consultation activities were carried out to collect the specific views of different categories of stakeholders, for instance through questionnaires, interviews and a workshop which took place on 23 January 2023. The workshop, was attended by 42 people, aimed at raising awareness around the planned EU intervention on asbestos screening and registration and to validate the preliminary findings of the external IA study, as well as providing input to feed into the multi-criteria analysis of the possible policy options.

Indoor Air Quality

One of the most essential parameters for a good indoor environment is the quality of its air. This depends on the quality of the building, the temperature, humidity, air exchange and occupant behavior. Therefore, design, construction and maintenance are playing a major role in achieving this goal. As indoor air quality depends on decisions by different actors across the lifecycle of buildings, regulators and public authorities are trying to steer these actors with different instruments, ranging from non-obligatory guidance to obligations laid down in regulations and administrative acts. The main actors at legislative level are national and regional authorities who set requirements in design, installations and the selection of products, and authorities who are charged with enforcing them.

To support these measures, the European Commission is providing supporting regulatory, administrative and technical instruments for authorities, professionals and occupants. While EU policies like the Renovation Wave, the EU Climate Adaptation Strategy and the Zero Pollution Action Plan are setting the general targets, EU legislation is providing more specific tools for coordinated approaches at EU level. Examples of this include the Regulation on Registration, Evaluation, Authorisation and Restriction of Chemicals (REACH), the Energy Performance of Buildings Directive, and the Ecodesign Directive[165]. This will support the exchange of expertise between professionals but also citizens across national borders to finetune their approaches.

The most precise instruments however have been developed at the level of the assessment of the indoor environment and of (construction) products as well as of data collection/distribution (e.g., Building Information Modelling – BIM). Research initiatives (like HEALTHVENT[166]) have been supported to define best ways of defining indoor air quality and to select the most effective measures to improve it. The chemicals legislation has set a solid system for defining risk levels while standardisation work under the

165 Covering also local space heaters

166 European Commission, 2020, Framework for health-based ventilation guidelines in Europe. https://data.europa.eu/doi/10.2788

Construction Products Regulation has provided technical assessment methods for emissions of substances from construction products. An indicative list of the EU policies, regulations and technical instruments will be published as Commission Staff Working Document in 2023. The EU policies promoting alternatives to solid fuel heating, which often also causes indoor-air pollution, help reduce exposure.

Fire safety

Fire safety of the built environment is regulated by the Member States. The EU level regulation in this area is exercised mainly through the Construction Product Regulation and related harmonised technical specifications. Although this division of responsibilities is very clear, it is also true that in such a complex and multi-dimensional subject as fire safety cross-fertilisation of experiences, knowledge and best practices can make a big difference in improving safety of the built environment all over the Europe. This is what Fire Information Exchange Platform (FIEP) aims to achieve.

The green and digital transitions will mean the use of new materials, products, and technologies. These new approaches bring along also new types of risks, and at the same time the experience and knowledge base for these novel solutions is thin. This is where FIEP can help the twin transitions and to be successful it needs broad participation both from regulatory and non-regulatory perspectives, and open discussion about the success stories as well as challenges encountered.

Accessibility

The construction ecosystem is responsible for the creation of the built environment, which directly affects the quality of life and wellbeing of the citizens. An important characteristic of the built environment is its accessibility. Studies show that over one billion people worldwide have a disability. They face problems including barriers to access in the built environment. The removal of barriers and accessibility are not always achieved in renovation projects or new construction. There is often a lack of skills, knowledge, and awareness among construction professionals about accessibility requirements and solutions, which must be addressed and improved.

At the same time, energy renovations that are taking place now massively across the EU can also be an opportunity to improve the physical accessibility of buildings, a major objective under the UN Convention on the Rights of Persons with Disabilities (UNCRPD). Accessibility for people with disabilities in buildings and infrastructures is required in the technical specifications of tenders according to the Public Procurement Directive[167].

6. Towards a fair and safe built environment		
Recommended action	**Actors**	**Timeframe**
6.1. Member States and stakeholders improve practices and building codes through **FIEP**, the EU platform for collaboration and peer learning in fire safety in the context of new materials, products and technologies.	MS, stakeholders	S/M

167 https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=celex%3A32014L0024

6.2. Put forward a legislative proposal on the **screening and registration of asbestos** in buildings and ask Member States to set up national strategies for asbestos removal.	EU/MS	S
6.3. Assess pathways and policy options to improve **indoor air quality**, focusing on the key factors of air quality and the main sources of pollution, including asbestos, and explore ways to raise greater public awareness and reduce risk.	EU	S
6.4. Improve **data availability on buildings' safety** through a regulatory proposal for digital building logbooks.	EU	S
6.5. Support decent and **affordable housing** for all (including support to non-profit private and cooperative social housing sector).	EU, MS, regions	S/M/L
6.6 Improve the **safety of construction products** through the revision of the Construction Products Regulation (improve the standardisation system and introduce product requirements to address inherent product safety).	EU, MS	S/M

Annex I: Action roadmaps: visualising the transition

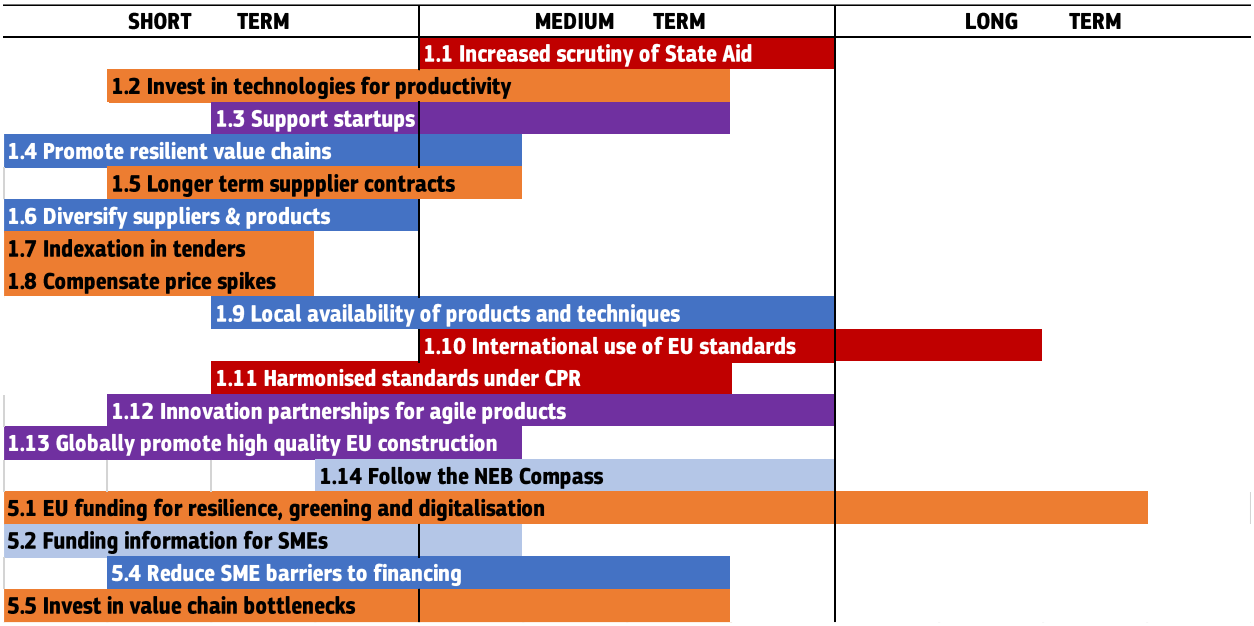
The structure of this transition pathway in specific Building Blocks follows the guidelines of the Industrial Forum. Each Building Block covers a key aspect of the twin transition and the move to greater resilience.

In this chapter we regroup the actions previously described and we position them in time, visualising the roadmaps towards the objectives of the ecosystem itself:

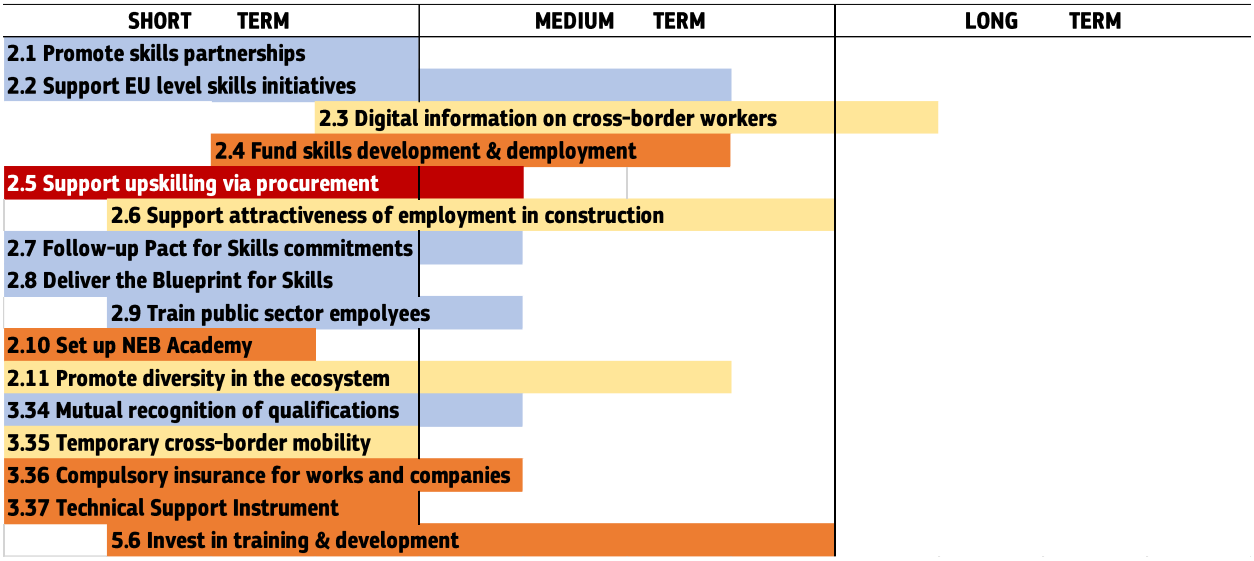
- Roadmap 1: A resilient a competitive construction ecosystem
- Roadmap 2: Upskilling and attracting talent
- Roadmap 3: Safe and affordable housing for all
- Roadmap 4: Greening construction
- Roadmap 5: Towards a greener built environment
- Roadmap 6: Towards a fully digital construction and built environment
- Roadmap 7: Fostering innovation in construction

Above: key to the Roadmap diagrams

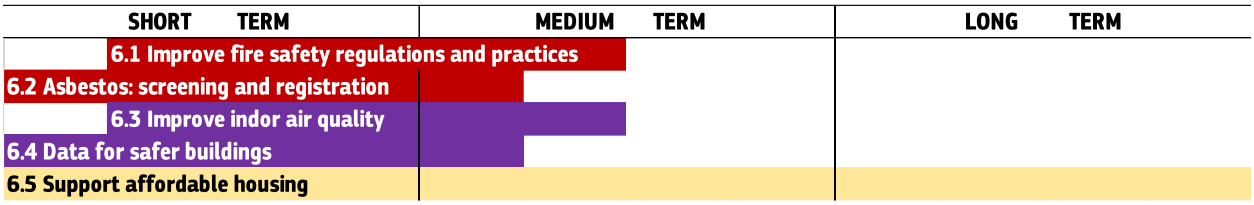
Roadmap 1: A resilient and competitive construction ecosystem



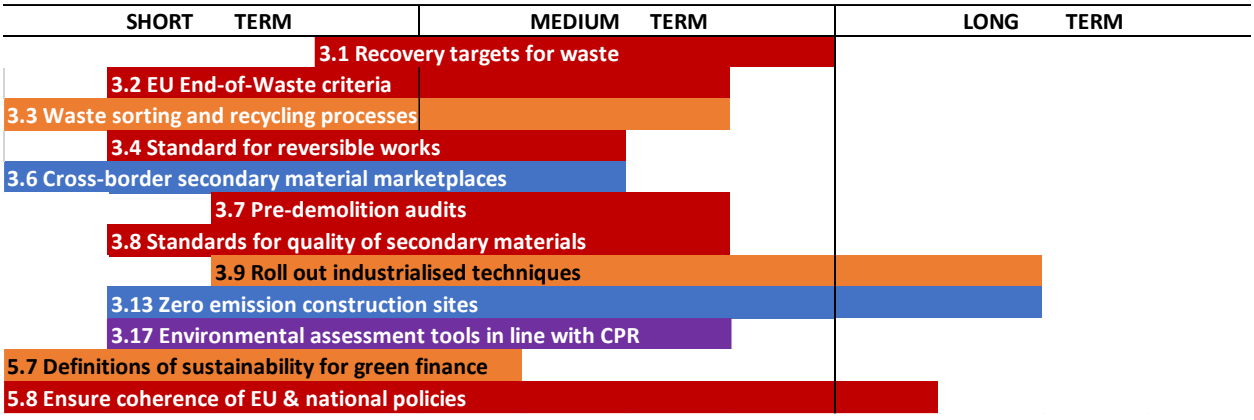
Roadmap 2: Upskilling and attracting talent



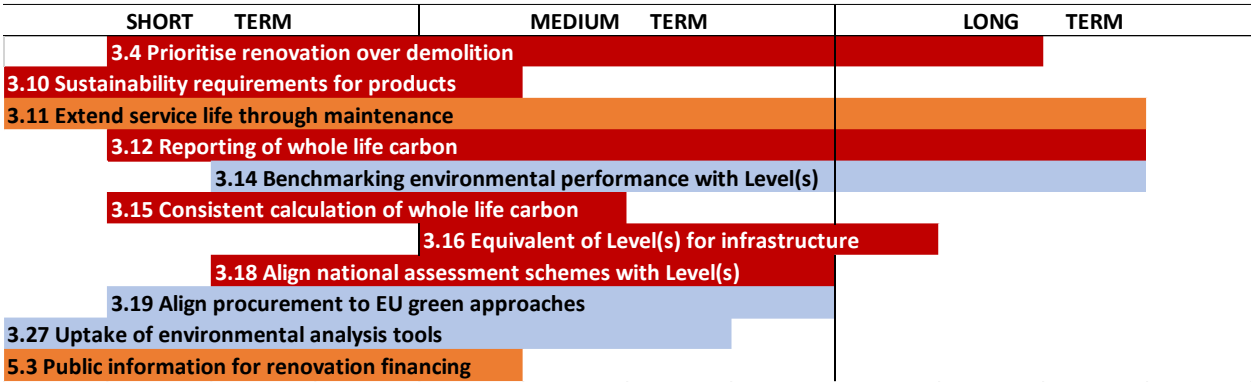
Roadmap 3: Safe and affordable housing for all



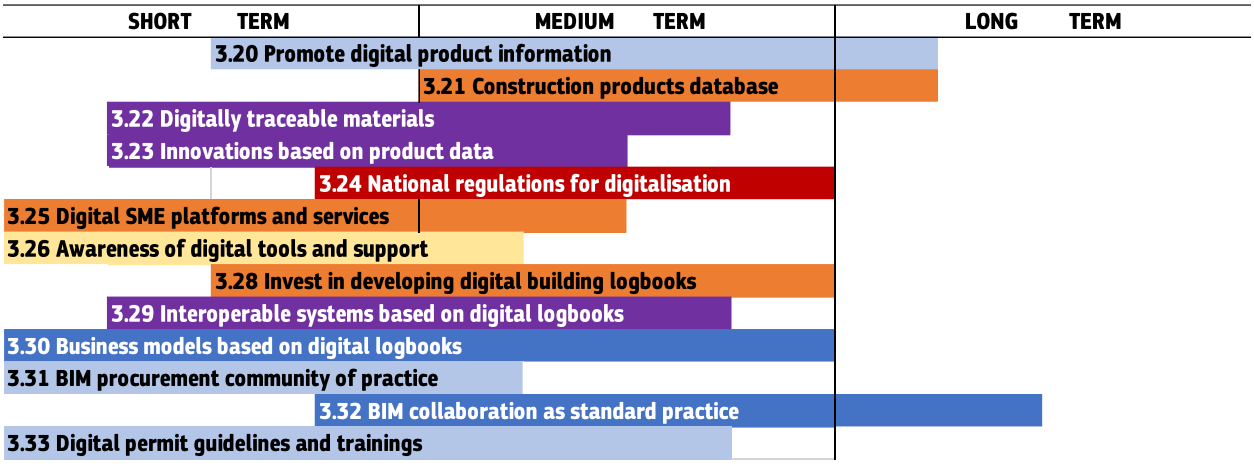
Roadmap 4: Greening construction



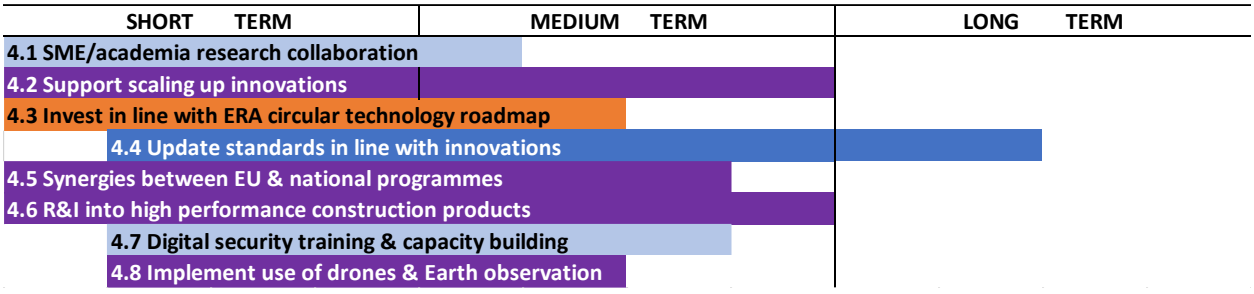
Roadmap 5: Towards a greener built environment



Roadmap 6: Towards a fully digital construction and built environment



Roadmap 7: Fostering innovation in construction



Annex II: National and industry commitments

As a response to the Commission's consultation Staff Working Document, and through the many exchanges in the High Level Construction Forum meetings, Members States and industry reported on their own commitments.

This annex lists the contributions of 20 Member States in the action that can lead to a resilient, greener and more digital construction ecosystem. Industrial stakeholders across the EU and from a plurality of sub-sectors reported on numerous initiatives, including industrial roadmaps, contributing to the accomplishment of over 20 actions described above, and the greening, digitalisation, and competitiveness of the ecosystem.

Following publication of this document, **the Commission now invites Member States, industry and other stakeholders to submit additional commitments that align with the transition pathway**. The Commission plans to publish an update of these commitments on an annual basis.

Member States commit by setting their own roadmaps for resilience, greening and digitalisation

- The **Danish Strategy for Sustainable Construction**[168] has a clear timeline and targets and was provided by the Permanent Representation of Denmark to the EU as a response to the Scenarios SWD. In addition, the **Danish Action Plan for Circular Economy** [169], has a specific section on buildings. Aligned with NEB principles, the Danish government on how to make cities with space for everyone[170]. Denmark established in 2019 a '**Climate Partnership for Construction**' to foster collaboration and action between the government and private stakeholders[171]. The partnership's recommendations[172] were considered in a 2020 national strategy for sustainable construction, and legislation for the staged phasing in of life cycle emissions criteria for construction works. *Enabling framework 3*
- **Estonia** has its own **"Long Term View on Construction 2035".** This document provides a strategic roadmap[1] for the construction industry in Estonia covering green, digital and resilient transition topics. The document outlines the key problems, vision, objectives, and actions (with responsible organisations) to achieve the objectives. Based on this document a development committee was formed and an agreement was signed between all the main public and private industry representatives to oversee the necessary actions. *Enabling framework 3.24, 3.25, 3.26, 3.32 3.33, 3.37*
- The **Czech** national BIM strategy, led by the national standardisation agency, is putting the focus on standardisation. The Czech Presidency of the EU prepared a Conference on Digital

168 https://im.dk/Media/637602217765946554/National_Strategy_for_Sustainable_Construktion.pdf
169 https://mim.dk/media/222902/handlingsplan-for-cirkulaer-oekonomi_0607211338.pdf

170 https://im.dk/Media/637695467299771367/Byer%20med%20plads%20til%20alle.pdf
171 https://em.dk/media/14288/sektorkoereplan-for-klimapartnerskab-for-bygge-og-anlaeg.pdf
172 Recommendations to the Danish Government from the Climate Partnership of the construction industry (2020). Available at https://kefm.dk/Media/1/7/Climate-Partnership-Construction-report-March-2020.pdf

Construction[173] which took place in November 2022, to discuss challenges and solutions of digitalisation and increase the awareness of the professional audience

Enabling Framework 3.26, Skills 2.11

- **Germany's** Road Map for Digital Design and Construction[174] outlines a path to introduce modern, IT-based processes and technologies for the design, construction, and operation of assets in the built environment.
  Enabling Framework 3.32, 3.33
- The **Greek** Ministry of Infrastructure and Transport, together with other competent Greek Ministries as well as Industry and Academia, is preparing a strategy and roadmap for the implementation of Building Information Modelling (BIM) in Greece, covering aspects such as public works, private developments, and skills. In addition, the Strategy is meant to prepare the ground for unlocking funding opportunities for buildings and construction linked to the green transition and digitalisation. The way of working and orientations are very close to our own transition pathways. The EC is supporting the effort through the Technical Support Instrument. In the same spirit of digital reform, Greece made in 01. 2021 the Electronic Building ID (local logbook) obligatory.
  Enabling framework 3.24, 3.25, 3.26, 3.27, 3.29, 3.32, 3.37
- Reducing the life cycle emissions of buildings and construction requires a holistic approach to both policymaking and industrial application across design and construction practices. The World Green Building Council have developed an EU Policy roadmap for whole life carbon in buildings, and supported development of **10 national whole life carbon roadmaps** (HR, FI, FR, DE, IE, IT, NL, PL, ES, UK). Several Member States have been developing national policies addressing life cycle greenhouse gas emissions, for example the **Nordic** countries have been collaborating in this area[175]. Many aspects of circular and resource efficient construction are effective strategies to reduce life cycle emissions, for example increasing re-use and recycled content in construction products, or prioritising renovation over demolition and reconstruction. During 2022 as part of the International Energy Agency's Annex 72 project 'Assessing Life Cycle Related Environmental Impacts Caused by Buildings'[176], around 40 scientific experts on life cycle emissions of the built environment signed the 'Monte Verità Declaration ' [177] This includes recommendations for action by policymakers, industry and other stakeholders.
  Enabling framework 3
- **Finland** revised its Land-use and Building act[178]. The legislative package approved by the Government will significantly reform construction and support the construction of a carbon-

173 Recorded sessions available at Ministerstvo průmyslu a obchodu ČR - YouTube
174 https://www.bmvi.de/SharedDocs/EN/publications/road-map-for-digital-design-and-construction.pdf?__blob=publicationFile
175 Nordic Declaration on Low Carbon Construction and Circular Principles in the Construction Sector (2019). See https://www.norden.org/en/declaration/nordic-declaration-low-carbon-construction-and-circular-principles-construction-sector
176 https://annex72.iea-ebc.org/
177 Monte Verità Declaration on a built environment within planetary boundaries. Available at https://annex72.iea-ebc.org/Data/Sites/5/media/documents/583_monteverita%CC%80declaration_v2.0.pdf
178 www.mrluudistus.fi

neutral Finland. For the first time, climate change mitigation and adaptation will be comprehensively integrated into construction legislation. This work will also take advantage of the opportunities offered by the circular economy and digitalisation.
Enabling framework 3.29, 3.33

- **Spain** has put together a long-term strategy for energy rehabilitation in the building sector that was updated in 2020[179] . BPIE (Buildings Performance Institute Europe) evaluated ERESEE 2020 as the best of the national strategies presented to the EU in compliance with the mandate of Directive 2010/31/EU.
Enabling framework 3.4
- **Sweden** is requiring climate reporting (upfront emissions) to obtain building permits for new buildings. Emission limit values are suggested for 2027[180].
Enabling framework 3.12

And an international example:

- The **Global Roadmap for Buildings and Construction**[181] sets out targets and timelines towards achieving zero-emission, efficient and resilient buildings, and construction between 2020 and 2050. The roadmap covers 8 themes, including urban planning, new buildings, existing buildings, building operations, appliances and systems, materials, resilience, and clean energy. For each of these themes, priority actions related to policy and technology are identified. This roadmap was developed in collaboration with the **GlobalABC** and **UN Environment Programme**.
Resilience and competitiveness 1.9, Enabling framework 3.4, 3.11

Stakeholders commit by setting their own roadmaps and initiatives for resilience, greening and digitalisation

- A large-scale partnership plans to upskill and reskill overall at least 25% of the workforce of the construction industry in the next 5 years, to reach the target of 3 million workers. The initiative was launched by the EU social partners **FIEC** (European Construction Industry Federation) and **EFBWW** (European Construction Industry Federation and European Federation of Building and Woodworkers) in cooperation with **EBC** (European Builders Confederation)[182], detailed activities are just being prepared. Any stakeholder can join the Pact with its own commitment. The Pact for Skills was the first pledge towards resilience in twin transition that was delivered by stakeholders as response to the Staff Working Document ''Scenarios for a transition pathway towards a resilient, greener, and digital construction ecosystem''.
Skills 2.1, 2.7
- **CECE** (Committee for European Construction Equipment) focuses its annual Congress in 2023[183] in the topic of diversity and discusses female participation in an all women panel.
Skills 2.11

179 https://www.mitma.gob.es/recursos_mfom/paginabasica/recursos/es_ltrs_2020.pdf
180 https://www.boverket.se/en/start/building-in-sweden/developer/rfq-documentation/climate-declaration/
181 https://www.iea.org/reports/globalabc-roadmap-for-buildings-and-construction-2020-2050
182 https://ec.europa.eu/social/BlobServlet?docId=25235&langid=en
183 https://www.cece.eu/congress

- The EU-funded project **CraftEdu**[184] is a Slovak and Czech collaboration in line with the Commission's BUILD UP Skills initiative. The project has developed training and qualifications for energy efficiency and renewable energy sources, initially for Czechia. An interactive e-learning platform aims to help the availability of the right skills amongst on-site workers and vocational schools, for seven established professions key to energy-efficient buildings, in either construction or renovation.
  Skills 2.2
- **DigiPLACE**[185] was a project funded under H2020, that resulted in an unprecedented collaboration of construction stakeholders from Member States, industry and academia. DigiPLACE delivered a framework allowing the development of future digital platforms as common ecosystems of digital services that will support innovation, commerce, etc. It will define a Reference Architecture Framework for digital construction platform based on an EU-wide consensus involving a large community of stakeholders, resulting in a strategic roadmap for successful implementation of this architecture.
  Enabling framework 3.25, 3.26, 3.27
- In **GAIA-X**, Germany and France and other Member States, together with companies, research institutions, associations, administrations develop a common European project towards a common goal: Innovation through digital sovereignty. It aims to achieve this by establishing an ecosystem in which data is made available, collated, and shared in a trustworthy environment.
  Enabling framework 3.26, Innovation 4.7
- The **EU BIM Task Group**[186], which aims at sharing good practice and build capacity in national level for the adoption of BIM, has set a roadmap towards acceleration and EU-level alignment. In its **Roadmap**[187]**,** it proposes measures need to be implemented at the EU level to enable the digital transformation of the construction industry, such as the requirement for the use of OpenBIM in all publicly EU co-financed construction and renovation projects. OpenBIM extends the benefits of BIM by improving the accessibility, usability, management, and sustainability of digital data in the built asset industry.
  Enabling framework 3.32, Skills 2.9
- **Smart CE marking**[188]**.** Reliable communication of product performance information in the BIM value chain: The standard UNE 41316:2020 provides a digital format for the information contained in the Declaration of Performance: the Smart CE marking. The purpose is to generate an XML structure for each family of construction products or, more specifically, for each harmonised standard,
  Enabling framework 3.20, 3.22, 3.23 Innovation 4.4
- **Information management systems, product data.** The BIM standards developed for Construction and infrastructure to digitise products, EN ISO 23386 & EN ISO 23387. Also, the standard for digitising Environmental Product Declarations (EPD) that is using the above-mentioned standards is relevant. This is also relevant for EU legal framework of REACH, CPR, LVD, MD etc. as the use of

184 https://database.craftedu.eu/cs.
185 https://www.digiplaceproject.eu/ https://www.digiplaceproject.eu/
186 http://www.eubim.eu/
187 http://www.eubim.eu/the-eu-bim-task-group-sets-its-roadmap-for-the-digitalisation-of-the-construction-sector-souheil-soubra-appointed-chair/.
188 https://www.buildingsmart.es/app/download/12726368926/Smart%20CE%20marking.pdf.

machine-readable Data Templates (EN ISO 23387) support the use of harmonised European Norms (product standards/test standards).
Enabling framework 3.20, 3.21, 3.22, 3.23, 3.32 Innovation 4.4

- Underlining their commitment to fossil free competitiveness, the **Swedish** construction industry has developed 22 **roadmaps for a fossil free future**. The Swedish Construction Federation have outlined eight steps which can be used in everyday work for implementing these roadmaps.
Resilience and competitiveness 1.4
- Developed by the **Italian** Associazione Nazionale Costruttori Edili (ANCE), the '**Sustainability Guidelines for the Decarbonisation of the Construction Sector in Italy**' provide different levers for companies to achieve their Net Zero strategies, including an operational calculation tool for emissions.
Enabling Framework 3.13, 3.27
- A very active partner of FIEP (EC's Fire Information Exchange Platform), **Fire Safe Europe**, has a network of 650 experts and stakeholders exchanging good practice towards fire safety. Fire Safe Europe provides evidence[189] for the need to improve Fire Safety (estimates 5000 fires, 11 fatalities and 190 hospitalisations a day in Europe, which represent 1% of our EU GDP ''burning'').
People and housing 6.1
- The **European Aggregates Association (UEPG) Roadmap to 2030**[190] lays out what is needed to be climate neutral by 2050. The European Aggregates Industry commits to, inter alia, contribute by committing to sustainable energy, supporting green public procurement and Environmental Product Declarations, and provide guidance on End-of-Waste for aggregates.
Enabling Framework 3.2, 3.8, 3.19, 3.20
- **Roadmaps for the cement industry** include the Global Cement and Concrete Association (GCCA), **2050 Cement and Concrete Industry Roadmap for Net Zero Concrete**[191], the collective commitment of the world's leading cement and concrete companies to fully contribute to building the sustainable world of tomorrow. The **CEMBUREAU Carbon Neutrality Roadmap**[192] looks at achieving net zero emissions down the cement and concrete value chain. Amongst other issues, the roadmap looks at how emissions savings can be made through a better use of concrete, and assess the re-carbonation process[5], whereby CO2 is trapped permanently in concrete structures. [193] The **ConcreteZero** initiative[194], launched in July 2022, aims to create a global market for net zero concrete. It is led by Climate Group in partnership with the World Green Building Council and the World Business Council for Sustainable Development. Also in this context, the Commission's Joint Research Centre published a technical report 'Decarbonisation options for the cement

189 https://firesafeeurope.eu/wp-content/uploads/2021/04/Sustainability-FSEU-Position-Paper-2020-FINAL.pdf.

190 https://uepg.eu/mediatheque/media/UEPG-Roadmap2030_Web.pdf
191 See https://gccassociation.org/concretefuture/ and https://bibm.eu/wp-content/uploads/2021/10/BIBM_GCCA-Concrete-Future-Net-Zero-Roadmap.pdf
192 http://www.cembureau.eu/media/kuxd32gi/cembureau-2050-roadmap_final-version_web.pdf
193 www.ivl.se/co2-uptake-concrete
194 https://www.theclimategroup.org/concretezero

industry' [195].
Enabling Framework 3.12, 3.15

- **The European Steel Association (EUROFER)** has developed a low carbon steelmaking roadmap[196].
Enabling Framework 3.12, 3.15
- **The European Asphalt Pavement Association (EAPA)** has pledged to publish during 2023 a roadmap to align the sector with climate neutrality.
Enabling Framework 3.1, 3.2, 3.8, 3.19

Channeling RRF towards resilience and twin transition in construction

All national measures below support the action *Financing 5.1*

- **Cyprus** plans to reform the license permitting process for RES projects by establishing a digital one-stop shop for technical and financial support to accelerate the energy renovation of buildings (estimated cost EUR 500.000). National recovery measures should also help to reinvigorate demand for buildings' renovation and revitalise the ecosystem, while applying high health, safety, and environmental standards.
Enabling framework 3.4
- **Greece** intends to reform urban policy consisting of the preparation of urban plans across 750 municipal units with the aim of addressing weaknesses and gaps in zoning and land use in order to promote sustainable economic activity and protect the environment (estimated cost EUR 5.3m).
- **France** will subsidise the thermal renovation of 28.75 million m2 of floors in public buildings by 2024, aiming to reduce energy consumption to tertiary building by 40% by 2030 (estimated cost EUR 3.8bn).
Enabling framework 3.4
- **Spain** will invest in a rehabilitation programme for economic and social recovery in residential environments. The objective is to support 510 000 energy efficiency renovation actions in at least 355 000 unique dwellings, to achieve on average a primary energy demand reduction of at least 30% verified by energy performance certificates (estimated cost EUR 3.42 billion).
- **Italy**, for instance, will reform student housing regulation to encourage further private investments in student accommodation, with the objective to increase the available place for students from 40 000 to over 100 000 by 2026 (estimated cost EUR 960m). The Ministry of Universities and Research will contribute a portion of the renting revenues for the first three years of operation of the structures.
People and housing 6.5
- **Portugal** will establish a support programme to safeguard decent and adequate housing for 26 000 households with the greatest needs and for the most vulnerable group (estimated cost EUR

195 Marmier, A., Decarbonisation options for the cement industry, EUR 31378 EN, Publications Office of the European Union, Luxembourg, 2023, ISBN 978-92-76-61599-6, doi:10.2760/174037, JRC131246.
196 https://www.eurofer.eu/publications/reports-or-studies/low-carbon-roadmap-pathways-to-a-co2-neutral-european-steel-industry/

1.2bn).

People and housing 6.5

- Proactively addressing the shortage of skilled labor force within the construction ecosystem and developing new high quality job profiles in innovative green solutions and digital tools is central in achieving this goal. **Croatia**n reforms will develop a framework for ensuring adequate skills in the context of green jobs necessary for post-earthquake reconstruction through improvement of existing and development of new education and training programmes (estimated cost EUR 5.3m).

Skills 2.4, 2.6

- **Austria** will advance a reform for raising awareness of building culture that will establish a framework for 'Baukultur' combining high quality architecture and built environment considering social, ecological, economic, and cultural components. Circular techniques such as design for deconstruction and reuse of components require different approaches than the traditional linear model and necessitate further development of the European sustainability indicators.

Resilience and Competitiveness 1.13

- **Slovakia** aims to address its low recycling rates by reforming the management legislation on construction and waste to increase the potential of the circular economy in construction and demolition waste. The reform will require that at least 70% of non-hazardous construction and demolition waste generated on construction is prepared for re-use or sent for recycling. In addition, the reform will introduce mandatory selective standards for recycling from construction and demolition waste, mandatory green public procurement for the contracting of construction works and improve data collection systems for construction waste.

Enabling Framework 3.1, 3.8, 3.19