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COMMISSION STAFF WORKING DOCUMENT

Scenarios for a transition pathway for a resilient, greener and more digital construction ecosystem

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This document is a European Commission staff working document. It does not constitute the official position of the Commission, nor does it prejudge any such position

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1. Introduction

On 10 March 2020, the Commission adopted a new Industrial Strategy[1] to help Europe's industry lead the green and digital transformations and to drive Europe's competitiveness and sovereignty. The update of the EU Industrial Strategy highlights the need to promote an inclusive recovery from the pandemic and further accelerate the green and digital transitions in line with the EU Green Deal and Digital Decade and increase the resilience of EU industrial ecosystems.

The Commission proposes a collaborative process with stakeholders – that includes Member States, industry, social partners and academia – to identify and co-design the way forward: a transition pathway for industrial ecosystems. Priority is given to the industrial ecosystems that face the most important challenges and have been most heavily affected by the crisis. One of these ecosystems is construction. The transition pathway resulting from this process would identify the milestones for the transition period, the actions required by different stakeholders and the costs and challenges along the way.

This Staff Working Document proposes scenarios for the transition pathway. It builds on the ecosystem fiche included in the 2021 Annual Single Market Report[2], the past Construction 2020 sectoral Strategy[3], and the broader context of Commission Strategies, legislative and non-legislative initiatives all of which require the transition of the construction ecosystem.

For the creation of this Staff Working Document, the service responsible engaged in dialogue with the construction ecosystem. Approximately 250 stakeholders (Annex I) were consulted in the High Level Construction Forum (HLCF)[4] and thematic digital[5], green[6] and resilience[7] cluster group meetings that took place in September and October 2021. This consultation process invited stakeholders' contributions for setting a vision for the future of the construction ecosystem, showing needs, challenges and opportunities for its green, digital and resilient transformation. Ideas and views expressed have been integrated in this document, and with it as a basis, concrete responses, proposals and possible commitments will be discussed further with all relevant stakeholders, within and beyond the HLCF.

This Staff Working Document pursues this consultation process and is another step towards co-creating a vision for a resilient, greener and more digital construction ecosystem. It invites the whole industrial ecosystem to collaborate and propose concrete actions, commitments and investments as well as a bottom-up assessment of scale, cost, long-term benefits and challenges and conditions for the required actions that could be implemented at industrial, local, national and European level by 2030.

The scenarios presented below consist of non-exhaustive lists for the purposes of the co-creation. The table is based on several consultation processes and positions provided by construction ecosystem stakeholders. This is a European Commission staff working document and does not constitute the official position of the Commission, nor does it prejudge any such position.

[1] European industrial strategy | European Commission (europa.eu)
[2] COMMISSION STAFF WORKING DOCUMENT Annual Single Market Report 2021 Accompanying the Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions Updating the 2020 New Industrial Strategy: Building a stronger Single Market for Europe's recovery - Publications Office of the EU (europa.eu)
[3] EUR-Lex - 52012DC0433 - EN - EUR-Lex (europa.eu)
[4] High Level Construction Forum meeting report https://webgate.ec.europa.eu/fpfis/wikis/display/industrialforum/2021/10/01/Construction+ecosystem%3A+High+Level+Construction+Forum+report
[5] 1st Digital Cluster Group. Towards a transition pathway for the construction ecosystem.pdf - Industrial Forum - EC Extranet Wiki (europa.eu)
[6] 1st Green Cluster Group meeting report. Towards a transition pathway for the construction ecosystem.pdf - Industrial Forum - EC Extranet Wiki (europa.eu)
[7] 1st Resilience Cluster Group. Towards a transition pathway for the construction ecosystem.pdf - Industrial Forum - EC Extranet Wiki (europa.eu)

1.1. Definition of the construction ecosystem

As described in the **Annual Single Market Report 2021**, the construction ecosystem includes activities carried out during the whole lifecycle of buildings and infrastructures. As such, it covers the design, construction, maintenance, refurbishment and demolition of buildings and infrastructure (e.g., transport infrastructure). The **activities included in the ecosystem** are:

- On site construction, renovation, refurbishment and demolition, including:
    - Development of building projects (e.g., buying land, project initiation, obtaining permits).
    - On-site construction of building and infrastructure projects: residential buildings, non-residential buildings (e.g., offices, warehouses.) and civil engineering projects (e.g., roads, railways, airports, utility networks, sewage, pipelines).
    - Specialised activities: site preparation, electrical, plumbing and other installation, roofs, and other forms of building completion and finishing.
- Other services:
    - Engineering and architectural services.
    - Activities supporting the operation of buildings, including facility management and landscaping activities.

In addition to the above, the definition of the ecosystems in the updated Industrial Strategy includes a share of manufacturing activities or services. These are labelled as 'horizontal sectors' and contribute to all ecosystems with varying shares, including to the construction ecosystem.

The **construction industry makes intensive use of installations and machines**. For this reason, 20% of 'manufacture of machinery' is allocated to the construction ecosystem. Furthermore, the construction ecosystem receives a share of 15.54% of 'repair and installation of machinery and equipment'. The 'manufacturing of fabricated metal products' is partially included within the construction ecosystem (30.52%). This includes metal frameworks for construction (masts, brides), prefabricated buildings of metal, doors, windows, shutters, gates, room partitions, building components of zinc (roof, sanitary).

As the construction industry generates important **waste** stream, a 13% share of the whole activity in the EU of 'waste collection, treatment, disposal and management' is allocated to the construction ecosystem. As for 'water collection, treatment and supply', 10% is allocated to the construction ecosystem.

Moreover, **some additional horizontal services** are treated as 'horizontal sectors' with the following share allocated to the construction ecosystem:

- 11.51% of the sectors 'legal and accounting activities' and 'activities of head offices and management consulting'.
- 10.41% of the sector 'scientific research and development'.
- 12.92% of the sectors 'rental and leasing activities' and 'employment activities'.

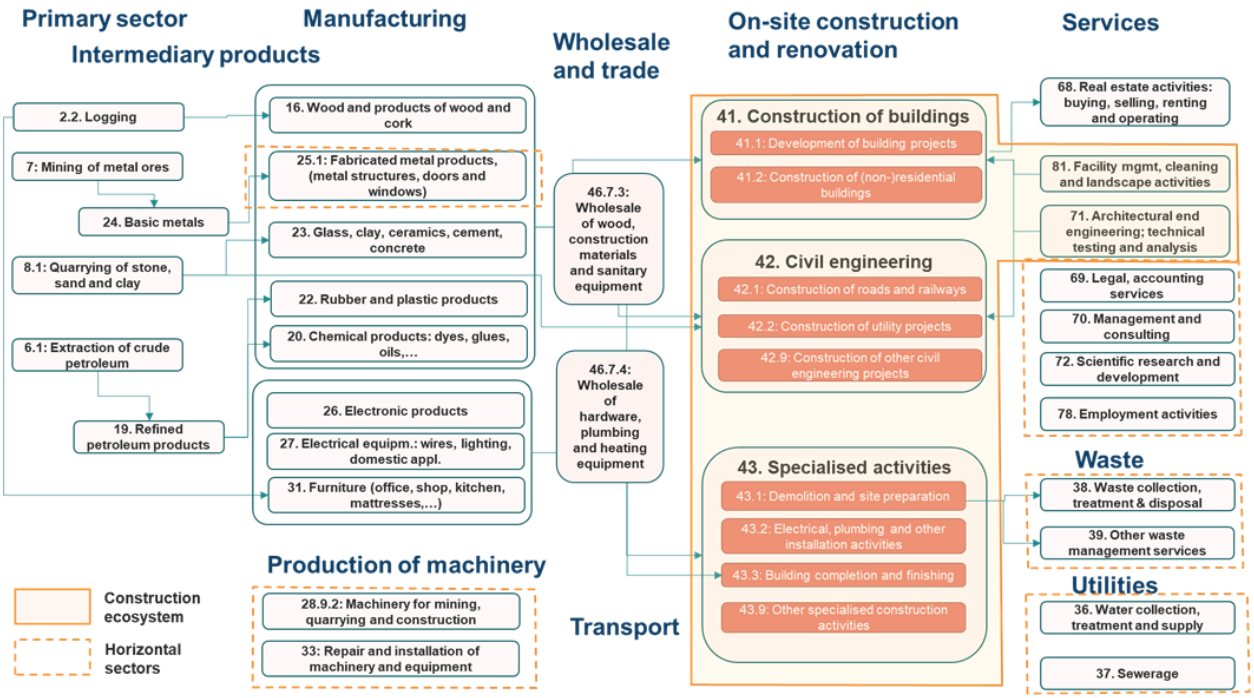

Figure 1: Overview of the construction ecosystem within the construction value chain (source: internally elaborated based on the definition in the Annual Single Market Report)

1.2. Key figures

The industrial construction ecosystem **employs approximately 24.9 million people** in the EU and provides a **value added** of EUR 1 158 billion (9.6% of the EU total). In terms of employment and value added, this ecosystem is the second most important of the 14 identified ecosystems[8], with retail as the only ecosystem with higher employment (29.8 million) and value added (11.5%).

The ecosystem is dominated by **micro and small enterprises**. With a total of 5.3 million firms, 99.9% companies of the ecosystem are SMEs, which represent 90% of employment and 83% of the total value added. The fragmentation of the ecosystem is accentuated by the fact, that around 90% of the companies are microenterprises, standing for 45% of employment and 32% of the total value added.

About 52% of the employment can be allocated to the sector 'construction and demolition activities' (NACE F), which accounts for 55% of the added value (Figure 2).

[8] swd-annual-single-market-report-2021_en.pdf (europa.eu)

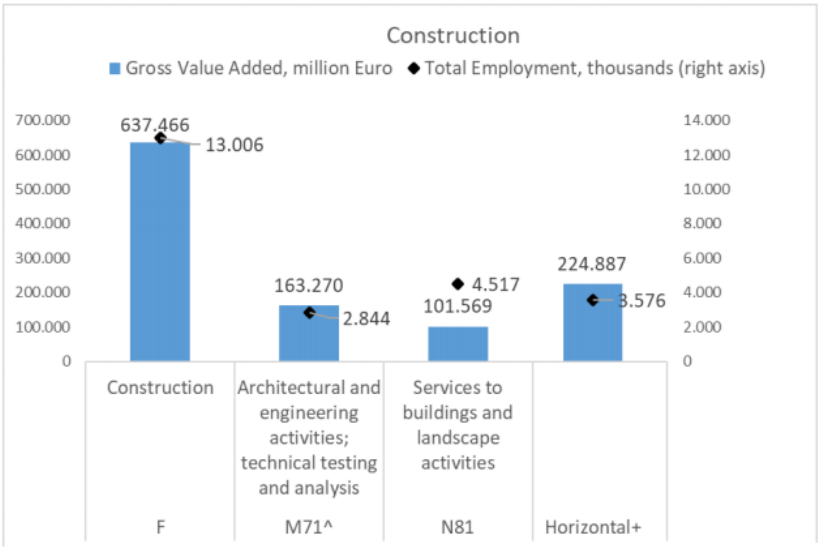

Figure 2: Gross Value Added and total employment in the Construction Ecosystem- Source: Eurostat, National Accounts. Data from 2018 (or latest year available).

1.3. Impact of the COVID-19 pandemic on the ecosystem

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. Moreover, EU production in construction increased by 3.8% in July 2021 compared to a year earlier[9].

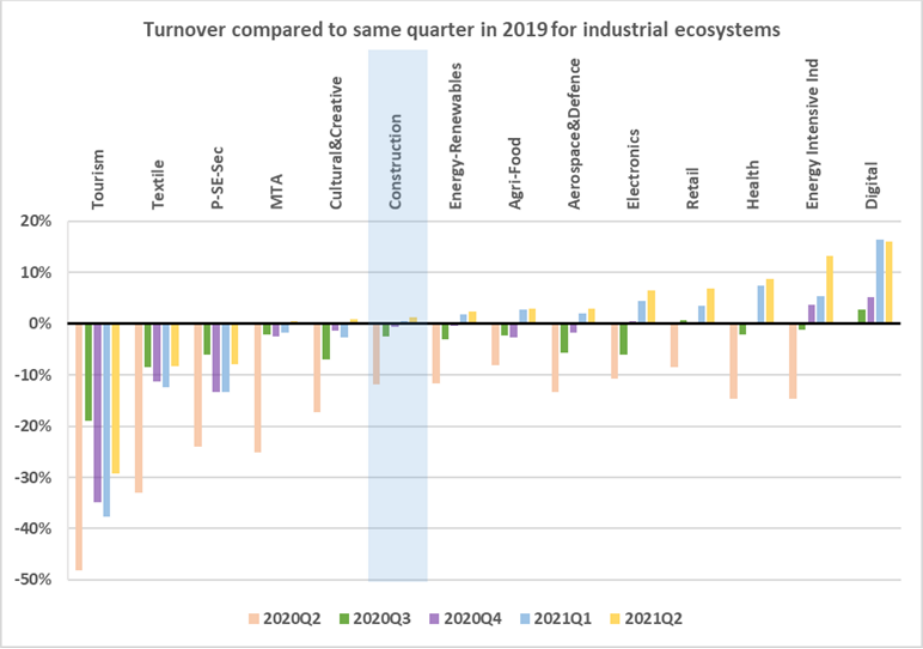

Figure 3: Change in turnover by industrial ecosystem in 2021- Source: EC analysis based on data by Eurostat Short-term business statistics [10]

[9] https://ec.europa.eu/eurostat/documents/2995521/11563279/4-17092021-BP-EN.pdf/edff43b7-5ef5-01c8-2cf8-f572825bab56?t=1631867055642

[10] As information is constantly updated, figure 3, 4 and 5 might be modified at the last version of this document.

As in many other ecosystems, output showed a strong partial recovery already in the third quarter of 2020, followed by a slower recovery from 2021 onwards. The output still has not reached the pre-pandemic level.

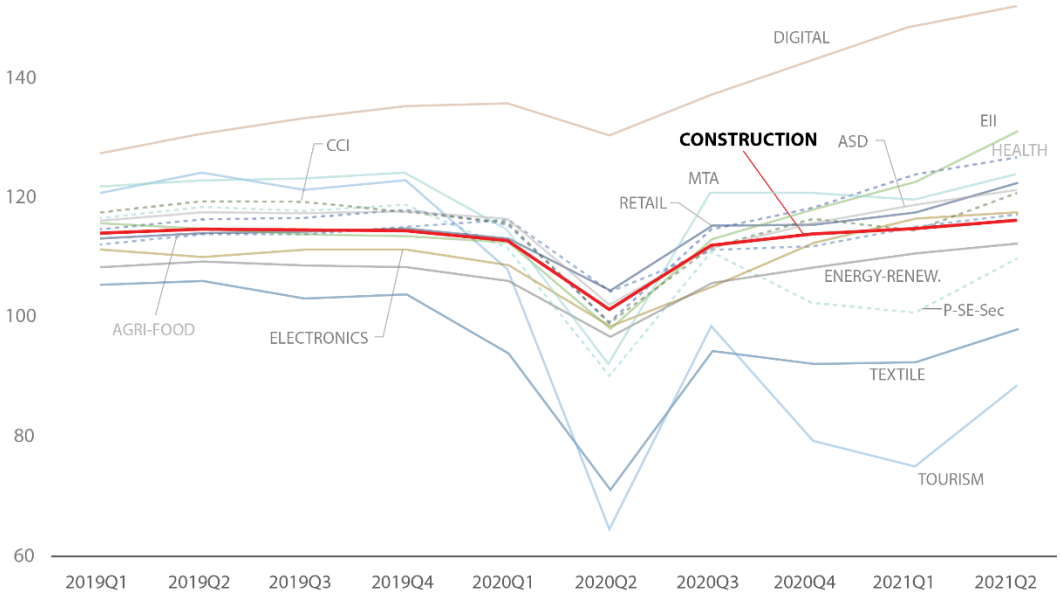

Figure 4: Change in turnover by ecosystem (base 2015 = 100) - Source: EC analysis based on data by Eurostat Short- term business statistics

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

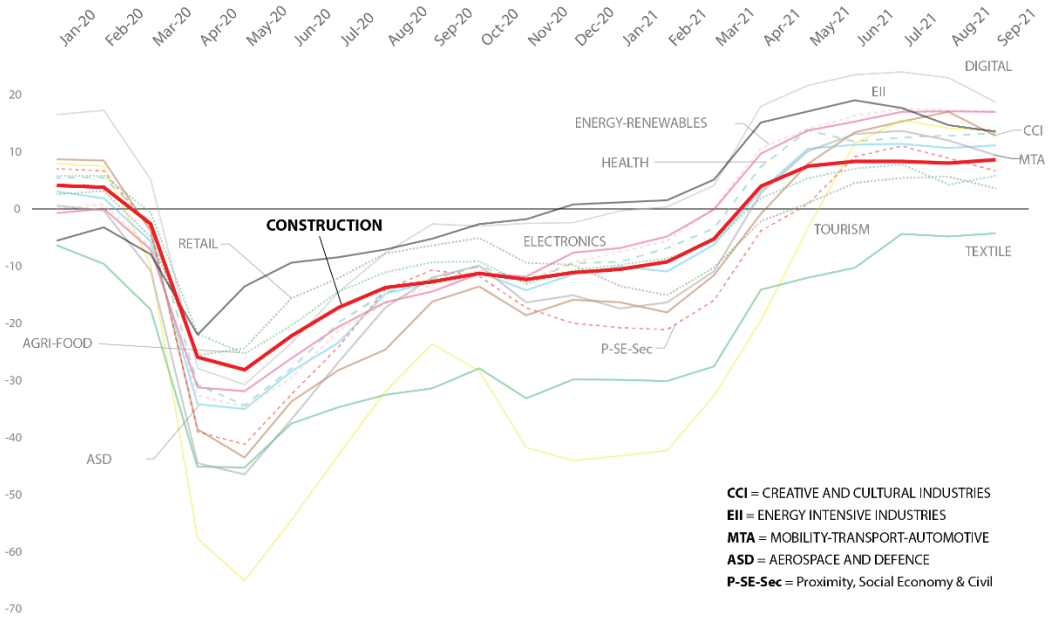

Figure 5: Change in confidence by ecosystem - Source: EC analysis based on survey by ECFIN

In addition to the general indicators such as turnover and confidence, it cannot be ignored that the pandemic had a substantial effect on the construction ecosystem, providing shifts in supply and demand for materials, finished products and workforce. Several examples and consequences of this are described below.

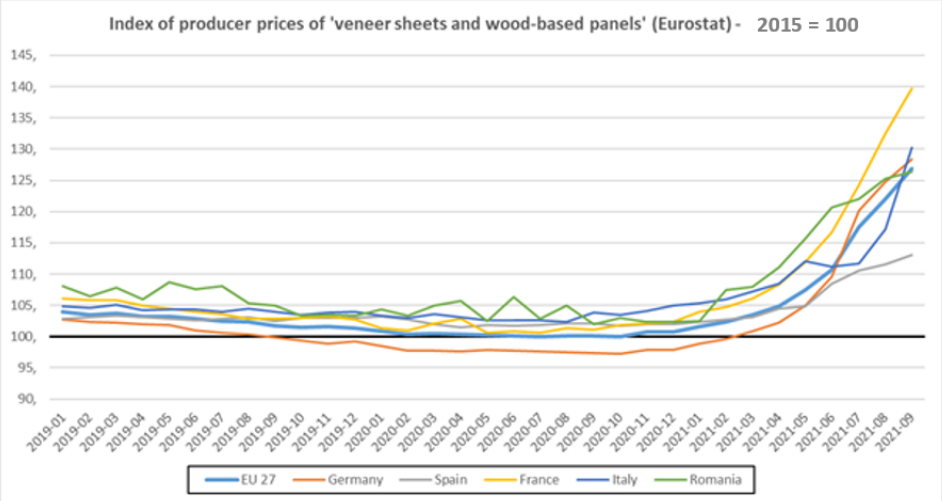

Figure 6: Index of producer prices of 'veneer sheets and wood-based panels' (Eurostat)

Shortages of materials and increased prices of building material are being reported by construction companies. It mainly concerns steel, copper, aluminum and wood construction products. Several factors are responsible for the trends in these markets.

- Recovery has been fast and demands strong from other parts of the world. The global economy is picking up pace and global growth is expected to reach 6% in 2021 and 4.4% in 2022 after falling by 4.9% in 202011. The transition to working from home and government financial incentives combined with the record-low interest rates further spurred the housing market in other parts of the world. These trends caused shortages in the market and a surge in prices, which affected European markets as the US increased its imports from Europe.
- Some supply chains have been disrupted, because of problems with mining and logging all over the world, resulting in supply shortages in copper, iron and lumber.
- An intense pressure on transport costs due to a huge increase in demand for consumer goods, combined with geographical demand, led to developments that disrupt typical flows of trucks and containers.

The supply of commodities is likely to be curtailed in the medium term, as already seen in steel markets. In the market of wood products, supply is adapting slowly, due to bottlenecks in the raw material supply (roundwood) and the ability of sawmills.

The pressure on freight costs could ease slowly as the supply adjusts to the demand across the world. Demand and growth are expected to remain high due to fiscal and monetary incentives focused on economic recovery. For this reason, the construction sector may need to prepare for a situation where prices do not fully fall back to initial levels in the longer term.

The lockdown and sanitary measures introduced by Member States blocked mobility of the workforce, caused major disruption on construction sites and added costs to construction enterprises and the entire value chain. The suspension of several services, such as those of building permits and safety coordination,

[11] World Economic Outlook (imf.org)

has caused significant delays. Furthermore, the delayed production of building materials, such as joinery and windowpanes, has also caused delays that are still being caught up.

A more in-depth research is being conducted to determine whether there are shortages that can be linked to strategic dependencies on third countries for raw materials, intermediate products or construction products within the different value chains serving the construction sector.

1.4. Links to other industrial ecosystems

Due to its complex nature, the construction ecosystem is linked to and dependent on other industrial ecosystems. The manufacturing of **most essential building materials is not included within the construction ecosystem** as many of them are part of the **Energy Intensive Industries (EII) ecosystem**. These include many products used for new construction and for energy renovations:

- Manufacture of wood and products of wood and cork.
- Manufacture of refined petroleum products.
- Manufacture of chemical products.
- Manufacture of plastic products.
- Manufacture of mineral products: glass products, refractory mortars and ceramic goods, clay building materials, bricks and tiles in baked clay, ceramic sanitary products, ceramic insulators, cements, lime, plaster, gypsum, precast concrete materials, plaster boards, ready-mixed concrete, building materials of vegetable substances, insulating materials, coal tar pitch and others.

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**.

To ensure the availability of sufficient building materials, the ecosystem is very dependent on supplies **from the primary sector** to produce building materials, particularly from the 'Agriculture, forestry and fishing'[12] sector that is part of the **Agri-food ecosystem**, and as described above the **Energy Intensive Industries** ecosystem and specifically mining of metal ores (iron, zinc, copper), quarrying of stone, sand and clay, and extraction of crude petroleum.

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** manufactures several products that are used in low-carbon new buildings and in making the built environment more sustainable:
    - manufacturing of electrical equipment used in buildings, infrastructure and construction machinery.
    - manufacturing of photovoltaics, heat pumps and other such equipment used in buildings.

1.5. The construction ecosystem in the Industrial Strategy and other EU strategies

The Industrial Strategy highlights the necessity of a green, digital and resilient construction ecosystem. Several other European initiatives highlight the role of construction in achieving goals such as renovation,

[12] NACE.R2 A

circularity, climate adaptation and mitigation or employment. Legislative initiatives, directly or non-directly linked to construction, are introducing changes to the industrial ecosystem.

1.5.1 EU level strategies

The **Renovation Wave** [13] aims to at least double the annual rate of building renovation in the EU. In practice, this would result in 35 million buildings being renovated by 2030. For the achievement of this ambition, a mix of policy instruments, funding and technical assistance is available. Delivering on these goals stands for an opportunity to modernize the operation, human capital and technological basis of the construction ecosystem. The renovation of buildings is estimated to create 13 to 28 jobs per million euros invested.[14]

The **EU Climate Adaptation Strategy**[15], sets out how the EU can adapt to the unavoidable impacts of climate change and become climate neutral and resilient by 2050. Extreme weather and climatic events can damage buildings and hamper their mitigation potential. However, buildings can also contribute to large-scale adaptation, for example through local water retention, and mitigation of the urban heat island effect with green roofs and walls. The Strategy announces that the Commission will explore options to better predict climate-induced stress on buildings and to integrate climate resilience considerations into the construction and renovation of buildings through relevant pieces of EU policy.

The New **Circular Economy Action Plan (CEAP)** proposes actions along the entire life cycle of products. It targets how products are designed, promotes circular and clean economy processes, encourages sustainable consumption, and announces a review of EU waste legislation with a focus on waste prevention. Additionally, the resources used should be kept in the EU economy for as long as possible[16]. The CEAP focuses on the sectors with greatest potential for circularity, including construction and buildings.

The vision of the **Zero Pollution Action Plan**[17] for 2050 is for air, water and soil pollution to be reduced to levels no longer considered harmful to health and natural ecosystems, that respect the boundaries with which our planet can cope, thereby creating a toxic-free environment. It thus complements the drive for decarbonisation by addressing pollution. This includes phasing out polluting fossil fuel heating. The plan also addresses healthy indoor environments, including temperature and humidity levels in buildings, as well as tackling the issue of avoidance and decontamination of toxic substances. Similarly, there is a scope for innovation on biobased products, including biobased materials, chemicals and additives, used in the construction sector, to benefit from their potential low-toxicity and zero-pollution characteristics, including in their production and processing cycles, as confirmed by life-cycle analysis. In this context, the **Chemicals Strategy for Sustainability**[18]aims to better protect citizens and the environment, and boost innovation for safe and sustainable chemicals, including in construction where chemicals are omnipresent.

The new **EU Forest Strategy**[19] 2030 is one of the flagship initiatives of the European Green Deal[20]. The strategy will contribute to achieving the EU's biodiversity objectives as well as greenhouse gas emission reduction targets. It recognises the central and multifunctional role of forests, and the contribution of

[13] 'A Renovation Wave for Europe - greening our buildings, creating jobs, improving lives', COM (2020) 662 final
[14] BPIE (2020). Building Renovation – A kick-starter for the EU Recovery. https://www.renovate-europe.eu/wp-content/uploads/2020/06/BPIE-Research-Layout_FINALPDF_08.06.pdf

[15] COM (2021) 82 - EU Climate Adaptation Strategy
[16] COM (2020) 98 final EUR-Lex - 52020DC0098 - EN - EUR-Lex (europa.eu)
[17] Zero pollution action plan (europa.eu)
[18] Chemicals strategy (europa.eu)
[19] COM/2021/572 EUR-Lex - 52021DC0572 - EN - EUR-Lex (europa.eu)
[20] A European Green Deal | European Commission (europa.eu)

foresters and the entire forest-based value chain for achieving a sustainable and climate neutral economy by 2050 and preserving socially coherent and prosperous rural areas.

Another strategy that contributes to the EU Green Deal is the **Bioeconomy Strategy**[21], which aims to accelerate the growth of a sustainable European bioeconomy. Among its 5 goals, relevant for construction are managing natural resources sustainably, reducing dependence on non-renewable, unsustainable resources, limiting and adapting to climate change and strengthening European competitiveness and creating jobs.

Bioeconomy could potentially have a relevant role to play in construction by providing options for carbon storage within construction products[22]. There is also potential for other innovations, such as replacing gravel and sand in concrete with synthetic aggregate that stores CO2 at low energy cost. The Commission Communication "**Sustainable carbon cycles**"[23] and a proposal for a regulatory framework for the certification of carbon removals[24] aim to support the development of sustainable carbon removal solutions.

While the construction ecosystem remains very labour intensive, its talent pool is shrinking due to an ageing workforce and reluctance of youth to consider a career in construction. At the same time demand for new skills and roles linked to the twin transition is rising. A skilled workforce is a prerequisite to the transition and guarantees the ecosystem's future sustainable competitiveness. The **European Skills Agenda for sustainable competitiveness, social fairness and resilience**[25] is therefore relevant also for the construction ecosystem. It sets ambitious, quantitative objectives for skills to be achieved within the next 5 years. Its 12 actions focus on skills for jobs, including green and digital skills, by partnering with Member States, companies and social partners to work together for change, by empowering people to embark on lifelong learning, and by using the EU budget as a catalyst to unlock public and private investment in people's skills.

1.5.2 Legislative initiatives

The **European Climate Law** writes into law the objectives, set out in the European Green Deal, for Europe's economy and society to become climate-neutral by 2050, by reducing net greenhouse gas emissions by at least 55% by 2030, compared to 1990 levels, and the goal to ensure continuous progress on climate adaptation.

In July 2021, the European Commission adopted the **Fit for 55 legislative package**[26] of proposals to make the EU's climate, energy, land use, transport and taxation policies fit for reducing net greenhouse gas emissions by at least 55% by 2030, compared to 1990 levels. This ambition was set out in the **European Green Deal**. Several parts of this package are relevant to the construction ecosystem:

It is proposed to extend the **EU Emissions Trading System (ETS)** to cover emissions from road transport and heating of buildings[27]. Effectively, this would place a carbon price on fossil fuel combustion in buildings.

- To address any social impacts that arise from this new system, the Commission **proposes** to introduce the **Social Climate Fund**[28]. The fund aims to support vulnerable households and micro-enterprises,

[21] A sustainable bioeconomy for Europe - Publications Office of the EU (europa.eu)
[22] Review (europa.eu)
[23] Climate change – restoring sustainable carbon cycles (europa.eu)
[24] Climate change – restoring sustainable carbon cycles (europa.eu)
[25] European Skills Agenda - Employment, Social Affairs & Inclusion - European Commission (europa.eu)
[26] EU economy and society to meet climate ambitions (europa.eu)
[27] COM (2021) 551 final
[28] COM (2021) 568 final

who spend a larger part of their incomes on energy, to mitigate the price impact of new carbon pricing. In the medium to long term, this would be achieved through investments that reduce reliance on fossil fuels through increased energy efficiency of buildings, decarbonisation of heating and cooling, and integration of energy from renewable sources. The size of the Social Climate Fund will correspond to a dedicated share of the revenues from the auctioning of emission allowances under the new system.

- Under the current legislation, EU Member States have binding annual greenhouse gas emission targets for 2021-2030 for those sectors[29] of the economy that fall outside the scope of the EU ETS. The **Effort Sharing Regulation** (ESR) translates this commitment into binding annual greenhouse gas emission targets for each Member State, based on the principles of fairness, cost-effectiveness and environmental integrity. The European Commission has **proposed an amendment** to this ESR, with among others new MS emission reduction targets by 2030 and aiming for an update of the national annual emission allocations for the years 2026 to 2030, making use of new data available in 2025.
- The proposal to recast the **Energy Efficiency Directive (EED**) will require Member States to almost double their annual energy savings obligations, leading the way by action throughout the public sector. All public authorities will be obliged to **renovate 3% of their buildings' floor space annually**[30].
- The proposed **revision of the Renewable Energy Directive (REDII)** increases the ambition for renewable energy consumption, including in buildings. Member States will have to set an indicative target for renewables in buildings in 2030 that is consistent with an indicative target of over 49% share of energy from **renewables in buildings** in the Union's final energy consumption in 2030[31]. Member States will also have to introduce measures in their **building codes** and support dedicated schemes.
- The **Energy Performance Building Directive (EPBD)**[32] aims to set up a highly energy efficient and decarbonised building stock by 2050, and to create a stable environment for investments with that aim in mind. The European Commission is proposing a revision to raise the ambition of the EPBD in line with the Renovation Wave strategy and the targets enshrined in the Climate Law. Under the current EPBD[33], policies and supportive measures to be adopted by Member States include:
    - Establishing long-term renovation strategies (Article 2a).
    - Setting cost-optimal minimum energy performance requirements for new buildings and existing buildings undergoing major renovation (Articles 4 and 5).
    - Ensuring that new buildings are nearly zero-energy-buildings (NZEB, Article 9).
    - Establishing the issuing of energy performance certificates (Articles 11 and 12).

The **Construction Products Regulation (CPR)**[34] lays down harmonised rules for the marketing of construction products in the EU, providing a common technical language to assess the performance of construction products. It ensures that reliable information is available to professionals, public authorities, and consumers, so they can compare the performance of products from different manufacturers in different countries. The revision of the Construction Products Regulation has the ambition to facilitate the harmonisation of technical rules and trade of safe and sustainable construction products across the EU including the possible introduction of recycled content requirements for certain construction products, considering their safety and functionality.

The **Waste Framework Directive**[35] regulates the management of construction and demolition waste. With the waste hierarchy, it has set a priority order in waste prevention and management legislation and policy.

[29] These sectors, including transport, buildings, agriculture, non-ETS industry and waste, account for almost 60% of total domestic EU emissions.
[30] COM (2021) 558 final
[31] COM (2021) 557 final
[32] https://ec.europa.eu/energy/topics/energy-efficiency/energy-efficient-buildings/energy-performance-buildings-directive_en
[33] Directive 2010/31/EU, amended by (EU)2018/844
[34] Construction Products Regulation (CPR) (europa.eu)
[35] Directive 2008/98/EC on waste. OJ L 312 22.11.2008

It reinforces the waste hierarchy through regulation that promotes selective demolition and sorting systems, prevention objectives and target for the recovery of construction and demolition waste (CDW), including the long-term objective to introduce at EU level material fraction specific preparation for re-use and recycling targets.

To help reach the Green Deal objectives of lower resource consumption and less environmental impact, the Commission is developing the **Sustainable Products Initiative**, which will revise the Ecodesign Directive[36] and propose additional legislative measures, aiming to make products placed on the EU market more sustainable. Consumers, the environment and the climate will benefit from products that are durable, reusable, repairable, recyclable, and energy efficient. [37].

The recast **Drinking Water Directive**[38] with water quality requirements in domestic distribution systems (e.g., lead and Legionella) and specific hygiene requirements for materials in contact with drinking water, could be relevant for the construction industry when implementing construction and renovation works.

The **European Accessibility Act**[39] contains accessibility for products and services and includes accessibility requirements for the built environment. The same accessibility requirements are to be used in the procurement of services in the scope of the Directive.

1.5.3 Other relevant initiatives

Several non-legislative initiatives either require an active engagement from the construction ecosystem to succeed or are contributing to the ecosystems digital and green transformation.

The **New European Bauhaus (NEB)**[40] initiative is a creative, participatory and transdisciplinary movement, providing a space of encounters to accelerate the transformation of various economic sectors in order to provide access to all citizens to circular and less carbon intensive goods. The project wants to be an inspiration for future ways of living, at the crossroads between art, culture and science, integrating three dimensions: sustainability (including circularity), quality of experience (including aesthetics) and inclusion (including affordability). The work being done on the transition pathway of the construction ecosystem is mentioned in the NEB Communication, as one of the actions for modernising the ecosystem and enabling it to contribute to the NEB vision.

The Davos Baukultur Quality System is an instrument enabling a quality assessment of the built environment. It incorporates and weights social, emotional and cultural values equally to technical and functional aspects. It provides the chance for the construction sector to integrate the terms of functionality with other criteria and provide solutions that are close to people and the places they live in. The report "**Towards a shared culture of architecture - Investing in a high-quality living environment for everyone**"[41] demonstrates that criteria for quality living space and design should not be only functional, ecological or economic but also fulfil social, cultural and psychological needs as well as a general sense of belonging.

Level(s) is the European framework that provides a common language for assessing and reporting on the sustainability performance of buildings[42]. Level(s) offers a tested system for measuring and supporting

[36] Sustainable product policy & ecodesign (europa.eu)
[37] Sustainable products initiative (europa.eu)
[38] https://eur-lex.europa.eu/eli/dir/2020/2184/oj
[39] Directive 2019/ 882
[40] New European Bauhaus : beautiful, sustainable, together. (europa.eu)
[41] New report provides recommendations to ensure high-quality architecture and built environment. | Culture and Creativity (europa.eu)
[42] Level(s) (europa.eu)

improvements, from early design to the demolition of buildings incorporating in this way circularity and lifecycle thinking.

The **affordable housing initiative**[43] makes help from the Renovation Wave available to social and affordable housing facilities. It will guarantee local social housing projects' access to necessary technical and innovation capacity. The initiative will pilot 100 lighthouse renovation districts, mobilising cross-sectoral project partnerships and linking them to local actors, such as social economy, SMEs, local authorities, housing associations and civil society and empowering residents in the renovation process. Also in the context of the Renovation Wave, the **Energy Poverty Recommendation**, aims to tackle energy poverty structurally, to make it easier for Member States to define energy poverty and be aware of best practices.

The **Pact for Skills** [44] aims at easing public-private cooperation by supporting large-scale partnerships in industrial ecosystems and priority areas identified in the Green Deal. Stakeholders will be encouraged to share expertise, resources and funding towards concrete up- and reskilling actions that will allow people to keep, change or find new jobs. The **Blueprint for Sectoral Cooperation on Skills**[45] initiative addresses short and medium-term skills needs, with digital skills emerging as a transversal element. The **European Alliance for Apprenticeships**[46] helps enhance mobility but also the supply, quality and image of apprenticeships, therefore contributing to more young people engaging in a construction career.

Additionally, there are initiatives aiming at the **collection of data and assessment of national and local level initiatives** contribute significantly to policy making.

- Since 2016, the **EU Building Stock Observatory**[47] has provided a better understanding of the energy performance of the building stock with more transparent, reliable and consistent information. The data published by the Observatory can also be useful for investors, stakeholders, local and national authorities and researchers.
- The **European Construction Sector Observatory (ECSO)**[48] analyses and carries out comparative assessments of the construction ecosystem in all EU countries. ECSO provides up-to-date information on market conditions and policy developments, while also monitoring national and regional strategies. Through its regular publications, it raised awareness, encourages knowledge sharing and the replication of good practice.

Questions to stakeholders:

- Is your organisation aware of the above-mentioned EU pieces of legislation, policies, instruments and initiatives and the upcoming changes or those that have been made recently? If not, how could awareness be improved?
- Are links and synergies between the above-mentioned EU pieces of legislation, policies, instruments and initiatives well-understood in your organisation? Has your organisation reflected on how to seize the numerous opportunities these represent?
- Are national legal provisions, policies, instruments and initiatives and recent EU actions or upcoming changes that are mentioned above consistent and synergetic with each other? If not, what is missing and how can greater consistency and synergies be ensured?

[43] Affordable housing initiative | Internal Market, Industry, Entrepreneurship and SMEs (europa.eu)

[44] https://ec.europa.eu/social/main.jsp?catId=1517&langId=en
[45] https://constructionblueprint.eu/
[46] https://ec.europa.eu/social/main.jsp?catId=1147
[47] EU Building Stock Observatory | Energy (europa.eu)
[48] Observatory (europa.eu)

- How could the Commission better communicate upcoming changes, ongoing initiatives and opportunities as well as engage the construction ecosystem's stakeholders in their development?

2. Possible pathway 2030: Towards a resilient, green and digital construction ecosystem

2.1 A resilient and competitive EU construction ecosystem

According to the 2020 Strategic Foresight Report[49] , resilience is the ability not only to withstand and cope with challenges but also to undergo transitions in a sustainable, fair, and democratic manner. The construction ecosystem can improve its resilience by improving its ability to anticipate developments likely to have adverse impacts on it and by considering the current and future crises, megatrends and emerging issues informed by strategic foresight. Being resilient also means the ability to quickly and efficiently adapt to changes and transform obstacles in occasions for learning and growing. A great potential lays in the cooperation between different stakeholders (industry, academia and civil society), and in the possibility to connect and transfer knowledge across sectors.

The COVID-19 pandemic reveals **strategic dependencies** that should be mitigated and **capacities** that should be strengthened. As also reflected in the 2021 Strategic Foresight Report[50], apart from the pandemic, digital, climate and environmental trends and targets pressure the ecosystem to adjust its way of operating or encourage it to explore and create new business models that are more agile and adaptive. Backed by innovation and reflecting its economic and societal importance as well as local conditions, such models are the guarantee of the ecosystem's future competitiveness.

Connecting to the Strategic Foresight Report, this section touches upon social and economic resilience. Specifically for the construction ecosystem post-pandemic, this would translate to challenges linked to skills, competencies and composition of the workforce as well as disruptions in the value chains such as rising prices and the shortages of materials.

The role of an enabling framework and of the single market

An **enabling and regulatory framework** fit for the future, that fosters investments and the building of trust is key to the ecosystem's resilience and a prerequisite for the twin transition. Combined with a reliable long-term planning for public investments and a favourable environment for private investments in infrastructure, buildings and innovation, it has the potential to boost construction confidence and assure a growing turnover of the ecosystem in constant prices. Along these lines, actions should be taken to support the ecosystem's SMEs that are offering local employment and face challenges that affect their survival deeply, such as late payments.

A well-functioning single market is another strategic capacity for the construction ecosystem[51]. The **single market** improves mobility of professionals, ensures that innovative business models can flourish and

[49] 2020 Strategic Foresight Report | European Commission (europa.eu)
[50] 2021 Strategic Foresight Report (COM(750) final

[51] The EU Single Market accounts for 450 million consumers and 22.5 million small and medium-sized enterprises (SMEs)

enhances access to goods and services throughout the EU. These points are particularly relevant for the topics to be described below.

Dealing with raw material shortages and the impact on the construction products market

COVID-19 has shown disruptions in the global supply chain and led to shortages of certain critical products in Europe. The EU Industrial Strategy recognised the need to further improve EU's open strategic autonomy[52].

Specifically in construction, after the lifting of the strict COVID-19 restrictions, a **rising demand** and sometimes important **supply challenges** were observed, as seen for example since April 2021 for some construction products. This increase in demand has been the main factor explaining these post-pandemic market developments. In the case of wood products, there is a growing demand for European raw wood in countries such as China and the USA. The latest Eurostat figures suggest an increase in exports of raw wood from EU27 to China, a trend to be confirmed.

In addition, for many construction products, there is a substantial increase in domestic demand resulting from national and European Programmes supporting renovation. The effects of the 'Renovation Wave' and the National Recovery and Resilience Plans (NRRPs) in the context of the 'flagship renovation', will last for years to come. As a result, one cannot expect general demand to fall in the short or even mid-term.

At the same time, **export restrictions** are being implemented by global actors (e.g., Russia and Ukraine), with detrimental impacts on the competitiveness of the EU industry and without any visible justification that would be sanctioned under applicable trade rules. Others such as China have put national measures in place that constrain domestic production of wood.

This led not only to price spikes but also to substantial delays in supply thus having an impact on the availability of materials. Additionally, there have been **logistics and transportation bottlenecks** (e.g., shortage of truck drivers and rising energy prices). The severity of the situation varied according to the type of products and across Member States. Combined, these factors have prevented the market from adjusting to this situation in the short term.

This situation showed interdependencies of the construction ecosystem in relation to other ecosystems, such as the **Energy Intensive Industries (EII)** being a major provider of relevant construction products, such as steel, glass and aluminium. The challenge to guarantee continuous availability in a context of an increased demand, also revealed, in some cases, the need to rethink supply chains with consideration given to more sustainable, timely, local or responsible approach and systems. This means building diversified value chains, decreasing dependence that can lead to vulnerabilities, raising circularity, promoting re-use and recycle, supporting innovation for alternatives and ensuring a greener and socially responsible level playing field in the single market and beyond[53][54]. Given the role of the Energy Intensive Industries ecosystem in providing inputs for critical infrastructures as well as construction and the built environment, a dedicated transition pathway is being developed[55].

[52] Why European strategic autonomy matters - European External Action Service (europa.eu)
[53] strategic_foresight_report_2020_1_0.pdf (europa.eu)
[54] Key opportunities include the upcoming European Raw Materials Alliance and the EU Raw Materials Intelligence Capacity, to explore these issues with industry and other key stakeholders.
[55] ''For a resilient, innovative, sustainable and digital energy-intensive industries ecosystem: Scenarios for a transition pathway DocsRoom - European Commission (europa.eu)

As described in the Annual Single Market Report 2021[56], resilience in construction supply chains also depends on the openness of the EU construction services market. However, its efficiency is currently held back by several Single Market barriers which include compulsory certification schemes based on national standards and regulation without functioning mutual recognition schemes, as well as restrictions with regards to exercise requirements such as professional qualifications or difficulties for companies to obtain the insurance coverage they need to offer their construction services in other Member States[57].

Investment in construction services is open to foreign entities, which is reflected in the EU's commitments under the General agreement on Trade in Services (GATS) and in the EU's trade agreements. Third country businesses can also provide a range of services cross-border that are relevant to the construction ecosystem, such as architectural and engineering services. An open and competitive EU market also places the sector in a strong position to engage in projects abroad. Through its trade agreements, the EU has secured access to a significant network of export markets, which may help to diversify supply chains and mitigate the effects of bottlenecks and other disruptions.

The importance of skills for the ecosystem's resilience

In the light of technological development, demographic and climate change and globalization, the world of work is changing. The trend of automation replacing labour and ageing population on one side and migration and mobility of workers on the other, alongside the transition towards sustainable economic growth is reshaping the future of work and altering the need for skills in all industrial ecosystems. Construction, being a particularly labor-intensive and one, is of course not left untouched.

The talent pool for the construction ecosystem is shrinking with ageing workers retiring and young people being reluctant to consider construction as their career choice. The situation is complicated further by the challenges of adapting and upgrading the skills and abilities of the current labour force. Industrial stakeholders often stress the needs 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 these would also improve the sectors attractiveness to qualified workers and talent. Addressing the current skills gap and anticipating future skills needs in the construction sector will mean providing more, better and safer jobs.

Professionals need to be equipped with adequate building skills, digital and green competences for the ecosystem to contribute to achieving 2050 EU climate targets. While white collar workers, such as architects and engineers, propose innovative solutions to challenges in the construction of buildings and infrastructures, these visions are realised through construction, renovation or demolition works. The skills of the whole workforce are important for the resilience and productivity of the ecosystem and the sustainability of buildings and infrastructures.

Questions to stakeholders:

- In your view, how resilient is the construction ecosystem? Do the above-mentioned EU pieces of legislation, policies, instruments and initiatives, upcoming or recent changes contribute sufficiently to strengthening the resilience of the construction ecosystem?
- Which changes and challenges could represent opportunities for the construction ecosystem to "bounce forward" in the twin green and digital transition, and how can they be best explored?

[56] SWD(2021) 351 final
[57] Annual Single Market Report SWD(2021) 351 final

- What other actions need to be taken by the Commission, national competent authorities and/or stakeholders to increase the resilience of the construction industry in the three areas mentioned above and beyond (e.g., safety of workers)?
- What kind of issues have you witnessed, and when, with regards to the resilience of value chains that contribute to the functioning of the construction ecosystem? Which value chains' bottlenecks are the most critical for the construction ecosystem? Can you provide data/evidence? What actions should be taken, and by whom, to address the issues you have witnessed?
- What type of measures can help remove cross-border barriers and thus increase the resilience of the construction industry (e.g., harmonised standards, reinforcement of mutual recognition)?
- How can we ensure that the actions you described are also supporting the green and digital transitions?
- Based on data available to you, what intermediary milestones need to be set for the different actions towards 2030? Should milestones be set beyond 2030? If yes, what would they be?

Issues	Possible actions and division of roles	Possible output scenarios for 2030[58]
Create an enabling framework to support the resilience of construction, including dealing with strategic dependencies.	**Commission/Member States could focus on the following priorities:** • Provide an enabling and stable regulatory framework, supporting the transition of the ecosystem and make it attractive for companies and the labour force. • 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. • Monitor via the dedicated EU observatory late payments. 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 sector through possible introduction of harmonized standards or reinforcement of mutual recognition of national schemes. • Use the support and recommendations of the European Labour Authority on promotion of cross-border service provision.	Construction confidence indicator to remain positive[59] and steadily growing turnover of the ecosystem at constant prices.

[58] A non-exhaustive list for the purposes of the consultation. The table is based on several consultation processes and positions provided by construction ecosystem stakeholders. This is a European Commission staff working document. It does not constitute the official position of the Commission, nor does it prejudge any such position.

[59] Business and consumer survey results for October 2021. Economic Sentiment and Employment Expectations up in the EU and the euro area bcs_2021_10_en.pdf (europa.eu)

Issues	Possible actions and division of roles	Possible output scenarios for 2030[58]
	• Support and accelerate the development and replication of prototype-projects via the NEB Lab, but also maximise the networking potential and visibility of good practices. **Industry could focus on the following priorities:** • Develop and implement innovative business models, to improve resilience, sustainability and competitiveness of construction value chain.	
Increase the resilience of the construction ecosystem to deal with value chain challenges or even disruptions besides its organic dependency to other industrial ecosystems (e.g., EII).	**The Commission could focus on the following priorities:** • Assess in depth the expected use of materials in construction and construction materials (e.g., wood) to ensure that EU and national renovation strategies can be carried out, and that raw material supplies can sustainably meet the demand in the long term. • Emphasise the importance of waste prevention and high quality recycling of construction and demolition waste, the reuse of construction products and the uptake of secondary raw materials. • Support knowledge and evidence building and public-private partnerships to foster innovation in agile building design that allows to replace construction materials and products easily in case of shortages, to avoid delays in building projects. • Support knowledge building on digital working methods that reduce dependencies to local markets through Digital Innovation Hubs. **Member States / Regions could focus on the following priorities:** • Support long-term contracts between construction companies and suppliers of material to avoid short-term price spikes and delays. • Put in place appropriate and coordinated mechanisms allowing to consider and weigh the need to apply sanctions in case of delays caused by supply chain disruptions. • Allow for adequate indexations on material prices in public tendering of projects.	Reduced number of construction sector companies reporting material shortages as a factor limiting construction output, with a reduction of the average and a reduction of the short-term peaks of this indicator.[60]

[60] There is currently no established EU level output. The current is a suggestion open to further discussion.

Issues	Possible actions and division of roles	Possible output scenarios for 2030[58]
	• Compensation schemes for companies affected by exceptional price spikes in fixed-price public contracts. **Industry could focus on the following priorities:** • Invest in (the use of) efficient building technologies. • Diversify suppliers, materials and products. • Make the best use of local and recycled materials in improving resilience. • Capacity building of the knowledge of replacement materials with similar characteristics in case of price spikes.	
Lack of workers, skills gaps and mismatches.	**The Commission could focus on the following priorities:** • Promote partnerships creation, sharing of good practice and development of skill-needs responses through European partnerships. • Fund skills deployment. • Continue and increase supporting initiatives for upskilling and re-skilling, such as the BUILD UP skills[61]. • Foster cross-border professional services and reduce administrative burden through introduction of a common form in an electronic format for the declaration of posting of workers. **Member States/Regions could focus on the following priorities:** • Provide enabling framework (e.g., curricula, funding) for skills deployment. • Exploit possibilities provided by the Cohesion Policy and the Recovery and Resilience Facility on the skills development and deployment[62]. • Foster public procurement contracts through open tenders supporting the upskilling of professionals and promotion of apprenticeships **Industry could focus on the following priorities:** • Create partnerships with education and training providers, employment services, social economy	By 2030, increase adult participation rates in training from ca 7.4% in 2020[63] to *[please provide your views on the possible aspirational target]*. By 2030 increase the share of female and below 49-year-old workers that stood in 2018 at 10% and 77% respectively[64] to *[please provide your views on the possible aspirational target]*. Implementation of the Pact for Skills commitments.

[61] BUILDUP Skills | ENERGY TRAINING FOR BUILDERS

[62] When linked to the smart specialisation strategy, authorities can use possibilities for funding under the European Regional Development Fund European Regional Development Fund - Regional Policy - European Commission (europa.eu)

[63] There is currently no established EU level output. The current is a suggestion to initiate further discussions.

[64] There is currently no established EU level output. The current is a suggestion to initiate further discussions.

Issues	Possible actions and division of roles	Possible output scenarios for 2030[58]
	and beyond, to predict and address skills needs (e.g., curricula adaptation, apprenticeships and other forms of work-based learning). • Improve through awareness raising and structural changes (e.g., use of digital working methods) the attractiveness of the ecosystem as an employer. • Consider upskilling and continuous training for employees.	

2.2. A greener EU construction ecosystem

The environmental impact of construction is significant and many EU initiatives, legislative or not, relate to sustainability in the construction ecosystem. The objectives of the European Green Deal are known, and several actions need to be undertaken by different stakeholders, including EU and national authorities. Consultations have pointed out the topics of higher interest to the industry, these being to set ambitions and acting towards a life cycle approach for construction, reducing whole life carbon emissions, promoting and supporting a circular economy, increasing the service life of buildings and infrastructures and spreading the use of nature-based solutions.

Energy renovation

Europe's ageing building stock suffers from a low rate of **energy renovation**, around 1% per year, which is insufficient to meet Europe's climate and energy goals by 2030 and beyond. The Renovation Wave strategy[65] foresees at least doubling this rate and deepening energy renovation. This is particularly relevant for the construction ecosystem, which will have to deliver on this ambition. Accelerating the rate of deep renovation will require a high volume of materials and skilled workers, and an increase in administrative procedures such as building permits. In addition to improving the energy efficiency of buildings, renovation will also support deployment of technologies such as solar panels, heat pumps, energy storage, and smart energy management systems, many of which are manufactured in Europe. These technologies are crucial if buildings are to operate intelligently in a smart energy system based on intermittent renewable sources. At the same time, such renovations can also be turned into an opportunity to improve the physical accessibility of buildings, and the affordability of utility bills.

The buildings sector is expected to reduce operational emissions strongly under the assessment made by the Commission, for instance, reducing direct CO_2 emissions in buildings (as covered by the proposed extension of the Emissions Trading System) by 54% by 2030 compared to 2015. In buildings, operational emissions decreased by 22% between 2010 and 2019. To make this possible, EU legislative initiatives will act in synergy to upscale energy renovations and facilitate fuel switch in buildings. This includes the extension of the Emission Trading System to buildings, and revisions of the Energy Performance of Buildings Directive, the Energy Efficiency Directive, and the Renewable Energy Directive.

Resource consumption, circularity and waste

In addition to improving energy performance, an accelerated rate of renovation is likely to increase **consumption of resources and generation of waste**, which is why the Renovation Wave also proposes

[65] Renovation wave | Energy, strategy (europa.eu)

action to address these aspects. Construction activity accounts for around half of the weight of Europe's extracted resources[66] and over a third of the EU's total waste weight generated per year[67].

Construction needs to operate in a more resource efficient way and make greater use of secondary materials, while avoiding the use of hazardous materials. The ecosystem needs to address every part of the life cycle of buildings and infrastructure. Designers have a significant role, including via material specifications, for making the best use of resources, and allowing for future refurbishments, repurposing and deconstruction. Professionals carrying out construction and demolition activities need to ensure waste is treated in an environmentally sound way in accordance to national waste management strategies and regulation.Local/national action also needs to be taken at the end-of-life of both buildings and infrastructure to recover materials for future reuse and recycling[68]. Techniques such as off-site prefabrication and additive construction can save resources as well as improve productivity. Digitalisation is an essential element to improve circularity in construction and a more efficient management of resources and of the built environment. As a result, the links with the digital transition are plenty. For example data needs to be tracked and traced throughout the design and construction process and the lifetime of the built asset. Tools such as Digital Building Logbooks can store all data in a single repository that facilitates retrieval and informed decision making.

Life cycle greenhouse gas emissions

Implementing more circular approaches to construction can also address **life cycle greenhouse gas emissions**[69]. The urgency of this issue is becoming increasingly apparent as the building stock becomes more energy efficient. The manufacturing and construction process is responsible for embodied greenhouse gas emissions before buildings are occupied, and when they reach the end of their service life. In fact, a new high energy performance building built today can be responsible for more embodied greenhouse gas emissions before it is occupied than during a 50-year lifetime of operation[70]. Furthermore, there is potential for buildings to act as a temporary carbon sink[71]. This would have a climate benefit, for example with green infrastructure and the use of organic building materials that can store carbon. Action that increases the service life of built assets, such as regular monitoring, maintenance and repairs to infrastructure, and design for future adaptation of uses, deconstruction and reuse, can avoid premature demolition and landfill.[72]

Nature-based solutions

Construction works can also result in other environmental impacts including pollution, noise and biodiversity loss, while the construction ecosystem also influences both indoor and outdoor air quality. Nature-based solutions[73] such as use of green walls and roofs and of biobased materials and natural resources such as rammed earth and wood, can help to mitigate such impacts while reducing greenhouse gas emissions.

[66] https://ec.europa.eu/growth/industry/sustainability/built-environment_en
[67] Eurostat, 2018. https://ec.europa.eu/eurostat/statistics-explained/index.php?title=Waste_statistics#Total_waste_generation
[68] European Commission, 2020. Circular Economy – Principles for Buildings Design https://ec.europa.eu/docsroom/documents/39984
[69] Eurostat has estimated the carbon footprint of construction and construction works across the EU27 in 2019 to be 9.4% of total domestic final use. Source: https://ec.europa.eu/eurostat/statistics-explained/index.php?title=Greenhouse_gas_emission_statistics_-_carbon_footprints
[70] Röck et al (2020). Embodied GHG emissions of buildings – The hidden challenge for effective climate change mitigation. Applied Energy, Volume 258.
[71] Kuittinen et al (2021). How can carbon be stored in the built environment? A review of potential options. https://doi.org/10.1080/00038628.2021.1896471
[72] European Commission, 2021. Study on circular economy principles for buildings' design: Final Report. https://op.europa.eu/en/publication-detail/-/publication/86c67cd0-0f83-11ec-9151-01aa75ed71a1/language-en/format-PDF/source-230073893
[73] Nature-based solutions | European Commission (europa.eu)

Nature-based solutions also serve for micro-climate regulation (tackling urban heat island effect, etc.), help increase air quality, reduction of energy consumption, mitigation of floods, and other benefits including human health and well-being. The proper use of these solutions will require enhancing the skills of architects, engineers and construction workers[74].

Enhancing climate resilience and adaptation to climate change

The long-term vision of the EU is that in 2050, the EU will be a climate-resilient society, fully adapted to the unavoidable impacts of climate change. The frequency and severity of climate and weather extremes is increasing. This affects the health and well-being of Europeans, but it also deteriorates the condition of buildings and infrastructure and is detrimental to the economy.

As buildings and infrastructure are both contributors to and affected by climate change, the construction ecosystem is called to decarbonise its activities and protect them - against the unavoidable impacts of climate change, natural and human-made disasters (floods, heatwaves, fires, earthquakes, landslides). To achieve climate-resilient buildings and infrastructure means that the planning, design, building and management of them happens in ways that anticipate, prepare for, and adapt to changing climate conditions and reduce built environment's carbon footprint.

Climate change adaptation and mitigation projects relating to urban development are often delivered through spatial planning. In most Member States, municipalities are encouraged to develop climate change adaptation and mitigation plans. In general, most of the higher level of climate change adaptation preparedness is found in the transport, urban development and water sectors, mainly because these are predicted to be the most impacted areas and due to their significant GHG emissions.

Albeit with different levels of ambition, all major current EU funding programmes include sustainability or climate proofing provisions, and such objectives are also embedded in the EU-level COVID-19 pandemic recovery effort. A successful green transition needs to also be a socially just one.

Questions to stakeholders:

- Is your organisation on track to transition successfully towards a more sustainable business model? Have you set specific targets and milestones? Based on your data, how far are you from achieving your goals? What are the challenges you foresee?
- What other actions can be taken for the green transition, beyond current EU policy initiatives, that you believe should be considered in this pathway?
- What other actions need to be taken by the Commission, national competent authorities and/or each stakeholder group to unlock the potential of the green transition? What are the future lead markets?
- How can synergies be ensured between actions and with the work described as part of digital transformation and resilience?
- Based on data available to you, what intermediary milestones need to be set for the different actions towards 2030? Should milestones be set beyond 2030 should be set? If yes, what would they be?

[74] https://ec.europa.eu/info/research-and-innovation/research-area/environment/nature-based-solutions_en

Issues	Possible actions and division of roles	Possible output scenarios for 2030[75]
Construction activity results in GHG emissions over the full life cycle of assets and these need to be reduced to meet climate targets.	**The Commission could focus on the following priorities**: • Improve collection and availability of data on GHG emissions of construction and demolition activity. • Generate new data on the embodied emissions of construction activity at EU level[76]. • Develop a regulatory framework to calculate embodied emissions of construction activity at EU level. • Develop a roadmap for whole life cycle carbon emissions reduction in buildings. • Address whole life cycle emissions from construction across EU policies. • Develop a regulatory framework for the certification of carbon removals. • Revise the CPR to provide a regulatory framework to communicate and declare environmental performances of construction products in a harmonised manner. • Incentivise large scale demonstrations/pilots to test innovative and systemic approaches that can decarbonise construction, waste and the built environment while fostering synergies among construction, mobility and waste sectors[77]. **Member States could focus on the following priorities:** • Calculate embodied emissions of construction activities based on an EU framework. • Enact national policies addressing whole life cycle emissions. • Address whole life cycle at policies and procurement in different spatial and administrative levels. • Promote and use Earth Observation data and information to support planning and environmental impact assessment[78]. **Industry could focus on the following priorities**:	Intermediate GHG reduction from construction activity, on a path towards climate neutrality by 2050. Increased disclosure of GHG emissions in construction projects.

[75] A non-exhaustive list for the purposes of the consultation. The table is based on several consultation processes and positions provided by construction ecosystem stakeholders. This is a European Commission staff working document. It does not constitute the official position of the Commission, nor does it prejudge any such position.
[76] upcoming DG ENV study
[77] See later chapter on Reasearch and Innovation.
[78] Resources and data | European Commission (europa.eu)

Issues	Possible actions and division of roles	Possible output scenarios for 2030[75]
	• Reduce embodied emissions in design and construction practices including at the stage of manufacturing of construction products. • Set industry targets and voluntary pledges to address embodied emissions at company or sector level using benchmarks. • Set roadmaps for the reduction of whole life carbon from their activities.	
The ecosystem needs to quickly become more circular and improve resource efficiency[79].	**The Commission could focus on the following priorities**: • Collect new data on the uptake of circular approaches in construction. • Consider setting reuse and recycling targets for construction and demolition waste and its material specific fractions. • Facilitate better generation of data and uptake of recycled materials in construction products, as part of the CPR review, including through the possible introduction of recycled content requirements for certain construction products, considering their safety and functionality. • Scope the development of EU end-of-waste and by-product criteria, including for construction and demolition waste. • Develop investment criteria for a circular economy via EU Finance Taxonomy. • Assess industry approaches to quality control of construction and demolition waste[80]. • Based on the recommendations of the Circular Economy Principles for buildings design[81], develop guidelines for public authorities to implement circularity in planning. • Update the EU Construction and Demolition Waste management protocol and guidelines for waste audits[82] including incorporating consideration of hazardous substances, in particular asbestos.	Improve circularity of the construction and demolition sector. Increase the use of secondary materials in construction.

[79] Construction accounts for 36% of waste generated and half of natural resources extracted in the EU.
[80] Upcoming study to be carried out by DG GROW.
[81] European Commission, 2020. Circular Economy – Principles for Buildings Design https://ec.europa.eu/docsroom/documents/39984
[82] https://ec.europa.eu/growth/content/eu-construction-and-demolition-waste-protocol-0_en

Issues	Possible actions and division of roles	Possible output scenarios for 2030[75]
	• Develop Safe and Sustainable by Design criteria that are applicable for construction[83] • Support research, innovation and deployment of climate neutral, low toxicity and resource-efficient/ circular construction materials[84]. **Member States could focus on the following priorities:** • Take measures to ensure waste generation is reduced in processes related to construction and demolition and promote repair and reuse[85]. • Support the development of urban reuse/recycling platforms for construction. • Develop approaches that encourage renovation over demolition and rebuild • Coordinate policies and actions at different administrative levels and spatial scales to improve resource efficiency and waste management.[86] • Use renovation as an opportunity to improve the accessibility of buildings.[87] • Build capacity and skills for circular approaches to construction. **Industry could focus on the following priorities**: • Improve resource efficiency in design, construction and demolition practices. • Incorporate future deconstruction possibilities at the design stage and in works on site. • Mainstream the use of Level(s) to measure and report against sustainability indicators. • Set targets or make voluntary pledges to increase waste prevention (incl. through reuse) and recycling rates at company level. • Develop and deploy circular business models such as products as a service, as well as solutions for modular design and identification of hazardous substances. • Develop alternatives for hazardous substances in construction. • Deploy flexible, modular designs for buildings that can adapt and be repurposed.	

[83] Mapping study for the development of sustainable-by-design criteria - Publications Office of the EU (europa.eu)
[84] See later chapter on Research and Innovation.
[85] Waste Framework Directive.
[86] See for example the Circular Cities Initiative https://ec.europa.eu/info/research-and-innovation/research-area/environment/circular-economy/circular-cities-and-regions-initiative_en
[87] https://ec.europa.eu/social/main.jsp?catId=1202

Issues	Possible actions and division of roles	Possible output scenarios for 2030[75]
Currently the annual rate of deep renovation is very low and pressure is mounting to accelerate the transformation towards a modernized building stock.	**The Commission could focus on the following priorities:** • Support Member States to implement national policies addressing the rate of renovation. • Improve the collection of data via the EU Building Stock Observatory. • Create a framework for Member States to map out the renovation needs and actions to transform the existing building stock in line with climate neutrality goals by 2050. • Support the achievement of higher renovation rates, in particular for worst performing buildings. • Support research, innovation for evidence based, cost effective and environmentally friendly renovation approaches. • Showcase best renovation examples via the initiatives of the New European Bauhaus such as the dedicated Festival, Lab and Prizes as well as the EU Prize for Contemporary Architecture – Mies van der Rohe Award[88] **Member States could focus on the following priorities:** • Transpose relevant EU legislation addressing renovation. • Develop support schemes such as one-stop-shops to simplify processes for the end user. • Incentivise higher renovation rates, particularly for worst performing buildings. • Support the roll-out of large-scale renovation programmes including at the district level. **Industry could focus on the following priorities**: • Invest in industrialised solutions such as prefabrication and automation. • Deploy techniques that reduce disruption for building occupants during renovation works.	Achieve at least *2%* annual rate of renovation by 2030 and substantially increase the rate of deep renovations (currently at 0.2%)[89].

[88] https://ec.europa.eu/culture/lt/node/656
[89] Renovation Wave (europa.eu)

Issues	Possible actions and division of roles	Possible output scenarios for 2030[75]
Buildings and infrastructures are vulnerable to the effects of climate crisis.	**The Commission could focus on the following priorities:** • Provide financial support to MS for the implementation of climate resilience and adaptation measures[90]. • Enhance safety, sustainability and climate resilience in the built environment as part of the upgrade of Eurocodes[91]`and other relevant building standards[92]. • Improve knowledge and understanding of the climate impacts on buildings[93]. **Member States/Regions could focus on the following priorities:** • Include measures on construction in national adaptation strategies according to the Climate Law. Use Commission guidance[94] on climate-proofing infrastructure when public funds are used. • Consider revising national building codes to include climate resilience criteria. • Raise awareness on climate resilience among building owners and professionals. **Industry could focus on the following priorities:** • Develop products, solutions and services to meet the challenges of climate crisis, including tools for predictive maintenance and adaptation of buildings and infrastructure. Inform on the resilience of such products.	MS put in place and implement national, regional or cross border disaster risk management plan(s) for climate-related risks, set up based on risk assessments, taking due account of the likely impacts of climate change and the existing climate adaptation strategies. Climate resilience criteria for buildings are based on sound knowledge and are applied across the EU to both new buildings and major renovations.

2.3 A digital EU construction ecosystem

Digitalisation is a means, an enabler to **achieve a better built environment for the planet and people**. At the same time, digitalisation is transformative to the whole ecosystem, resulting in process efficiency; support for circularity; certification and traceability etc. It is important in this context to analyse the role of digitalisation for the industrial ecosystem itself and the construction processes, rather than the digitalisation

[90] For the implementation of their disaster risk management plans for climate-related risks Member States can primarily use the Cohesion Funds, but also other financial instruments like RRF and CEF.
[91] Eurocodes: Building the future - The European Commission website on the Eurocodes 0 (europa.eu)
[92] Ongoing work in CEN-CENELEC under Mandate 526 of the Commission, see https://www.cencenelec.eu/areas-of-work/cen-cenelec-topics/environment-and-sustainability/climate-change/
[93] JRC Publications Repository - Expected implications of climate change on the corrosion of structures (europa.eu) JRC Publications Repository - Thermal design of structures and the changing climate (europa.eu)
JRC Report: Eurocodes Scientific and Technical Report by M.L. Sousa et al, 2020. https://eurocodes.jrc.ec.europa.eu/showpublication.php?id=577
Thermal design of structures and the changing climate, JRC Report: Eurocodes Scientific and Technical Report by A. Athanasopoulou et al, 2020. https://eurocodes.jrc.ec.europa.eu/showpublication.php?id=578

[94]https://op.europa.eu/en/publication-detail/-/publication/23a24b21-16d0-11ec-b4fe-01aa75ed71a1/language-en

of the building itself (i.e., smart energy-efficient building). The **potential and transformative implications** to the ecosystem are significant:

- Digitalisation creates a bridge between the different scales of the built environment: from data on a building, information can be fed to urban planning.
- Digitalisation creates a bridge among the different professionals and users: from the vision of the architect, the work in the construction site can become more participative, the management of a building can be optimised and even its demolition. As a result, it can revolutionise the work of different professionals and increase productivity in planning, approval, execution, operation and reuse.
- Digitalisation can help create trust, transparency and improve decision-making in construction processes (e.g., procurement, construction permits).

The construction ecosystem has been considered **to be lagging in the adoption of digital technologies**. However not all professions and activities in the ecosystem are at similar levels of digital maturity. JRC analysis [95] confirms that architectural and engineering activities for buildings and infrastructure rely on and take advantage of digital tools, while the adoption is slower at the construction sites as well for maintenance. Low digitalisation rates are seen in the public sector and, notably in administrative processes linked to construction, such as procurement, collection and sharing of data and issuing of building permits.

The dominance of SMEs, and particularly microenterprises, partly explains partly the low digitalisation: few large companies undertake projects and sub-contract parts of their activities to SMEs that do not always have the margins for initial investments in innovative technologies. At the same time, the lifetime of the built environment itself is so significantly longer than the end product of any other industrial ecosystem, making technology use for it obsolete in the noticeably short initial part in the lifecycle of a building or infrastructure.

It is also important to note that the use of digital technologies differs significantly depending on the project. While construction of small residential projects remains 'traditional', the construction of large infrastructure projects, due to their complexity, demands the use of digital technologies.

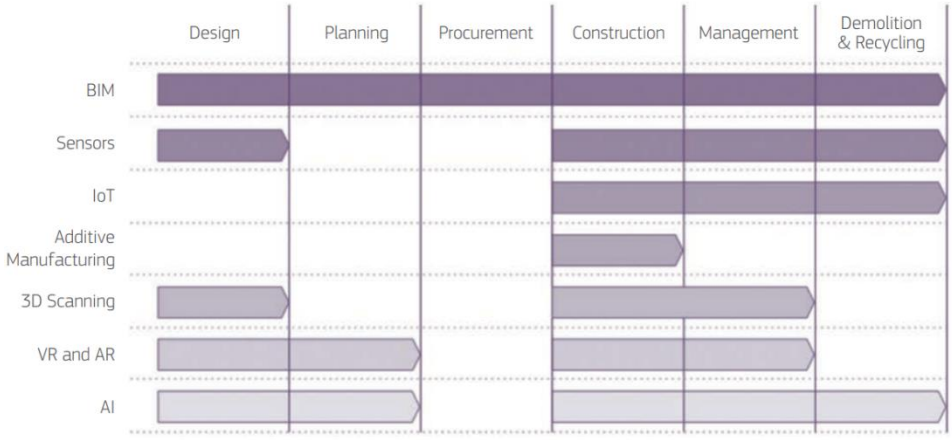

Figure 8: Digital technologies and tools transforming construction in different stages of the project lifecycle[96]

Both policy and market drivers play a key role in the digitalisation of the construction sector. The **main**

[95] JRC Publications Repository - Digital Transformation in Transport, Construction, Energy, Government and Public Administration (europa.eu)
[96] JRC Publications Repository - Digital Transformation in Transport, Construction, Energy, Government and Public Administration (europa.eu)

market drivers are companies' needs to improve productivity and cut costs, and market demand in the uptake of digital technologies, which push construction tech companies to innovate[97].

EU and national **policy initiatives and frameworks** in the past years have supported the digitalisation of the EU construction ecosystem, and can be categorised as follows:

- Digitalisation policies which put in place a broad framework aiming to support the adoption of digital technologies – sometimes through different policy areas. Several MS have drawn up such strategies, while others received Structural Reform Funds support to develop dedicated digital construction strategies.
- Construction-related digital platforms, which are often used to support the coordination between public and private sector initiatives and to ease policy implementation. Through Horizon 2020 DigiPLACE[98] over 40 different public authorities, industrial representatives and researchers came together to propose a reference architecture framework and strategic roadmap for platforms that can serve the future development of a construction data space.
- Government e-services also play a key role in facilitating the digitalisation of construction related processes. For instance, this is the case for the digitalisation of building permit systems. The Commission has delivered recommendations through NRRPs for the development of such systems, while several efforts have been supported in the past through Structural Reform Funds. Dedicated calls under Horizon Europe will support the experimentation in the field and the development of new systems to the benefit of authorities and professionals.
- Tools optimising the sharing and organisation of information. Digital building logbooks, which are common repositories for all relevant building data, are another way through which governments can support the digitalisation of the construction sector. The EC aims to deliver guidelines to Member States for the implementation of logbooks. The Smart Readiness Indicator[99] is going through a voluntary test phase and provides better information on the readiness of buildings to adapt to the needs of the occupants.
- Initiatives dedicated to ecosystem building and networking, collaborative research and skills development, awareness creation and concept validation and prototyping. In EU level this is mostly done through Digital Innovation Hubs and the Digital Europe Programme, as well as Clusters and technology centers. At national level, this is addressed through several types of platforms[100], private-public partnerships or private sector initiatives.

Overall, recent developments at the EU level, such as the Renovation Wave (that requires an enormous increase in efficiency and productivity) and support measures made available for the digitalisation of public procurement, funding streams (e.g., the Recovery and Resilience Facility, Technical Support Instrument) can incentivise national governments to support further the digitalisation of their construction sector. For the digital transition to be successful, we need to assure that none is left behind. Small and micro enterprises, as well as workers have many needs in skilling, reskilling and overall support. This will be crucial to support the transformation of the sector and its growth, but also to reach climate and sustainability-related objectives. However, to be effective, any policy intervention should be evidence-based and carefully monitored throughout its implementation to adjust to possible changes and reflect the interests and constraints of construction actors and other public and private stakeholders[101].

[97] DocsRoom - European Commission (europa.eu)
[98] Home (digiplaceproject.eu)
[99] Smart Readiness Indicator for Buildings | Smart Readiness Indicator for Buildings
[100] An example is KROQI – Edu BIM in France Kroqi - La plateforme de travail collaboratif.
[101] ibid

Questions to stakeholders:

- Are there any additional barriers to the uptake of digital technologies by the construction ecosystem that you believe should be considered in this pathway? What are they? Can you provide relevant data/evidence?
- What other actions need to be taken by the Commission, national competent authorities and/or each stakeholder group for the digital transition? What are the future lead markets?
- How can these actions also support resilience and the green transition?
- Based on your data, what intermediary milestones need to be set for the different actions towards 2030? Should milestones be set beyond 2030? If yes, what would they be?
- How can the adoption of the new technologies be stimulated?
- How can the exchange of data among different stakeholders be fostered? What interoperability framework (common standards, open formats, licenses) is needed to secure the exchange of data?

Issues	Possible actions and division of roles	Possible output scenarios for 2030[102]
Limited data availability, sharing and use. Data is lost and needs to be re-created	**The Commission could focus on the following priorities:** • Support the deployment of a Construction Data Space through upcoming funding Programmes, and other databases (e.g., on energy performance) with the collaboration of the Data Spaces support center. • Promote European tools and protocols for data sharing, use and organization, such as digital building logbooks, reinforced Energy Performance Certificates (EPC) and Building Renovation Passports (BRP) and the Smart Readiness Indicator (SRI). Harness the potential of these tools in achieving green transition and climate adaptation[103]. • Promote the use of European space data (Copernicus[104], Galileo[105]) to increase the efficiency of construction operations, for example with early detection and remote monitoring of construction sites or accurate construction surveying. **Member States could focus on the following priorities:**	An operational European Data Space for construction to centralise construction and building related data and enabling new business models. All MS to have set up digital building logbooks and databases on energy performance of buildings to increase data availability and sharing[106]. Promote EU standards worldwide and ensure their uptake in EU partner countries' legislation.

[102] A non-exhaustive list for the purposes of the consultation. The table is based on several consultation processes and positions provided by construction ecosystem stakeholders. This is a European Commission staff working document. It does not constitute the official position of the Commission, nor does it prejudge any such position.

• [103] According to the Climate Adaptation Strategy, digital building logbooks can inform building owners and construction professionals on the climate resilience of buildings.

[104] Homepage | Copernicus
[105] Galileo (europa.eu)
[106] Currently 6 MS have no initiatives (or even pilots) in place or rely on paper-based systems.

Issues	Possible actions and division of roles	Possible output scenarios for 2030[102]
	• Incentivise the use of digital technologies (through procurement, training, support in purchase of equipment etc.) • Participate in the extension of the network of Digital Innovation Hubs, and especially the ones supporting construction. **Industry could focus on the following priorities:** • Use the available infrastructure for experimentation, training and funding for innovative technologies. • Follow up on the recommendations of DigiPLACE when developing initiatives. • Utilise funds available from InvestEU under its RDI Window and the SME Window.	
Slow, paper- based administrative processes that challenge productivity and the re-use of data.	**The Commission could focus on the following priorities:** • Propose a toolkit for the digitalisation of building permit systems. • Together with MS, improve access and use of procurement data through a dedicated data space. **Member States could focus on the following priorities:** • Facilitate data sharing by digitalizing the information held by public administrations and digitalise (make machine-readable) the rules and building codes. • Develop (or align to EU guidelines) their national tools (permits, logbooks etc.) • Utilise the support from Next Generation EU, and other instruments such as the Technical Support Instrument and the ERDF. **Other stakeholders could focus on the following priorities:** **European Standardisation Organisations** • To propose standards with the potential to better support the implementation of EU policies and legislation on digitalisation of construction.	All Member States to have fully digitalised their building permit systems and integrated Building Information Modelling in the process[107].
Low digitalisation rates and lack of investment in construction	**The Commission could focus on the following priorities:**	Increase the number of construction companies reaching Digital Innovation

[107] According to the European Construction Sector Observatory, currently 5 MS have fully digital building permit systems in place and 1 is planned. 2 Member states (Romania and Bulgaria) are entirely paper based.

Issues	Possible actions and division of roles	Possible output scenarios for 2030[102]
enterprises, mostly SMEs. Certain companies and people cannot participate in the digital transition.	• Support experimentation and innovation by combining digital technologies and business needs in construction through Horizon Europe calls. • Propose and promote tools for SMEs to assess their digital maturity and take steps to digitalise. Organise training for SMEs and trainers based on the tool. • Facilitate digitalisation through testing and experimentation with new technologies (such as sensors, augmented and virtual reality, drones, Artificial Intelligence big data, high performance computing). [108]. • Review[109] the Workplace Directive[110] and the Display Screen Equipment Directive[111] to improve working conditions linked to digitalisation. **Member States could focus on the following priorities:** • Assure a level playing field using open formats. Assure independence to software providers. • Create a supportive regulatory framework and incentivize the use of digital technologies such as through procurement) • Support SMEs through training, support in purchase of equipment/software and provision of supporting services. • Participate in the extension of the network of Digital Innovation Hubs, and especially the ones dedicated to construction. • Make digitalisation affordable for SMEs (e.g., project guarantees, supply tools to calculate Return of Investment). • Use possibilities for funding under ERDF for the ICT uptake in SMEs including infrastructures and services to support this (digital innovation hubs, living labs, etc.). **Industry could focus on the following priorities:** • Use the available infrastructure for experimentation, training and funding for innovative technologies.	Hubs or similar structures (e.g., Clusters, Technology centres). Spread the use of the self-assessment tool across all MS. Increase the current share of construction companies investing in innovation[112].

[108] Testing and Experimentation Facilities | Shaping Europe's digital future (europa.eu) EDIHs | Shaping Europe's digital future (europa.eu)
[109] As stated in the EU Strategic Framework on health and safety at work for the period 2021-2027.
[110] Council Directive 89/654/EEC of 30 November 1989 concerning the minimum safety and health requirements for the workplace

[111] Council Directive 90/270/EEC of 29 May 1990 on the minimum safety and health requirements for work with display screen equipment
[112] The construction sector generally invests little in innovation, with only 24% of the construction companies investing in new products, processes or services. Source: European Builders Confederation, members data. www.ebc-construction.eu

Issues	Possible actions and division of roles	Possible output scenarios for 2030[102]
	• Follow up on the recommendations of DigiPLACE when developing initiatives. • Increase transparency of data use. • Utilise funds available from Horizon Europe, InvestEU under its RDI Window and the SME Window.	

3. Supporting the ecosystem transition and long-term horizontal challenges

3.1. Procurement as enabler

There is a shared understanding between EU, national and local level authorities and other stakeholders that by creating a stable framework and increasing demand for innovative, green and socially responsible products and services, we can transform an industrial ecosystem. In construction, public spending reaches 30% of all spending. At the same time, 250 000 public entities across Europe engage in procurement for construction. The role of public procurement in fostering innovation in construction and quality in the built environment is known and highlighted in many EU level initiatives.

The **Big Buyers Initiative**[113] for Climate and Environment is a Commission initiative promoting collaboration between large public buyers and implementation of strategic public procurement for sustainable solutions. There have already been working groups on zero emission construction sites, and circular construction.

As part of the **recast Energy Efficiency Directive proposal,** Article 7 on public procurement is to oblige public buyers to only procure buildings that are energy efficient. Contracting authorities may decide to require that tenderers show information on the life cycle global warming potential of a new building. Additionally, the Renovation Wave supports the inclusion of lifecycle and circularity in public procurement with an action on the development of green public procurement criteria based on Level(s). It also recommends to include aspects linked to climate resilience.

The public sector plays a key role in supporting and promoting the uptake of digital technologies in the construction sector as buyers and administrators of buildings and infrastructures. Significant work has already been done in the area of **Building Information Modeling (BIM)**[114] and through collaboration with the EU BIM Task Group**[115].**

The Commission also recently adopted guidance on how to achieve **social impact** through public procurement, which provides concrete recommendations on the use of requirements related to social considerations in public procurement[116]. A collection of good practices[117] showcases how public buyers can

[113] BigBuyers | Home
[114] EU Handbook for the adoption of Building Information Modelling Handbook – EU BIM Task Group
Cost Benefit Analysis for the use of BIM in public procurement. Methodological handbook and calculation tool Cost Benefits – EU BIM Task Group
[115] EU BIM Task Group
[116]https://ec.europa.eu/docsroom/documents/42753/attachments/7/translations/en/renditions/native and https://ec.europa.eu/docsroom/documents/42742/attachments/5/translations/en/renditions/native
[117] https://ec.europa.eu/docsroom/documents/42742

work with economic operators and suppliers in the sector to ensure that labour law and human rights are complied with, and that disadvantaged people are better integrated in the job market. Initiatives and tools on socially responsible procurement help integrate social objectives in construction projects, such as model procurement systems for work integration[118], for monitoring compliance of labour law[119] or facilitators of social clauses[120] that can accompany the implementation of contract clauses. **Accessibility** for people with disabilities in buildings and infrastructures is required in the technical specifications of tenders according to the **Public Procurement Directive**[121], demonstrating the social impact of procurement from another scope.

Apart from EU level initiatives, national, regional and local authorities have a variety of tools at their disposal. For example, they can use Green Public Procurement criteria[122], or mandate the use of sustainability certification schemes like BREEAM, LEED or Passivhaus through urban planning requirements. By digitalising the building permits system, green and digital conditions can be introduced. It is important also to develop pilot projects and facilitate circularity by supporting local recycling platforms.

Questions to stakeholders:

- What other actions need to be taken in the area of public procurement by public authorities at different levels (municipal, regional, national, EU)?
- How can we ensure that synergies and coherence are created between actions on public procurement and the twin transition and resilience?
- How to ensure that industry and national competent authorities are prepared to meet potential new requirements in digitalisation?
- What role can industry play in the modernization of public procurement?

Issues	Possible actions and division of roles	Possible output scenarios for 2030[123]
Public procurement has untapped potential for fostering green, digital and social innovation.	**The Commission could focus on the following priorities:** • Co-develop and provide guidelines to MS on circularity. • Develop a public procurement Data Space as part of the Data Strategy. • Develop GPP criteria for selected building type. **Public authorities could focus on the following priorities:**	By 2030, BIM to be introduced in all MS for public tenders of buildings and infrastructures[127].

[118] https://ec.europa.eu/docsroom/documents/42753/attachments/2/translations/en/renditions/native
[119] idem
[120] idem https://ec.europa.eu/docsroom/documents/42742/attachments/5/translations/en/renditions/native
[121] EUR-Lex - 32014L0024 - EN - EUR-Lex (europa.eu)
[122] https://ec.europa.eu/environment/gpp/index_en.htm
[123] A non-exhaustive list for the purposes of the consultation. The table is based on several consultation processes and positions provided by construction ecosystem stakeholders. This is a European Commission staff working document. It does not constitute the official position of the Commission, nor does it prejudge any such position.
[127] There is currently no established EU level output. The current is a suggestion to initiate further discussions.

	• Incorporate in the existing GPP handbook and the methodology for calculating costs and benefits for the adoption of BIM[124]. • Mainstream the use of green public procurement for construction works, addressing the whole life cycle and facilitating circularity. • Create favourable frameworks for high-quality architecture in public procurement, regulatory simplification and innovative procedures that foster high-quality approaches[125]. • Strengthen awareness, knowledge and competences at all relevant governance levels to use high quality criteria and standards in decisions related to architecture and the built environment[126]. **Industry could focus on the following priorities:** • Participate in dialogue with authorities and help identify challenges in the application of new procurement rules (e.g., dependency on providers when it comes to digital procurement).	Phase-out of worst performing buildings and at last 3% buildings to be renovated at NZEB level[128].

3.2. Funding and financing

It is key that existing and future funding and financing instruments are utilised, in support of the transition of the construction ecosystem.

The **National Recovery and Resilience Plans (NRRPs)** are an importance source of funding and financing – partly in the form of grants and partly in the form of low interest loans – which the EU negotiated in response to the pandemic crisis. The measures in the NRRPs would ideally contribute to tackling challenges identified in the 2021 Annual Sustainable Growth Strategy, which sets out EU-wide ambitions for each of them. The ambitions are called European Flagships. One of them is the '**Renovate**' flagship: Improve the energy and resource efficiency of buildings and foster deep renovation. A case study for Italy showed that 14% of the total budget was allocated to 'Energy upgrading and renovation of buildings'[129].

The **Technical Support Instrument (TSI)** supports Member States in a wide range of reform areas in any reform phase, from design to implementation and evaluation, through annual, demand driven calls. Reform efforts in the field of construction policies, including the introduction of BIM, have been supported in various Member States. In the current call (TSI 2022) of October 2021 project requests have been encouraged in the fields of European Flagships, including Renovation Wave.

The Digital Europe Programme aims at shaping the digital transformation of Europe's society and economy, bringing benefits to everyone, but in particular to small and medium-sized enterprises. The Programme supports setting up industrial data spaces, allowing different industrial ecosystems, including

[124] Handbook – EU BIM Task Group
[125] https://www.consilium.europa.eu/en/meetings/eycs/2021/11/29-30/?utm_source=dsms-auto&utm_medium=email&utm_campaign=Education%2c+Youth%2c+Culture+and+Sports+Council
New report provides recommendations to ensure high-quality architecture and built environment. | Culture and Creativity (europa.eu)
[126] idem
[128] EDD and EPBD Commission proposals.
[129] National_RRPs_DiscussionPaper.pdf (epc.eu)

construction, to tap into the large potential of new data driven business models. Skilling of workers through courses in advanced digital skills and support to Digital Innovation Hubs, which are key for the digital transformation of SMEs, are also part of Digital Europe.

Building on the model of the Investment Plan for Europe in the period 2015-20, the **InvestEU** Programme will trigger a new wave in investments using an EU budget guarantee. All four windows of the programme Research, innovation and digitalisation; Small and medium-sized companies; Social investment and skills and especially Sustainable infrastructure will have a direct impact to support the construction ecosystem, particularly the last one devoted to financing projects in sustainable energy, digital connectivity, transport, the circular economy, water, waste, other environment infrastructure and more. Apart from the main funding instruments for the ecosystem described above, one can access information on funding on other databases, such as the table describing the EU funding instruments for upskilling and reskilling[130], or the one-stop-shops for residential building renovation[131].

The **ERASMUS+** 2021-2027 EU 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.

LIFE is a multi-sectoral Programme aiming for a more sustainable and circular economy, protecting and improving the quality of the environment and reverse biodiversity loss and degradation of ecosystems[132]. LIFE was recently expanded to also include action addressing the clean energy transition. With a budget of EUR 5.4 billion, it touches many elements of the construction ecosystem. For example, it supports energy efficiency finance projects and one-stop shops for building renovation, market uptake of existing solutions, capacity building, the **BUILD UP** portal for energy efficiency in buildings, and skills-related projects via the BUILD UP Skills initiative.

The **EU Finance Taxonomy** is a classification system for investment purposes that translates the EU's climate and environmental objectives into criteria for specific economic activities. It recognises as green, or 'environmentally sustainable', economic activities that make a substantial contribution to at least one of the EU's climate and environmental objectives, while at the same time not harming significantly any of these objectives and meeting minimum social safeguards. This system is expected to foster the finance of sustainable activities in companies themselves and of individual construction projects (construction of transport infrastructure; water projects; new buildings; renovation of existing buildings; individual renovation measures, installation of renewables on-site and professional, scientific and technical activities, acquisition of buildings).

The **Social Climate Fund** aims at addressing challenges of affordability for building renovation and supporting households that suffer from energy poverty.

Public funds alone will not be sufficient to finance building renovation on the necessary scale. The Renovation Wave foresees annual investments in the range of EUR 275 billion. It is therefore critical to use private financing sources for energy efficiency, for example by bundling and aggregating small projects in large investment portfolios that are more attractive to financial institutions. Other promising approaches include de-risking of investments133, energy efficiency mortgages, on-tax and on-bill schemes.

[130] EU funding instruments for upskilling and reskilling - Employment, Social Affairs & Inclusion - European Commission (europa.eu)
[131] JRC Publications Repository - One-stop shops for residential building energy renovation in the EU (europa.eu)
[132] https://cinea.ec.europa.eu/life_en
[133] See for example the work of the Energy Efficiency Financial Institutions Group including the DEEP De-Risking Energy Efficiency Platform https://ec.europa.eu/eefig/index_en

State aid is defined as an advantage in any form conferred by national public authorities to undertakings on a selective basis (i.e., measures open to all enterprises do not constitute State Aid). As a company that receives government support gains an advantage over its competitors, the Treaty generally prohibits State aid unless it is justified by reasons of general economic development. In this context EU State aid rules foresee possibilities to provide public support for several of the objectives of the construction ecosystem.

Cohesion Policy[134]supports actions related to skills development in priority areas of Smart Specialization Strategies, to enhance the competitiveness of SMEs and job creation in SMEs, ICT up-take in SMEs including infrastructures and services to support this (digital innovation hubs, living labs etc.), new or significantly upgraded services for e-government and e-skills, circular economy, building of new and renovation of existing buildings and infrastructure. The exact allocation of funds in such actions will be known once cohesion policy programmes are adopted. In the 2021-2027 period, at least 8% of the national **European Regional Development Fund** resources, other than for technical assistance, must be allocated to sustainable urban development in priorities and projects that are selected by cities themselves and based on their own sustainable urban development strategies. Special attention should be given to tackling environmental and climate challenges, notably the transition towards a climate-neutral economy by 2050, to harnessing the potential of digital technologies for innovation purposes, and to support the development of functional urban areas., must be allocated to sustainable urban development in priorities and projects that are selected by cities themselves and based on their own sustainable urban development strategies. Special attention should be given to tackling environmental and climate challenges, notably the transition towards a climate-neutral economy by 2050, to harnessing the potential of digital technologies for innovation purposes, and to support the development of functional urban areas. The **European Social Fund+** is the major EU programme to support Member States and regions to achieve high employment levels, fair social protection and a skilled and resilient workforce ready for the future world of work. Through the **Just Transition Mechanism,** support can be mobilized in the regions most affected by the socio-economic transition to climate neutrality in line with the Territorial Just Transition Plans (TJTPs). Potential areas for support are: (a) energy; (b) decarbonisation projects, economic diversification of the regions and social infrastructure; (c) circular economy and (d) re-skilling, upskilling of workers. The **Cohesion Fund** supports investments in the field of environment and the trans-European transport networks in the less prosperous EU countries.

The **European Agricultural Fund for Rural Development (EAFRD)** supports in the rural areas of the EU various actions related to skills development and advisory services, water and waste management, renewable energy, construction of agricultural and agro-processing buildings, public infrastructures of generally small scale (e.g, road axes, bridges, dams, broadband). The exact allocation of funds in such actions depends on and varies among Member States.

The Connecting Europe Facility (CEF)[135] is an EU funding instrument supporting the development of high performing, sustainable and efficiently interconnected trans-European networks in the fields of transport, energy and digital services. It contributes also to their decarbonisation and resilience.

Questions to stakeholders:

[134] Cohesion Policy 2021-2027 - Regional Policy - European Commission (europa.eu)

[135] https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=legissum%3A4538697

- Who are the most important actors in the private investment environment for development and adoption of resilient, green and digital solutions in the ecosystem?
- How can private investment be mobilised for the twin transition and strengthen resilience?

3.3. Research and Innovation

Horizon Europe is the largest ever transnational Programme supporting research and innovation[136]. The Programme, which succeeds Horizon 2020, has a budget of around €95.5 billion for 2021-2027.

Several parts of the Horizon Europe Work Programme are relevant to the construction ecosystem:

- Under Cluster 4 "**Digital, Industry and Space**", research and innovation topics focus on the twin green and digital transitions of the construction industry ecosystem. Projects funded under cluster 4 address the competitiveness and productivity of the industry, enabled by improved resource efficiency and digitalisation. For example, topics in Work Programme 2021-2022 feature advanced materials, digital logbooks, digital permits & compliance checks, and tools to valorise construction and demolition waste.
- Under Cluster 6 "Food, Bioeconomy, Natural Resources, Agriculture and Environment", topics support **integrated solutions for circularity in buildings and the construction sector**, but also research and innovation on eco-designed biobased construction materials, including structural elements based on wood composites and materials resulting from the circular and cascaded use of biomass, e.g. insulation, paneling, and biobased chemicals used in various industrial sectors applied in construction and housing sectors, e.g. paints, adhesives, and composites.
- Under the same cluster, **Circular Cities and Regions Initiative** (CCRI)[137], which supports the deployment of circular and climate-neutral territorial solutions, includes civil society and in particular aspects of housing and the living environment.
- The **Circular Bio-based Europe Partnership**, which focuses on the circularity of bio-based materials and the valorisation of biomass, might produce (low toxicity and circular) bio-based chemicals and materials solutions for the construction sector. It will also have a strong regional dimension, using regionally available and sustainable resources.
- Under Cluster 5 "Climate, Energy and Mobility", the **Built4People** co-programmed partnership[138] will drive innovation across the entire value chain for delivering a sustainable built environment. It has a particular 'people centric' approach, addressing end users and occupants of buildings, and will work with innovation clusters in every Member State.
- The **Mission on climate neutral and smart cities**[139] is to yield 100 climate-neutral and smart cities by 2030 and ensure that these cities act as a catalyst for all European cities to follow suit by 2050.
- Selected topics across Horizon Europe have been specifically earmarked for their relevance to the **New European Bauhaus** and the **Affordable Housing Initiative**.

To maximise synergies between different R&I efforts and make them useful for industrial transitions, the **European Research Area (ERA)** common **industrial technology roadmaps** launched in 2020 in the New ERA Strategy will align and link key partnerships under Horizon Europe with 3 key industrial ecosystems, including construction. They will provide comprehensive evidence on European R&I development for

[136] Horizon EUROPE & Horizon 2020 | EU Funding Overview
[137] Circular cities and regions initiative | European Commission (europa.eu)
[138] https://ec.europa.eu/info/research-and-innovation/funding/funding-opportunities/funding-programmes-and-open-calls/horizon-europe/european-partnerships-horizon-europe_en
[139] https://ec.europa.eu/info/research-and-innovation/funding/funding-opportunities/funding-programmes-and-open-calls/horizon-europe/missions-horizon-europe/climate-neutral-and-smart-cities_en

breakthrough low-carbon technologies from basic research to deployment and point to strengths and weaknesses in investment agendas and framework conditions at EU and national level.

Questions to stakeholders:

- What are the unmet needs to enable R&I from basic research to deployment in order to achieve the twin transition of the construction ecosystem?
- Are there barriers to technology transfer from research institutions to industry and particularly to SMEs? Which are they?

3.4. Other emerging topics

Together with the mapping and the proposals described above, the definition of the future of the ecosystem requires us to consider emerging challenges, whether they are linked to the pandemic or not.

Presence of asbestos in buildings

One of the challenges for the construction ecosystem is the presence of asbestos in buildings. Exposure to asbestos can cause cancer and other health problems. Although manufacturing, placing on the market and use of asbestos have been banned in the EU since 1 January 2005, products in use before the ban can remain in use until the end of their life. As asbestos-based products were widely used in buildings in the 20th century, asbestos can still be found in buildings.

The **risk of exposure** is mostly related to the handling of asbestos containing materials and dispersion of asbestos fibers during renovation, refurbishment and demolition works. The Directive 2009/148/EC foresees that such works may only be carried out by undertakings that are familiar with all the precautions to be taken in order to protect workers and lays down the minimum requirements, including exposure limit value for airborne concentration of asbestos, which have to be transposed and implemented by Member states. The Commission has already committed to lowering the exposure limit, following the latest scientific evidence[140]. A key point is also the availability of inventories of asbestos presence in buildings. Such information can be provided through digital repositories, like digital building logbooks.

Rising energy prices

The increasing energy prices, rising particularly in the last year of the pandemic, have a social impact (such as energy poverty) and affect the demand for building renovation. In this context the support of the Social Climate Fund[141] and the new European Social Fund (ESF+)[142] , is important. Additionally, they have an indirect effect on the construction sector, as it is linked to the increased cost of some building materials, especially metal products, bricks, concrete and cement which are heavy users of natural gas. This increase will add even more pressure to already low margins and could lead to new supply chain disruptions if suppliers are forced to reduce production.

The European Commission published a Communication on Energy Prices[143] with immediate measures to protect consumers and businesses and medium-term measures for a decarbonised and resilient energy

[140] Additionally, DG JRC is working on identifying and mapping regions across the EU with buildings at higher risk of having asbestos based on the period of construction and asbestos consumption data (in buildings).
[141] Social Climate Fund (europa.eu)
[142] ESF news - Commission welcomes political agreement on the ESF+ (europa.eu)
[143] Commission Communication on Energy Prices (europa.eu)

system. One of the measures in the longer term is a greater investment in smarter energy systems for buildings to increase EU's energy independence from fossil fuels.

Changing living conditions

The widespread use of **remote working** has already brough a shift in people's priorities related to living conditions. Citizens have been increasingly valorizing access to green spaces or living space of improved quality at affordable prices that can be more easily found outside urban centers.

At the same time the pandemic revealed or worsened challenges that precariat workers (often including construction workers) and low-income families (such as energy poverty or household crowding) face. It remains to be seen how these different phenomena will specifically affect the construction ecosystem, and how the construction ecosystem will have to react to societal challenges.

The New European Bauhaus apart from exploring new ways of living, it also reaches and supports "forgotten citizens" (the ones who would need more help). [144]

4. Key performance indicators

To monitor progress of the construction ecosystem towards resilience and the twin transition, the following key performance indicators are relevant. These partially overlap with the key performance indicators (KPIs) identified in the 2021 Annual Single Market Report that are monitored on an annual basis:

General KPI's can usually be sourced from Eurostat. They are available for the different sub-sectors of the construction ecosystem, notably 'construction', 'manufacture of furniture' and the services 'architectural activities' and 'engineering activities and related technical consultancy'. Most of these general indicators are available for different size classes (or at least separately for SMEs). These include:

- Value added.
- Number of enterprises.
- Production in construction (for Buildings and Civil Engineering)
- Apparent labour productivity.
- Building activity development.
- Number of jobs in construction, by skill level.

Several KPI's concern the construction sector (NACE sector 'F') and allow the monitoring of the **ecosystem's resilience**:

- Confidence indicator.
- Job vacancies.
- R&D personnel and researchers in business enterprise.
- Investment.
- Factors limiting building activity (Insufficient demand, weather conditions, shortage of labour, Shortage of material and/or equipment, financial constraints)
- The main skills targeted by CVT courses (IT skills, Management skills, Foreign language skills, Technical skills, Communication skills)
- Construction cost for new residential buildings

[144] NEB Communication chapter 3.3.3: *Prioritising the places and people that need it the most* New European Bauhaus Communication (europa.eu)

Within the KPI's on the **green transition**, it is necessary to distinguish between KPI's concerning construction activities, and KPI's concerning the performance of the building stock. The EU Building Stock Observatory[145] collects data on the building stock, energy consumption, building elements and technical building systems installed, energy performance certificates, nearly zero-energy buildings and renovation rates, but also areas like energy poverty and financing aspects.

On construction activities, KPIs for the green transition include the following:

- Emissions of greenhouse gases by the construction ecosystem (including CO_2 and CO_2-equivalents of other gases)
- Pollutant emissions (including SOx, particulate matter (PM2.5 and PM10), and nitrogen oxides (NOx)
- Carbon intensity (GHG emissions/value added)
- Recovery rate of construction and demolition waste (Eurostat CEI_WM040)
- Generation of waste, by waste category, hazardousness and NACE Rev. 2 activity (Eurostat ENV_WASGEN)
- Share of procurement contracts that make use of green public procurement[146]

Indicators from the Building Stock Observatory (BSO) include:

- Building stock by construction age
- Building shell performance (U-values)
- Number of nearly zero-energy buildings (NZEB)
- Distribution of energy performance of the building stock (residential and non-residential)
    - Energy consumption per dwelling / building and per m²
    - EPC ratings of buildings across the building stock
- (Deep) renovation rate of EU Member States and at overall EU level for residential and non-residential buildings

The implementation of the 'Smart Readiness Indicator' (SRI) could make available more data on the needs and comfort of building occupants.[147]

Eurostat provides a few KPIs on the **digitalisation** of the construction sector. They usually only apply to the (narrow) construction sector (NACE-sector F). These include:

- Enterprises that employ ICT specialists[148].
- Enterprises providing training to develop ICT skills of personnel[149].
- Share of people working in construction with basic digital skills.

Many figures and parameters have been gathered in the past based on (ECSO) surveys[150], and should be tracked persistently to monitor the evolution of digitalisation in the construction sector:

- Share of SMEs that reach at least a basic level of digital maturity.
- Investments in digitalisation in the construction ecosystem.
- Increase (%) of data collection and use in the construction ecosystem.
- Number of data sharing arrangements in and across the construction ecosystem.
- Use of BIM in public tenders.

[145] https://ec.europa.eu/energy/topics/energy-efficiency/energy-efficient-buildings/eu-bso_en
[146] https://ec.europa.eu/environment/gpp/index_en.htm
[147] https://ec.europa.eu/energy/topics/energy-efficiency/energy-efficient-buildings/smart-readiness-indicator/sri-explained_en
[148] based on the ICT enterprise survey
[149] idem
[150] For example: "Digitalisation in the construction sector", analytical report by ECSO, April 2021

- Digitalisation of building permit system.
- Observed relevance of EU policies and Programmes to foster the digitalisation of the construction sector.

Other institutions are gathering interesting and important indicators although they do not aggregate always at EU level.

- Decarbonisation index trend for buildings and construction (UN Environmental Programme).
- Global buildings sector energy consumption by fuel type, with scenarios towards 2060 (International Energy Agency and OECD).
- Energy use per square meter (International Energy Agency and OECD).
- Emissions of greenhouse gases by the existing building stock during use phase (European Energy Agency)[151].

It is important to note the role of the Level(s) framework[152], which currently cannot serve measuring the progress of the ecosystem, which provides 16 indicators to measure the sustainability of individual buildings. This set of indicators can serve the further development of the above-mentioned data collection tools. On another area, as part of the European Pillar of Social Rights action plan, the Commission proposed a new indicator on fatal accidents at work that is relevant on occupational health and safety in construction.

Questions to stakeholders:

- Is the list of KPIs above comprehensive enough? What additional KPIs would be necessary?
- What other data could Member States, local authorities and industry provide?

5. Stakeholder consultation and co-creation

Stakeholders were invited to contribute to the creation of this mapping and scenarios. To achieve and operationalise this participatory process, the High Level Construction Forum (HLCF) was activated, an initiative which has evolved from the earlier Construction 2020 Strategy[153]. Based on the updated EU Industrial Strategy (May 2021), the HLCF was consulted and the input fed into this Staff Working Document (SWD). Later, following this SWD, the HLCF will co-create the green, digital and resilient transition pathway for the EU construction ecosystem.

The first meeting of the HLCF was held on 28 September 2021[154], bringing together approximately 250 stakeholders from industry, public authorities, social partners and other relevant stakeholders. During the meeting, stakeholders introduced their visions for a green, digital and resilient construction ecosystem, and discussed challenges as well as key aspects to be considered for the development of targets and actions. Introductory statements from Commission services, industrial representatives, national authorities were complemented by discussions, surveys and polls (Annex I). In parallel, informal consultations with the participation of 9 Commission DGs[155] were conducted before the formal Interservice Consultation on this document was launched.

[151] https://www.eea.europa.eu/data-and-maps/indicators/#c0=30&c12-operator=or&b_start=0
[152] HYPERLINK "https://ec.europa.eu/environment/levels_en"https://ec.europa.eu/environment/levels_en
[153] EUR-Lex - 52012DC0433 - EN - EUR-Lex (europa.eu)
[154]Short meeting report https://webgate.ec.europa.eu/fpfis/wikis/display/industrialforum/2021/10/01/Construction+ecosystem%3A+High+Level+Construction+Forum+report
[155] GROW, CLIMA, ENER, ENV, JRC, RTD, CNECT, SG, EMPL

To go into depth on the specific challenges, opportunities and necessary actions for the green, digital and resilient transition, stakeholders were invited to take part actively (acting as rapporteurs, facilitators and participants) in three cluster group meetings on resilience, green and digital that took place on 19, 20 and 22 October 2021.

Main conclusions of these meetings and the overall consultations are annexed in this document and published on the dedicated webpage of DG GROW[156].

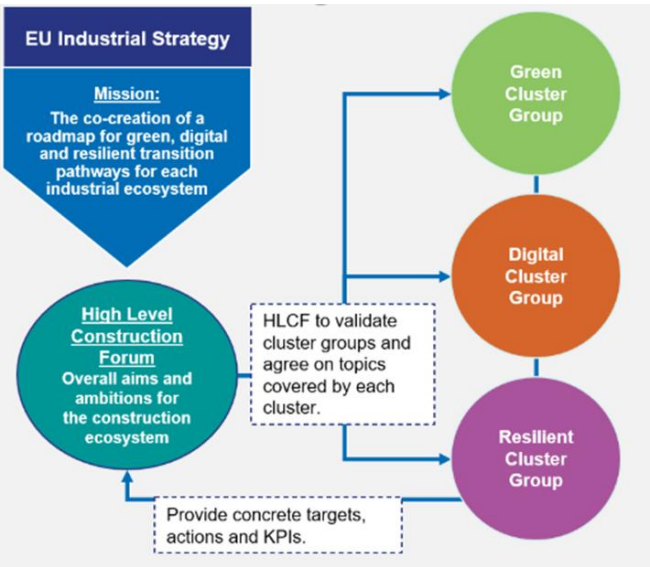

Figure 9: The role of the High Level Construction Forum and its cluster group meetings for the creation of the transition pathway.

6. Conclusions

This paper is proposing scenarios of how the recovery from the COVID-19 crisis could lead to a greener, digital and more resilient construction ecosystem. To reach the vision for 2030, several actions need to be undertaken, and different stakeholders should work together. This paper invites the entire ecosystem to collaborate and propose concrete actions, commitments and investments that could be implemented at industrial, local, national and European level. Interested partners beyond the stakeholders already engaged in the process are invited and welcome to participate in future work.

Concrete responses, proposals and commitments will be collected through online consultation that will run till February 2022. Those will be discussed in relevant fora such as the High Level Construction Forum and the Industry Days.

In the context of the recovery from the COVID-19 pandemic, and the general policy framework, this Staff Working Document describes initiatives, legislation, instruments and other enablers contributing to a resilient, green and digital construction ecosystem. The transformation can only take place when different stakeholders collaborate. With both the support of the public sector and initiative from the industry, small, medium size and large players, are invited to find common ground and lead the transition by proposing concrete actions, commitments and investments that will complement policy actions designed by the Commission.

[156] 2021 - Industrial Forum - EC Extranet Wiki (europa.eu)

In the perspective of 2030, together with commitment to actions, stakeholders should also contribute to the assessment of scale, cost, long-term benefits and conditions of the required actions. Key issues and questions were discussed during the High Level Construction Forum and cluster group meetings. An online consultation and follow-up meetings for the collection of pledges and proposals will follow in 2022.

ANNEX I: Stakeholder consultation during the 1st High Level Construction Forum and thematic Cluster group meetings

Around 250 construction stakeholders were consulted through the meeting of the High Level Construction Forum[157] and thematic cluster group meetings on digital[158], green[159] and resilience[160] that took place in October 2021. Each thematic cluster group meeting was attended by 80-90 stakeholders. The meetings included approximately 40 speakers and session facilitators. The discussions are summarized in the meeting reports.

During the meetings, stakeholders were also asked to respond through discussions and use of digital tools to the following questions:

High Level Construction Forum Meeting on 28.09.2021

- Considering the **vision** for a green, digital and resilient construction ecosystem, what are the challenges ahead and what should be our **priorities** in overcoming them?
- Which do you think is the most **pressing challenge** the construction ecosystem is currently facing?
- What type of **targets** should a transition pathway for to the construction ecosystem include?
- What are the key existing EU, national or sectoral **instruments** and actions contributing towards achieving these targets for the construction ecosystem?
- Considering the EU's ambitious green, digital and resilient targets, what **supportive horizontal measures** are needed to ensure that the construction ecosystem can effectively contribute towards achieving the transition targets?
- Considering the vision for a green/ digital/ resilient construction ecosystem, what are the challenges ahead and what should be our priorities in overcoming them?
- How do the green, digital and resilience targets relate to construction, how can construction contribute to Europe's green and digital ambitions?
- What is the role of the EU, industry, Member States and local authorities in following up on these actions?
- Considering the potential disruption by the twin transition, what measures are needed to ensure the future resilience of the construction ecosystem?
- What do you see as the **primary areas of interest** for the green/digital/resilient cluster group to advance the transition of the construction ecosystem? How can you contribute to these?
- Considering the key topics identified by stakeholders, what do you see as the primary areas of interest for the green/digital/resilient cluster group to advance the transition of the construction ecosystem? How can you contribute to these?

Digital cluster group meeting on 19.10.2021

Supporting frameworks for digital technologies

- What is the role of public procurement?
- What is the private sector's perspective in digitalisation of procurement and digital building permit systems?

Data governance and digital platforms

- What are the challenges, ambitions and actions for platforms and data spaces in construction?
- How can the open data directive, data governance act and data act contribute?
- What are the major concerns and constraints on the promotion and creation of a construction data space?
- What are the priority use cases to address through digital platforms? (Poll question)

[157] Construction ecosystem: High Level Construction Forum report - Industrial Forum - EC Extranet Wiki (europa.eu)
[158] 1st Digital Cluster Group. Towards a transition pathway for the construtions ecosystem.pdf - Industrial Forum - EC Extranet Wiki (europa.eu)
[159] 1st Green Cluster Group meeting report. Towards a transition pathway for the construtions ecosystem.pdf - Industrial Forum - EC Extranet Wiki (europa.eu)
[160] 1st Resilience Cluster Group. Towards a transition pathway for the construtions ecosystem.pdf - Industrial Forum - EC Extranet Wiki (europa.eu)

Digitalisation of SMEs

- What are the drivers and opportunities?
- What role can the private sector and notably large companies can play?
- What re the necessary measures to be taken by EU and national level policy makers?
- How can we incentivise/persuade SMEs to invest in digital?

Green cluster group meeting on 22.10.2021

Reducing whole-life-carbon emissions

- Several Member States are developing policies in this area. Are there any new developments?
- Have industry bodies signed up to any targets? Are industry bodies involved in preparing roadmaps, or do they envisage doing so?
- Is the industry ready for mandatory measures, like mandatory Life Cycle Analysis (LCA) requirements and carbon limit values? What might need to be done to prepare for these?
- What is the likely extra workload to carry out a Whole Life Carbon (WLC) assessment - for designers, builders and administrators?

Enhancing facilities for circularity and secondary raw material markets

- Coordination at local/regional levels is an important enabler for the effective establishment and use of Construction and Demolition Waste infrastructure - are there commitments to improve collaboration?
- Who is making use of the possibilities for resource efficient operations (e.g., industrial lines for re-use, prefabrication)?
- With regards to the need for material data, how many construction products have produced Environmental Product Declarations (EPDs)? Are there targets for more EPDs? What commitments are there to set up or expand databases?

Increasing the service life of built assets

- Durability and maintenance - are there targets set by industry or Member States?
- Adaptability and flexible reuse of built space - is this something that can be committed to by industry or policymakers?
- Design for future deconstruction and end-of-life - can targets be set for this? Does industry need to invest?

Enabling carbon storage and nature-based solutions

- Are Member States acting on this?
- Are building designers addressing this? Should they?
- Do any certification schemes or standards address this?

Resilient cluster group meeting on 20.10.2021

Providing the labour force with the right skills

- What are the key challenges in upskilling/reskilling the workforce?
- Can you help us identify existing EU/national/ sectoral initiatives?
- What actions need to be taken in this area to develop a transition pathway?

Enhancing climate resilience and adaptation

- What are the key challenges?
- Can you help us identify existing initiatives?
- What actions need to be taken in this area to develop a transition pathway?

Building a resilient construction industry

- What are the key challenges?
- Can you help us identify existing initiatives?
- What actions need to be taken in this area to develop a transition pathway?

The following organisations were represented in the consultation through the HLCF and cluster group meetings:

3M	FleishmanHillard,
AIA Eur	FPS health,
ANAEPA Confartigianato Edilizia	Fraunhofer ISI (DE),
Ance	Glowny Urzad Nadzoru Budowlanego -The Gener-al Office of Building Control (PL),
APMCR	Government Offices of Sweden,
ArcelorMittal	Green Spots,
Architects' Council of Europe (ACE)	GROW.H4,
Architektenkammer Baden-Württemberg	Grupo Casais,
ASTM International	HaDEA,
ATIC	HeidelbergCement,
Austrian Institute of Construction Engineering (OIB)	Holcim Romania,
Autodesk	Honeywell ,
AVITECH CO	ILNAS-Market Surveillance Authority (LU),
BAT-KARTELLET	Industrieverband Kunststoffbahnen (IVK Europe e.V.),
BBRI	Institute for Human Rights and Business,
BDM (BE)	Instytut Techniki Budowlanej (PL),
BIBM - Federation of the European Precast Concrete industry	ISG GmbH,
BIM Design Hub	ISG Ltd (DE),
BImA (Institute for Federal Reals Estate - BE)	ITAINNOVA,
Bimmetry	ITeC (ES),
BMK	Kadaster (The Netherlands' Cadastre, Land Registry and Mapping Agency),
Bouwend Nederland	Karuk"Asher Ltd InoV-A-SioN,
BOUWgen	Komatsu Europe NV,
BOUYGUES Europe	Le Forem (BE),
Boverket	Living Future Europe,
BPIE	Majandus- ja kommunikatsiooniministeerium,
Brick Association of Czechia and Moravia	METALS FOR BUILDINGS,
Build Europe	Ministry for Ecological transition (FR),
Building information foundation RTS	Ministry of Housing (FR),
Buildings21	Ministry for Infrastructure (MT),
buildingSMART International	Ministry for Innovation and Technology (HU),
Bundesarchitektenkammer BAK	Ministry for the Ecological Transition and Demografic Challenge (ES),
CADWARE Engineering	Ministry of Business and Trade (CZ),
CAREL Industries SpA	Ministry of Ecological Transition (FR),
CASAIS Engenharia e Construção (PT)	Ministry of Economic Affairs and Communications (EE),
CECE	Ministry of Economic Development and Industry (PL),
CEI-Bois	Ministry of Economic Development and Technology (PL),
CEMBUREAU	Ministry of Economic Development and Technology (PL),
CEN/TC442 (NO)	Ministry of Economic Development and Technology (SL),
Centro tecnológico de la Construcción de la Región de Murcia (ES)	Ministry of Energy and Spatial Planning (FR),
Cerame-Unie	Ministry of Environment (LT),
CINEA	Ministry of environment CZ (CZ),
COBATY International	Ministry of Finance (SE),
Cobuilder	Ministry of Industry (ES),
Concular (DE)	Ministry of Industry and Trade (CZ),
Confartigianato Imprese	Ministry of Industry and Trade of the Czech Republic (CZ),
Confederación Nacional de la Construcción (CNC)	
Construction Products Europe AISBL	
CSTB - Centre Scientifique et Technique du Bâtiment (FR)	
Czech Office for Standards, Metrology and Testing	

Danfoss	Ministry of Regional Development and Public Works (BG),
Danish Housing and Planning Authority	Ministry of Regional Development and Public Works (BG),
DBC (DE)	Ministry of the Environment (FI),
Delft University of Technology	Ministry of Interior and Kingdom Relations (NL),
Deutsche Bauchemie	Ministry of Regional Development and Public Works (BG),
DEYA TYRNAVOU	Ministry of Transport and Construction (SK),
DG CNECT	Ministry of Transport and Construction of the Slovak Republic (SK),
DG ENV	MoE CZ (CZ),
DG GROW	MPO (CZ),
DG MOVE	MRPiT (BE),
Digital Findet Stadt GmbH	MRPiT (Ministry of Development and Technology Poland) (PL),
EBC	Nadace pro rozvoj architektury a stavitelství (CZ),
EC/JRC	National Technical University of Athens (EL),
ECAP	NBN & Owens Corning,
ECCE - European Council of Civil Engineers	NBN Owens Corning,
ECOS (BE)	NBN Owens Corning,
ECSPA - European Calcium Silicate Producers Association	NEW EUROPE CONSULTING SRL,
ECSPA - European Calcium Silicate Producers Association	Oficemen,
ECTP	OIB (European Commission),
EFBWW	Permanent Representation of Croatia to the EU,
EFCA	Permanent Representation of Germany to the EU,
EISMEA	Permanent Representation of Romania to the EU,
EIT InnoEnergy	PlasticsEurope,
EMO	PU Europe,
Environmental Coalition on Standards (ECOS)	PwC,
EPEE	R&D INSTITUTE ICMET CRAIOVA,
Ermco	RAECOM Oy,
Estonian Ministry of Economic Affairs and Communications	Research & Planning Unit, Public Works Dept., Ministry for Infrastructure, Malta.,
ESWA	Research and Planning Unit, Public Works Dept., Ministry for Infrastructure (MT),
EU-Consulting Ulrich Paetzold	RetroKit Ltd,
EUEW - European Union of Electrical Wholesalers	RICS,
EUMEPS	Rina Consulting S.p.A.,
EUPAVE	Rina Consulting S.p.A.,
EuPC	Royal Institution of Chartered Surveyors,
EURIMA	Service public de Wallonie (BE),
EuroACE & Renovate Europe Campaign	Siemens,
EUROLUX (European Group for Rooflights and Smoke Ventilation)	SIS SA,
European Aggregates Association (UEPG)	Sixense Group,
European Aluminium	Slovak Craft Industry Federation,
European Asphalt Pavement Association (EAPA)	Sluamor Ltd,
European Association for External Thermal Insulation Composite Systems (ETICS)	Small Enterprises' Institute (IME GSEVEE),
European Builders Confederation	SMEunited,
European Calcium Silicate Producers Association (ECSPA)	Soprema srl,
European Cellulose Insulation Association	Spanish Association for Standardisation (UNE),
European Committee of Heating, Ventilation, Air Conditioning and Refrigeration Manufacturers (Eurovent)	SPW,
European Consortium of Anchors Producers	Sto SE & Co. KGaA,
European Construction Industry Federation	Stora Enso (ES),
European Copper Institute	Sunthalpy (SE),
	Svenskt Trä (SE),

European Council of Civil Engineers (ECCE) European Environmental Bureau European Federation for Construction Chemicals (EFCC) European Federation of Building and Woodworkers European Floorcoverings Association (Eufca) European Forest Institute European General Galvanizers Association European Panel Federation European Parliament European Steel Association (EUROFER) Eurovent EUSPA Federal Ministry of Internal (DE) Federal Ministry of the Interior, Building and Community (DE) Federal Office for Buildings and Logistics (CH) Federal Office for Constructions and Logisitics Federation of the Finnish Woodworking Industries FEICA FEP FFB FIEC - European Construction Industry Federation Finnish Association of Construction Product Industries FIPEC FIR Fire Safe Europe	Swedish National Board of Housing, Building and Planning, Tata Steel, Technical Chamber of Greece, Tecnosumit North-East, TEICOS, Teicos UE Srl (IT), The European Steel Association (EUROFER), The Ministry of Environment of the Republic of Lithuania, The Permanent Representation of Denmark to the EU, TNO, UEPG - the European Aggregates Association, UIPI, Ulrich Paetzold EU-Consulting, UNI ente italiano di normazione, UniBs, Uniep, Università degli Studi di Brescia, University of La Laguna (ES), Vastuu Group, VELUX, Viessmann, VOEB, World Green Building Council, Xtralsi UK Ltd, ZDB - Zentralverband des deutschen Baugewerbes, ZDB German Construction Confederation, ZVEI - Zentralverband Elektrotechnik- und Elektronikindustrie e.V.,