Market potential of offsite construction for housing supply

Report

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Summary

The adoption of offsite construction in the EU is gradually increasing, particularly in Northern and Western countries such as the Netherlands, Germany, Ireland, France, Austria and the Nordics. However, conventional onsite construction still dominates in the EU. Recently, in the context of a housing crisis, EU governments, including Germany, announced incentives for offsite construction to accelerate the provision of affordable housing.

This study aims to inform future initiatives of the European Commission that could support affordable housing through offsite construction. An extensive EU-wide consultation was conducted based on a High-Level Construction Forum research note.[1] Experiences from 231 construction practitioners (architects, engineers, contractors and offsite construction manufacturers) were collected and analysed through a survey followed by targeted focus group discussions. Enriched through additional desk research, the findings provide information and data on critical challenges, good practices and actionable recommendations.

The report finds that offsite construction has higher adoption rates in commercial and infrastructure projects, while it remains limited in housing. When it comes to housing, higher demand is observed for social and student housing, that belong basically to lower cost residential construction. Across the EU, the demand is perceived as moderate to low, except for Germany, France and the Netherlands, where stakeholders perceive moderate to high demand. Generally, the demand outlook is optimistic, with stakeholders anticipating significant growth over the next five years. This growth expectation is driven by the benefits offsite offers, including reduced construction times and cost efficiency. Additionally, the increasing focus on sustainability and the reduction of construction waste are key factors driving adoption. Technological innovation plays a crucial role in this growth, with the integration of digital tools, automation technologies, and new materials enhancing production efficiency, quality control, and traceability.

Investment in technologies is essential for the broader adoption of offsite. Countries with higher overall development in offsite construction, such as Austria and Germany, exhibit higher levels of technological integration. Emerging technologies like advanced robotics, AI, digital twins, IoT-based real-time monitoring, improved transport and logistics solutions, and advanced materials are expected to drive the next phase of growth in offsite construction.

Several key barriers are slowing the adoption of offsite construction in the EU. These can be categorised into regulatory, supply chain, financial and insurance, and human capital-related barriers:

- Regulatory barriers are significant, with permitting processes and building codes being the most frequently cited issues. Lengthy permitting procedures, inconsistent application and interpretation of fragmented building codes often hinder the adoption of offsite practices and construction overall. Public procurement processes that are prescriptive to onsite construction and its financing patterns can end up preventing the use of offsite construction.
- The main supply chain barriers to offsite construction are the lack of standardisation, logistical challenges, especially in urban centres and transportation costs, and the limited availability of components.
- Financial barriers include high initial investment costs, difficulties in securing capital, and low profit margins. The unfamiliarity of insurers with offsite construction processes raises premiums and limits coverage options, making projects appear riskier to financiers.
- Human capital and cultural barriers involve a shortage of skilled workers and slow adaptability to new ways of working. A lack of workers is observed throughout

[1] Technical Secretariat of the High-Level Construction Forum (2024) Research Note on Offsite Construction, available here: https://ec.europa.eu/docsroom/documents/64156.

construction, onsite and offsite, and is also due to the low attractiveness of the sector to younger workers.

To address these barriers, EU, national and local policy makers, as well as the industry, could:

1. Streamline funding for offsite construction for affordable housing through, for example, Cohesion Funds.
2. Boost skills and availability of workers in the construction ecosystem.
3. Support European leadership in standardisation.
4. Accelerate permit issuing and improve transparency of procedures.
5. Enable digital, adaptive and innovation-friendly public procurement

This report presents the above findings in further detail and is structured as follows:

1. The Market Potential of Offsite Construction for Housing Supply: Chapter 1 provides the context for the research questions, including the housing challenges, the opportunities and benefits of offsite construction, and the research approach.
2. Offsite Construction in the EU: In Chapter 2, we present the main findings from the survey on the current status of offsite construction, such as demand and adoption across Member States and emerging technologies.
3. Barriers to the adoption of Offsite Construction: Chapter 3 presents the perceptions across the barriers identified that hinder a wider adoption of offsite construction.
4. Policy recommendations: Finally, in Chapter 4, we present a set of actionable recommendations to address some of the most pervasive challenges.

1. The Market Potential of Offsite Construction for Housing Supply

The affordability, availability, and quality of housing are key challenges across the EU and beyond. Although housing is not a direct EU competence, the ongoing housing crisis has called on European policymakers to support coordination efforts and to unlock public and private investment and drive increased construction productivity. The political guidelines for the 2024-2029 European Commission include the proposal to develop a European Strategy for Housing Construction[2] as part of the European Affordable Housing Plan. Specifically, the Strategy will focus on measures supporting housing supply, reducing building costs, increasing the skills of the labour force, raising productivity, and enhancing the environmental performance of construction.

In the framework of the development and implementation of the European Strategy for Housing Construction, the Directorate-General for Internal Market, Industry, Entrepreneurship and SMEs (DG GROW) is exploring options to help the construction ecosystem improve its productivity and competitiveness and eventually accelerate the delivery of housing. This small-scale study was conducted to look at the current uptake and potential of offsite construction as a possible part of the solution.

1.1. Housing challenges in the EU

The EU faces low housing availability[3] due to several factors such as geographically concentrated demand (urban and economic centres), low provision of new housing, and lack of adequate affordable housing policies. In addition to low housing supply, housing has become significantly more expensive for Europeans during the last decade: Construction production prices rose 54% between 2010 and 2024.[4] The period 2015-2023 marks a significant increase in housing prices by 48%. Mortgage conditions also worsened in the last 5 years, with the average interest rate increasing from 1.3% in January 2022 to 3.8% in April 2024.[5]

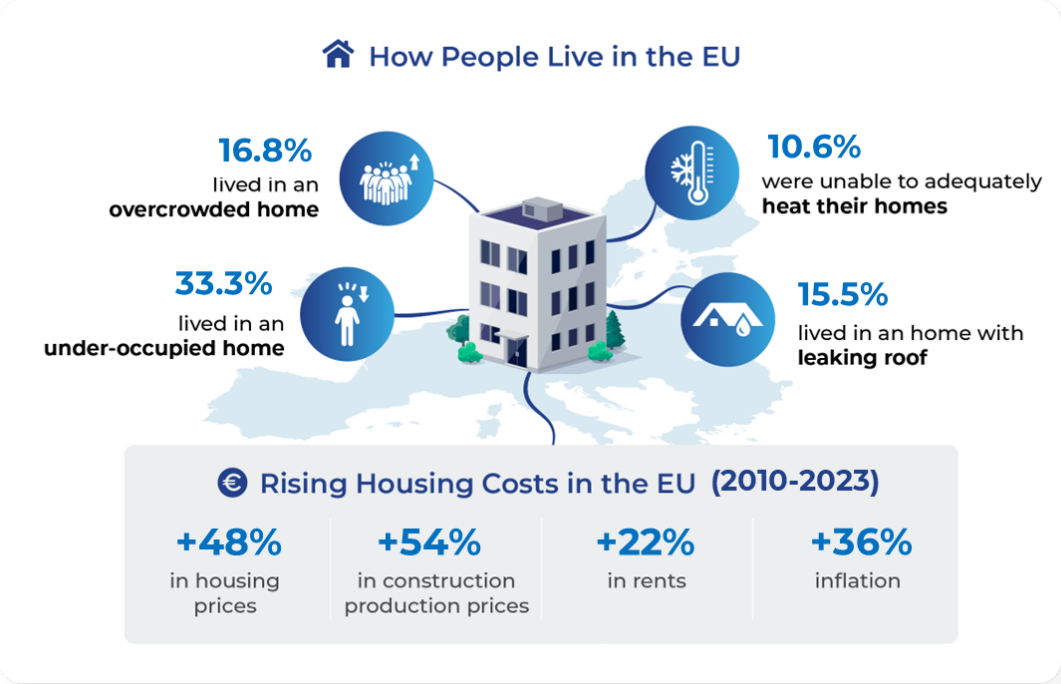
Beyond availability and affordability, the quality of available housing is also concerning. According to the latest available EU-level data (Figure 1):

- 16.8% of the EU population lives in an overcrowded home
- 10.6% cannot keep their house warm
- 15.5% live in a home with a leaking roof.

At the same time, 33.3% of the EU population lives in an underoccupied home, mainly older couples living alone in former multi-member family homes[6]. This significant share of the housing stock is expected to require refurbishments or demolitions and rebuilds in the medium and longer term. This is not only due to it being old, but also because of the important changes in lifestyles and purchase power reduction during the last decades. For example, families have become smaller in EU that faces one of the lowest fertility rates in the world (1.38 children per woman),[7] and the high prices per square meter led people to live in smaller homes. Transforming the existing building stock requires effort and resources, and relevant initiatives can provide a critical part of the solution to the low availability of affordable housing.

[2] Statement at the European Parliament Plenary by President Ursula von der Leyen, candidate for a second mandate 2024-2029. Available here.
[3] European Central Bank (2024). Cost of borrowing for households for house purchase - euro area, Euro area (changing composition), Monthly. Available here.
[4] European Central Bank (2025). Construction output prices – Euro area 20, quarterly. Available here.
Eurostat (2023). Construction producer price and construction cost indices overview. Available here.
[5] European Central Bank (2024). Cost of borrowing for households for house purchase - euro area, Euro area (changing composition), Monthly. Available here.
[6] Eurostat (2023). Housing in Europe – 2023 edition. Available here.
[7] Eurostat (2025). Record drop in children being born in the EU in 2023. Available here.

Figure 1. Housing challenges in the EU



Source: Authors' elaboration. Information from Housing in Europe, European Commission (2023), referring mainly to 2022 data, unless otherwise stated.

High permitting costs, material and worker shortages, unsustainable practices, as well as supply chain issues or errors, add to the above-mentioned challenges. Moreover, the low productivity and environmental impact of common construction practices are a concern among policymakers in multiple sectors, such as employment, growth, and the green transition. For example, the revised EPBD requires the calculation of whole life-cycle carbon for new buildings, that can be very high in the case of common on-site construction practices that rely on (often inefficient use of) materials with high embodied carbon.

To meet housing demand in a sustainable and affordable way, the EU must find solutions without compromising on quality, performance, or environmental objectives.

1.2. Offsite construction: a solution to many challenges

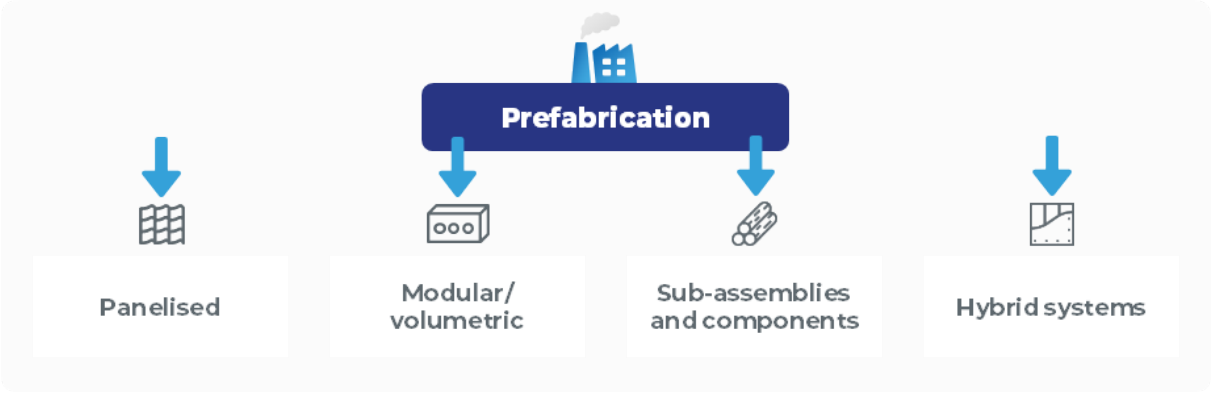
As societal and environmental pressures push for the construction sector to deliver, the approach to building itself is being re-evaluated. Modern Methods of Construction (MMC), as referred to in Ireland and the United Kingdom, aim to improve traditional design and construction processes through component and process standardisation, design for manufacture and assembly, prefabrication, preassembly, offsite manufacturing, and onsite innovations such as 3D printing.[8]

Offsite construction is a specific segment of industrialised construction where components are manufactured in a factory and then assembled on-site. This process of prefabrication includes the manufacture of panellised and volumetric (3D) units or models produced in a factory to be then transported to the construction site (Figure 2).[9] This definition of offsite construction is used throughout this report. Known for streamlining the construction process, offsite methods – including modular and prefabricated approaches – are gaining interest due to their potential to reduce costs, increase productivity, and deliver environmental and social benefits.

[8] CIOB. 2024. Modern methods of construction: barriers and benefits for Irish housing, available at the following https://www.ciob.org/industry/policy-research/MMC-Ireland.
[9] For a more detailed definition, see also: Technical Secretariat of the High Level Construction Forum (2024) Research Note on Offsite Construction.

The transition to new ways of building and cleaner construction, including offsite and prefabricated construction, presents a critical opportunity to improve housing availability, affordability, and inclusivity whilst also improving working conditions. However, unlocking these benefits requires achieving significant economies of scale, which can be supported through measures such as stimulating demand, enhancing standardisation and addressing skills shortages. To enable this transition, policies on procurement, construction permits, and upskilling are needed[10].

Figure 2. Categorisation of prefabrication and its subcategories



Source: Author elaboration. Based on the Technical Secretariat of the High-Level Construction Forum (2024) Research Note on Offsite Construction.

1.3. Benefits of offsite construction

Offsite construction has been found to have various economic, social and sustainability-related benefits.[11] (see Figure 3).

In terms of economic benefits, offsite construction has the potential to lower costs through increased productivity due to manufacturing processes and reduced on-site labour requirements. In addition, it allows for better predictability of costs and respect for the original budget, while traditional construction is known to exceed both planned timing and costs. In Ireland, for example, offsite construction is estimated to improve delivery times by 20% to 60%[12]. Standardised processes may further drive cost savings by enabling economies of scale, although achieving this benefit relies on widespread adoption. Completing the majority of the construction work in a controlled factory environment before assembling it on-site reduces the complexity and can increase quality.[13]

The world's tallest 56-storey prefinished modular concrete condominium was completed in 2023 in Singapore. 80% of the work was done offsite reducing manpower by up to 40%.

(Archdaily 2020) .Copyright: ADDP Architects

Offsite construction can also help improve the environmental performance of construction, being one of the sectors with the highest emissions and waste generated. Offsite construction can also contribute to lower life cycle emissions, easier re-use of materials and reduce air, water and noise pollution.

[10] C40 (2025) Global Policy Report. Building Greener Cities: Green Job Opportunities in Clean Construction. Available here.
ILO (2023) Non-standard forms of employment. Available here.
Ahn, S., Crouch, L., Kim, T. W., & Rameezdeen, R. (2020). Comparison of worker safety risks between onsite and offsite construction methods: A site management perspective. *Journal of construction engineering and management*, *146*(9), 05020010.
[11] Technical Secretariat of the High Level Construction Forum (2024) Research Note on Offsite Construction.
[12] NESC Boosting Ireland's Housing Supply: Modern Methods of Construction Council Report (2024). Available here.
[13] McKinsey Global Institute (2017). Reinventing Construction: A Route To Higher Productivity. Available here.

Finally, offsite construction can bring certain social benefits. Primarily, it offers safer working conditions and less exposure to extreme weather events, potentially attracting more workers to the sector. Moreover, less on-site working time reduces local air and noise pollution and creates fewer disruptions for citizens.

Figure 3. Main benefits of offsite construction

Source: Author elaboration. Based on the Technical Secretariat of the High-Level Construction Forum (2024) Research Note on Offsite Construction.

The benefits of offsite construction are recognised by analysts and the construction ecosystem itself. Yet, smaller companies face challenges in shifting away from traditional construction. International case studies show that the adoption is more widespread in larger companies that can achieve economies of scale.[14]

Offsite construction represents a fundamental shift for the construction industry. Existing construction companies can evolve and transition to new ways of building, yet some are at risk of losing considerable value[15]. In addition, job vacancies could move from the construction site to factory settings, changing employment opportunities and skills requirements in the construction sector.

Over the past decade, offsite construction has steadily increased its share compared to traditional onsite methods in emergency situations (e.g rapid hospital deployment during the COVID-19 pandemic in Italy and the UK) and in major infrastructure projects such as bridges and airports. For decades, offsite constructions methods have also dominated sectors like retail, storage, logistics, and industrial construction. Yet, smaller companies focusing primarily on residential housing continue to face challenges when trying to shift away from traditional (onsite) construction.

Specifically in the EU market, offsite construction continues to have low adoption rates. However, uptake varies greatly between Member States. For example, in Spain, only about 1% of buildings are constructed using industrialised systems, despite the country facing a housing shortage of approximately 600,000 homes,[16] which could create an opportunity for transforming the ways of construction. Conversely, in Sweden, 90% of one and two-family houses are constructed using prefabrication methods, predominantly panelised systems.[17]

1.4. Context of the research

To better understand the low overall adoption of offsite construction in the EU and explore the potential of offsite construction in supporting the increase of housing supply, the European Commission commissioned experts to prepare a preliminary research note on the adoption of

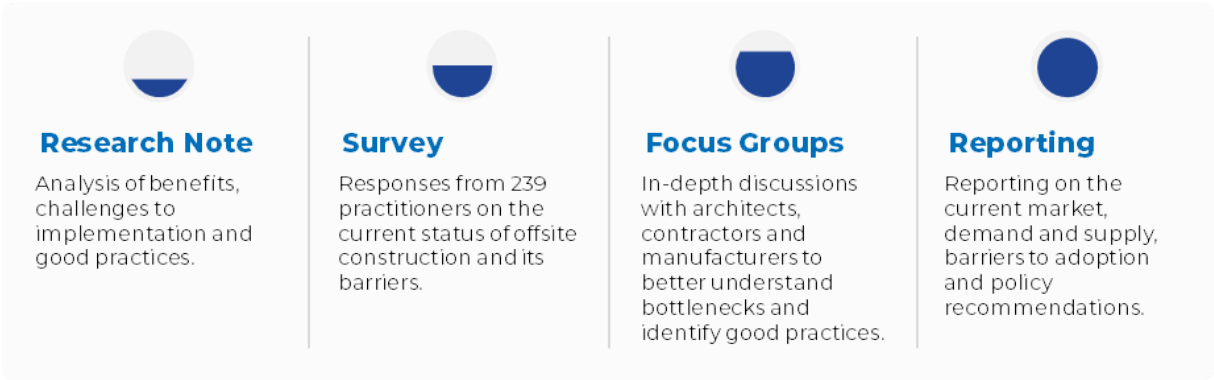
[14] Ibid.
[15] BCG,08.05.2019, The Offsite Revolution in Construction. Available here.
[16] InSpainNews, 14.10.2024, From boom to deficit: Spain's housing crisis deepens as construction slumps.
[17] Built Offsite, 15.11.2024, How Sweden Became The Home Of Prefabrication.

offsite construction in the EU, its main benefits and barriers[18]. The findings of this research were presented to the High-Level Construction Forum that took place on 21 November 2024.[19]

Building on the initial contextualisation of offsite construction in the EU, this research delves further into the identified barriers, including regulatory and policy barriers, a lack of market demand, financial barriers, low client acceptance, a shortage of skilled labour, supply chain issues, and challenges with on-site assembly, and evaluates their impact. Furthermore, as data availability is limited, and prior academic and industrial research focuses on specific countries or frontrunners, this research provides additional data on the current market and its potential in the EU and its Member States.

Specifically, we consulted 231 construction practitioners from the EU[20] (operating also in EFTA countries and the UK) in a dedicated survey on perceived barriers and opportunities for offsite construction. The survey findings were complemented through profound discussions on the details of these barriers, in three focus groups compiled by: Architects and Engineers, ii. Contractors, iii. Suppliers and Manufacturers. Enriched through additional desk research, the findings will provide the European Commission with information and data on critical challenges, good practices and action recommendations (see Figure 4).

Figure 4. Research steps



Source: Own elaboration.

To contextualise the research findings presented below, it is important to consider the geographical distribution of the survey responses (Figure 5).

Most respondents operate in France and Spain, followed by Italy and Germany. While this distribution does not serve as a direct proxy for market activity, it provides essential context regarding the representation of stakeholders and highlights potential biases that may influence the subsequent analyses. Respondents were predominantly suppliers, manufacturers, industry associations, and consultants, with additional representation from designers, contractors, and public administrators (Figure 6). This distribution reflects stronger input from upstream and coordination actors within the construction value chain, which should be considered when interpreting stakeholder perspectives throughout the report.

It is equally important to understand the extent to which offsite construction is currently integrated into stakeholder operations, based on their profile explained above (Figure 7). The study results reveal a moderate to high rate of adoption of offsite construction across respondents. Over half of the respondents reported that offsite construction is a core part of their operations, and 14% stated that they occasionally use offsite construction methods. However, it's important to note that many respondents already have some level of engagement with offsite construction, which may skew results toward higher adoption rates.

[18] Technical Secretariat of the High Level Construction Forum (2024) Research Note on Offsite Construction. Available here.
[19] 21 November 2024, HLCF webinar on industrialised construction methods. See here the webinar report and recording.
[20] Some questions were only raised to a sub-set of respondents. Where this number differs, we provide the 'n'-number directly in the graph.

Figure 5. Geographic distribution of survey respondents - Which is the main country of your operation (and for which you will primarily answer this questionnaire)?

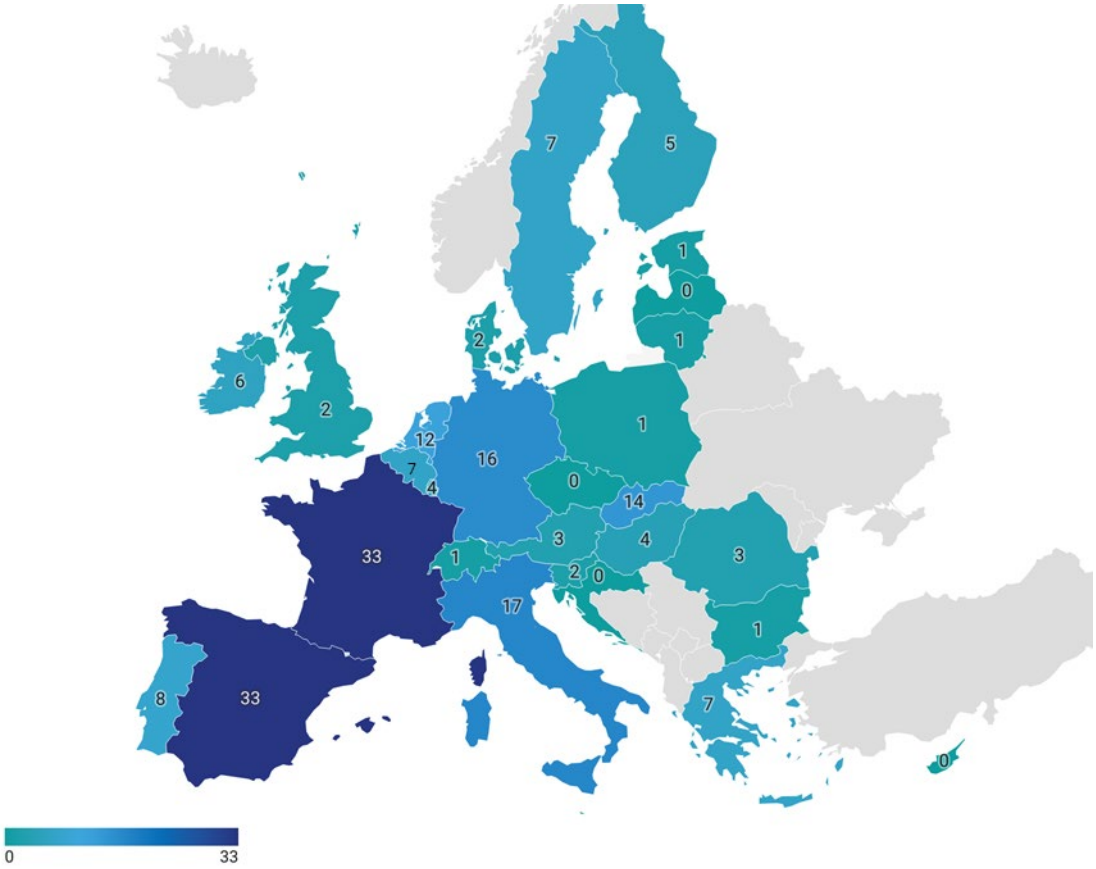


Figure 6. Respondents' role in offsite construction - What is your primary role?

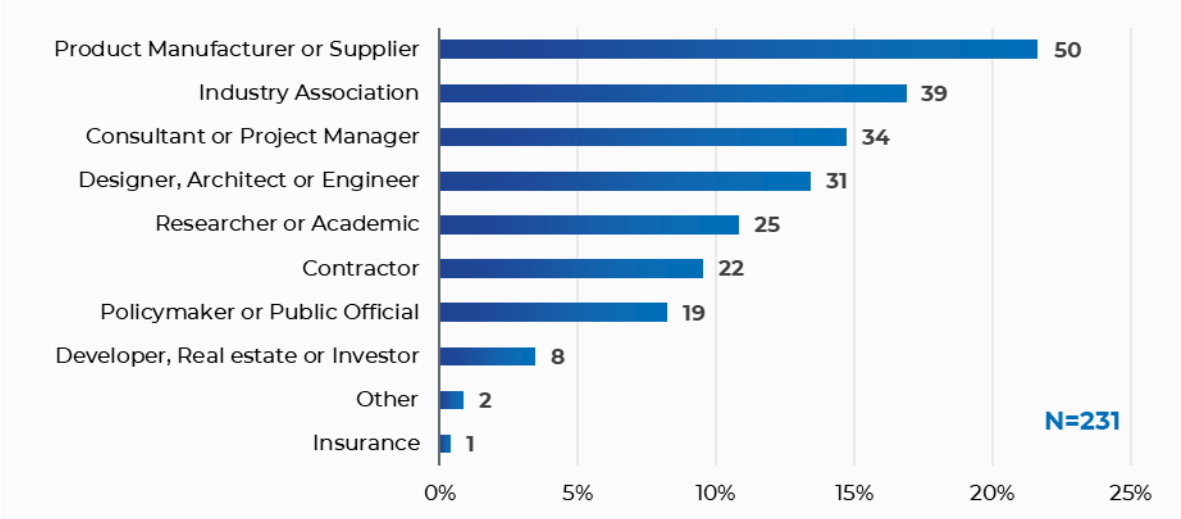
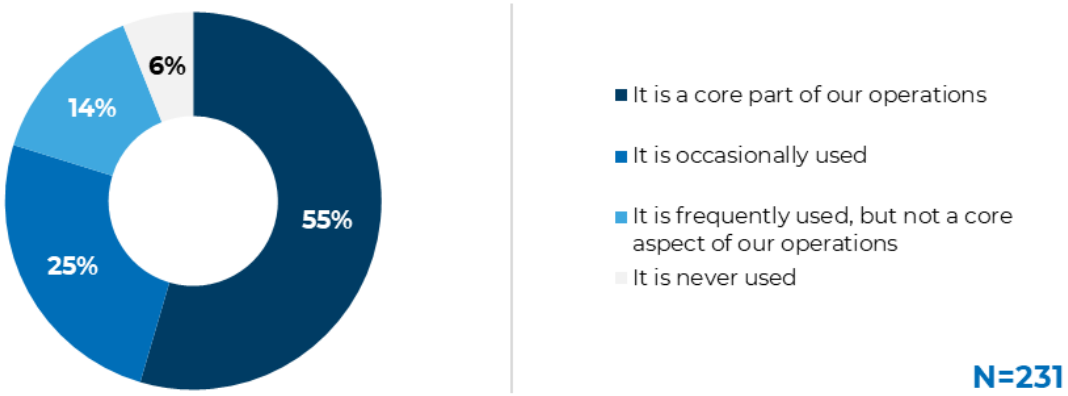


Figure 7. Integration of offsite construction into respondents' work - To what extent is offsite construction integrated into your organisation's work?



In the following chapters, we present our findings on the current market across Member States, showcasing findings from frontrunners and other countries on the adoption and potential of offsite construction, technological developments and customer demand. We then present the main barriers to the adoption of offsite construction and the perception of practitioners regarding them, before presenting good practices from different Member States and based on these, provide our policy recommendations.

2. Offsite Construction in the EU

This chapter presents the findings of the research on the current market for offsite construction in the EU. It examines perceptions of demand and market size, the adoption of technologies and the potential for growth, based on stakeholder insights collected through surveys and focus group discussions.

2.1. The Market for Offsite Construction

Offsite construction has the potential to progressively reshape the European construction market, although adoption rates and demand levels may vary significantly across Member States. This section presents a consolidated view of the current state of demand and adoption across the EU, drawing on stakeholder insights from the research.

Previous research found that offsite construction remains a niche within the overall construction industry, and that it is gradually gaining traction in certain countries, such as Sweden, Finland, Ireland, Germany and, to a lesser extent, the United Kingdom (UK).[21] In countries such as Ireland and the UK, which are facing severe housing shortages, offsite methods emerge as a viable option to quickly build affordable houses. In response, national governments are introducing plans to incentivise offsite as a response to housing shortages.[22]

Nevertheless, across all Member States, conventional onsite construction continues to dominate, as structural barriers – including regulatory constraints, financial hurdles, and supply chain limitations – persist and slow down broader adoption of offsite construction methods.

To better understand the current position of offsite construction within the European market, the following sections examine the underlying demand dynamics in the first place (Section 2.1.1) and then assess the extent and patterns of adoption across Member States (Section 2.1.2).

2.1.1. Demand for Offsite Construction

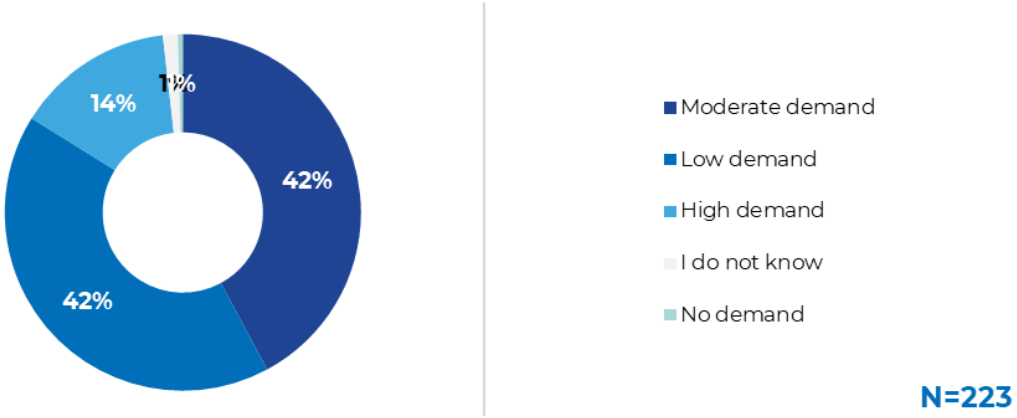
Overall perception of demand

Despite the recognised potential of offsite construction, overall market demand across the EU is perceived as moderate to low (Figure 8). We observe that most respondents who perceive a high demand operate in Germany, followed by those operating in France and the Netherlands. Countries where most respondents perceive a low demand are Italy, Greece, Portugal and Romania. However, responses within countries vary greatly, as for example, in France, 14 respondents perceive low demand, while 12 perceive a moderate demand, and 6 a high demand. Similar in Spain, with 16, 15 and 1 respondents, respectively (see Annex A for the country-specific responses).

Only a limited share of stakeholders reported high demand in their countries of activity. While examples of stronger demand exist, offsite construction is still far from mainstream. Stakeholder insights reveal that the demand profile is highly fragmented, influenced mainly by the project type, but also by client acceptance and broader market conditions.

[21] Technical Secretariat of the High Level Construction Forum (2024) Research Note on Offsite Construction. Available here.
[22] See Report on Boosting Ireland's Housing Supply: Modern Methods of Construction. Accessed by: https://www.nesc.ie/app/uploads/2024/09/166_modern_methods_of_construction.pdf

Figure 8. Perceptions on demand – How do you perceive the demand for offsite construction in the countries of your activity?

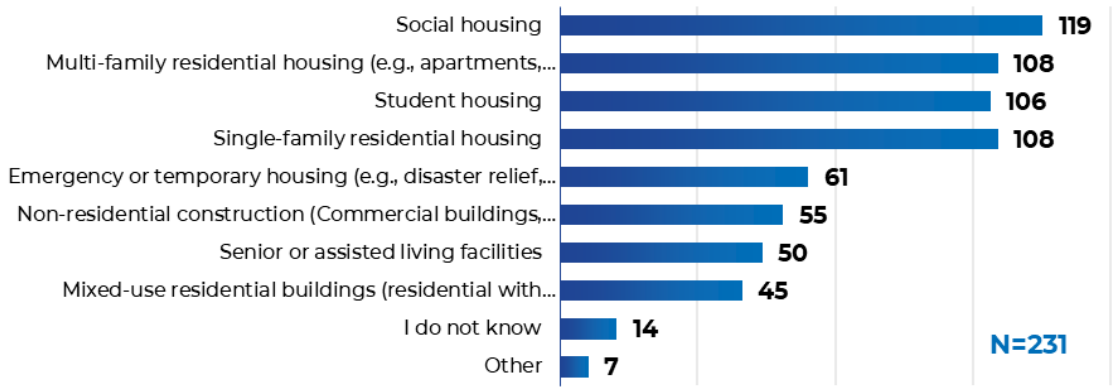


Stakeholders' responses suggest that demand for offsite construction is closely tied to stakeholder confidence in the potential of offsite construction. In countries where offsite construction is well established or supported by government initiatives, such as Ireland and Sweden, the demand tends to be higher. On the other hand, in countries where offsite construction is facing more issues in its adoption, demand tends to remain low. Hence, there is a strong connection between perceived demand and structural issues within the sector, such as lack of financial incentives, insurance, financing and supply chain challenges.

Demand patterns by housing segment

Offsite construction is not equally relevant for every building type, and some housing projects are more suited for offsite than others (Figure 9). Following the survey responses, we find that demand for offsite is perceived as the highest with social housing, multi-family and single-family residential housing, as well as student housing. Emergency or temporary housing, senior living, and mixed-use and non-residential buildings also featured prominently in the survey results.

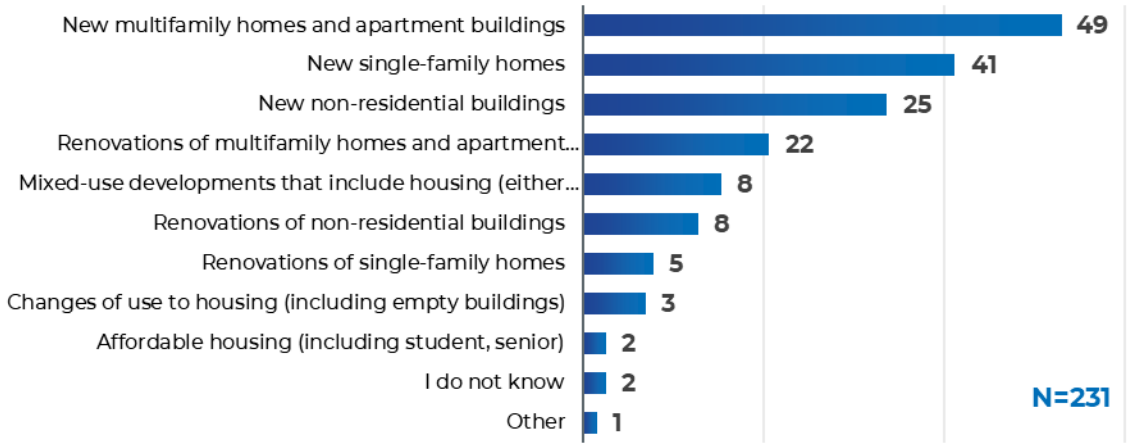
Figure 9. Demand by type of projects – In which types of housing projects is there the highest demand for offsite construction in your country? [Unrestricted multiple choice]



Stakeholders' perceptions of technical and commercial suitability largely mirror the patterns observed in demand. Here, new multi-family homes, single-family homes and apartment buildings are deemed the most suitable (Figure 10). Among renovation projects, multifamily housing and mixed-use developments were rated the highest. Suitability drops for projects involving major renovations, change of use, or bespoke architectural requirements, where standardisation becomes more difficult to achieve. Generally, new non-residential buildings

were deemed highly suitable for offsite construction methods such as educational facilities, hospitals and hotels.

Figure 10. Suitability of housing projects – Which types of housing projects are most suitable for offsite construction? [Unrestricted multiple choice]

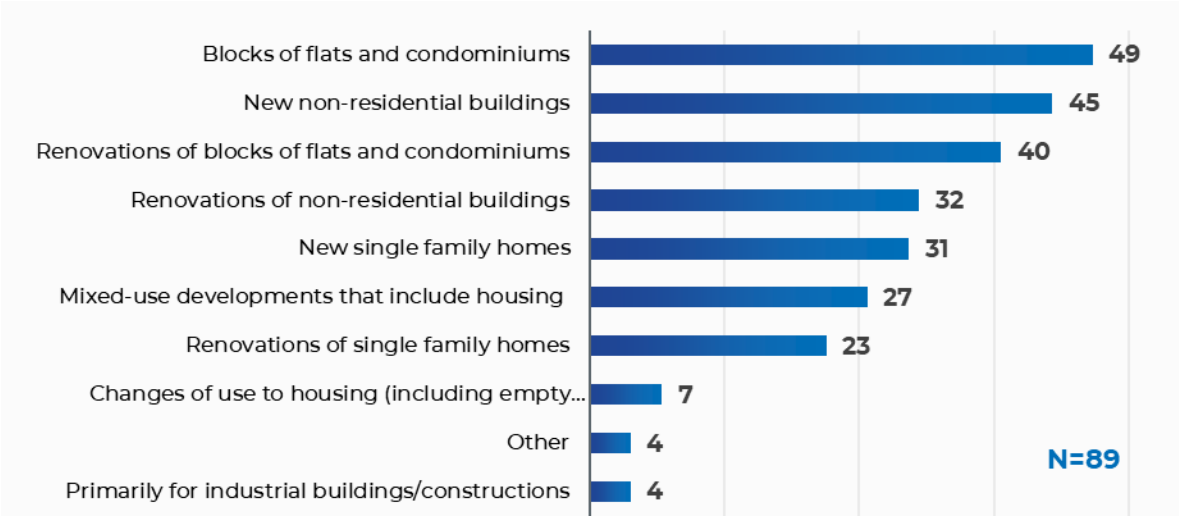


During the focus group discussions, stakeholders correlated the suitability of offsite construction to the client type.[23] Individual buyers may be concerned with traditional notions of durability or require unique designs for their project, excluding offsite as an option. On the other side, the final user does not get a say when it comes to affordable and governmental housing projects. In such cases, the standardisation, repetition and cost-effectiveness of offsite are particularly appreciated.

Finally, when segmenting the housing market into different types of buildings, our survey among practitioners involved in offsite construction found that the adoption of offsite construction is most prevalent in the construction and renovation of blocks of flats and condominiums,[24] followed by new single-family homes and mixed-use developments that include housing. Apart from housing, offsite construction is also prevalent in the construction and renovation of non-residential buildings, which stakeholders indicated as the 2nd and 4th most common types of projects.

[23] Stakeholder opinion from the Focus Group Discussion.
[24] 'New multifamily homes and apartment buildings' is the most selected project type for most respondent types, but not all. It is the top choice for Contractors, Architects/Designers, and Developers. However, Consultants or Project Managers selected "New single-family homes" most frequently, with "New multifamily homes and apartment buildings" coming in second.

Figure 11. Types of projects in which suppliers, manufacturers, contractors, developers, designers, architects and engineers are mainly involved - In what types of projects are you involved? This question applies only to the stakeholder types mentioned above. [Unrestricted multiple choice]



2.1.2. Adoption of Offsite Construction

Earlier research shows that offsite construction is significantly improving its share in countries such as Sweden, Germany, Ireland, France, and the Netherlands, with the United Kingdom being another relevant player with impacts in the EU market.[25] More broadly, Northern and Western European countries appear to be more advanced in terms of market readiness and adoption, while Southern and Eastern Europe (except Poland and Spain) are still in earlier phases of market development and adoption.[26]

The survey respondents confirmed these findings. When asked about the leading European countries for offsite construction, they mentioned the Netherlands, followed by the UK, Germany, Sweden, other Nordic countries, France and Austria. Less frequently, they mentioned Italy, Belgium, Spain and the Baltic States.

Specifically, the reasons for wider adoption can be rooted in weather conditions, building traditions, available material and overall, the culture of each country. As was raised by survey respondents, the following factors favour offsite construction:

- Weather Conditions: According to focus group participants, less favourable conditions to work onsite and outside, as in Northern European countries, make offsite construction more favourable and have led to the increased establishment of offsite construction.
- Available construction materials: Countries producing wood, due to the nature of the material, have a long tradition in prefabrication.
- Widen regulatory frameworks can indirectly incentivise offsite: Governmental initiatives supporting new ways of building, or MMC, as in Ireland[27][28] and the UK or countries

[25] Technical Secretariat of the High-Level Construction Forum (2024) Research Note on Offsite Construction. Available here.
[26] For example, a market study by USP Marketing Consultancy - a market research firm specialised in construction trends - found that Sweden leads in the adoption of offsite with 85% of its newly constructed residential buildings in the recorded year, constructed making use of modular elements. The Netherlands and Belgium followed closely with 47% and 46% of residential buildings, respectively, being constructed offsite. Other countries, such as Poland and Spain, are also advancing in offsite with around 34% adoption rates. See reference in Green Building Advisor, 22.11.2024, The Path Forward for Offsite Construction. Available here
[27] For example, the Irish government recommends early engagement with the Modern Methods of Construction (MMC) Forum during the pre-tender phase. This approach aims to define building specifications that accommodate OSC, facilitating its integration into public housing projects. Ibed – Innovation Increasing supply. How offsite construction can help address the housing crisis.
[28] In Ireland, the Department of Enterprise, Trade and Employment has established an MMC Leadership and Integration Group. This group focuses on promoting OSC through policy development and interdepartmental collaboration, aiming to address challenges in housing, healthcare, and education infrastructure. See https://enterprise.gov.ie/en/what-we-do/innovation-research-development/construction-innovation/

trying to automate their permit system and standardise housing components for the sake of efficiency, like the Netherlands[29] and Germany,[30] incentivise indirectly offsite construction.

- Existing Industrial Base and Technology: Countries adopting offsite often have a well-established industrial base for manufacturing, prefabrication and advanced technology in construction. For example, Germany and Italy were brought up by responders as references in manufacturing, an industrial culture that can be beneficial to offsite construction development.
- Economic Factors: High labour costs in countries like the Netherlands and Germany, in combination with unpredictability of onsite construction times, make offsite construction an attractive alternative due to its efficiency and reduced reliance on on-site work.

Country-specific findings

France

In **France**, offsite construction represents a significant part of the construction industry. 75% of survey respondents operating in the country stated that it is a core part of their operations, which is notably higher than the 55% average. Although figures suggest that the current market size in France is lower than its neighbouring countries (e.g. the Netherlands, Germany, Belgium), there is significant growth potential. French offsite construction was developed later than in its neighbouring countries, but now it is growing in popularity. The turnover of French companies using offsite methods increased by 10% in 2021.[31]

Currently, France focuses on a variety of offsite projects, including the renovation and new builds of blocks of flats and condominiums, single-family homes, new non-residential buildings, and changes of use to housing. Further, new building regulations implemented in 2021 aim at improving the sustainability and reducing GHG emissions from buildings, creating a fertile ground for offsite to further evolve.[32]

The Netherlands and Belgium

Both the **Netherlands** and **Belgium** have substantially increased their adoption of prefabricated components in their construction processes, with about half of projects containing some form of prefabricated elements in January 2024.[33] The types of projects most in demand in the Netherlands include blocks of flats, condominiums, and renovations of non-residential buildings. The housing projects with high demand for offsite are multi-family residential housing, social housing, and non-residential construction.

Spain

In **Spain**, offsite construction is also growing and has seen mixed responses, with some stakeholders stating it is highly underdeveloped and others stating a high percentage of prefabrication.[34] Similar to other Member States, Spain suffers from housing shortages and a lack of affordable housing and is looking at various ways to address this issue. The government's 20,000 Housing Plan aims to increase

[29] For instance, Dutch municipalities have begun piloting 'pre-approved' permitting systems for offsite construction based on functional requirements, while at the national level, the government has proposed introducing quality labels for prefabricated components and forward commitment procurement to stimulate demand and market maturity. From research by Miguel Ortega et al. (2020). Modernizing the Dutch Housing Industry using offsite construction: Removing adoption barriers through innovation policy

[30] In Germany, "Totalunternehmervergaben" (total contractor tenders) mentions the advantages of clear articulation of Unique Selling Propositions (USPs) in ways that directly address the needs of German public authorities, including technical innovations where modular construction is presented as an example of such cutting-edge technologies. Source: https://practiceguides.chambers.com/practice-guides/public-procurement-2025/germany/trends-and-developments.

[31] French Planning and Architectural services (2023) Modern Methods Of Construction - The growing use of Modern Methods of Construction. Available here.

[32] Ibid.

[33] USP Marketing Consultancy, 12.01.2024, The Netherlands Leads Europe in Prefabrication Adoption. Available here.

[34] USP Marketing Consultancy, 12.01.2024, The Netherlands Leads Europe in Prefabrication Adoption. Available here.

public housing stock from 2.5% to 8% by 2030, backed by €340 million in investments. Industrialised methods, particularly prefabrication, are seen as essential to meeting this demand efficiently and sustainably.[35] Given this, Spain's offsite construction industry is projected to grow significantly in the next few years in attempts to renovate older buildings and to modernise infrastructure, as well as address current residential housing shortages.

Germany

Germany's construction industry is also facing challenges and is trying to keep up with its ambitious goal of creating 400,000 new apartments every year.[36] Amidst these challenges, Germany has invested in offsite construction and is therefore also experiencing a notable shift towards modular and prefabricated construction methods. In 2024, prefabricated homes accounted for 26.1% of newly approved single-family and two-family homes, up from 24.5% in 2023.[37] This trend indicates a growing preference for offsite construction techniques, driven by the need for efficiency and sustainability. Prefabrication is also increasingly used in multi-family housing, with approvals for modular and serially produced buildings rising from 7.0% in 2023 to 8.2% in 2024. This shift reflects a growing recognition of prefabrication as a scalable solution for urban housing needs and the increasing demand in Germany.

Ireland

Finally, offsite construction is on track to play a crucial role in addressing **Ireland's** severe housing crisis. The Irish Government launched a new housing plan in 2021 titled ''Housing for all'' which aims to increase affordable housing across the country by delivering an average of 33,000 new homes annually until 2030. To achieve this, the government has also adopted a Roadmap for the adoption of MMC for public housing delivery, which aims to significantly accelerate the delivery of affordable housing through offsite construction methods.[38]

To conclude, while the degree of offsite construction adoption varies among Member States, there is a clear trend across Member States towards the increasing adoption and development of offsite construction. Many Member States are looking to offsite as a potential solution to address housing shortages, and national governments are starting to implement supportive policies to encourage offsite construction.

2.1.3. Cross-border operations

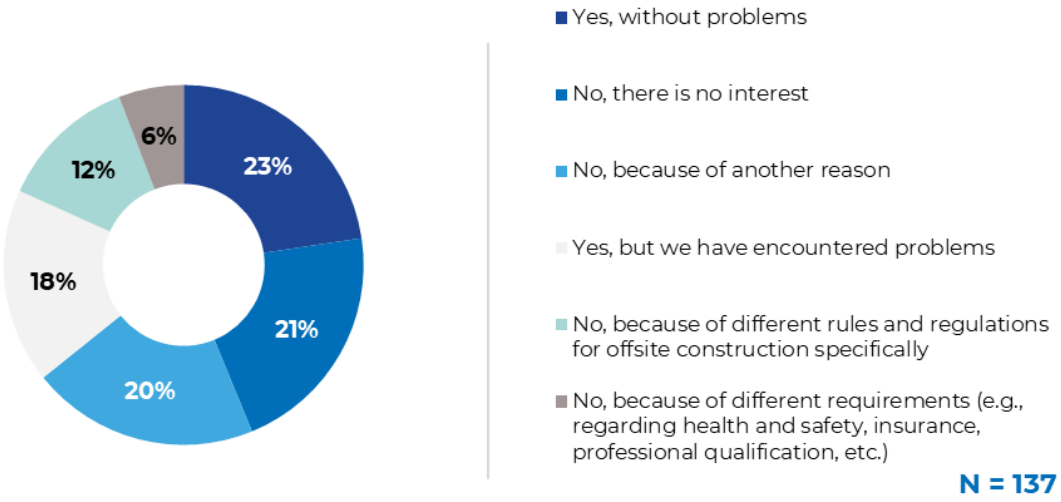
From our survey respondents, 41% reported operating in multiple countries within the EU and neighbourhood countries (Figure 12). These include contractors, product manufacturers, architects and engineers, developers and others. Among them, we see similar shares of responders operating cross-border without issues (23%) and operating cross-border yet encountering problems (18%). Operating cross-border is not necessarily a goal for all professionals, with 21% not doing so due to a lack of interest or other reasons (20%). Only 18% of respondents reported that the barriers stop them from operating cross-border. 12% referred to specific regulatory differences, with another 6% referring to health and safety, insurance, qualifications and other requirements.

Challenges faced by professionals and companies with cross-border operations are inherent to construction activities overall, and to doing business cross-border. There were no specific challenges reported that were inherent to offsite construction. As in traditional construction and

[35] GlobalNewswire, 18.06.2024, Spain Prefabricated Construction Industry Databook 2024: 100+ KPIs, Market Size & Forecast by End Markets, Precast Products and Precast Materials - Forecasts to 2028. Available here.
[36] DW. April 2024.German housing crisis: Like winning the lottery! Available here.
[37] Built Offsite, 28.02.2025, Germany's shift to modular and prefabricated construction accelerates. Available here.
[38] See MMC Ireland. Roadmap for Increased Adoption of Modern Methods of Construction in Public Housing Delivery. Available here.

any business, professionals who participated in the consultations reported relying upon a local partner when operating in another country. Moreover, in the focus groups, suppliers and manufacturers expressed confidence that they can produce components and prefabricated elements according to any building code.

Figure 12. Cross-border operations – Does your organisation work on offsite construction projects across borders in other countries? This question applies to Developers, architects, engineers, contractors, developers, real estate and investors.



When requested to elaborate on the types of problems encountered when operating across borders, respondents raised the following:

- Regulatory challenges: Issues with different regulations, differences in building codes, procedures for certification and norms used, as well as with procurement rules, sustainability references and general building regulations (e.g. for communicating construction product environmental information via Environmental Performance Declarations). Annex D provides a list of illustrative responses.
- Logistical challenges: Transportation costs and difficulties in obtaining related permits.
- Financial or market challenges: Reluctance of investors, lack of guarantees for payments and more complex administrative formalities, as well as very protected national building markets.

2.2. Technologies and Investment

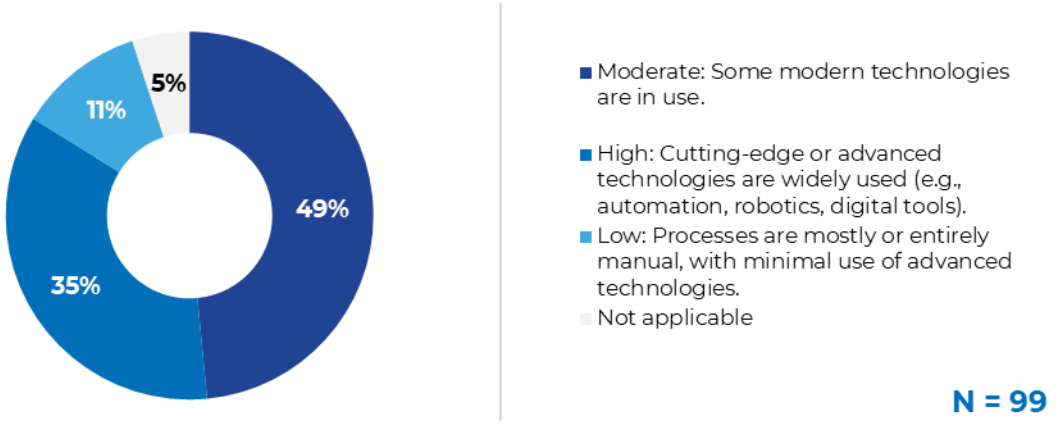
Technological innovation plays an important role in enabling the broader adoption of offsite construction methods. The integration of digital tools, automation technologies, and new materials not only enhances production efficiency but also improves quality control, traceability, and sustainability outcomes. Still, levels of technological adoption and investment remain uneven across the EU.

2.2.1. Current integration of technologies

A wide range of offsite construction technologies is currently in use across Member States. Survey results reveal significant variation in both the availability and adoption levels of these technologies across different national markets. Overall, the degree of technological integration in offsite construction can be classified as moderate, with a growing share of Member States emerging as advanced adopters. Most construction stakeholders report engaging with digital tools and technologies to some extent, although full-scale digitalisation and automation remain a work in progress. Nevertheless, a notable proportion of organisations already report high levels of technological integration. Across all group segments, technological adoption is

moderate. Approximately half of the respondents declared "some use of modern technologies" across all stakeholder groups (with responses ranging from 43 to 52% per group). Cutting-edge or advanced technologies were reported to be more widely used by contractors, 48% of whom reported using high-end technologies. In comparison, architects and engineers, and product manufacturers and suppliers, both showed similar lower adoption levels, with 32% of respondents selecting.

Figure 13. Technological integration – How would you describe the level of technological integration in your work?



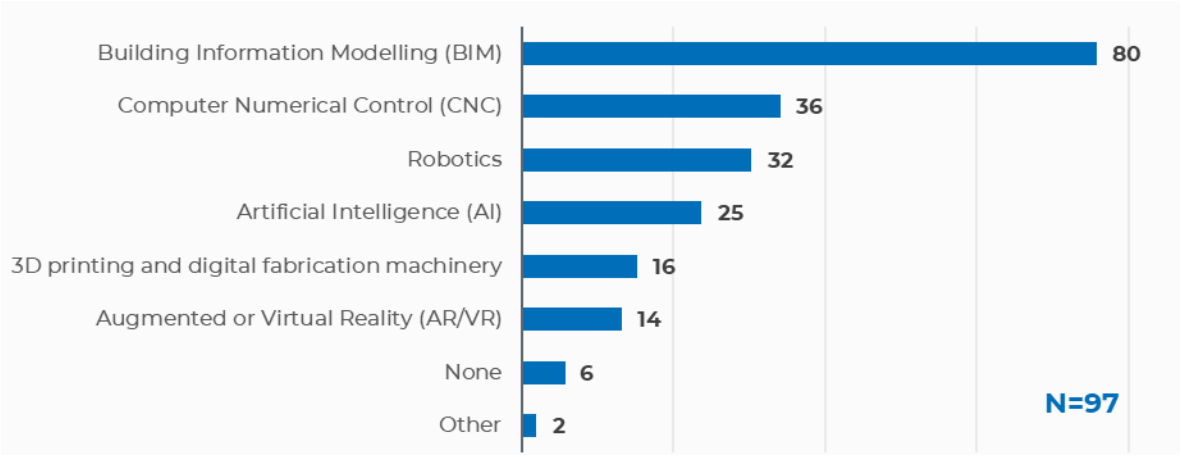
Note: This question applied to architects, engineers, contractors, developers, real estate and investors.

Building Information Modelling (BIM) is the most adopted tool across many companies and dominates the digitalisation landscape in construction overall (Figure 14). This applies transversally across all stakeholder groups, with the highest rates of adoption being amongst architects and engineers (38%), and the lowest amongst contractors (35%). Other technologies are also used. Further, the widespread adoption of BIM has also encouraged ongoing research and development efforts, leading to faster improvements in technology and more regular updates occurring. The functionality of BIM is therefore improving rapidly. Computer Numerical Control (CNC) is very relevant to manufacturing and is adopted by 24% of responders in the product manufacturers and suppliers' segment. Naturally, robotics are more widely used among contractors and product manufacturers (20% and 17% respectively) rather than architects and engineers (6%). A surprising 25% of responders work with artificial intelligence (AI) that is confirmed to be applied in manufacturing widely, according to the focus group discussions. Responders reported smaller use of augmented or virtual reality (AR/VR), which is reasonable considering their wider applicability in real estate and in the interface with non-professional clients.

Overall, it is important to consider that the survey responders are professionals with at least some experience in offsite construction that demands the use of digital tools and technologies. As a result, the digital maturity we observe through this survey is not transferable to the whole sector, as past studies show.[39]

[39] European Construction Sector Observatory (2021). Analytical Report ''Digitalisation in Construction''. Available here.

Figure 14. Use of new technologies – Which digital tools or automation technologies are currently in use in your construction processes? This question applies to designers, architects, engineers, product manufacturers, suppliers and contractors. [Unrestricted multiple choice]



Based on input from responders, higher levels of adoption of cutting-edge technologies – such as robotics, automation, and 3D printing – are observed in countries like Austria and Germany, where industrial capacity and R&D investment are strong. In contrast, countries such as Spain and Italy exhibit more moderate levels of technological integration, with limited but growing use of modern technologies and more constrained investment levels.

Poland and Hungary report lower technological adoption overall, largely due to financial constraints, which also limit significant investment in innovation. In these countries, regulatory barriers and skills shortages are among the challenges of integrating advanced technologies into offsite construction processes.

The correlations drawn from the analysis of the survey results suggest that countries with higher overall development in offsite construction also have more advanced technological adoption and integration. Financial barriers, such as high investments, as well as regulatory and policy barriers, and market demand volatility, are common challenges affecting technology adoption (see Chapter 3).

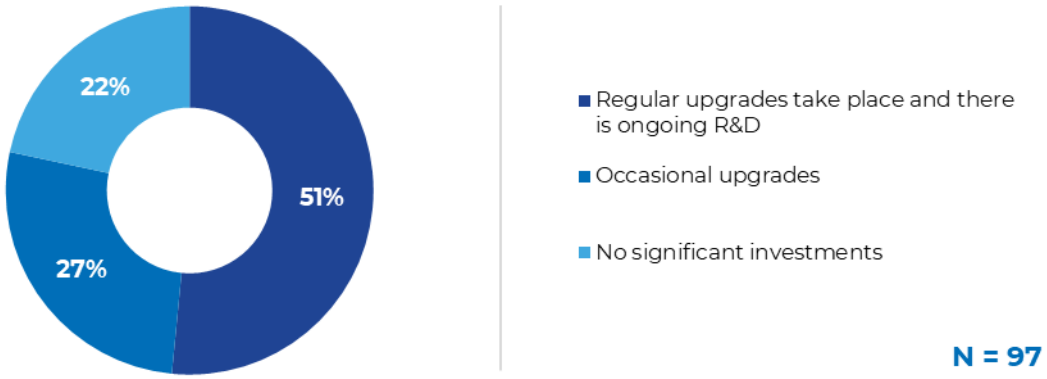
In turn, the research suggests that technology adoption also enhances the financial viability of construction projects.[40] Advanced digital tools and automation support improved project monitoring, accountability, and stakeholder transparency, all factors that attract investment by increasing confidence among banks and other financiers. The improved accountability and reliability through technology can make investments more likely.

2.2.2. Investments and emerging technologies

The need to invest in new technologies and foster research and development in offsite construction is widely recognised across the sector. Survey findings show that while over half of respondents report regular technological upgrades and ongoing R&D activities, a significant proportion of organisations still make only occasional investments, and a notable minority report no significant investment efforts (Figure 15).

[40] Cited from Focus Groups, see Annex C.

Figure 15. Technological investment – To what extent does your organisation invest in technology and innovation related to offsite construction?



Note: This question applied to developers, architects, engineers, contractors, developers, real estate and investors.

Enhanced digitalisation and innovation can lead to higher quality outputs, greater customisation, faster production processes, and improved scalability,[41] all of which are factors that directly support the business case for offsite methods. Looking specifically at contractors, these reported the highest levels of regular investment in technology and innovation for offsite construction, as 70% of them indicated ongoing R&D. This was followed by product manufacturers and suppliers at 52%. Designers, architects, and engineers reported the lowest rate of regular investment, with only 39% indicating continuous R&D efforts. Notably, occasional upgrades were most common among designers, architects, and engineers (35%). These results are explained through the nature of construction work, with manufacturers having to introduce new products to the market (high need to invest in R&D), contractors having to gradually modernise the work on site, meeting requirements on environmental performance and pollution reduction and to accommodate the use of new materials, equipment machinery. This need reduces as we move to the conception and design of a project.

[41] See also: Bajpai, A. and Misra, S.C. (2024), "Evaluation of success factors to implement digitalization in the construction industry", *Construction Innovation*, Vol. 24 No. 4, pp. 865-891. https://doi.org/10.1108/CI-02-2022-0042

IRELAND
Supporting Technological Integration[42]

Ireland

Ireland is actively promoting increasing technological innovation and digitalisation in offsite construction and its supply chains. Since January 2024, BIM integration has been made mandatory for all publicly funded projects over EUR 100 million, with plans to extend this requirement to all public sector construction projects by 2028.

Ireland is also promoting the adoption of Digital Building Passports, which aim to track building materials and data throughout an asset's lifecycle. Allowing products to be tracked and traced facilitates better product design, increased accountability for manufacturers, material traceability and improved collaboration across various stakeholders in the supply chain.

A notable landmark project taking place in Ireland is Europe's first 3D-printed concrete social housing complex, in Dundalk, County Louth. The project demonstrated a 35% faster construction time compared to traditional methods and highlighted the potential of 3D printing in addressing housing shortages.

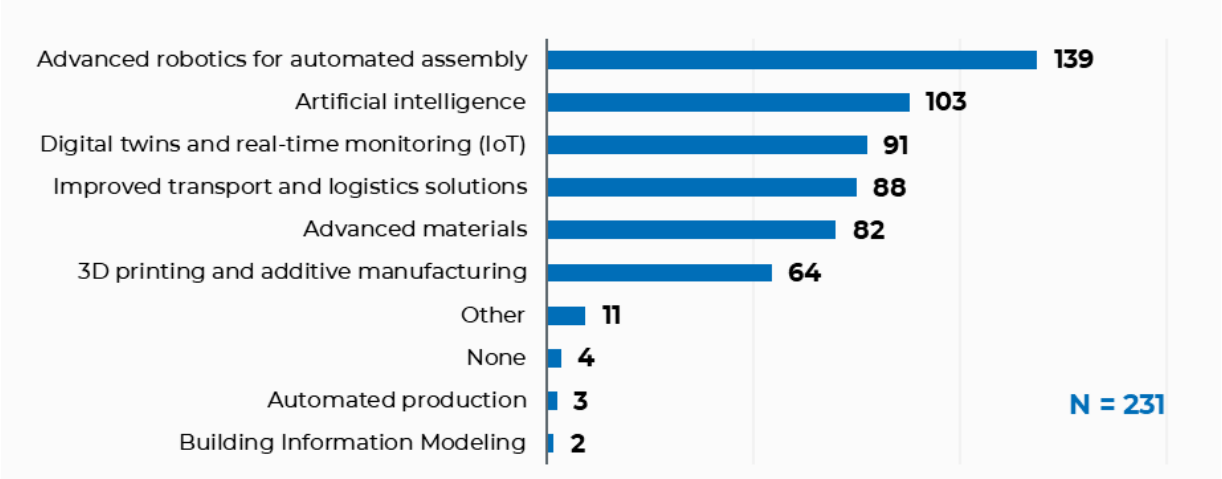
Emerging technologies

Looking forward, stakeholders anticipate technological transformations in offsite construction over the next 5 to 10 years. Survey respondents identified advanced robotics for automated assembly as the most impactful emerging technology, followed by artificial intelligence (AI), digital twins and IoT-based real-time monitoring, improved transport and logistics solutions, and advanced materials development (Figure 16).

The prominence of robotics and AI reflects a clear expectation that industrialisation, automation, and smart digital systems will drive the next phase of growth in offsite construction. These technologies are seen as critical for increasing efficiency, ensuring quality control, optimising production workflows, and enabling more predictable project delivery. Additionally, improvements in transport and logistics are recognised as key to unlocking greater scalability, particularly given the challenges of moving large, prefabricated components efficiently and cost-effectively. Innovation in advanced and bio-based materials, together with 3D printing technologies, is expected to support the sector's sustainability goals, enhancing the environmental performance and circularity of construction.

[42] Roadmap for increased adoption of Modern Methods of Construction in Public Housing delivery. Government of Ireland. Department of Enterprise, Trade and Employment and Department of Housing Local Government and Heritage.

Figure 16. Mid-term innovation – Which of the following emerging technologies do you believe will have the greatest impact on offsite construction in the next 5–10 years? [Multiple choice restricted to a maximum of 3 choices]

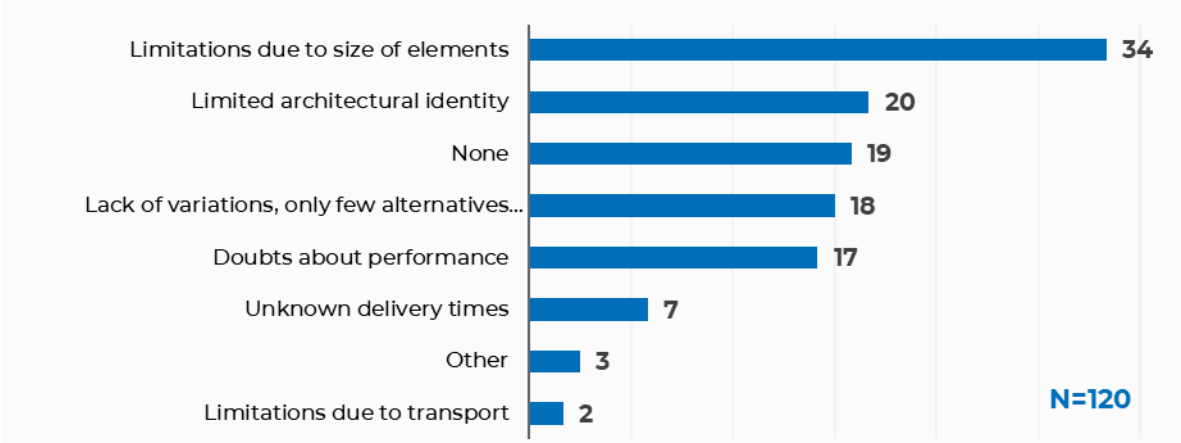


2.2.3. Design limitations of offsite construction

Offsite construction, especially 3D modular construction, is constrained by certain design limitations, mostly related to the size and flexibility of prefabricated elements. Among designers, architects, engineers, manufacturers, and suppliers, the most cited constraint was limitations due to the size of elements, followed by limited architectural identity, and a lack of variation in available options (Figure 17).

Suppliers found the physical size of prefabricated elements to be a particular issue for logistics. Many modular elements cannot be transported due to vehicle capacity, crane lifting capabilities, and sometimes even road regulations in Member States. Challenges occurring due to the size of the modules are more likely in rural or remote areas, as these are likely to be less accessible mostly due to narrower roads or inaccessible paths. As a result of these limitations, prefabricated modules must be designed in a certain way, or designed to be smaller than ideal, to ensure that they can be transported. This naturally makes the process more complex and means that some modular elements must be segmented and built back together on site, which increases the complexity, cost and time.

Figure 17. Design limitations – What design limitations have you faced when using prefabricated elements or building parts? Are any imposed by current offsite construction technologies? This question applies to designers, architects or engineers, product manufacturers and suppliers. [Multiple choice restricted to 3 answers]



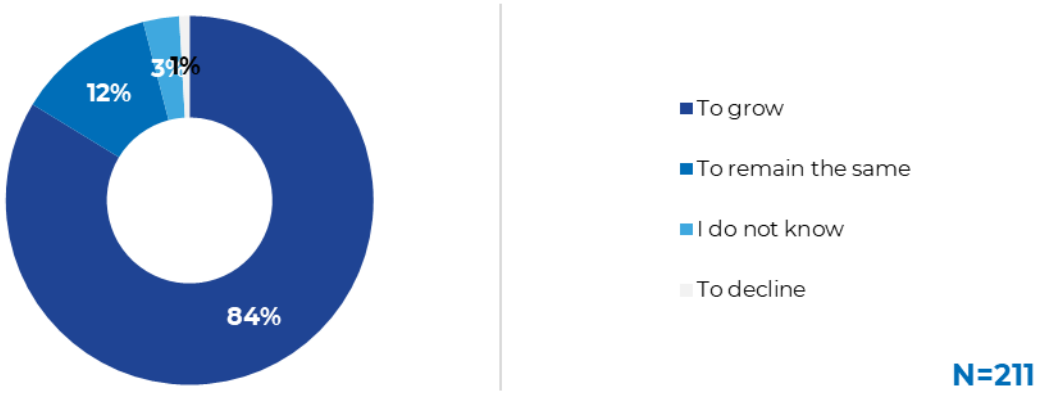
2.3. Outlook for Offsite Construction

2.3.1. Growth expectations

Despite current perceptions of moderate to low demand, expectations for the future of offsite construction are highly optimistic among the responders. Across all stakeholder groups surveyed, there is a strong consensus that the market will expand in the next five years.

As shown in Figure 18, an overwhelming majority of respondents anticipate growth, with only a very small minority expecting stagnation or decline. This reflects a broad recognition of the increasing role offsite construction is expected to play in addressing the challenges of traditional construction.

Figure 18. Growth expectations – How would you expect the offsite construction market to develop in the next 5 years in your main country of activity?



2.3.2. Drivers for offsite construction

The adoption of offsite construction is being driven by a combination of systemic challenges and local enablers. Governments at all levels, as well as private and public sector actors, are increasingly promoting offsite and modern construction methods to address persistent issues in the traditional construction sector (such as low productivity, high emissions, labour shortages, and on-site safety risks).

At the same time, local factors play a critical role. These include the availability of suitable construction materials, regional innovation capacities, and climate conditions that make traditional on-site work less predictable or efficient. In addition, offsite construction delivers measurable benefits for clients – such as improved cost control, faster project delivery, and enhanced sustainability – which further strengthens demand.

This section explores the main factors influencing the uptake of offsite construction across Europe, drawing from stakeholder feedback, survey findings, and illustrative case studies.

Local weather conditions

Climate and weather conditions influence the demand for offsite construction. Traditional construction methods, particularly those involving materials like cement, are sensitive to environmental factors such as rainfall, humidity, and temperature fluctuations. Many construction tasks can only be performed within certain weather periods, leading to project delays and increased costs.

Offsite construction offers a solution to environmental challenges by moving processes into controlled factory environments, which helps to provide greater reliability and efficiency regardless of external conditions. In the Nordic European countries, like Sweden, which is characterised by long, dark, and cold winters, offsite construction is well established, as

traditional on-site activities can be highly constrained. Across Northern Europe, a long-standing tradition of timber construction aligns naturally with the requirements and advantages of offsite construction methods.

Conversely, in Southern European countries, milder climates and a historical reliance on heavier construction materials like stone and concrete have seemingly played a role in slowing the uptake of offsite solutions. However, this dynamic is expected to evolve as extreme weather events become increasingly frequent across Europe, as even traditionally favourable climates face new uncertainties. Many construction materials have temperature limitations in their application, while many types of onsite work are constrained during rainfalls. This trend is likely to further disrupt conventional construction schedules and, in turn, may potentially influence demand for offsite alternatives.

Local materials, sustainability and innovation

Local availability of construction materials and regional innovation capacities are key enablers of offsite construction adoption. In some regions, traditional material preferences naturally align with offsite methods. For example, Nordic countries have a strong tradition of working with timber, a material well-suited for prefabrication and modular construction. National and EU-level incentives to wood and wooden construction materials could also drive both offer and demand for offsite.

Elsewhere, emerging environmental regulations and market demands are reshaping construction practices. In France, there is a growing emphasis on developing low-carbon construction solutions to meet climate targets. This shift towards sustainable building practices and sustainable materials is expected to further drive demand for offsite construction methods, particularly where they offer measurable reductions in embodied carbon.[43]

FINLAND
The wood construction programme[44]

Finland

Finland's wood construction programme for the 2016–2023 period aimed to diversify the use of wood and increase its value-added processing. Run by the Ministry of Environment, the programme focused on promoting and developing internationally competitive wood construction expertise and industrial entrepreneurship.

The programme introduced targets for the share of wood use in construction, aiming for 45% by 2025. This target, combined with the mobilisation of public authorities to integrate wood use into procurement practices, created a visible and stable market for manufacturers. As a result, companies were able to invest in expertise, production capabilities, and innovation.

The promotion of wood and the establishment of clear targets are incentivising the development of know-how for infrastructure projects such as bridges and apartment buildings. However, according to a Program Manager at the Ministry of the Environment, the adoption of offsite solutions for certain building typologies, such as tall wooden-framed apartment buildings, remains challenging.[45]

Despite these initial challenges, Finnish manufacturers expect the European market for offsite wood construction to grow. Increasing requirements for building performance, embodied carbon reductions, and emission targets for the construction sector are strengthening the business case. Data from 2024 shows that 83% of

[43] Cited from the Focus Group Discussions, see Annex C.
[44] Ministry of Agriculture and Forestry in Finland. Wood construction and wood products. Available here.
[45] HOISKO, 06.10.2020, Julkisessa rakentamisessa on edessä puuloikka – Kuntia tuetaan rahalla ja opastuksella. Available here.

Finnish plywood production was exported, underscoring the growing international demand for industrially processed wood materials.[46]

However, it is not only the local materials that drive the offsite market, but the local innovation capacities as well. Demand can increase when efficient and competitive solutions are brought from research to the market. Regional and national governments support such innovations, including through public-private and multistakeholder partnerships, such as clusters and innovation hubs that test competitive solutions and bring them to market.

FRANCE

Build'in, a regional platform for offsite and digital construction[47,48]

France

The 'École nationale des ponts et chaussée', with the support of the Region Île-de-France created Build'in, a technological co-innovation platform dedicated to robotics in construction in 2017. Build'in is equipped with robotic fabrication and the expertise provided by researchers, engineers, and technicians dedicated to its operation.

The mission of Build'in is to bridge the gap between research and industrial application through diverse collaborations with industry stakeholders. As Romain Mesnil, the project manager, explains:

"Through our projects and research, we quickly identified the strong potential of offsite construction to address major construction challenges. Coupled with new shape optimisation tools and more virtuous materials, the precision of industrial robots allows for the creation of innovative and resource-efficient construction systems. In this spirit, we are working on the construction of optimised reinforced concrete structures. 3D printing, combined with the flexibility and precision of industrial robots, enables manufacturing at a reasonable cost."

Building on these concepts, Build'in is also leading a dedicated action on robotic offsite construction, funded by a regional innovation project. This initiative aims to provide a comprehensive overview of the opportunities and challenges of prefabricated construction as a response to the climate change impacts.

Government programmes and policy incentives

Government programmes further play a crucial role in shaping the demand for offsite construction. In general, in countries where government-led initiatives and procurement strategies support and promote offsite construction, offsite adoption rates tend to be higher, as explained above with Finland and the Wooden Construction Programme.

Government-led initiatives provide some visibility to the market, at least for the medium term, removing some of the risks for suppliers and contractors regarding demand for their products. According to consulted practitioners, in the UK and Ireland, dedicated government-led programmes and policies have boosted demand for offsite construction.[49,50] The Irish strategy on housing and construction, as explained below, is multifaceted, motivating the progress of

[46] Finnish Forest Industries, 03.03.2025, Share of export in forest industry production. Available here.
[47] For more information about the project, see: https://www.buildin-enpc.fr/.
[48] Maison de l'architecture, Communiqué de presse: Hors-site (Mais pas hors-sol). Available here: https://www.maisonarchitecture-idf.org/wp-content/uploads/2023/09/Communiqu%C3%A9-de-presse-_Hors-site-mais-pas-Hors-sol-28-sept.pdf; and https://www.maisonarchitecture-idf.org/2023/10/18/la-construction-hors-site-face-a-lanthropocene/.
[49] For example, survey respondents highlighted the *Homes England* and the *Affordable Homes* Programme as offering direct subsidies for modular housing. Also, they highlight the City of London's education department includes offsite in specific mandates for offsite in certain projects.
[50] In Ireland, respondents highlight the *Housing for All Strategy*, which promotes MMC to accelerate delivery. Modular housing is also stated to be prioritised in public procurement, and is included in tax relief and grant schemes that are available for offsite providers.

the sector towards public goals (large-scale affordable housing provision) with different instruments. In addition, desk research on press and literature confirms that the UK and Germany, recently announced important public subsidies to support offsite use for the quick provision of affordable housing[51][52]. Internationally, governments like the Australian federal government have also launched new programmes to support offsite construction to tackle the housing crisis.[53]

Similarly, in the UK, local authorities are under pressure to adopt offsite construction for the building of schools, hospitals, and temporary housing. Such government strategies have not only encouraged innovation but also reduced the perceived risk for contractors and suppliers to invest time and resources into offsite construction.

IRELAND

Housing for all plan, enabled by Modern Methods of Construction (MMC)[54]

Ireland

The Irish government is carrying out a programme of accelerated delivery of housing, for over 1,500 new social homes that started being constructed during 2023 and 2024, utilising MMC, with offsite representing an important share. To achieve its objectives, the government partners with the private sector, academia and others to find ways to deliver homes more efficiently, more sustainably and at a lower cost.

The initiative recognises that the construction industry needs to accelerate the adoption of MMC to deliver. The government has taken the following actions to support the industry:

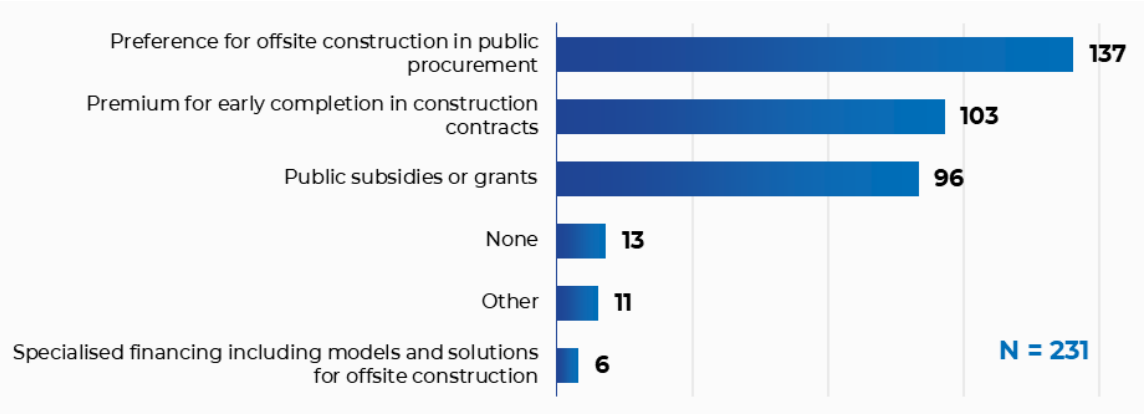
1. The establishment of the Construct Innovate Technology Centre led by the University of Galway.
2. The 'Built to Innovate' initiative by Enterprise Ireland, which extends innovation and business transformation supports to the domestic residential construction sector.
3. The upcoming establishment of an MMC Demonstration Park at Mount Lucas, led by Solas and Laois-Offaly ETB.
4. The Build Digital project led by TU Dublin.

Finally, a financing scheme, the Growth and Sustainability Loan Scheme (GSLS) supports SMEs to access appropriate and affordable finance suitable to their stage of development. This scheme recognises the challenges of the offsite sector to provide substantial upfront investments in their fixed and intangible assets, like human capital and designs.

Policy incentives are seen both as supportive measures and as active market makers for offsite construction. Survey results show a strong consensus: procurement decisions can play a decisive role, beyond the one of financing tools. Figure 19 below illustrates that giving preference to offsite methods in public procurement is considered an effective way to accelerate adoption by most stakeholders. The role of public clients can be crucial to early adopters, as it helps to validate offsite solutions at scale and to set technical expectations across the industry.

[51] Jarvis, 19.02.2025, Offsite Manufacturing: Leveraging UK Government Funding for Modular Construction. Available here.
[52] Built Offsite, 19.01.2024, Modular construction primed for massive government support in Germany. Available here.
[53] Emilie Lauer (spi), 25.03.2025, $54m funding to fast-track home construction. Available here.
[54] Roadmap for increased adoption of Modern Methods of Construction in Public Housing delivery. Government of Ireland. Department of Enterprise, Trade and Employment and Department of Housing Local Government and Heritage.

Figure 19. Financial incentives – What types of financial incentives or other support mechanisms would best encourage growth in offsite construction? [Multiple answers possible]



Beyond procurement preferences, contract structures that reward early delivery ranked second. This reflects a shift in market logic from valuing lowest cost alone to valuing speed and reliability. These are both advantages where offsite methods can be particularly competitive.

Interestingly, public subsidies or grants are seen as less critical than procurement levers, which suggests that companies are not primarily seeking financial assistance but rather predictable project pipelines where they can apply offsite techniques profitably. Similarly, specialised financing models were mentioned far less often, indicating that the bottleneck is not primarily access to capital, but securing enough volume of suitable projects to justify investment in new production models.

ESTONIA

The Factory Reconstruction Grant Scheme for Apartment Buildings[55]

Estonia

The Factory Reconstruction Grant Scheme for Apartment Buildings ran from 2020-2024. It was implemented by the KredEx Foundation, a state-funded national development bank. The scheme provides grant funding to apartment associations to support the reconstruction of Soviet-era buildings using prefabricated components. With 12 million available, grants of up to EUR 1,000,000 per apartment association could be obtained to the extent of 50% of the eligible expenses.

To facilitate the adoption of new technical solutions to support and improve the reconstruction of apartment buildings while achieving energy efficiency and a better indoor climate for apartment buildings, the scheme applies a novel approach through the installation of prefabricated components for specific building types. Together with energy and climate gains, an accelerated renovation process is achieved using offsite components.

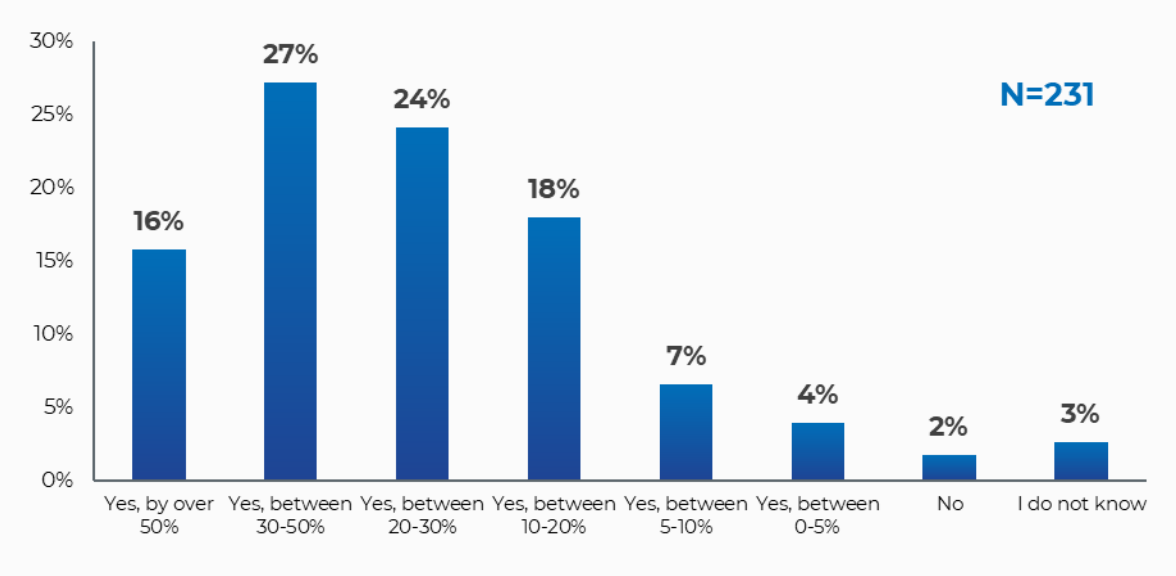
Perceptions on the efficiency of offsite construction

Time savings are widely recognised as a primary advantage of offsite construction. As shown in Figure 20, over half of the respondents estimate that project timelines could be reduced by 30% or more with offsite construction compared to conventional methods, with a substantial share expecting gains of over 50%. The main drivers behind this advantage are process

[55] Factory reconstruction grant for apartment buildings, for more information see here: https://kredex.ee/en/element.
ECSO (2021). Estonia - Factory Reconstruction Grant Scheme for Apartment Buildings. Policy Fact Sheet

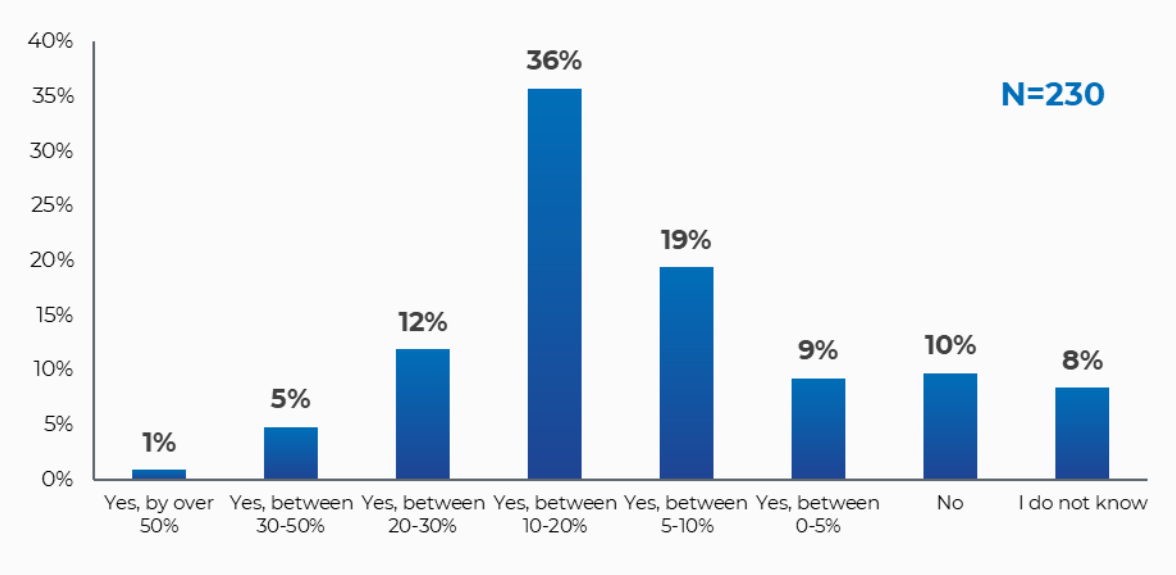
parallelisation and protection from on-site disruptions. Unlike traditional construction, multiple phases can progress simultaneously in factory settings, largely decoupling project timelines from weather conditions and site-related delays.

Figure 20. Time efficiency – Do you think offsite construction can reduce project time compared to conventional methods? (from design to finished project).



Cost efficiency is perceived more cautiously. As Figure 21 indicates, most respondents expect cost reductions in the range of 10–30%, with few anticipating savings beyond that range. While offsite methods reduce waste, rework, and project overruns, initial production setup costs and logistics remain significant barriers to larger-scale cost savings.

Figure 21. Cost efficiency – Do you think offsite construction can reduce costs compared to conventional methods?



Overall, stakeholders see offsite construction as a tool for reliable, accelerated delivery, where time gains are more certain than headline cost reductions.

FRANCE

An assessment model for municipalities comparing traditional and offsite construction for affordable housing[56]

France

In the context of delivering 100 social housing units in Nantes, an **assessment model was developed to compare modular (offsite) and traditional construction methods.**

While initial construction costs were similar, offsite construction proved 21% cheaper in overall project costs once logistics, rental losses, and end-of-life factors were considered. A key driver was material logistics: the mass and weight of materials transported to the site for offsite projects was only one quarter of that required for traditional builds.

The model also highlighted significant community benefits. Offsite methods reduced the duration of neighbourhood disruption by 77%, and heavy machinery operating time by 88%—a major advantage for urban areas. Environmental performance also improved, with an 8.5% reduction in carbon impact and 34% less lifecycle waste compared to conventional methods.

Although initially designed as a proof-of-concept for a specific project, the model provides a practical framework for municipal authorities and financing institutions to better quantify the lifecycle benefits of offsite solutions. The findings suggest that while upfront gains may be moderate, cumulative savings across operation, maintenance, and deconstruction phases are substantial.

Client acceptance

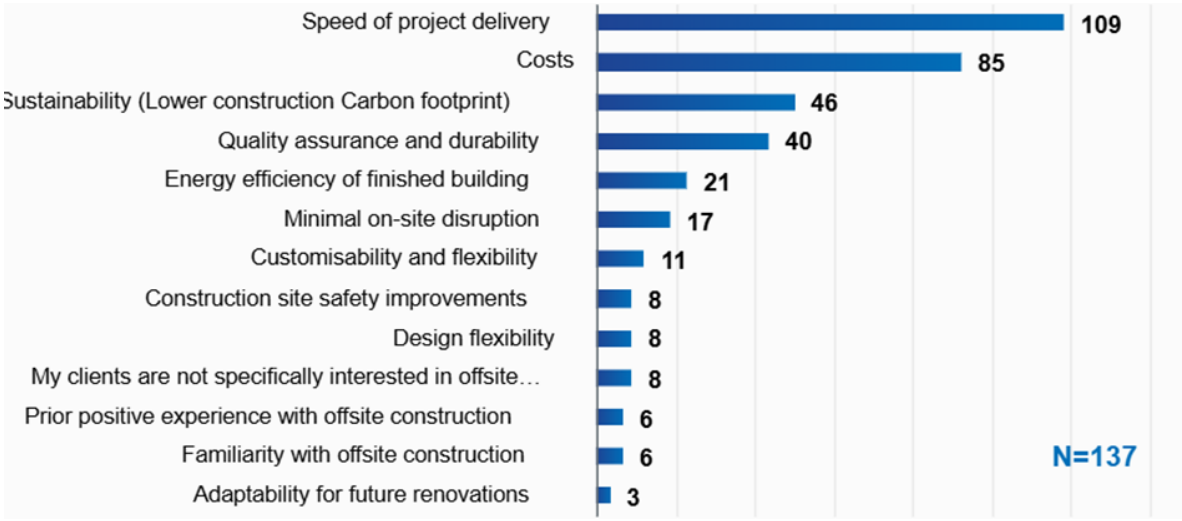
Finally, while client perceptions have sometimes acted as a barrier (see Section 3.4.1), our survey suggests that clients are not inherently opposed to offsite construction. Instead, their support depends on recognising advantages such as faster project delivery, lower costs, improved sustainability. Specifically, our survey showcases that client acceptance of offsite construction appears largely positive but remains conditional. Most survey respondents indicated that clients are supportive of offsite solutions when there are clear, tangible benefits. Acceptance is therefore driven by perceived positive outcomes rather than strong enthusiasm or resistance.

Figure 22. Client acceptance – How would you describe the level of client acceptance of using offsite methods for construction?

[56] Comparative study of modular construction system vs traditional for a 100 social housing units in Nantes. Study by ACIM, Avelis, CETEAM and Tribu Energie. The study was submitted to the research team for the development of this report.

Speed and cost rank highest among the benefits valued by clients (Figure 23), reflecting long-standing frustrations with delays and budget overruns in traditional construction. Environmental performance and reduced on-site disruption are also seen as important, particularly in dense urban environments where minimising noise and inconvenience is critical.

Figure 23. Important features for the clients – Which features of offsite construction are most important to your clients? [Multiple answers possible]



Overall, the survey responses suggest that for clients, reliability and consistency in costs and delivery times are more important than the construction method itself. Clients focus primarily on outcomes. Those investing in their own assets prioritise quality and timely delivery, while those building to sell place a stronger emphasis on price.

Architects and engineers noted that poor client understanding of offsite construction capabilities can lead to challenges. In some cases, limited awareness has resulted in mid-project design changes, causing additional costs and delays. Furthermore, while many offsite projects aim to incorporate low-carbon materials, this is not always feasible across all typologies. In such cases, projects have sometimes reverted to traditional construction methods.

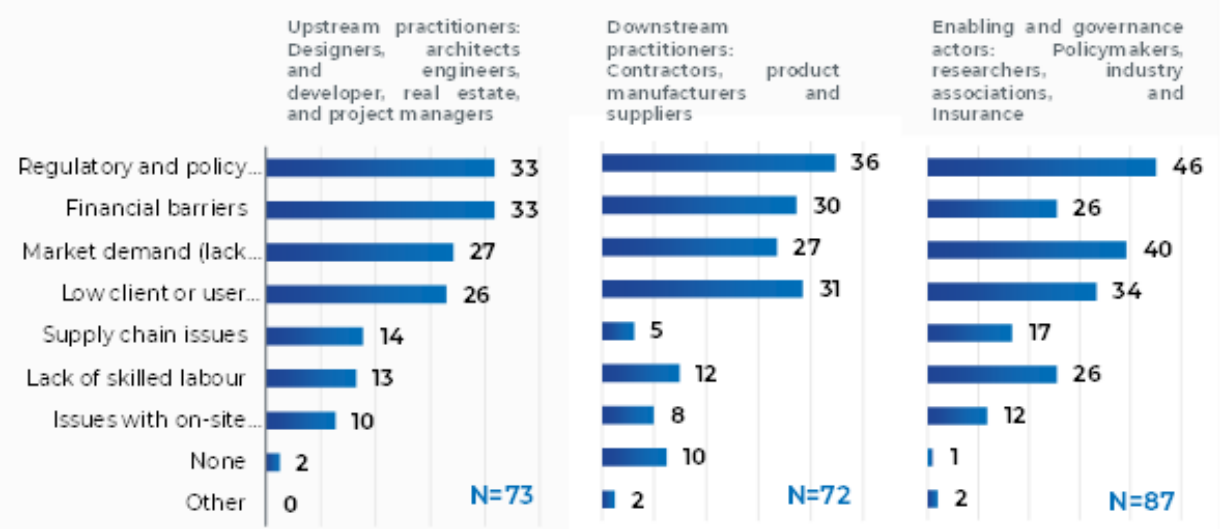
To meet client expectations and strengthen acceptance, offsite providers must ensure predictable costs, delivery schedules, and performance. Reliability and quality assurance are key advantages over traditional on-site construction, which is often associated with budget overruns and project delays. By consistently delivering on predictability, offsite construction can build trust and expand its market acceptance.

3. Barriers to the adoption of Offsite Construction

Through the survey and focus group discussions, we aimed to better understand the key barriers to the adoption of offsite construction. Participants' inputs were examined in depth, as they provided practical examples based on their experience in facing and overcoming these barriers. Where necessary, the analysis is cross-referenced and reinforced through literature review and desk research.

Some of the barriers identified are structural to the construction sector as a whole and not specific to offsite construction such as a lack of workforce. Others, such as logistics are technical in nature and must be accepted as inherent limitations. In certain cases, on-site construction is the only feasible solution.

Figure 24. Key barriers to offsite construction adoption by stakeholder group - What are the main barriers you encounter in advancing the adoption of offsite construction? [Multiple selection with up to 3 answers]



The barriers identified are listed and evaluated based on their importance and the type of action that can be taken to address them. In the next chapter, we will propose action recommendations for the barriers with the highest importance and potential for action. The barriers are evaluated as follows:

Significance of barriers

Low	This barrier is rare and does not materially block the development of offsite construction.
Medium	This barrier is significant and hinders the uptake of offsite construction.
High	This barrier can prevent offsite construction from being a viable option.

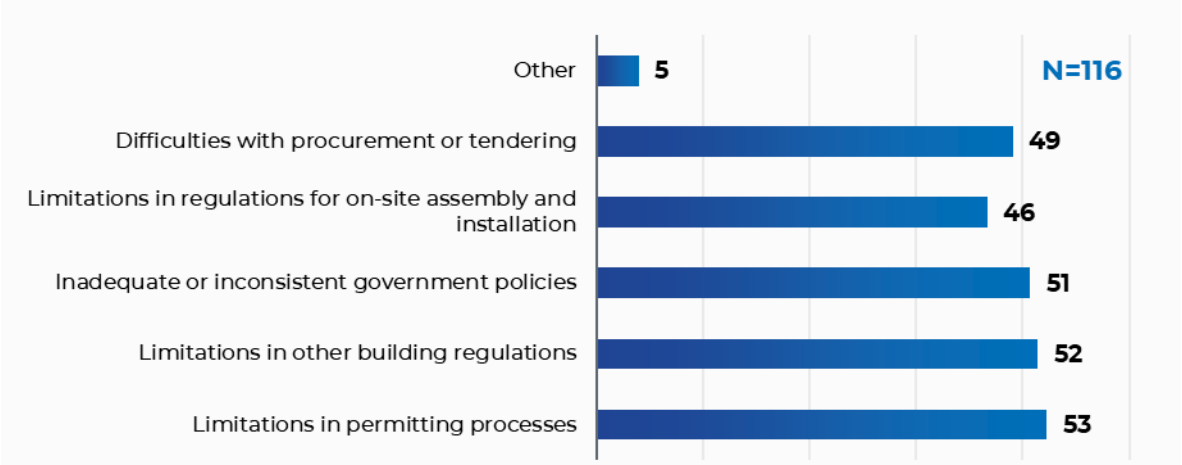
Levels of action to address the barriers

1	Policymakers have a limited role. Actions to address the barrier, if any, are to be taken by the sector.
2	Policymakers at the EU, national, and local levels can implement soft measures, such as awareness raising, capacity building, or enabling collaboration.
3	Policymakers can introduce regulatory or financial measures, including setting financing criteria, defining EU-level targets, or directing and incentivising Member States to reform procedures.

3.1. Regulatory barriers

The consultation identified several regulatory barriers to the adoption of offsite construction, particularly relating to permitting, building codes and local regulations, procurement, and liability.

Figure 25. Regulatory and policy barriers – [of those who reported regulatory and policy barriers as one of the main barriers they encounter]. What are the main regulatory and policy barriers you encounter? [Multiple answers possible]



Permitting processes and building regulations are the most frequently cited regulatory barriers to offsite construction. Among respondents who identified regulatory and policy barriers (116), the top issues were limitations and timeframes of permitting processes (56) and building regulations (52). Close behind were inadequate or inconsistent government policies (51), as well as difficulties with procurement or tendering (49) and regulations related to on-site assembly (49).

3.1.1. Permits

Challenges related to permitting processes are not unique to offsite construction but are common across the entire construction sector. They relate, among other things, to complex processes, a lack of harmonisation, unclear terminology or inconsistent roles and responsibilities, as well as differing procedures for public involvement. These challenges find their root causes in decentralised governance, legal and cultural diversity, historical evolution and are often exacerbated by a lack of capacities or capabilities among local authorities, as well as a lack of access to digital tools.[57]

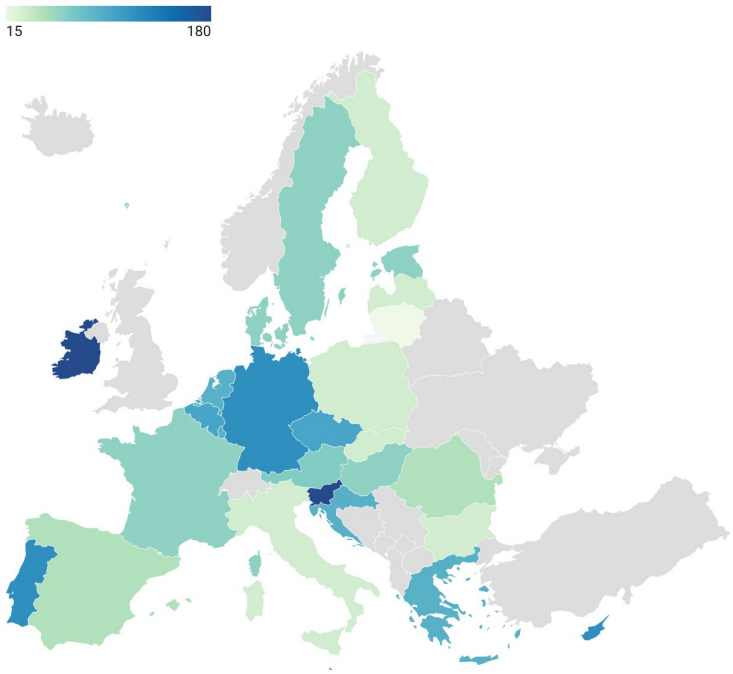
Considering these issues, it is not surprising that permitting remains an issue for construction, however, compared to many other regions, within the EU, permitting procedures tend to be slower. According to the Business Ready 2024 Report[58] and the Enterprise Surveys[59] conducted by the World Bank Group, obtaining a construction-related permit takes 38.2 days on average across all economies. Europe and Central Asia are the slowest, with 53.7 days, while East Asia and the Pacific are the fastest, with 17.5 days. Within the EU27, procedures tend to be even slower. Several EU Member States are among the slowest globally: Slovenia and Ireland have an average permitting time of 180 days, followed by Portugal, Germany, and Cyprus with 120 days. The EU average is 78 days.

[57] For a discussion on these challenges, characteristics and patterns across Europe, see: Judith Fauth et al (2025) Investigating building permit processes across Europe: characteristics and patterns, Building Research & Information, 53:4, 417-434, DOI: 10.1080/09613218.2024.2400467.
[58] The World Bank, Business Ready 2024 Report. Available here.
[59] The World Bank, Enterprise Surveys, Regulations. Available here.

Table 1. World Bank Group (2025). Days to issue a construction permit per region in the world.

Days to obtain a construction permit across world regions (2024[60])	
Average worldwide	**39.2**
South Asia	14.8
East Asia and Pacific	18.4
Sub-Saharan Africa	24.8
Latin America and the Caribbean	45.6
Europe and Central Asia	54.2
Middle East and North Africa	54.7

Figure 26. Days to obtain a construction permit across the EU MS (2024).[61] The EU average is 78 days.



Source: Authors' elaboration based on World Bank Group data (2025).

However, accelerating permits cannot be at any cost and specifically to the detriment of environmental and social interests. Compared to other world regions, it is obvious that there are several underlying issues causing important delays to permitting across EU Member States. Many of the above-mentioned EU Member States also rank high in comparison to their international peers in terms of the share of time that companies' senior management spends dealing with regulation, and the number of days to receive payment under a government contract. Although these two indicators are not construction-specific, they play a significant role in the overall delays in different aspects of a construction project.

Slow provision of housing is one of the identified challenges for affordability, however, the delays start before the construction itself.

[60] When 2024 data is not available, the most recent year's data is used.
[61] When 2024 data is not available, the most recent year's data is used.

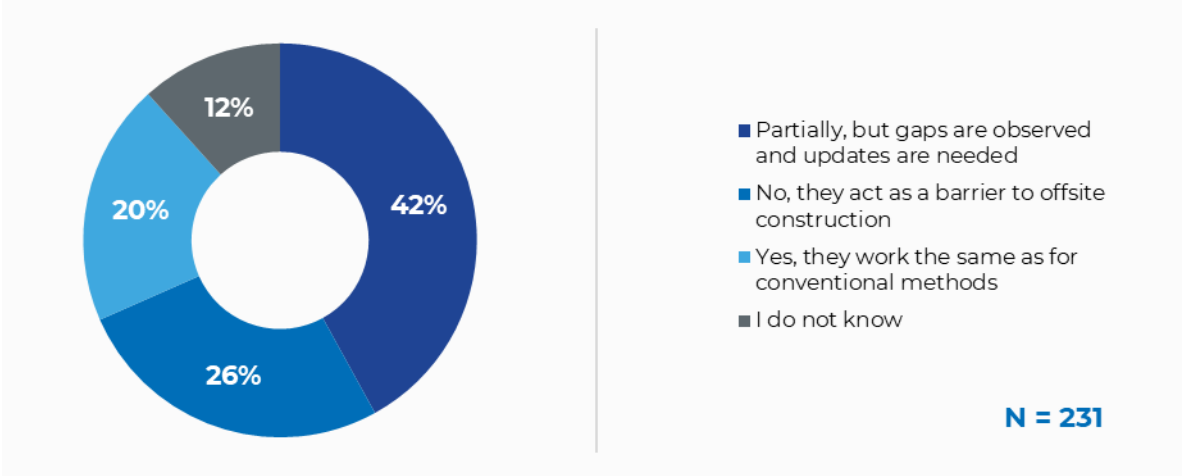
Slow issuing of permits

Significance Medium | **Level of action** 3

3.1.2. Building codes and local regulations

Building codes across the EU are generally only partially supportive of offsite construction. According to the survey, 42% of respondents reported that existing codes partially accommodate offsite methods, but these codes require updates or revisions. 26% of the respondents viewed current building codes as barriers, 20% considered them as functioning similarly to conventional construction, and 12% were unsure. These findings highlight a clear regulatory gap that construction practitioners must face although building codes are not universally restrictive, they often fail to actively enable the adoption of offsite construction.

Figure 27. Building codes – Do building codes or local regulations facilitate the use of offsite construction in the main country of your activity?



Building codes are a Member State competency. Codes need to be consistent and long-lasting to provide certainty to the market and are typically revised approximately every ten years. The lengthy cycle between updates poses challenges for integrating new materials and techniques, particularly for offsite construction.[62]

Construction professionals operating in multiple countries and their representatives often call for ''harmonisation'' of building codes across the EU. This is highly challenging. Building codes balance the consideration of hazards to public safety, health and general welfare[63], the architectural character and the preservation of traditional materials, crafts and building techniques, as well as environmental protection aspects and even resilience of the built environment to natural catastrophes and hazards, earthquakes, etc. These elements are deeply embedded in national legal frameworks, cultural practices, technological capacities, and institutional structures.[64]

Rather than aiming for full harmonisation, efforts should focus on ensuring that building codes are clear and comparable, avoiding overlaps and gaps, and finally that they are flexible enough to accommodate new technologies and construction methods. Digitalisation, particularly machine learning, can support this objective by enabling automatic compliance checks that reveal regulatory inconsistencies.

[62] France, Belgium, Portugal, Greece and Ireland's major updates on their building codes were taken as a sample.
[63] Babrauskas V, Lucas D, Eisenberg D, Singla V, Dedeo M, Blum A. Flame retardants in building insulation: a case for re-evaluating building codes. Building Research & Information 2012;40:738–55. https://doi.org/10.1080/09613218.2012.744533 .
[64] Judith Fauth, Peter Nørkjær Gade, Stefanie Kaiser, Kavita Raj, Jonas Goul Pedersen, Per-Ola Olsson, Nicholas Nisbet, Silvia Mastrolembo Ventura, Antero Hirvensalo, José Granja, Harald Urban, Snežana Rutešić, Ruben Verstraeten, Christopher-Robin Raitviir, Anna-Riitta Kallinen, Christian Schranz, Trajche Stojanov & Jernej Tekavec (2025) Investigating building permit processes across Europe: characteristics and patterns, Building Research & Information, 53:4, 417-434, DOI: 10.1080/09613218.2024.2400467.

Overall, Member States could be encouraged and should be supported to make meaningful updates to their building codes to better enable innovation, including in offsite construction.

3.1.3. Public procurement

Construction professionals consulted through the survey and focus groups did not report any systematic bias in public procurement processes favouring on-site over offsite construction. However, several structural challenges were identified:

- Procurement procedures are not always adapted to offsite construction: The pricing of prefabricated components can vary significantly between the bidding stage and implementation, particularly with delayed project timelines.
- Stock management and availability: The requirements for offsite construction, such as advanced manufacturing and inventory management, are not easily compatible with lengthy procurement cycles.
- Payment structures: Offsite construction often requires different payment timing, with upfront investment needs (see Section 3.3 on Financing).

Overall, offsite construction has an important and increasing share in infrastructure projects, such as tunnels, bridges, and airports. Therefore, improving procurement procedures to accommodate its specificities is extremely necessary.

Looking at procurement challenges overall, many are not exclusive to offsite construction but reflect broader inefficiencies in public sector contracting. Procurement modernisation is needed across the construction sector. The adoption of digital tools, such as Building Information Modelling (BIM), is already improving transparency, trust, and decision-making in some contexts. As highlighted in the sections on permitting and building codes, digitalisation, including AI, can also streamline compliance checks and accelerate both authorisation and construction phases.

3.1.4. Liability

The issue of liability for architects and engineers concerning modules or components manufactured offsite can create hesitancy among professionals. While not widespread across all Member States, a lack of clarity regarding liability was raised in several instances.

Due to its complexity and sensitivity, this study did not explore the legal dimensions of liability in depth. However, stakeholder consultations suggest that the underlying challenge may often be less about actual legal liability and more about hesitation towards adopting new working methods (see also Section 3.4.3).

The legal distinction between a "building" and a "product" can be difficult to navigate in certain cases. Nevertheless, new business models are emerging that fully integrate design, manufacturing, and assembly services. By vertically integrating the entire value chain, these companies can mitigate liability risks and streamline project delivery.

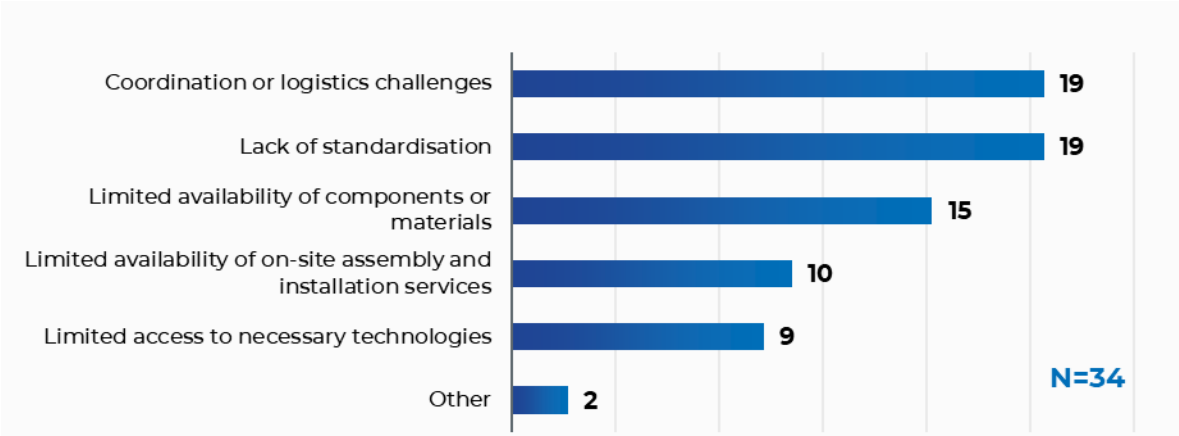
Liability of architects and engineers

Significance Low | **Level of action** 1

3.2. Supply chain barriers

As shown in Figure 28, supply chain challenges focus on standardisation, logistics, and material availability. Among respondents citing supply chain barriers (34), the most commonly reported issues were lack of standardisation and coordination or logistics challenges (both cited 19 times). These were followed by limited availability of components or materials (15) and on-site assembly and installation services (10). Fewer participants mentioned limited access to technologies (9). The two 'other' responses refer to quality control issues and issues with corruption.

Figure 28. Supply chain barriers – [of those who reported supply chain barriers as one of the main barriers they encounter]. What are the main supply chain issues you encounter? [Multiple answers possible]



3.2.1. Logistics

The transportation of prefabricated elements can be challenging. Not every component can be shipped everywhere and not every construction site is reachable by any supplier. Manufacturers and suppliers consistently noted that logistics are a primary consideration. If transportation cannot be assured, they decline the project.

3D modular construction faces the greatest logistical challenges, particularly regarding the transportation of large units, whereas 2D elements are generally easier to transport. When consulted about remote locations, such as islands, suppliers indicated that transport by boat is feasible, but that the repairability of components in such contexts remains a major challenge.

Logistics constraints are particularly acute in historical urban centres, where narrow streets, overhead cables, and bridge restrictions limit the delivery and on-site movement of prefabricated elements. As a result, it is often easier to integrate offsite construction into open sites rather than densely built environments. It is important that policymakers and stakeholders promoting offsite construction also understand these physical constraints, especially when planning projects in European contexts with the mentioned characteristics.

Survey and focus group participants expressed optimism that transport and logistics solutions will improve in the medium term (see Figure 16 in Section 2.2.2). In particular, the combination of offsite methods with 3D printing and other additive manufacturing techniques is seen as a promising way to address many current logistical constraints, as well as gaps with customisation.

Logistics

Significance	Level of action
High	1

3.2.2. Standardisation

Lack of standardisation remains a complex barrier that amplifies other challenges, such as insurance access and high investment costs. Without consistent standards, reliability and quality consistency are reduced, creating additional risks for manufacturers, contractors, and clients. Overall, the absence of standardisation is seen as a major obstacle to scaling up the offsite construction market.

At the same time, European suppliers and manufacturers advise that standardisation must be approached carefully. While greater standardisation could facilitate growth, it could also risk opening the European market to cheaper foreign products. Stakeholders noted, for example, that Chinese manufacturers are highly responsive to new standards and could adapt their production within months, creating intense competition.

Indeed, China currently chairs the ISO/TC 59/SC 19 committee on prefabrication, which has already published ten international standards, with six more under development (see Figure 29). In contrast, no comparable work on offsite construction standards is currently tracked on the CEN/CENELEC platform. Consulted practitioners warned that Europe must act faster to retain competitiveness in this rapidly evolving field.

Although the development of standards, no matter where, could lead to significant growth of the market and subsequent faster provision of affordable housing, the EU should keep in consideration the protection of its own innovators. As explained in the next section, the EU Standardisation Strategy highlights clearly the importance of EU leadership on standards as supportive to local companies and to the systemic transformation of key economic sectors.

Figure 29. ISO Standards under development on prefabrication

Standard and/or project under the direct responsibility of ISO/TC 59/SC 19 Secretariat (6) ↑	Stage	ICS
ISO/CD 7728 Typical horizontal joints between an external wall of prefabricated ordinary concrete components and a concrete floor — Properties. characteristics and classification criteria	30.99	
ISO/CD 7729 Typical vertical joints between two prefabricated ordinary concrete external wall components — Properties, characteristics and classification criteria	30.99	
ISO/WD 25084 Prefabricated Building — Terminology and General principles	20.60	
ISO/AWI 25192 Prefabricated building — Modular building — part 1: concepts and general principles	20.00	
ISO/AWI 25266 Standard for polyhedral modular box building design	20.00	
ISO/AWI 25267 Technical standard for kitchen and washroom in polyhedral modular box building	20.00	

Lack of standardisation

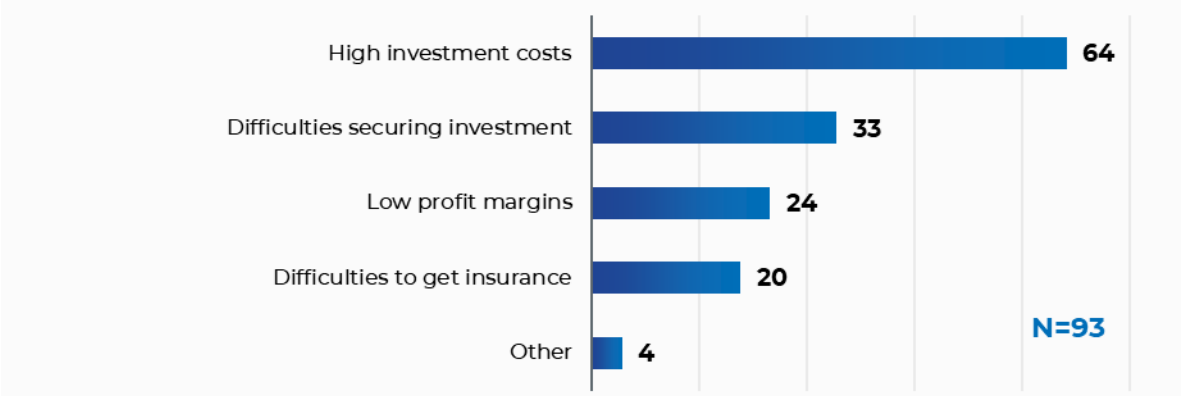
Significance	Level of action
High	2

3.3. Finance and insurance

High investment costs are the dominant financial barrier to offsite construction, followed by challenges in securing capital and profitability. Among respondents who identified financial barriers (93), high investment costs for suppliers/factories of offsite products (67) were the

most frequently cited issue. This was followed by difficulties securing investment (33) and low profit margins (27), indicating concerns over both upfront capital requirements and longer-term returns. Insurance access (20) also emerged as a notable challenge, while few respondents selected “other,” pointing to a consistent set of financial constraints across stakeholders.

Figure 30. Financial barriers – [of those who reported financial barriers as one of the main barriers they encounter] What are the main financial barriers you encounter? [Multiple answers possible]



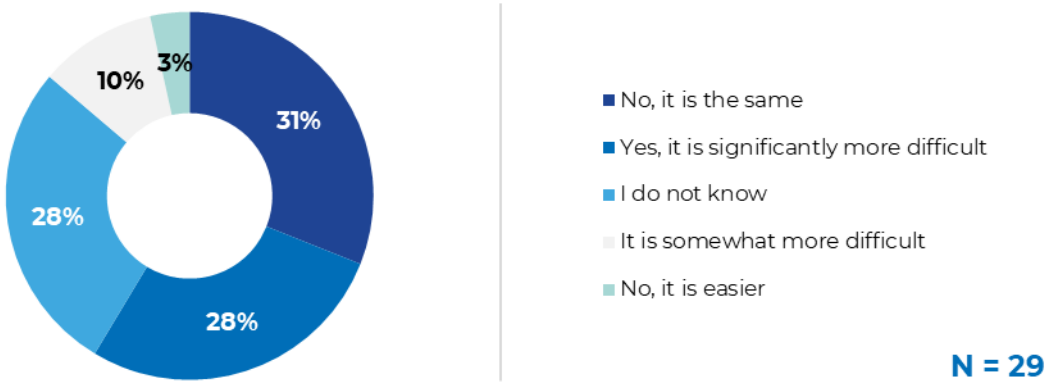
Financial barriers raised under the ‘other’ category include changes in payment schedules due to the nature of offsite projects, which require more anticipation and less flexibility during construction. Additionally, high land costs, regulatory complexities, and difficulties in closing business cases due to various regulations and unpredictable planning processes further complicate the financial viability of offsite construction projects.

Insurance issues further compound financing challenges. The unfamiliarity of insurers with offsite construction processes, along with the lack of widely recognised standards, raises insurance premiums or limits coverage options, making offsite projects appear riskier to financiers.

3.3.1. Financing

Financial barriers were widely cited as a barrier. Specifically, when asking contractors and developers, 10% said that securing financing for offsite construction projects is somewhat more difficult, and 28% responded that it is significantly more difficult. However, 31% of the responding developers and contractors perceive the difficulties as the same compared to conventional construction projects, showing a somewhat mixed picture (Figure 31).

Figure 31. Financing difficulties for contractors and developers – Do you face more difficulties in securing financing for offsite construction projects compared to conventional ones?



In a traditional onsite construction project, crews and workers are paid as work progresses and upon completion, and the materials are paid off during delivery. In a business-as-usual scenario, when investing in a new, under-construction unit within a housing complex, a client will usually need to cover 20-40% cost upfront, and the remainder is paid off upon completion or at stages during the construction process. Such well-established models cannot be applicable to offsite that needs significant upfront investments. Consulted practitioners confirmed that it is more challenging to secure funding for offsite construction, largely due to the different financial dynamics involved.

These challenges are expressed in many similar ways:

- The return on investment is slow for manufacturers/suppliers, compared to conventional construction companies. Suppliers need significant capital to make their factories operational before they can start producing. By the moment of assembly, suppliers must have already covered all equipment, facilities, material and workers' costs.
- Banks are concerned about project completion in the case of a manufacturer's bankruptcy. [65,66]
- Prefabrication requires high initial investments that can make clients hesitant and even be incompatible with the payment plans of loans. The large upfront costs and the time it takes before revenue is generated often make also developers and investors hesitant to invest.
- Modular construction developers who lack experience in this industry face uncertainty in scheduling and pricing, resulting in inconsistencies in risks.[67]

Direct subsidies to offsite might not be the solution. During the focus group discussions, professionals warned that the moment direct subsidies to offsite construction companies end, these companies risk closing. For example, the UK had in the past provided direct subsidies to offsite construction suppliers, yet according to consulted practitioners, many of these companies went bankrupt after subsidies were withdrawn. Although these statements could not be confirmed from research, there is literature indicating that certain types of government subsidies, notably unit cost subsidies, can lead to significant increases in the price of offsite, ultimately harming its uptake[68]. Based on the good practices presented above, notably from

[65] Feutz D. The Hurdles to Financing Modular Development. Cornell Real Estate Review, 17(1), p.23, 2019.
[66] Salama T, Figgess G, Elsharawy M, Elsokkary H. Financial Modeling for Modular and Offsite Construction, 2020.
[67] Ibid.
[68] Dan-Yi Wang and Xueqing Wang (2023) Supply Chain Consequences of Government Subsidies for Promoting Prefabricated Construction and Emissions Abatement, Journal of Management in Engineering, Volume 39, Issue 5, https://doi.org/10.1061/JMENEA.MEENG-5285.

Ireland and France, it becomes obvious that to provide sustained support to innovative construction and housing, governments need to implement complete frameworks with several action points, not stand-alone measures.

3.3.2. Insurance

The hesitancy of banks to issue loans and other financial products for offsite construction can often be topped by the hesitancy of insurers. The challenges in obtaining insurance add burden to stakeholders, making the transition into a perceived ''riskier'' domain of construction less likely. In addition, a lack of standards and clear, coherent and relevant regulations discourages insurers, together with processes and business models unfamiliar to them.

Insurances for projects are often procured by and directly linked to the contractors delivering the project. As such, if the contractor becomes insolvent, the insurances linked to that contractor will cease to cover those projects. In such circumstances, a replacement insurance must be sought, and if available, that would come at an additional cost and likely not provide the breadth of coverage that the project originally had. Furthermore, there may be existing and/or new insurance losses that may be uninsured, potentially placing the project under significant financial stress.[69]

Focus group responders agreed that one main consideration with offsite is the high dependence of the project on one company, which cannot be easily replaced. While construction, onsite or offsite can take years to be completed, a company supplying an important share of components or the whole unit could fail. Finding a replacement could take a very long time, if even pursued as a solution. At the same time, an onsite project depends way less on one provider. In addition, offsite construction suppliers are often newer companies which have a higher risk profile than established construction companies, basing their operations.

Another challenge discussed was that contract templates used for ''typical'' onsite projects might not serve the needs of offsite construction ones. It is important to note that ''insurance for construction'' refers to several types of insurance required, such as General Liability insurance, Workers' Compensation insurance, Builder's Risk insurance, Professional Liability insurance, and surety bonds, among others.[70,71,72] It was recommended by participating practitioners that some appropriate templates, if developed, could help address related blockages. A study looking into insurance disputes for offsite construction in Canada showed a very big variety of causes and levels of disputes, highlighting again that an appropriate framework should be designed. To add to that, history of disputes and claims can also affect negatively a company, limiting insurance options.[73]

[69] Lockton (2022) Six construction trends and what insurance buyers need to know. Available here.
[70] Capital Premium Financing, 09.05.2024, Insurance Costs in the Construction Industry. Available here.
[71] Apex Risk & Insurance Services, 21.11.2024, Common Insurance Pitfalls in the Construction Industry: What They Are and How to Avoid Them. Available here.
[72] Yıldıran, Merve Pelinsu., Demirdöğen, Gökhan. Identification of Contractual and Financial Dispute Causes in the Off-Site Construction Projects Buildings 2024, 14(8), 2530.
[73] Ibid, Chan, E.E. Analysis of Construction Dispute Cases in Canadian Courts and Lessons Learned for Modular and Off-Site Construction Contracts. Concordia University, Montreal, QC, Canada, 2021

3.4. Human capital and construction culture

Ultimately, it is people who can transform construction, including streamlining offsite. From client perceptions to the choices taken by architects and engineers, and the capacity of professionals at all levels and functions to accommodate new ways of working, human capital and construction culture can act as barriers or enablers.

Through the survey and focus group discussions, we identified barriers exclusive to offsite construction, but also structural challenges for the whole construction sector.

3.4.1. Client acceptance

As highlighted in Section 2.3.2, and as shown from the survey, client acceptance of offsite construction is overall positive, yet conditional. Clients are supportive when they see tangible benefits, rather than showing strong enthusiasm or resistance. Overall, client acceptance was not flagged as a major barrier during the focus group discussions. Clients recognise key benefits of offsite construction, as consistent budgets, more predictable timelines, improved energy efficiency, and minimal onsite disruption. This confirms that clients prioritise tangible performance outcomes over technical familiarity or attachment to traditional methods.

Most respondents have also indicated that offsite construction is already dominant or expanding in sectors such as social housing, student accommodation, emergency housing, senior living, and assisted living (Figure 9). In these contexts, end users do not influence construction methods. Multifamily residential buildings are also a growing application for offsite methods, although in these projects, client acceptance can play a somewhat greater role.

Industry-led studies often bring forward impressive time and cost efficiencies to convince potential clients of the possibilities that offsite has to offer. Such impressions were also partly shared in the survey (Figure 20). However, focus group participants, especially suppliers and manufacturers, were more down-to-earth about the true potential of time and budget savings. They warned that ambitious projections on budget and time reductions can end up harming offsite uptake, creating unrealistic expectations for clients. In practice, they noted, the costs and timelines of offsite projects are often comparable to those of traditional construction, with two key differences:

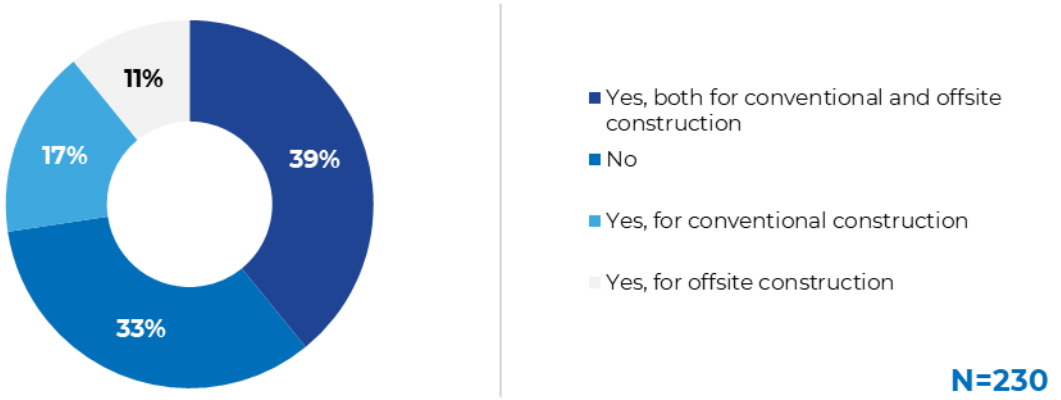
- Offsite construction offers greater cost predictability, with lower risk margins and fewer budget overruns, leading to more consistent project delivery.
- While final onsite assembly is faster for offsite projects, the overall project duration includes several steps as design, production, and permitting, that take a significant amount of time to complete, that in the end can become comparable to the timelines of onsite construction.

Clarifying misconceptions and presenting a realistic image of the benefits of offsite can be beneficial to client perceptions in the longer term, improving credibility of offsite construction overall and the professionals working in this sector.

3.4.2. Skills and availability of workers

Overall, respondents report a lack of workers across the whole construction sector. Traditional on-site construction is evaluated as more challenging due to its conditions, which make it more difficult to attract workers. This is why some stakeholders argue that the shortage of workers could increase the demand for offsite construction (see Section 2.3). Nevertheless, the lack of workers remains a barrier for both offsite and onsite construction.

Figure 32. Lack of skilled workers on onsite and offsite construction



The construction workforce has been declining in numbers as workers retire and traditional construction jobs are not attractive to younger people[74][75]. The traditional solution – importing workers from abroad – is becoming less viable as immigration policies tighten.[76]

Offsite construction can address some of these challenges by disassociating the location of the workforce from the building site. However, the shortage of skilled workers is transversal and affects all levels, from assembly line operatives to white-collar professionals such as supervisors, engineers, and project managers.

Focus group participants debated whether traditional construction workers could transition easily to offsite roles. Opinions were mixed. On the one hand, reskilling incentives are limited, given the current high demand and good remuneration for traditional construction jobs. In many Member States, blue-collar workers in construction can command competitive wages, often exceeding those of some white-collar roles. Construction crews can be selective about assignments, contributing to workforce shortages, particularly for renovations and small-scale residential projects.

Manufacturers also noted that candidates drawn to traditional on-site construction roles often differ in profile from those seeking employment in factory settings. Nevertheless, upskilling from traditional onsite functions to assembly remains possible. Manufacturers reported that new assemblers can become operational after completing a handful of small projects, suggesting that practical on-the-job training can be effective.

High labour costs and persistent shortages in the traditional construction workforce could gradually push developers, contractors, and designers to favour offsite methods where feasible. Although no sources are supporting these statements for the EU market, international examples confirm this trend. Hong Kong has long faced challenges in providing adequate public housing. Due to the city's high labour costs, prefabrication is increasingly used to produce apartment modules[77]. In the Philippines, due to the large-scale governmental '"Build, Build, Build'' programme that aimed to address the need for housing and rapid urbanisation, offsite construction adoption accelerated greatly. The advantages offered were critical, as the demand for infrastructure and housing outpaced traditional construction capabilities.[78]

Lack of skills and availability of workers

Significance High

Level of action 3

74 ECSO (2020). Improving the human capital basis. Analytical reports.
[75] Boston Consulting Group (2019) The Offsite Revolution in Construction.
[76] Ibid.
[77] ArchDaily, 08.03.2025, From High-Tech Icons to Social Housing: The Evolving Role of Prefabrication. Available here.
[78] https://www.sciencedirect.com/science/article/pii/S1226798825003976 Wenlei Xiong, Melito A. Baccay, Economic Benefits of Adopting Prefabricated Building Systems in the Philippines, KSCE Journal of Civil Engineering, 2025, 100282, ISSN 1226-7988, https://doi.org/10.1016/j.kscej.2025.100282.

3.4.3. New ways of working

Even a simple construction project requires the collaboration of various professionals and companies. At a certain extend though, different phases exist in their own silos. Authorisation and permitting, conceptual and large-scale architectural design, execution plans and onsite work, and production of materials and products, might require among them only minimal or no interaction.

Offsite construction requires close collaboration among construction professionals who would not directly interact in a traditional construction project, as the product manufacturer and the architect. In offsite construction, more than one traditional role can also be centralised in just one professional. The manufacturer can also be the contractor in the case of a fully prefabricated building.

This is not necessarily a barrier to offsite construction uptake, but rather shows a work in progress, as construction is evolving and transitioning to new ways of building.

The transition to more integrated ways of working is heavily supported by digital tools. Our survey demonstrated a high level of digital fluency among participants (see Figure 14 in Section 2.2.1). Building Information Modelling (BIM) is by far the most widely adopted digital tool. Other technologies, such as CNC machining, robotics, and artificial intelligence, are emerging but remain less widespread.

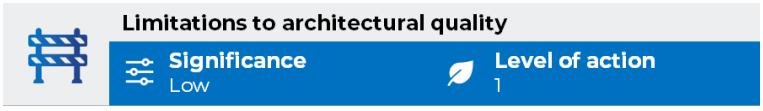
Focus group participants confirmed that offsite construction and digital transformation go hand in hand. Digital tools are essential to offsite manufacturing and as enablers to the hybrid use of onsite and offsite construction. In addition to all efficiency benefits, digitalisation comes with greater transparency, a differentiating and competitive advantage that offsite manufacturers bring forward.

3.4.4. Architectural quality

As introduced in Section 2.2.3, size and design flexibility are the main limitations that construction professionals face with the use of prefabricated elements. Among designers, architects, engineers, manufacturers, and suppliers, the most cited constraint was limitations due to the size of elements, followed by limited architectural identity, and a lack of variation in available options (see Figure 17). Concerns around performance and unknown delivery times were less prominent. Notably, 19 out of 120 respondents reported no design limitations, suggesting that while challenges exist, they are not universal.

The suppliers' and manufacturers' focus group emphasised that they are technically ready to collaborate with architects and produce any of their digital designs. In a new generation of offsite construction, manufacturers are eager to directly collaborate with architects. Yet to get to that point, some advancement is necessary in terms of education and information availability within the white-collar sector. While universities prepare engineers and architects mainly for the traditional construction techniques, it is difficult for offsite to penetrate the market.

Suppliers and manufacturers expect to address most of the barriers in the medium term (3-5 years), with the market growing together with their capacities to propose more alternatives. In the meantime, all professionals who participated in the focus group discussion reported that the most common way of constructing is hybrid, merging traditional and offsite. This combination can address many challenges for the sector and the housing provision, and at the same time, does not pose any barriers to creativity.



3.5. Prioritising barriers

Barriers were evaluated based on their impact and the level of response (Table 2). In the next chapter, we make action recommendations that address the barriers with the highest impact, requiring EU and Member State action.

Table 2 Evaluation of barriers based on their impact and required level of response. We prioritise action recommendations to address barriers with the highest impact, and where EU and MS action is required.

High impact	**Logistics**	**Standardisation**	**Financing** **Skills and availability of workers**
Medium impact	**New ways of working**	**Building codes** **Insurance**	**Permits** **Procurement**
Low impact	**Client acceptance** **Liability** **Architectural quality**		
	1	2	3
	Level of action		
	Limited role of policy markers	Soft national/local policy measures	Regulatory or financial measures for MS or EU level

4. Policy recommendations

Our analysis on drivers and barriers, combined by the political opportunity to address the lack of affordable housing, leads us to the formulation of five policy recommendations.

To achieve affordable housing provision in a timely manner, and while harnessing the opportunities offered by offsite construction, we recommend integrating offsite construction in key policy, funding and regulatory initiatives carried out at the EU level and implemented through national, regional and local level initiatives. In addition, we suggest that initiatives that address challenges in the broader construction sector, such as on digitalisation and automation, continue, and when necessary, scale up. Such initiatives not only support offsite construction, but in combination with new ways of building, can support EU-level provision of quality, green, and affordable housing.

Considering that support for offsite construction is a part of broader construction policy, the policy recommendations below are related to the recommended actions from the Transition Pathway for the Construction ecosystem.[79]

Table 3. Links between the Transition Pathway for Construction and the recommendations

	Recommended actions to support offsite				
Transition pathway actions	1	2	3	4	5
1.10 Support international standardisation and mainstream EU Standards.					
2.6 Improve through awareness raising and structural changes (e.g., use of digital collaboration and working methods) the attractiveness of the ecosystem as an employer.					
2.9 Train public sector employees dealing with procurement, permits and management of buildings and infrastructure in the use of BIM and other digital technologies and tools.					
4.4. Ensure that standards are rapidly developed and revised to keep up with market needs, innovation and policy developments.					
5.1 Activate and utilise EU funding to support resilience, greening and digitalisation in the construction ecosystem in general and in offsite construction in particular					
5.5 Channel public investments towards bottlenecks in the value chains. Monitor such bottlenecks.					
6.5. Support decent and affordable housing for all.					

[79] European Commission (2023). Transition Pathway for the construction ecosystem. https://single-market-economy.ec.europa.eu/sectors/construction/construction-transition-pathway_en

4.1. Streamline funding for offsite construction for affordable housing, through Cohesion Policy funds

Barrier addressed:	Financing
Actions to be taken by:	European Institutions and bodies (notably the European Commission and European Investment Bank), National authorities and financial institutions.

The European Commission has proposed to double the funding available for affordable housing under Cohesion Policy, up from the current EUR 7.5 billion. The Commission also urges public authorities to "streamline permitting and planning rules to accelerate delivery", to use financial instruments, including the pan-European Investment Platform with the European Investment Bank (EIB), and to support housing projects consistent with the New European Bauhaus.[80]

This context offers a great opportunity for the national authorities managing Cohesion Policy funds to address the housing crisis, while improving speed of delivery, transparency in spending and quality of jobs available, including through offsite construction.

Therefore, in the context of the Cohesion Policy mid-term review, the competent Commission services should work to streamline such considerations on construction modernisation within the funding packages for affordable housing.

4.2. Boost skills and availability of workers in construction

Barrier addressed:	Skills and availability of workers, new ways of working
Actions to be taken by:	European and national-level policy makers, Sectoral organisations and Trade Unions.

The lack of blue-collar workers is a generalised and cross-sectoral challenge within the EU. With an ageing population and strict immigration policies, this challenge is exacerbated. Both onsite and offsite construction suffer from a lack of workers.

Although the EU has no direct competence over the curricula of white-collar professions, the strong track record of EU-level initiatives has positively influenced skills development in the construction sector (e.g., Pact for Skills,[81] Construction Blueprint for Skills,[82] Build Up Skills).[83] In the opportunity presented by the Union of Skills,[84] such initiatives could be continued and amplified.

However, it is important to differentiate the current context from that of the previous decade. Today's high demand for workers has, paradoxically, reduced the incentive for upskilling. Professionals typically pursue training to enhance their career prospects, not when they are already well remunerated and in high demand. This dynamic underscores the need to attract a new generation of workers into the construction sector and to make construction careers more appealing to a broader segment of the workforce.

- The European Commission can support in addressing the integration of construction sector challenges via broader horizontal policies that directly or indirectly include

[80] European Commission, A modernised Cohesion policy: The mid-term review, COM(2025) 163 final.
[81] European Commission. Pact for Skills https://pact-for-skills.ec.europa.eu/index_en.
[82] Construction Blueprint, see here: https://constructionblueprint.eu/ ee here: https://constructionblueprint.eu/.
[83] Build up skills, see here: https://build-up.ec.europa.eu/en/bup-skills.
[84] Union of skills, see here: https://commission.europa.eu/topics/eu-competitiveness/union-skills_en.

construction, such as the European Pillar of Social Rights, the Union of Skills, and frameworks related to employment, education, and migration.

- National authorities and the sector itself can strengthen efforts to attract new workers into construction by promoting technical and vocational professions among adolescents and young adults, and by adapting immigration policies to reflect actual labour shortages in construction.
- Sectoral associations and trade unions can assist their members in transitioning towards offsite construction and roles of lower intensity, particularly supporting workers affected by accidents or health and age-related constraints, helping to retain skilled labour within the industry.

4.3. Support European leadership in standardisation

Barrier addressed:	Lack of standardisation
Actions to be taken by:	European Commission, European standardisation bodies, Industry and its associations.

Further standardisation can enable the scaling up of production, cross-border operations, and access to insurance, which ultimately contributes to reducing construction costs. International standards are being developed, however, the EU's ambitions towards a resilient and competitive economy cannot be delivered without European standards. Having a strong global footprint in standardisation activities and leading the work in key international fora and institutions will be essential for the EU to remain a global standard-setter, including for offsite construction. By setting global standards, the EU exports its values while providing EU companies with an important first-mover advantage.

Practitioners who participated in the survey and focus group discussions warned that the EU does not have the lead in standardisation of offsite construction and its components and is risking losing its share of the market. Their concerns are confirmed by looking at the composition of the competent ISO committee and the lack of EU standards in this area.

EU-level policy makers concerned with construction and affordable housing policies, together with industry representatives, should engage in the CPR Acquis Expert Group and especially in its respective sub-group on Building kits, units, and prefabricated elements which will prepare the content for standardisation requests for products related to offsite construction.

To avoid trade-offs between the quick provision of affordable housing and the share of EU companies in the market, it is important that standardisation experts participate in the reflection for future work. While the opportunity is not lost yet, European standardisation efforts need to accelerate.

4.4. Accelerate permit issuing and improve transparency of procedures

Barrier addressed:	Slow issuing of permits
Actions to be taken by:	European, national and local policy makers

Slow issuing of permits is a pan-European problem. In the current context of a lack of affordable housing, permit issuing needs to be accelerated for all types of construction. However, accelerating permits cannot be at the detriment of environmental and social interests, such as safety or protection of natural areas.

There are ways to accelerate the issuing of permits, without risking the integrity of the building and its users, nor pushing planetary boundaries. Accelerating construction permits was in the

spotlight of European policymakers during the COVID-19 pandemic, when lockdowns made in-person, paper-based procedures impossible and demonstrated their inefficiencies.

Since then, Member States have taken important steps to digitalise and accelerate (parts of) their permitting procedures, as analysed in previous EU-level studies[85]. In addition, EU funding was made available through Horizon Europe and the Technical Support Instrument to pilot and implement the latest generation of digital permits, and integrate automatic compliance checks using BIM, GIS and other digital tools and technologies. These automatic checks lead to important time savings and increase transparency and trust without trading off social and environmental interests that building codes aim to protect.

Examples of such European projects include CHEKdbp,[86] AD4GD,[87] ACCORD[88] and DigiChecks,[89] while the European Network for Digital Building Permits[90] has been in place since 2020, enabling the exchange and sharing of lessons between practitioners. In addition, a toolkit on Digital Building Permits for Municipalities[91] was issued by the European Commission.

While there is a lot of knowledge and guidance on accelerating permitting available, as outlined in the previous paragraph, it is time for a coordinated push to improve permitting systems and accelerate relevant procedures. EU and national policy makers should consider setting performance targets (i.e., set a limit to the maximum number of days to issue a permit) and in parallel through technical assistance, assist municipalities and other involved authorities to improve processes and systems, examine and reinforce the availability of staff, skills and software at municipal level. While work and conversations take place at the EU level, hundreds of municipalities across Europe are called to process permits and adapt to the digital transformation, often with minimal support.

4.5. Enable digital, adaptive and innovation-friendly public procurement

Barrier addressed:	Public procurement
Actions to be taken by:	European, national and local policy makers

Public procurement can be a key tool in driving the development of innovative goods and services within the European market. Specifically on innovation, the Commission issued a dedicated guidance with several clarifications on construction.[92] Green public procurement criteria are available for Building Design, Construction and Management, allowing for support or at least the provision of offsite as an option.[93] Nevertheless, the integration of strategic procurement and the consideration of environmental, social and innovative criteria beyond the most economically advantageous tender is only implemented to a limited extent, as has been reported by the European Court of Auditors.[94]

Overall, digitally enabled, adaptive and innovation-friendly public procurement can be beneficial to offsite construction and can be further operationalised with actions steered at the EU level and tested at the local level.

- The European Commission launched a call for evidence and opened a public consultation to evaluate the Public Procurement Directives (2014/23/EU, 2014/24/EU,

[85] ECSO (2021) Analytical Report - Digitalisation in the construction sector. Available here.
[86] CHEK - Change Toolkit for Digital Building Permits, available here: https://chekdbp.eu/.
[87] AD4GD – All Data 4 Green Deal, available here: https://ad4gd.eu/.
[88] ACCORD - Automated Compliance Checks for Construction, Renovation or Demolition Works, available here: https://accordproject.eu/.
[89] DigiChecks – Digital environment for management of permits and compliance in building and construction, available here: https://digichecks.eu/.
[90] EUnet4DBP - European Network for Digital Building Permits, available here: https://eu4dbp.net/.
[91] PwC (2023) Toolkit on Digital Building Permits for Municipalities, available here: https://ec.europa.eu/docsroom/documents/64155?locale=en.
[92] European Commission (2021). Guidance on innovation procurement. DocsRoom - European Commission
[93] EU Green Public Procurement Criteria, Green Business - Library. Available here.
[94] European Court of Auditors, 2023, Special report 28/2023: Public procurement in the EU – Less competition for contracts awarded for works, goods and services in the 10 years up to 2021.

2014/25/EU) in December 2024. Such evaluation and following actions can create an opportunity to better integrate innovation and new ways of building (including offsite) and digital tools in procurement for construction. Offsite construction is already increasing in share in infrastructure projects of public interest (such as bridges, tunnels, airports), including social and affordable housing.

- Offsite construction, as a cleaner and more environmentally friendly construction method, offers significant benefits to local and regional authorities. By reducing on-site disturbance, air pollution, and noise pollution, offsite approaches contribute directly to improved urban living environments. C40 cities, as part of the Clean Construction Accelerator[95] – and in partnership with the World Green Building Council – commit to taking several actions, including promoting offsite construction directly and indirectly, through the setting of high environmental performance and employment standards in construction and the construction sites.[96] The Communities of Practice (CoP) of the Big Buyers initiative[97] have repeatedly followed similar topics, such as zero-emission construction sites and BIM. An offsite construction-focused CoP could provide good practices at the local level and practical knowledge on the benefits of offsite not only to professionals and users associated with a building, but of the communities within which it is located.

[95] Clean Construction Accelerator - C40 Cities: https://www.c40.org/accelerators/clean-construction/
[96] C40 (2025) Global Policy Report. Building Greener Cities: Green Job Opportunities in Clean Construction. Available here.
[97] Big Buyers Working Together | Public Buyers Community: https://public-buyers-community.ec.europa.eu/about/big-buyers-working-together.

Annex A: Study objectives and methodology

In this Annex, we provide a summary of the study objectives and methodology.

Overall approach

Considering the potential of offsite construction but also the barriers to its more widespread adoption, it is paramount to better understand the offsite construction market in the EU and its Member States. With this purpose in mind, this study assessed the available technology, market, customer acceptance, regulatory impediments and possibilities, technical and non-technical barriers to wider uptake of offsite construction.

To do so, we built on a research note developed by the Technical Secretariat of the High-Level Construction Forum.[98] The report provides an overview of the context and history as well as the main benefits of and challenges to offsite construction. To complement it, we consulted stakeholders in the Member States to assess the current market and potential for offsite construction in the EU. Building on this assessment, we drafted policy recommendations and highlighted good practices in Member States that can address barriers and support unlocking the potential of offsite construction.

In terms of the scope, the study focuses on offsite construction for residential buildings, whereas findings on offsite construction for non-residential buildings are only considered if relevant to the purpose of the study. Geographically, the study focuses solely on the EU and draws particular attention to the situation and differences in Member States.

Following an initial desk research and structuring of the research questions, our research approach included the following three tasks:

1. A targeted survey with stakeholders from the industry including EU and national industry associations, product manufacturers, contractors, architects, engineers, developers, policymakers and other stakeholders.
2. A structured dialogue through three focus group discussions with contractors, architects and engineers, and product manufacturers.
3. The consolidation and reporting of findings including the drafting of conclusions and recommendations.

Approach to the targeted survey

The survey aimed to gather additional information from EU-level and national-level stakeholders on the market and potential of offsite construction in the EU. It was implemented in three steps:

1. Survey design and preparation: The survey was designed based on the benefits and implementation barriers identified through the research note on offsite construction. We structured it into several sections (benefits, barriers, perceptions on demand, efficiency gains, cross-border operations, technology, good practices and recommendations) programmed it, and thereafter translated it into 12 EU languages before launching it.
2. Survey distribution: In parallel to the survey design, we mapped stakeholders at EU and the national level. The survey was then distributed to the mapped stakeholders as well as disseminated through existing groups such as the High-Level Construction Forum.
3. Survey analysis: Following the closure of the survey, we reviewed responses by cleaning the survey data and creating graphs representing the responses (see Annex B). These were then summarised in a Discussion Paper, which served as input for the structured dialogue with stakeholders.

[98] Technical Secretariat of the High-Level Construction Forum (2024) Research Note on Offsite Construction.

Approach to the structured dialogue

The purpose of the structured dialogue was to engage with stakeholders in focus group discussions to validate survey findings and deepen our understanding of the contextual factors and differences in perceptions across the value chain. We therefore organised three focus group discussions, one with contractors, one with architects and engineers, and one with product manufacturers.

Each focus group was organised in a similar manner. Participants were invited to 2-hour sessions where we presented survey findings by topic and then discussed these findings with participants, as well as raised follow-up questions. Participants received a discussion paper a few days ahead of the focus group discussion, allowing them to familiarise themselves with the survey findings and prepare.

Following each session, we prepared summaries of the discussions (see Annex C) and used the inputs received to draft this study report.

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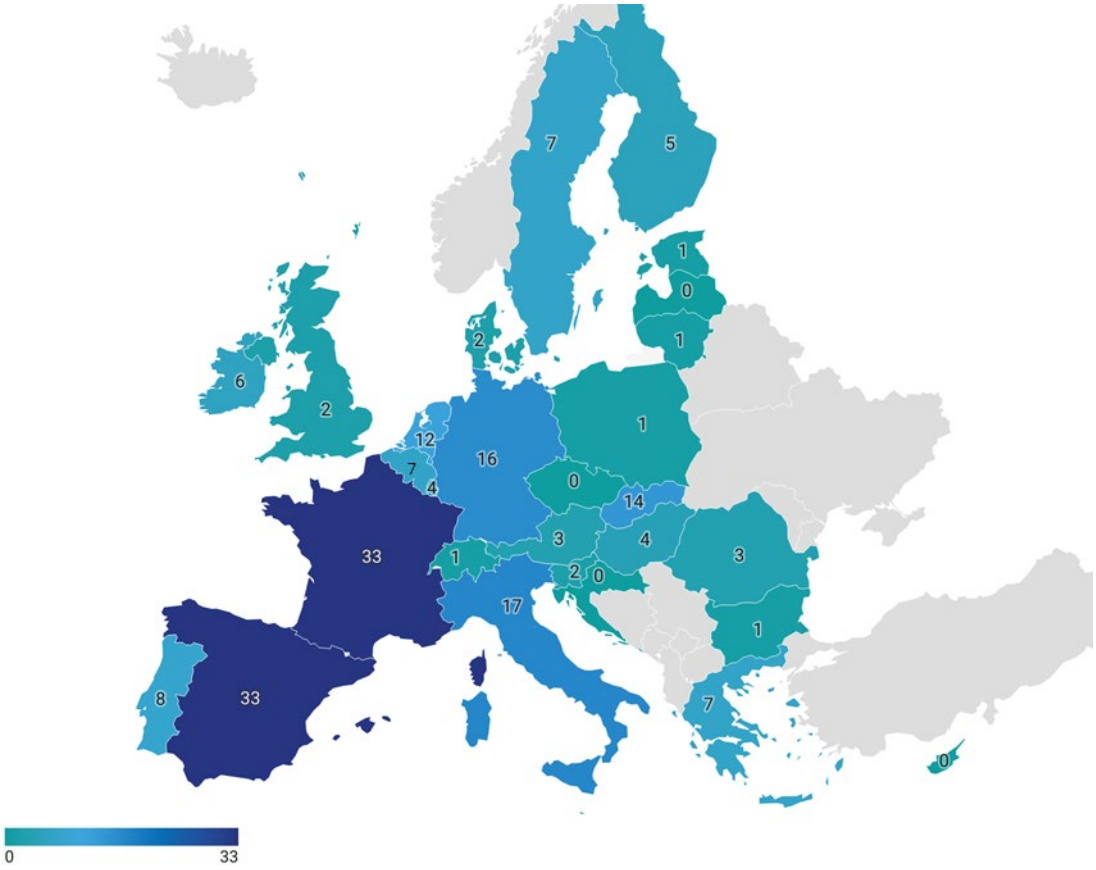
Annex B: Survey results

Number and origin of responses

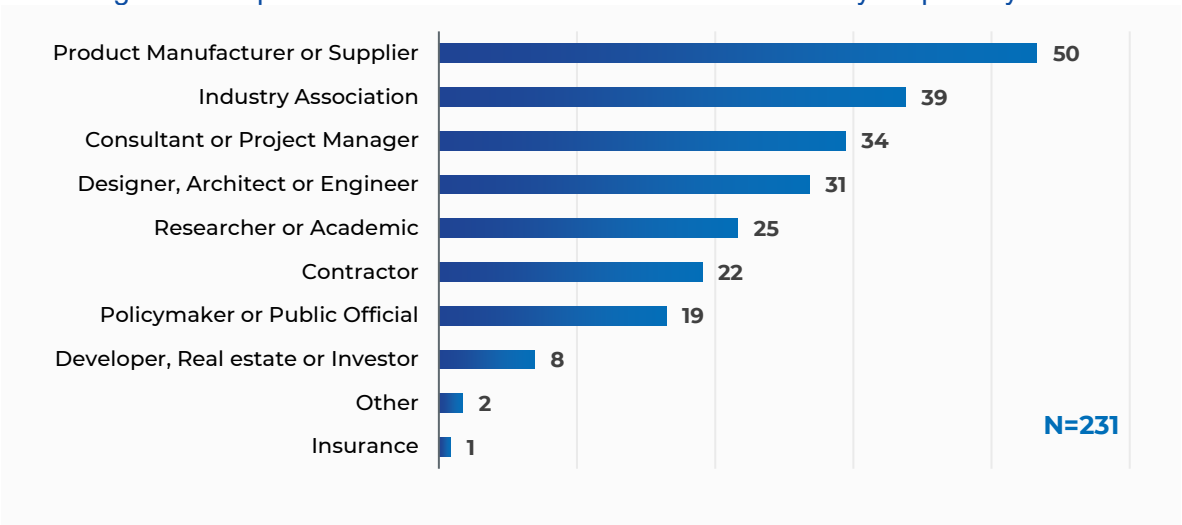
The survey obtained 231 responses in total. This includes responses from EU Member States, EU-level organisations, and non-EU countries.

Figure 1 Geographic distribution of survey respondents - Which is the main country of your operation (and for which you will primarily answer this questionnaire)?



Survey responses are concentrated from Western EU Member States and institutions, with lower inputs from Eastern Europe. Most responses came from France (33), Spain (33), Italy (17), Germany (16), as well as from EU-level organisations (44). Participation from several Eastern and smaller Member States was low or absent, which may affect the geographic balance of insights. A small number of responses also came from non-EU countries, including Switzerland, the UK, China, and others, suggesting some international relevance. No responses were received from the following Member States: Croatia, Cyprus, Czechia, and Malta.

Figure 2 Respondent's role in offsite construction - What is your primary role?



The survey captured a broad cross-section of the construction ecosystem, with the strongest engagement from suppliers, associations, and consultants. Product manufacturers or suppliers (50), industry associations (39), and consultants/project managers (34) made up the largest share of respondents, reflecting strong representation from upstream and coordination actors in the value chain. Participation from designers, academics, contractors, and public officials was also notable, while downstream roles, such as developers, investors, and insurers, were less represented.

Figure 7 Integration of offsite construction into respondents' work - To what extent is offsite construction integrated into your organisation's work?

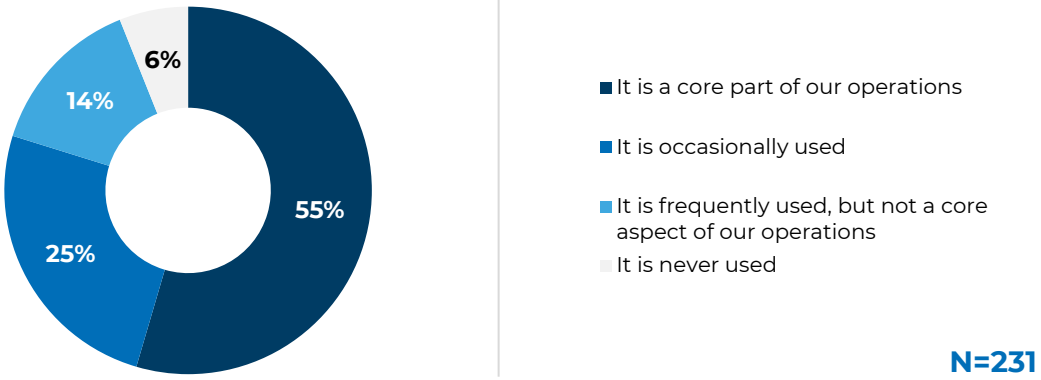
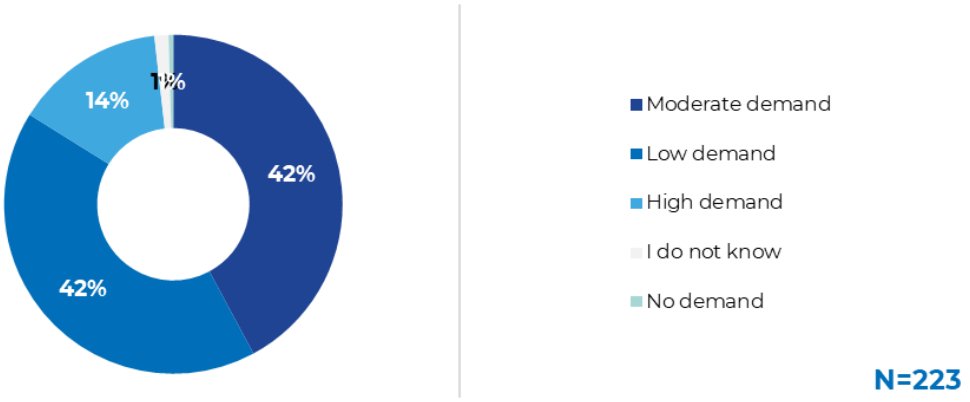


Figure 8 Perceptions on demand – How do you perceive the demand for offsite construction in the countries of your activity?



Perceived demand for offsite construction is largely moderate to low across countries of activity. Across all respondents, moderate demand (94) and low demand (93) were the most frequently selected perceptions. Only 32 respondents reported high demand, while almost no one indicated no demand (1) or uncertainty (3 did not know). The table below splits these responses by the country of operation of the respondent, showcasing that most respondents who perceive a high demand are operating in Germany and France. The table shows, however also that perceptions within one country can differ greatly as both Spain and France have close to an equal number of respondents perceiving a moderate and low demand.

	No Demand	Low demand	Moderate Demand	High Demand	I do not know
Austria	0	0	3	0	0
Belgium	0	3	3	0	1
Bulgaria	0	0	1	0	0
Croatia	0	0	0	0	0
Cyprus	0	0	0	0	0
Czech Republic	0	0	0	0	0
Denmark	0	1	1	0	0
Estonia	0	1	0	0	0
Finland	0	1	1	3	0
France	0	14	12	6	0
Germany	0	4	2	9	0
Greece	0	5	1	1	0
Hungary	0	3	1	0	0
Ireland	0	2	2	2	0
Italy	0	9	6	0	1
Latvia	0	0	0	0	0
Lithuania	0	0	0	0	0
Luxembourg	0	2	2	0	0
Malta	0	0	0	0	0
Netherlands	0	4	5	3	0
Poland	0	1	0	0	0
Portugal	0	4	3	0	0

Romania	0	3	0	0	0
Slovakia	1	6	7	0	0
Slovenia	0	1	1	0	0
Spain	0	16	15	1	1
Sweden	0	1	5	1	0
EU level representation	0	12	23	6	0

Demand for offsite construction is highest in social, multi-family, and student housing projects. Respondents identified social housing (119), multi-family residential housing (108), and student housing (106) as the top segments where offsite construction and single-family homes (108) were in highest demand. Emergency or temporary housing (61) and segments such as non-residential, senior living, and mixed-use buildings also featured prominently.

Figure 9 Demand by type of projects – In which types of housing projects is there the highest demand for offsite construction in your country? [Unrestricted multiple choice]

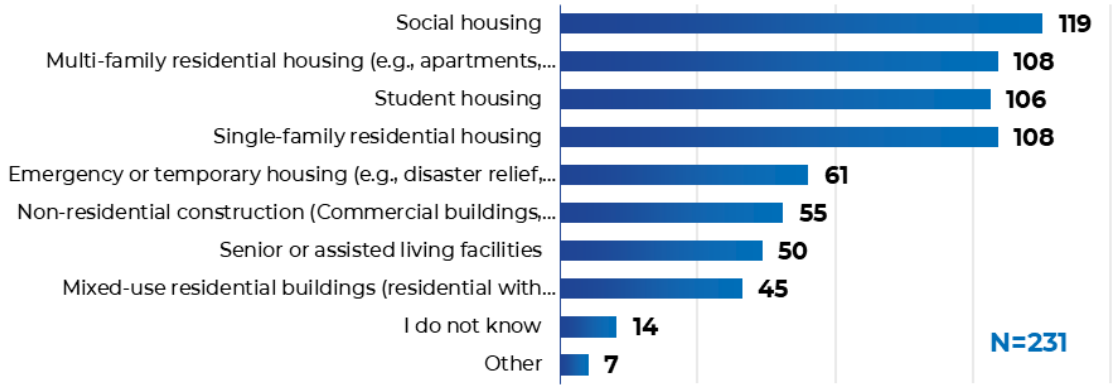
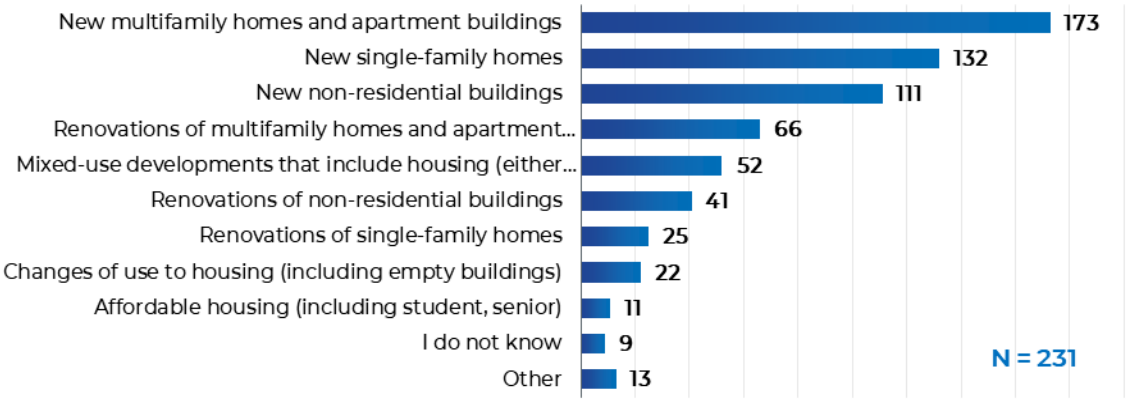
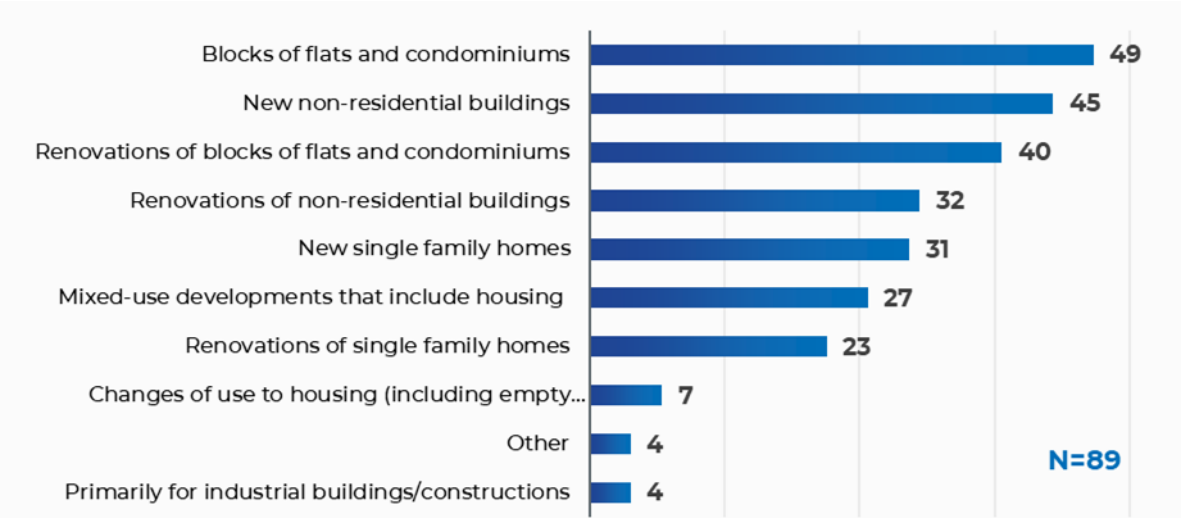


Figure 10 Suitability of housing projects – Which types of housing projects are most suitable for offsite construction? [Unrestricted multiple choice]



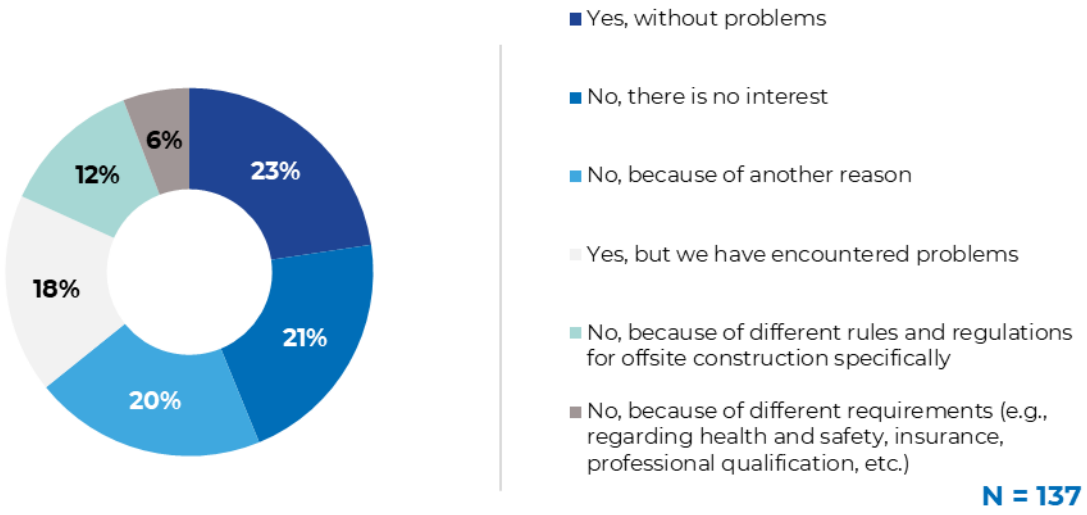
New multi-family housing is seen as the most suitable application for offsite construction, followed by single-family and non-residential new builds. Respondents ranked new multifamily homes and apartment buildings (173) as the most suitable project type for offsite construction, followed by new single-family homes (132) and new non-residential buildings (111). Among renovation projects, multifamily housing (66) and mixed-use developments (52) were rated highest. Lower suitability was reported for change-of-use projects (22), and renovation of single-family homes (25).

Figure 11 Types of projects in which suppliers, manufacturers, contractors, developers, designers, architects and engineers are mainly involved - In what types of projects are you involved? (select all that apply). This question applies only to the aforementioned stakeholder types. [Unrestricted multiple choice]



Stakeholders are most active in multi-unit housing and new non-residential construction, with growing involvement in renovation projects. Among the 89 respondents from contractor, developer, project management, and design professions, the most common project types were blocks of flats and condominiums (49) and new non-residential buildings (45). Renovation projects also featured, both for renovations of blocks of flats and condominiums (40) and of non-residential buildings (32), reflecting stakeholders involved in the integration of offsite approaches in retrofitting. Engagement in single-family homes, mixed-use developments, and change-of-use projects was more limited, while industrial applications are marginally represented.

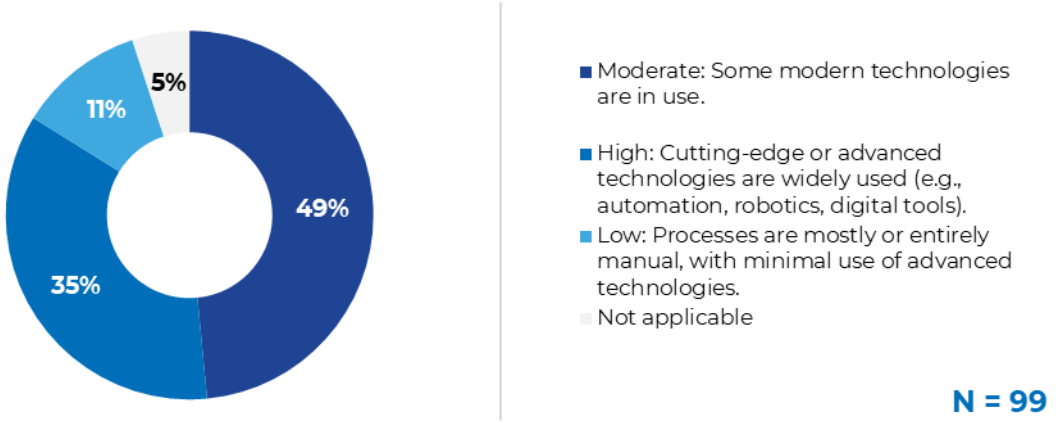
Figure 12. Cross-border operations – Does your organisation work on offsite construction projects across borders in other countries? This question applies to Developers, architects, engineers, contractors, developers, real estate and investors.



Cross-border activity in offsite construction is limited, with regulatory fragmentation a key constraint. Among developers, architects, engineers, and contractors, only 31 reported operating across borders without issues, while 24 do so but face challenges. A similar number cited no activity due to lack of interest (29) or other reasons (28). Notably, 17 pointed to specific regulatory differences in offsite construction, and 8 referenced broader cross-border requirements (e.g., health and safety, insurance, qualifications). These findings highlight both

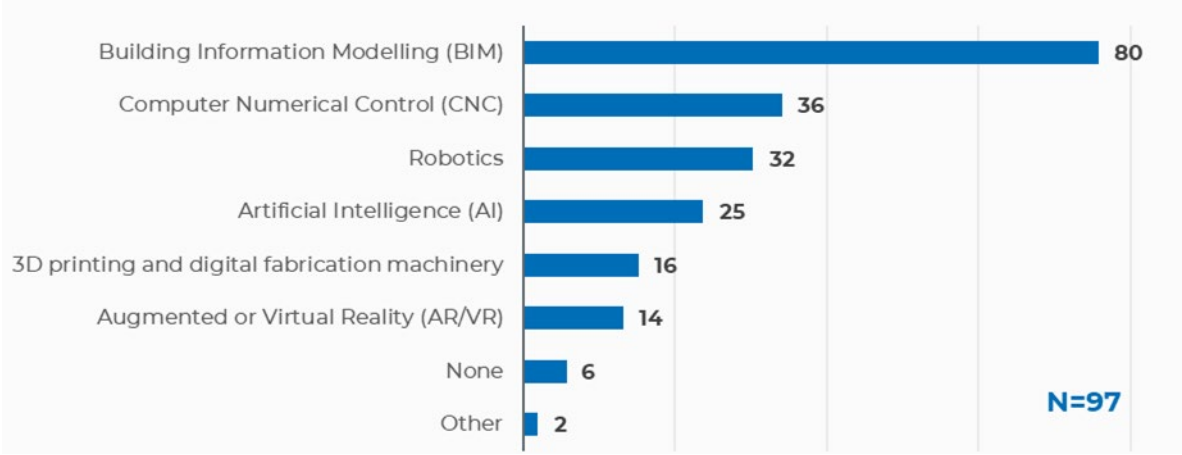
interest and potential in cross-border collaboration, but that this is tempered by fragmented regulatory environments and practical barriers.

Figure 13. Technological integration – How would you describe the level of technological integration in your work? This question applies to Developers, architects, engineers, contractors, developers, real estate and investors.



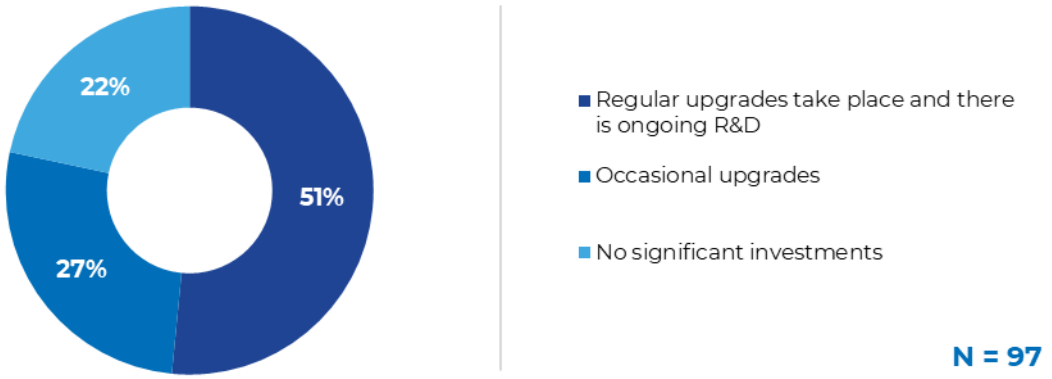
Technological integration in offsite construction is moderate overall, with a growing share of advanced adopters. Among developers, designers, contractors, and investors, 48 reported moderate use of modern technologies, while 35 indicated high integration of advanced tools such as automation, robotics, or digital platforms. A smaller group (11) operate with minimal technology. These responses suggest that while most stakeholders are engaging with technology to some extent, full digitalisation and automation remain in progress.

Figure 14. Use of digital tools – Which digital tools or automation technologies are currently in use in your construction processes? This question applies to designers, architects, engineers, product manufacturers, suppliers and contractors.



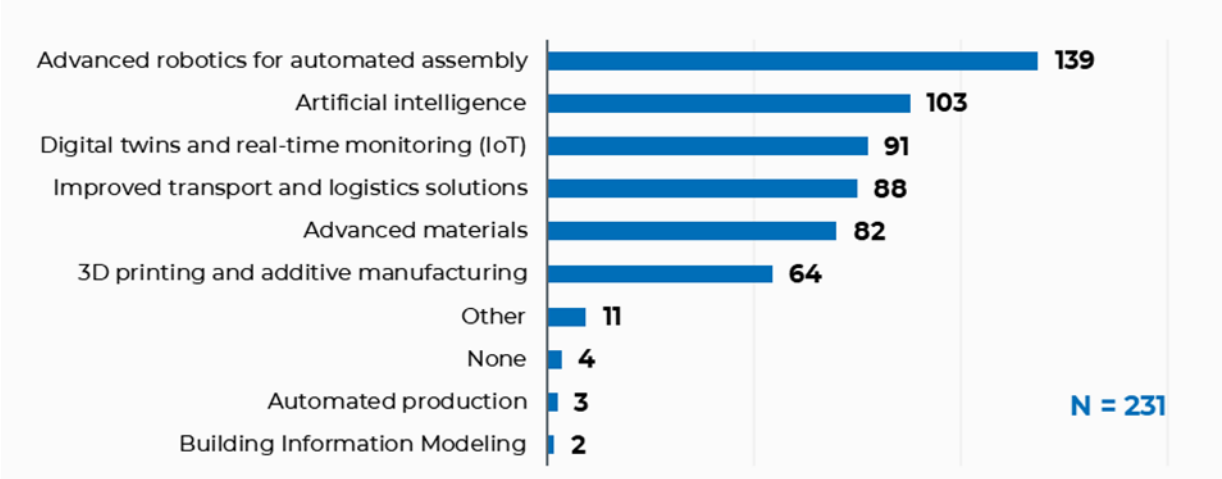
Building Information Modelling (BIM) dominates digital tool adoption in construction, while advanced automation remains niche. Among designers, architects, engineers, manufacturers, and contractors, BIM (80) is by far the most widely used digital tool. Other technologies such as CNC (36), robotics (32), and AI (25) show emerging uptake, while 3D printing (16) and AR/VR (14) are still relatively limited.

Figure 15. Technological investment – To what extent does your organisation invest in technology and innovation related to offsite construction? This question applies to Developers, architects, engineers, contractors, developers, real estate and investors.



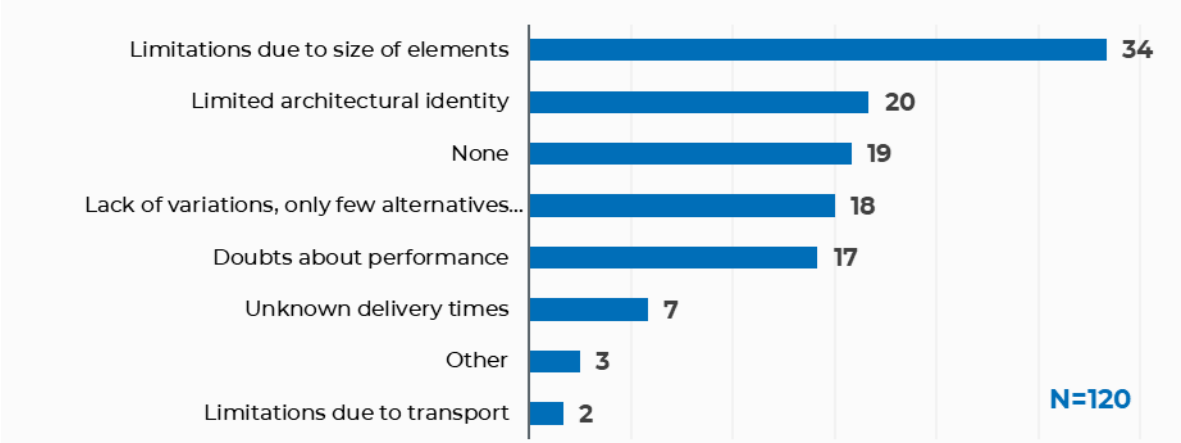
Half of the respondents report ongoing investment in offsite-related technology and innovation, though others remain cautious. Among developers, architects, engineers, contractors, and investors, 50 indicated their organisations engage in regular upgrades and ongoing R&D for offsite construction. 26 reported making occasional upgrades, while 21 stated there are no significant investments.

Figure 16. Mid-term innovation – Which of the following emerging technologies do you believe will have the greatest impact on offsite construction in the next 5–10 years?



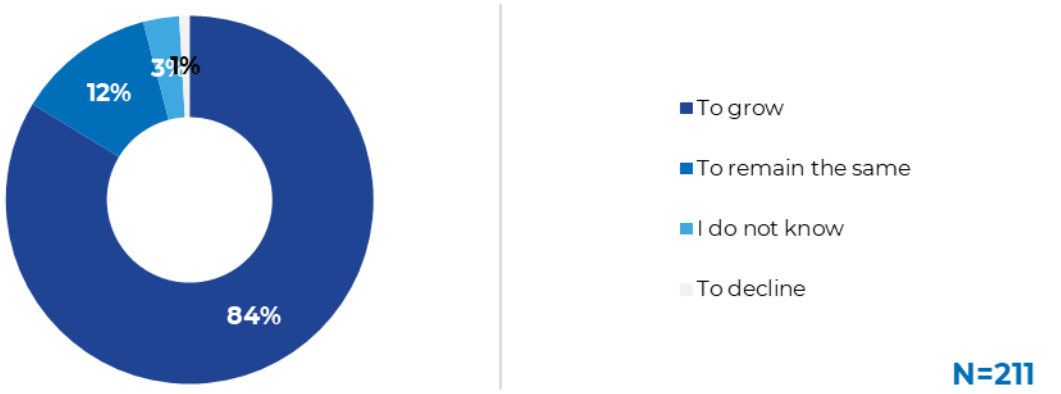
Advanced robotics, AI, and digital monitoring are expected to drive the next wave of offsite construction innovation. Respondents identified advanced robotics for automated assembly (139) as the most impactful emerging technology over the next 5–10 years, followed by AI (103) and digital twins/IoT (91). Other key areas include improved transport and logistics (88), advanced materials (82), and 3D printing (64). Only a few selected other technologies (11).

Figure 17. Design limitations – What design limitations have you faced when using prefabricated elements or building parts? Are any imposed by current offsite construction technologies? This question applies to designers, architects or engineers, product manufacturer and suppliers.



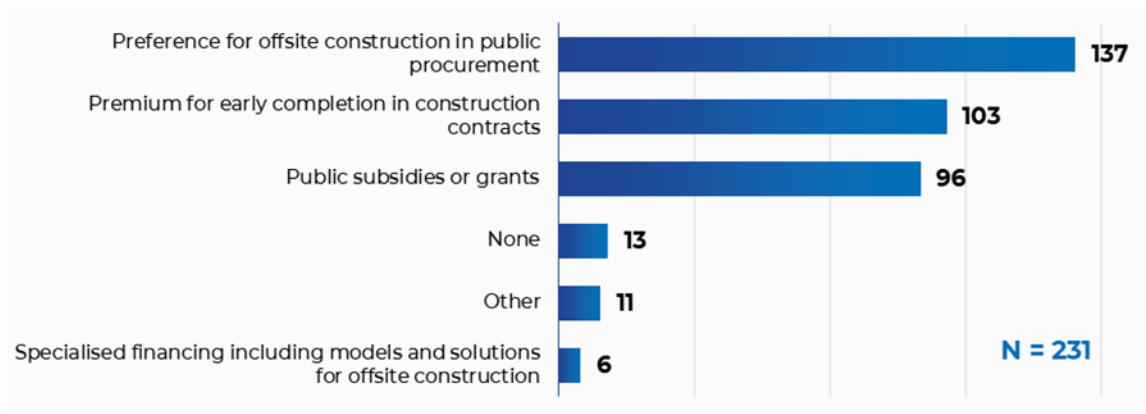
Size and design flexibility are the main limitations faced when using prefabricated elements. Among designers, architects, engineers, manufacturers, and suppliers, the most cited constraint was limitations due to the size of elements (34), followed by limited architectural identity (20) and a lack of variation in available options (18). Concerns around performance (17) and unknown delivery times (7) were less prominent, while only a few respondents mentioned transport issues (2) or selected other (3). Notably, 19 reported no design limitations, suggesting that while challenges exist, they are not universal.

Figure 18. Growth expectations – How would you expect the offsite construction market to develop in the next 5 years in your main country of activity?



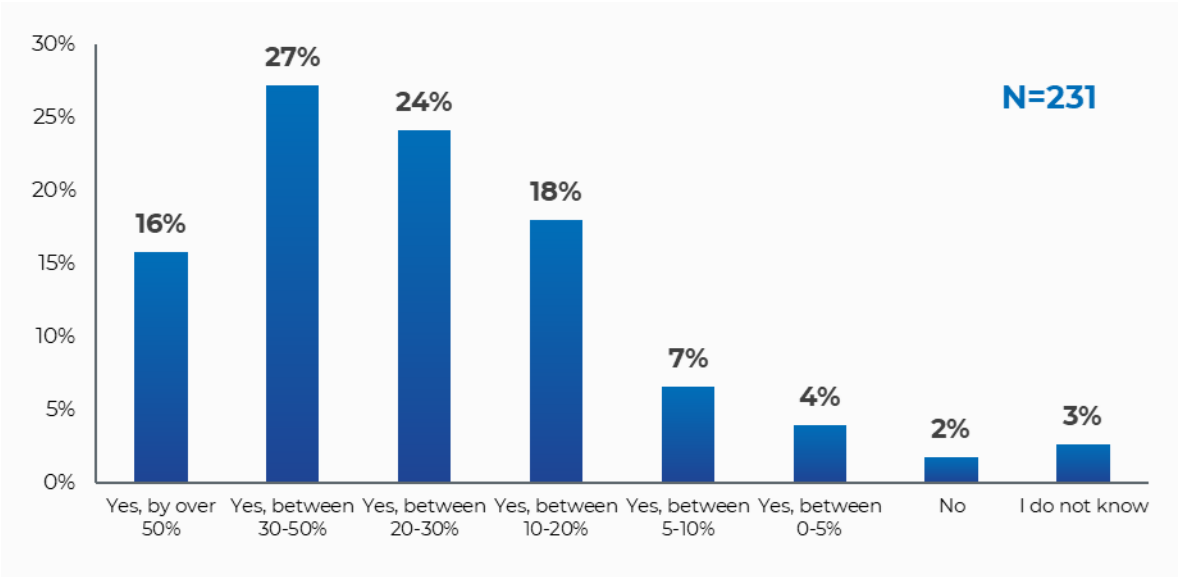
Expectations for offsite construction are overwhelmingly positive, with strong confidence in market growth. Amongst all respondents, 188 expect the offsite construction market to grow over the next five years in their main country of activity. Only a small share expect it to remain the same (27), decline (2), or were uncertain (7).

Figure 19. Financial incentives – What types of financial incentives or other support mechanisms would best encourage growth in offsite construction?



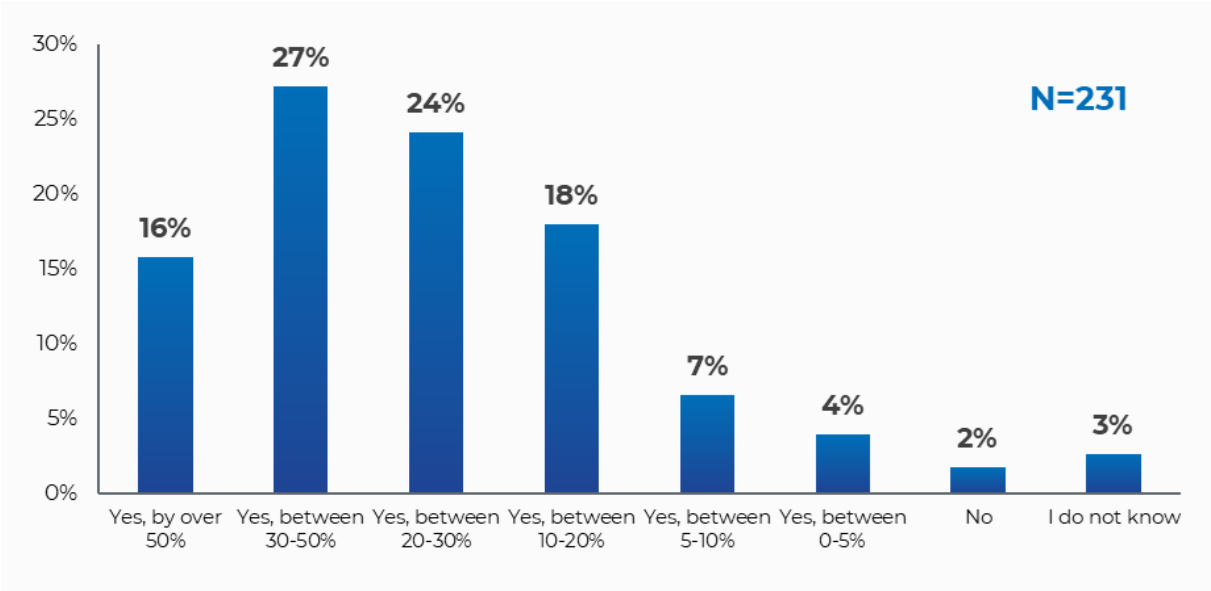
Public procurement preferences and contractual incentives are seen as the most effective levers to accelerate offsite construction. The most widely supported measures were preferential treatment in public procurement (137) and premiums for early completion in construction contracts (103). Public subsidies or grants (96) also received strong support, while fewer respondents saw value in specialised financing models (6). A small group felt that no incentives were needed (13), and 11 proposed other ideas.

Figure 20. Time efficiency – Do you think offsite construction can reduce project time compared to conventional methods? (from design to finished project).



Time savings are seen as a major advantage of offsite construction, with many expecting reductions of over 30%. A large share of respondents believe offsite construction can significantly reduce project timelines, with 36 estimating savings of over 50%, and 62 expecting 30–50% faster delivery. An additional 58 foresee 20–30% time reductions. Fewer respondents anticipate more modest gains, while only 4 saw no time advantage, and 6 were unsure.

Figure 21. Cost efficiency – Do you think offsite construction can reduce costs compared to conventional methods?

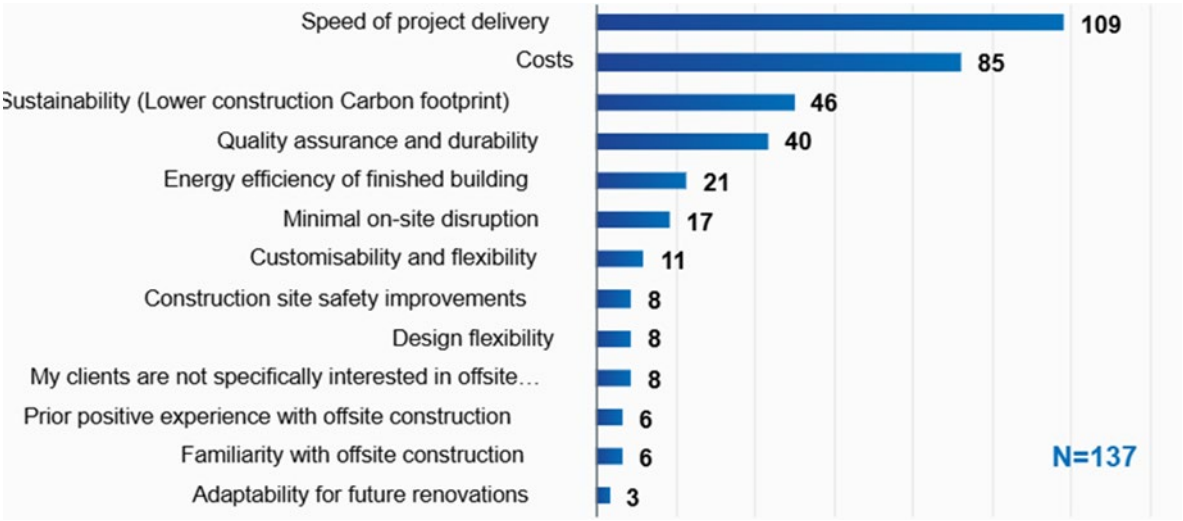


Most respondents believe offsite construction can reduce costs, though typically at modest levels. Most respondents see potential for cost savings between 10–20% (81) or 5–10% (44) when using offsite methods compared to conventional construction. A smaller share expect savings of 20–30% (27) or more, and only 2 respondents believed savings exceed 50%, while 25 said there are no savings, and 19 were unsure.

Figure 22. Client acceptance – How would you describe the level of client acceptance of using offsite methods for construction?

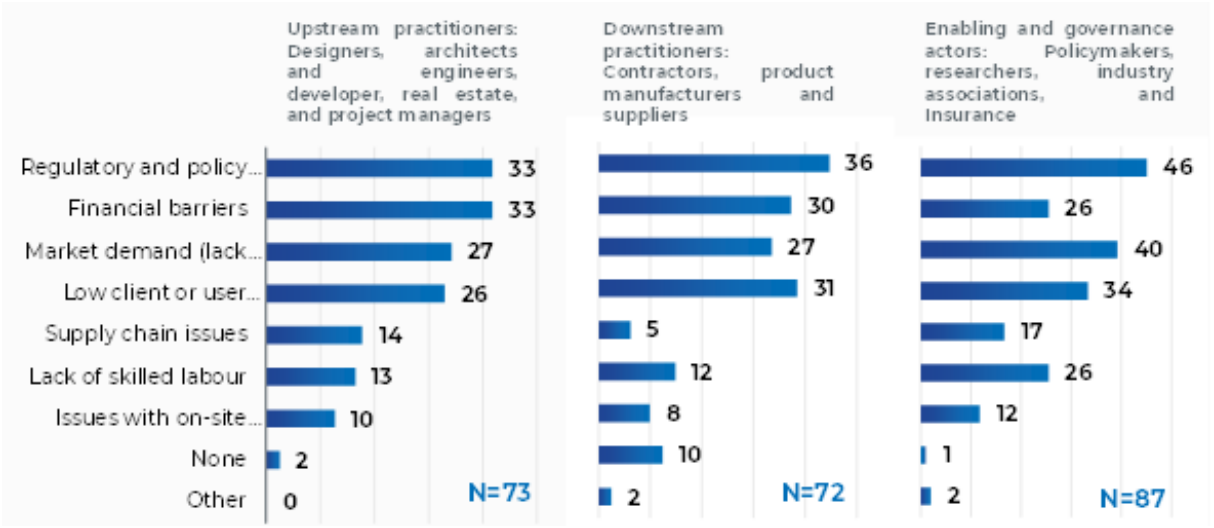
Client acceptance of offsite methods is conditional and benefit-driven, rather than fully enthusiastic or resistant. The majority of respondents (103) indicated that clients are supportive when clear benefits are demonstrated, suggesting a pragmatic, outcome-focused stance. Far fewer reported neutrality (17) or strong support (10), while 7 noted general opposition, and 3 were uncertain.

Figure 23. Important features for the clients – Which features of offsite construction are most important to your clients?



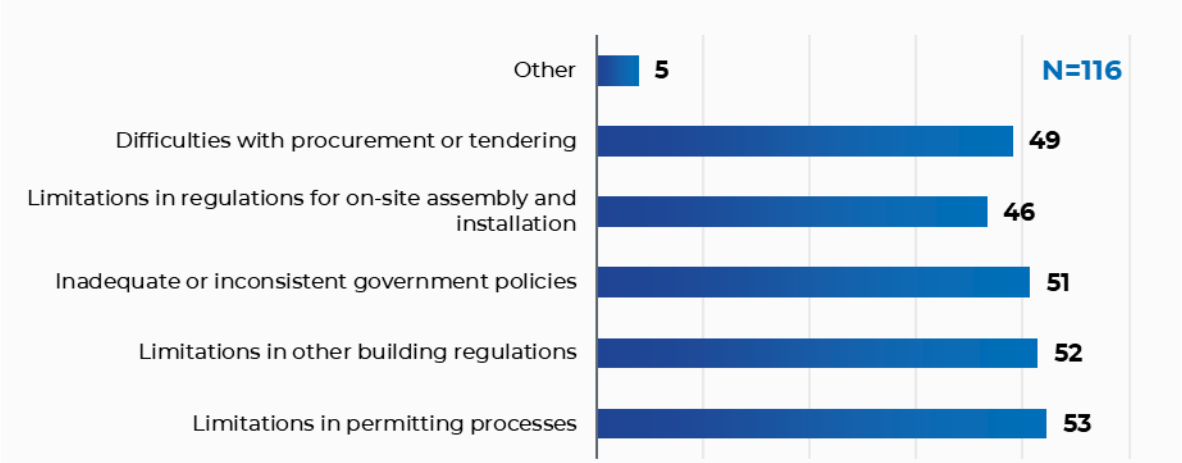
Speed, cost, and sustainability are the most valued features of offsite construction from the client perspective. Respondents indicated that speed of project delivery (109) and costs reductions (85) are the most important features for clients, followed by sustainability (46) and quality assurance and durability (40). Other considerations like energy efficiency (21) and minimal on-site disruption (17) also ranked moderately. Features such as customisability, design flexibility, and prior experience were cited less frequently, and only a small number noted lack of client interest. This suggests that clients prioritise tangible performance outcomes over technical familiarity or flexibility.

Figure 24. Key barriers to offsite construction adoption by stakeholder group - What are the main barriers you encounter in advancing the adoption of offsite construction? (Select up to 3)



Regulatory and policy barriers are consistently identified as the top obstacle across all stakeholder groups, but the relative importance of other barriers varies by practitioner type. Upstream practitioners (designers, architects, engineers, developers, and project managers) place greater emphasis on financial barriers and market demand challenges, while downstream practitioners (contractors, product manufacturers, and suppliers) are more impacted by labour shortages and on-site assembly issues. Enabling and governance actors (policymakers, researchers, industry associations, and insurers) highlight broader market and regulatory gaps, reflecting their system-wide perspective.

Figure 25. Regulatory and policy barriers – [of those who reported regulatory and policy barriers as one of the main barriers they encounter]. What are the main regulatory and policy barriers you encounter?



Permitting processes and building regulations are the most frequently cited regulatory barriers to offsite construction. Among respondents who identified regulatory and policy barriers (116), the top issues were limitations in permitting processes (53) and building regulations (52). Close behind were inadequate or inconsistent government policies (51), as well as difficulties with procurement or tendering (49) and regulations related to on-site assembly (46). Only a small number (5) selected "other," suggesting that the majority of concerns are concentrated in predictable regulatory bottlenecks.

Figure 26. Days to obtain a construction permit across the EU MS (2024[1]).

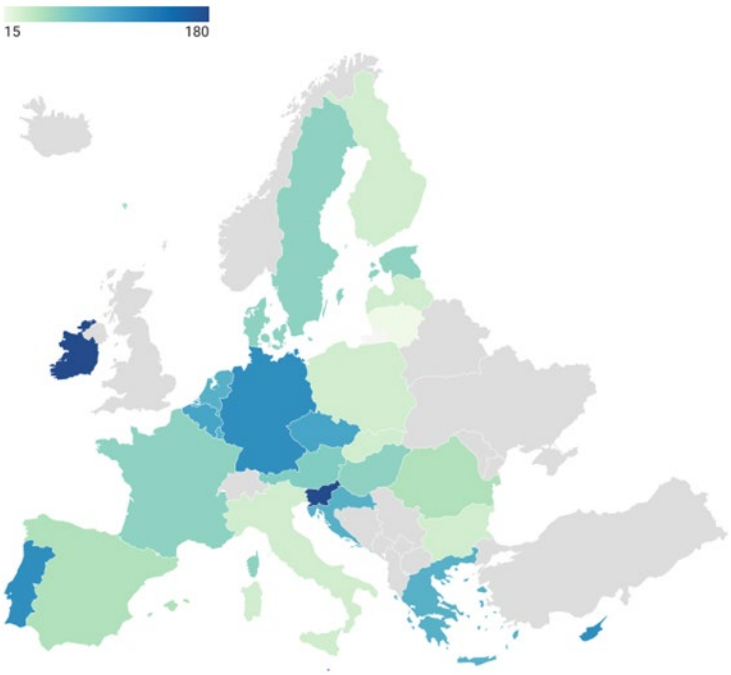
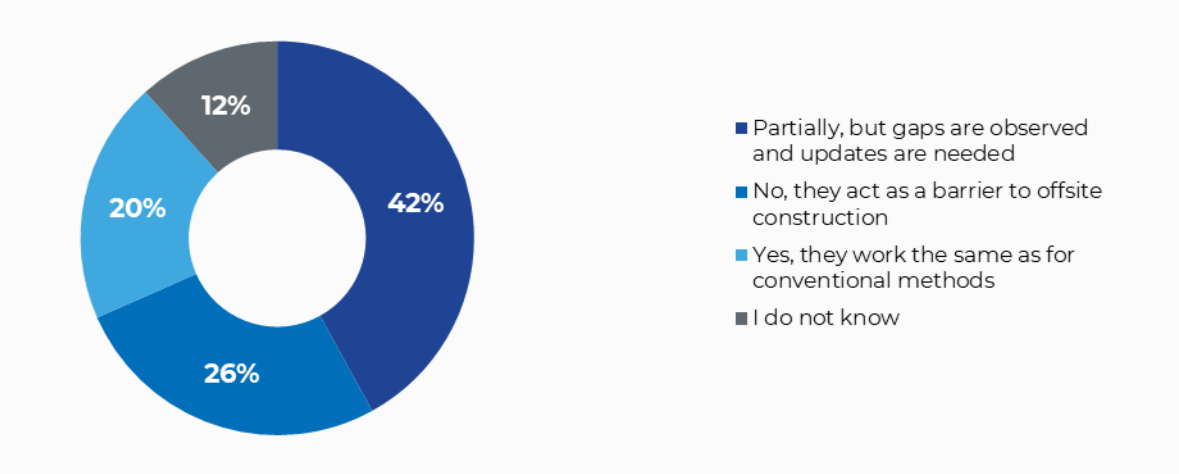
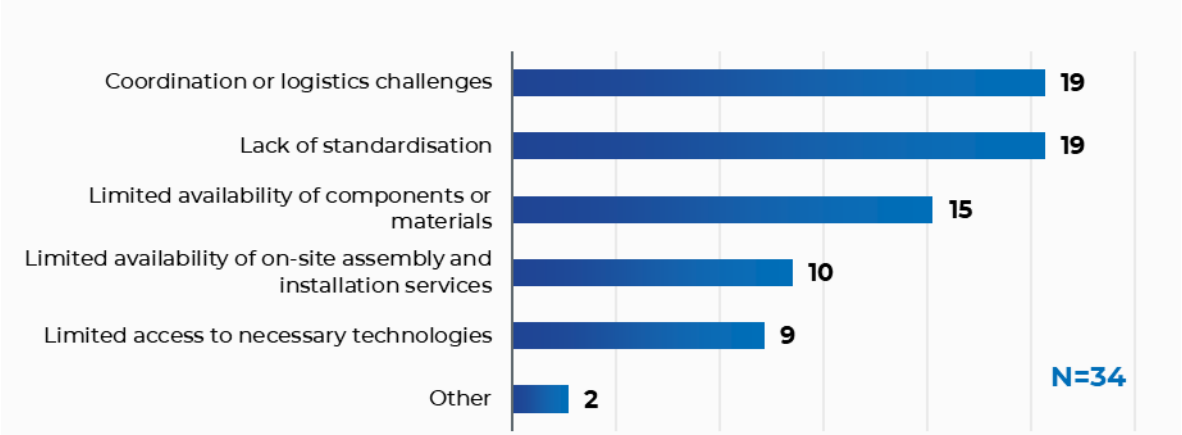


Figure 27. Building codes – Do building codes or local regulations facilitate the use of offsite construction in the main country of your activity?



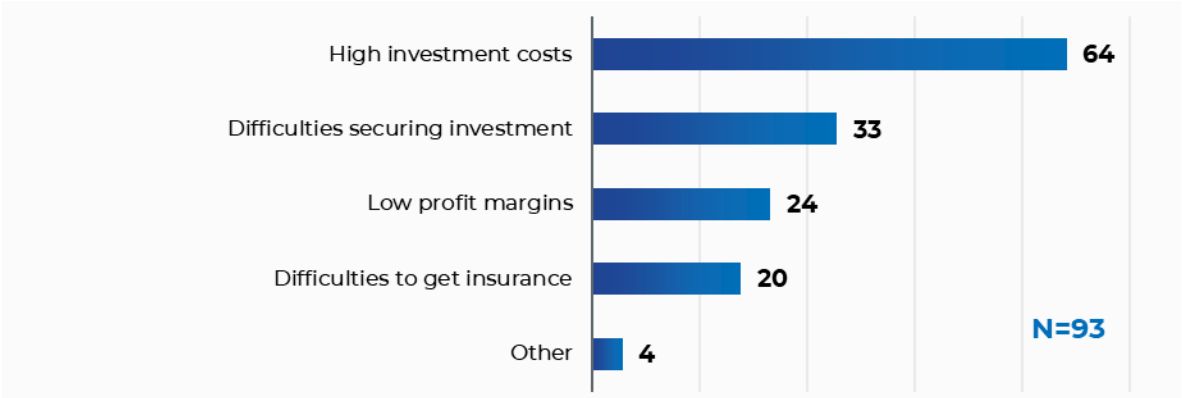
Building codes are only partially supportive of offsite construction, with many stakeholders calling for updates. Most respondents (100) indicated that current building codes partially support offsite construction but require revisions or updates. 61 view existing codes as barriers, while 46 feel they are neutral and work similarly to conventional methods. 27 were unsure. These findings highlight a clear regulatory gap: although not universally restrictive, current frameworks often fall short of enabling or accelerating offsite adoption.

Figure 28. Supply chain barriers – [of those who reported supply chain barriers as one of the main barriers they encounter]. What are the main supply chain issues you encounter?



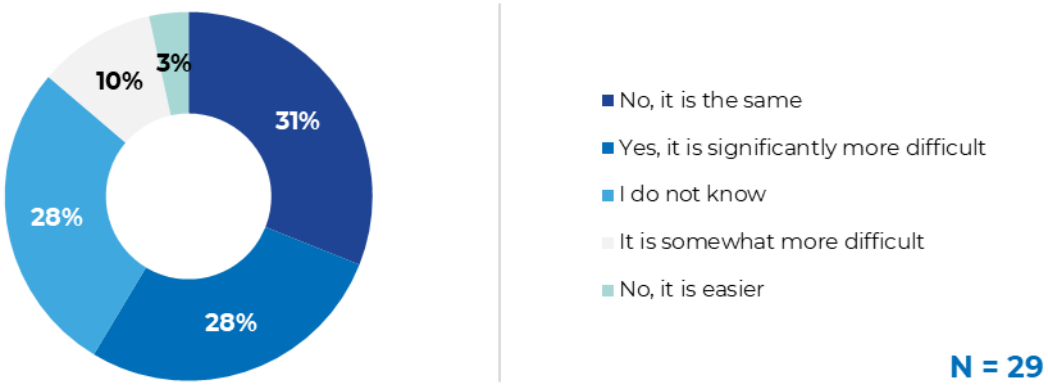
Supply chain challenges focus on standardisation, logistics, and material availability, with few concerns around quality or corruption. Among respondents citing supply chain barriers (34), the most commonly reported issues were lack of standardisation and coordination or logistics challenges (both cited 19 times). These were followed by limited availability of components or materials (15) and on-site assembly and installation services (10). Fewer participants mentioned limited access to technologies (9), while quality control, corruption, and other concerns were rarely reported.

Figure 30. Financial barriers – [of those who reported financial barriers as one of the main barriers they encounter] What are the main financial barriers you encounter?



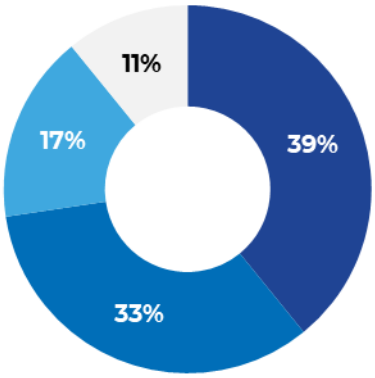
High investment costs are the dominant financial barrier to offsite construction, followed by challenges in securing capital and profitability. Among respondents who identified financial barriers (93), high investment costs (64) were the most frequently cited issue. This was followed by difficulties securing investment (33) and low profit margins (24), indicating concerns over both upfront capital requirements and longer-term returns. Insurance access (20) also emerged as a notable challenge, while few respondents selected "other," pointing to a consistent set of financial constraints across stakeholders.

Figure 31. Financing difficulties for contractors and developers – Do you face more difficulties in securing financing for offsite construction projects compared to conventional ones? This question applies only to the aforementioned stakeholder types.



Financing challenges for offsite construction are mixed, with no clear consensus among contractors and developers. Among the 29 contractors and developers responding, 9 indicated that financing offsite projects is about the same as conventional ones. A combined 11 found it somewhat or significantly more difficult, while 1 said it is easier. Notably, 8 respondents were unsure, pointing to uncertainty or limited experience in this area. These results suggest that while financing may be a barrier for some, it is not universally perceived as more challenging than for traditional construction.

Figure 32. Lack of skilled workers on onsite and offsite construction

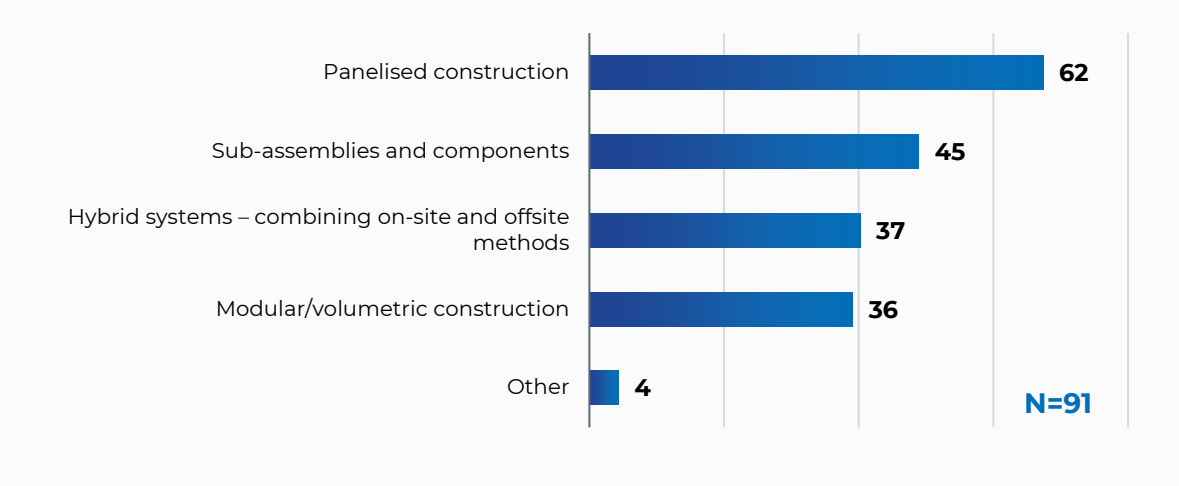


- Yes, both for conventional and offsite construction
- No
- Yes, for conventional construction
- Yes, for offsite construction

N=230

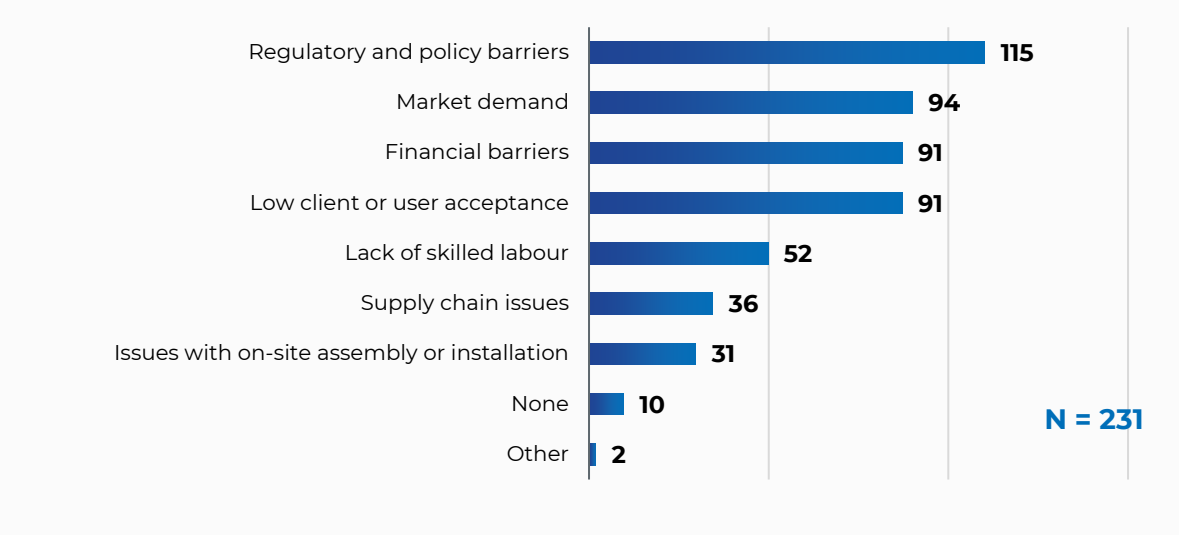
Figures not used in the main body of the text

Figure B 3 Types of projects in which contractors, developers, project managers, architects and engineers are involved - In what types of offsite construction or prefabrication are you involved? (Select all that apply). This question applies only to the aforementioned stakeholder types.



Panelised construction is the dominant offsite method among surveyed professionals, with hybrid and modular approaches also in use. Among the 91 relevant stakeholders, panelised construction was the most widely used method (62), followed by sub-assemblies and components (45). Hybrid systems that combine on-site and offsite methods (37), and modular/volumetric construction (36) came close behind. The data suggests that lighter, more adaptable offsite solutions are slightly more commonly used in professional practice.

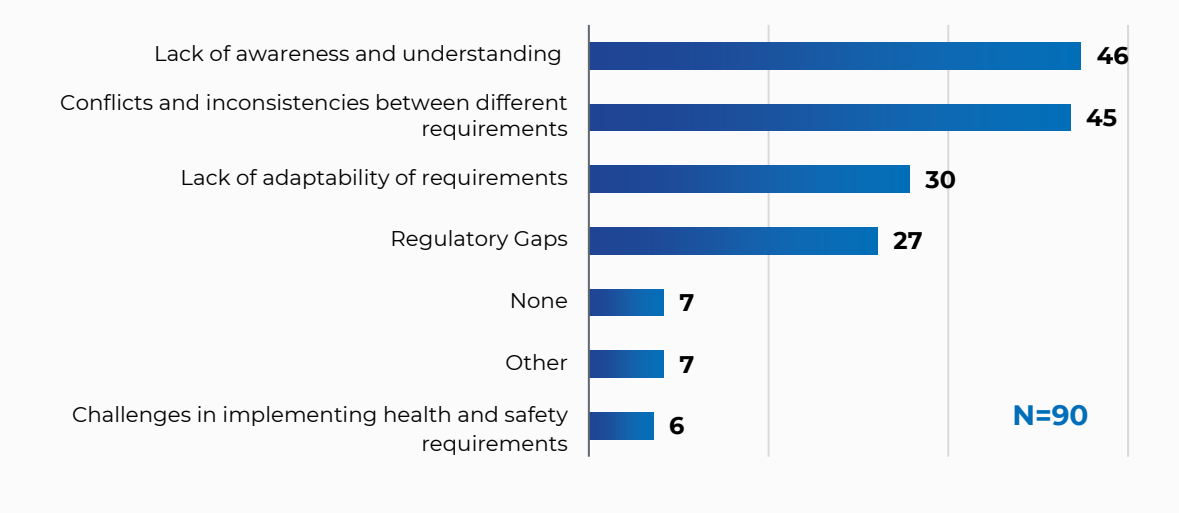
Figure B 4 Main barriers to the adoption of offsite construction (combined by stakeholder types) - What are the main barriers you encounter in advancing the adoption of offsite construction? (Select up to 3)



Regulatory, market, and financial barriers are seen as the most significant constraints to offsite construction adoption. Respondents most frequently cited regulatory and policy barriers (115), followed by market demand (94) and financial barriers (91), as the top obstacles to advancing offsite construction. Issues such as low client/user acceptance and lack of skilled labour were also prominent, reflecting both systemic and cultural challenges. Supply chain limitations and on-site installation issues were less frequently mentioned but still notable. Very

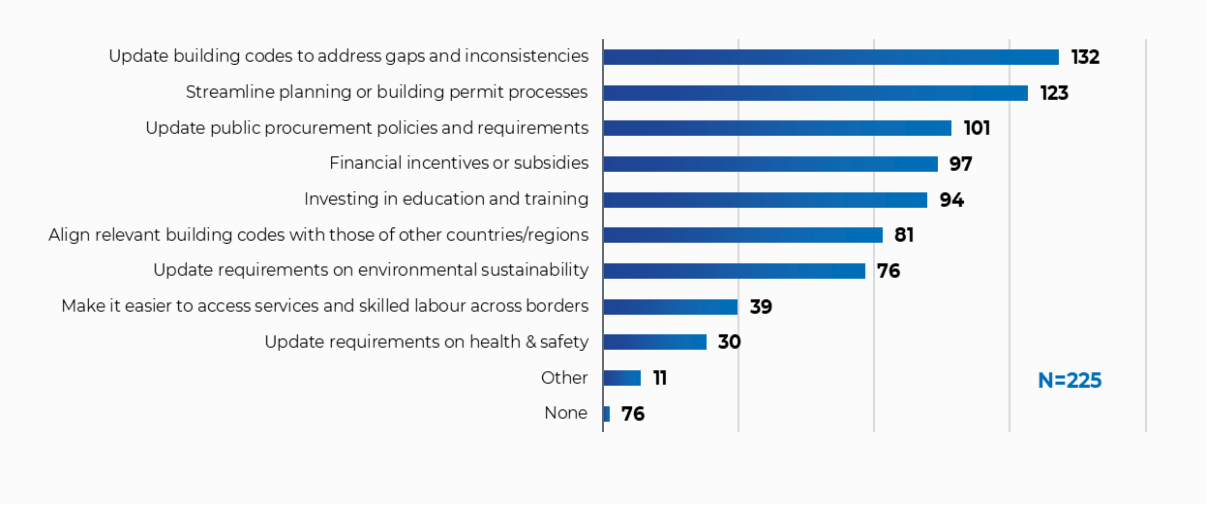
few respondents selected “none,” indicating that most experience some form of barrier in scaling offsite methods.

Figure B 3 Compliance challenges – What are the main compliance challenges you face when using offsite construction methods? This question applies to Developers, architects, engineers, contractors, developers, real estate and investors.



Compliance challenges are driven by a lack of awareness, regulatory gaps, and inconsistent requirements. Among developers, architects, engineers, contractors, and investors, the most cited compliance barriers were a lack of awareness and understanding (46) and conflicts or inconsistencies between different requirements (45). Respondents also pointed to a lack of adaptability in existing regulations (30) and regulatory gaps (27). Only a few flagged health and safety implementation challenges (6) or selected none (7), underscoring that compliance remains a non-trivial obstacle to offsite construction adoption.

Figure B 4 National/regional policy support – Which areas of national or regional policies should be modified to support the uptake of offsite construction in your country?



Stakeholders call for updating building codes to address gaps, streamlined permitting, updating public procurement policies, and financial incentives to enable offsite construction. Respondents identified updating building codes to address gaps (132) and streamlining planning and permit processes (123) as the top priorities for policy reform. Other highly ranked areas include updating public procurement policies (101), financial incentives (97), boosting education and training (94), aligning relevant building codes across countries (81), and updating requirements on environmental sustainability (76). While fewer respondents highlighted making it easier to access services and skilled labour across borders (39) or

updating health and safety requirements (30). Finally, 11 respondents raised other aspects, which are summarised below:

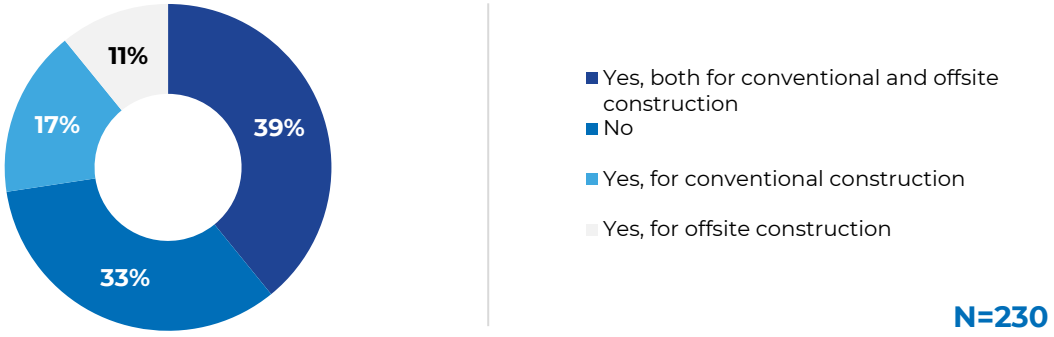
- It would not be possible to align relevant building codes with those of other EU countries, due to the varying climatic conditions. Instead, investment is needed in material technology, building physics, science & engineering of new and novel modern methods of construction, plus a mapping exercise of the Eurocodes, national standards, codes of practice, local rules, etc. that currently exist for each built environment sector across the EU-27 countries.
- Since off-site construction is mostly built in wood, the regulatory reporting burden as a result of the Regulation on Deforestation-free Products (EUDR) increases the construction costs, hampering the uptake of offsite construction.
- City planning from local authorities that is adapted for modular construction.
- There is a need to develop EN Standards for offsite in the areas of light gauge steel frames, modular and completed precast walls.
- There is a need to build better to be able to integrate offsite solutions with onsite solutions. There are still many errors in tolerances, and this affects the final result, since offsite construction is a millimetric process.
- De-risk innovation in construction through thoughtful and focused public procurement practices that accept increased risk in the interests of creating a shift in construction practices. This cannot be undertaken without recognising that there is a cost, not a saving, associated with innovation and that the cost-benefit rewards of off-site will not be delivered until the team has constructed its tenth off-site project.

In a separate survey question, respondents were asked to share any policy recommendations or regulatory best practices. In the below table we summarised and categorised the responses:

Theme	Recommendation/Best Practice
Regulatory Alignment & Harmonisation	Streamline and simplify building regulations across EU Member States to reduce barriers for offsite construction.
	Recognise offsite construction as equivalent to traditional methods in building codes.
	Update codes to include whole life-cycle assessments and support modular methods.
	Avoid over-regulation and ensure evidence-based standards.
	Prevent regional/local 'gold plating' of standards.
	Harmonise Eurocodes or national regulations across countries.
	Encourage flexible urban planning and principle-based permitting.
Financial Incentives	Offer tax reliefs, grants, and R&D support for offsite construction.
	Provide bonuses for early project completion.
	Reduce VAT on low-carbon and prefabricated products.
	Support industrialised renovation through programs like Germany's BEG-SS.
	Ensure funding also supports supply chain industrialisation and human capital development.
	Enable ex-ante financing for prefabricated elements and insurance products tailored to offsite.
Public Procurement	Require a minimum percentage of offsite solutions in public housing (e.g., 50% panelised).
	Prioritise modular solutions in tenders based on speed, sustainability, and efficiency.
	Avoid vague mandates—clearly define offsite systems to prevent loopholes.
	Follow Ireland's holistic approach: address the full value chain from owners to manufacturers.
	Invest in workforce training to support industrialised construction.
	Avoid failures like in the U.S., where automation outpaced workforce readiness.

Training & Skills Development	Promote specialised education in industrialised building methods.
	Accelerate learning curves and overcome cultural resistance to offsite (e.g., perception of poor quality).
Digitalisation	Promote digitalisation as a foundation for design and installation.
	Use digital tools to improve coordination and reduce errors.
	Encourage robot-oriented design and integrated digital workflows.
Sustainability & Innovation	Support low-carbon, circular, and energy-efficient offsite solutions.
	Require CO_2 reporting for public/commercial buildings.
	Encourage prefabrication of main structures and services.
	Promote sustainable timber and lightweight prefabricated systems.
	Highlight best practices like Energiesprong (Netherlands) and Sweden's permitting reforms.
Integrated & Strategic Approaches	Develop a national strategy for offsite construction.
	Align stakeholders across the value chain (architects, engineers, manufacturers, contractors).
	Use catalogues of prefab solutions to match building types and ensure predictability.
	Encourage coordinated renovation planning at neighbourhood/city/regional levels.

Figure B 5. Technological investment – Has your organisation encountered problems with the availability of skilled labour for construction?



Skilled labour shortages affect both conventional and offsite construction, though challenges are more pronounced for the former. Most respondents (93) reported labour shortages impacting both conventional and offsite construction, while 38 cited issues specific to conventional construction. 25 noted shortages specific to offsite, and 77 reported no issues. These findings highlight that workforce constraints are a systemic concern, with offsite construction not immune.

Annex C: Summaries of the Focus Group discussions

Three focus groups took place between the 26th March and 28th March 2025 in the form of three 2-hour online sessions. The focus groups were split into the following stakeholder groups: 1) contractors, 2) architects, engineers and designers, and finally 3) product manufacturers and suppliers. Around 13-18 stakeholders were selected per stakeholder group to participate, based on the interest they indicated when completing the stakeholder survey. Following this, the final stakeholder selection was made based on geographic coverage and type of stakeholder.

A separate presentation was prepared for the focus group sessions, and the following agenda was followed:

1. Welcome and introductions
2. Project objectives and results of the research note
3. Preliminary survey results and discussion
    - Main barriers to offsite construction
    - Perception on demand and MS differences
    - Time and budget gains
    - Cross-border operation
    - Technology
    - Good practices and recommendations

In the notes below, the focus group discussions are summarised per topic of discussion and stakeholder type.

Regulatory and legal barriers

Contractors

- Building codes are designed for traditional methods and do not accommodate offsite construction.
- Building codes may not be the main problem, it's more a lack of offsite building standards
    - Without standards, there cannot be proper insurance policies.
- The Construction Products Regulation further complicates market standardisation:
    - Each country has its own building codes, making it difficult to create a single market.
    - Manufacturers struggle to scale construction products and methods across multiple markets.
    - Differences in building codes are also inevitable due to varying regional conditions.
- Certifications
    - QB53 is a modular certificate recognising modular construction.
    - Certification could be expanded to different modular building types (e.g., timber, concrete).
- ISO
    - China is already advancing in modular construction standardisation.

    - Europe must act faster to remain competitive as Chinese materials are cheaper, putting pressure on European markets.
    - China could adapt to EU requirements within months.
    - In a factory setting, there are no unsolvable problems.
- Public Procurement
    - Public procurement rules must be respected, but new standards must also be developed.
    - Some offsite practices may be restricted under current procurement regulations.
- Liability Concerns:
    - Some designers and architects hesitate to adopt offsite methods due to liability risks.

Architects and Engineers

- There is a lack of existing building codes that fully account for offsite construction.
- The industry is still immature and lacks standardisation.
- There are 3 levels of regulation:
    - Planning & Application: Not a major issue in France.
    - Building Regulations: A significant challenge — current regulations are designed for traditional construction and have not been adapted for offsite methods.
    - Contract Regulations: In France, early supplier contracts pose issues when using specific offsite technologies.
- Public Procurement
    - Delays in procurement and tenders impact project timelines.
- There are no EU-wide directives for offsite construction, leading to fragmented regulations.
- Protectionism in some countries limits material sourcing, even for certified products.
- Differences in legal systems (civil law vs. common law) also create cross-border operational challenges.
- Insurance and banking regulations do not always accommodate offsite construction.

Suppliers

- Emphasis on the financial risks due to payment structures and the need for standardised regulations for newer types of offsite construction across countries.
- Challenges in Spain, including the need for mortgage credit for offsite construction and the responsibility of architects and constructors.
- Fragmented regulations and procurement barriers are significant challenges.
- UK's strict fire regulations and the need for public procurement frameworks.
- Professional associations of architects oppose public projects aimed at industrialisation, leading to legal challenges.
- Legislative changes are required to support offsite expansion.

Financial Barriers

Contractors

- Financial issues, particularly significant in Spain.
    - This is because promoters can pay for work done onsite but not offsite.
    - Traditionally in Spain, contractors are paid in stages based on onsite progress, not on work done offsite in factories. This aligns with how banks, insurers, and clients verify progress as they inspect the physical structure being built on the actual site.
        - In offsite construction, a large portion of the work is completed in a factory before it's delivered to site.
        - This causes financial issues as Spanish financial institutions and project promoters often do not release funds for that offsite work because it is not physically present on the construction site.
- Investment costs
    - High initial investments (e.g., factories, machinery) can take up to five years to recoup.
    - In Spain, manufacturers must buy materials upfront, making the financial burden significant.
    - Further the increased speed of the construction process is currently not properly taken into consideration with the investments.
- Value for Money & Budget Predictability:
    - Faster project timelines should make offsite construction a good investment.
    - However, high material costs and lack of standardisation prevent cost reductions.
    - Offsite construction could provide better value, but cost savings are not well quantified.
    - There are no regulations or clear processes for financing, which makes it difficult.
- Market Predictability
    - A larger, more developed market would improve budget predictability.
    - Offsite construction involves both products and processes, requiring better forecasting.
    - The value for money is offsite is currently not yet assessed in terms of money savings.
- 2D vs 3D
    - 2D and 3D panels offer different financial dynamics.
    - Hybrid solutions (combining onsite and offsite methods) could provide some flexibility.

Architects and Engineers

- CAPEX
    - Suppliers struggle to utilise their CapEx effectively due to lack of demand and visibility.

    - Need for productivity gains higher than CapEx amortisation to achieve competitiveness.
- Uncertainty
    - Uncertainty in project flows creates further financial risk in offsite construction, making cost concerns a major obstacle.
- A fundamental shift in design approaches is needed for offsite construction to succeed.

Suppliers

- High investment costs and the difficulty in securing investments due to uncertain demand and fragmented procurement processes.
- The difficulty in predicting project pipelines and the risk of bankruptcy for offsite manufacturers.
- Fragmented procurement processes leading to inefficiencies and stock management issues.
- Need for financial support and normalisation of industrialisation categories.
- Risk of investing time and money with partners who may go bankrupt.
- Lack of standardisation leads to high cost variations.
- Difficult to transfer successful models due to different regional approaches.
- Permitting processes for suppliers and manufacturers are complex.
- Poor internal financial management and stock control affect efficiency.
- In developed offsite markets, these issues are minimised, but investment remains risky.
- A clear vision of 10% operational profit is needed to justify investments.

Skills Shortages

Contractors

- Offsite work may be easier for older workers compared to traditional onsite labour.
- There is currently a lack of assembly guidelines (specifically reported in Spain).
- Offsite construction requires more collaboration than onsite construction between professionals and the traditional construction sector.
- Contractors cannot deliver offsite projects alone and stronger partnerships are needed.

Architects and Engineers

- Skill shortages affect both on-site and offsite construction.
- Suppliers and contractors face difficulties hiring skilled workers.

Suppliers

- Onsite and offsite construction attract different skill sets and worker profiles.
- There is a need for specialised training and different skills are required for offsite versus traditional onsite construction.

- There is a need for organised training and collaboration between construction training institutes and the practical value chain.
- There is a lack of specialised training facilities for offsite construction in the EU compared to other regions.
- Transitioning workers from traditional construction to offsite is challenging.
- Training programs for offsite construction exist in Sweden.
- In the U.S., certain states already provide facilities for offsite construction training.

Client Support

Contractors

- Offsite construction is not relevant for every building type.
- For example, offsite construction is very interesting for public housing and social housing.
- In private housing, acceptance depends on ownership (difference between B2B and B2C clients).
- Rental markets tend to care less.
- Buyers of offsite homes care more about quality and design.

Architects and Engineers

- Client preferences play a crucial role in the adoption of offsite construction.
- Clients who invest in their own assets are more interested in quality and time delivery, while those who build to sell prioritise price and quality.
- Environmental benefits, such as the introduction of low carbon materials, are also important. However, some projects have had to revert to traditional construction methods due to various challenges.
- Clients prioritise cost and quality over construction methods.
- Poor understanding of offsite leads to design changes mid-project.

Suppliers

- Reliability and consistency of costs and delivery times with offsite methods.
- Clients are generally supportive of offsite construction if they see clear benefits such as speed, cost reduction, and sustainability.
- The importance of consistent costs and delivery times in offsite construction.
- Reliability and quality assurance as key benefits for clients.
- Offsite projects require strong client support to succeed.
    - Only 10% of clients recognise offsite as a viable solution.
    - Traditional construction often exceeds initial cost estimates, whereas offsite provides cost certainty and reliability.
    - Supply chain issues must be factored into project planning.

Other barriers

Contractors

- Is there a barrier to creativity?
- Concerns about aesthetics and architectural flexibility.
- Expected to improve within 3–5 years.
- Currently most projects are not fully offsite but hybrid, hence normally there is no issue with creativity.

Architects and Engineers

- Lack of harmonised regulations and fragmentation are major barriers.
- There are challenges posed by insurance and banks, and the need for a European framework for bio-based materials
- The construction industry is very local, which can lead to protectionism.
    - Efforts to create regional employment and make it more sustainable are ongoing
- There is no established pipeline for offsite projects due to uncertainty.
- Fragmented supply chains hinder efficiency.

Suppliers

- There is a need for collaboration with architects and the challenges in historical contexts.
- Offsite requires a dedicated design phase, unlike traditional construction where design evolves during the process.
- Manufacturer drawings and designs are lagging behind industry needs.
- Subcontractors in traditional value chains struggle with the shift to offsite due to tight tender validation timelines.
- Offsite projects must be planned from the beginning, making last-minute adjustments difficult.
- Supply chain issues
    - Geopolitical events impact supply chains (e.g., reliance on Chinese components).
    - Logistics remain a challenge, especially for remote areas.
    - Transportation limitations in old cities complicate delivery.
    - Tunnel and bridge height restrictions create further obstacles.
    - Certification processes for industrialisation need improvement.

Perception on demand

Contractors

- Some are convinced by offsite; some aren’t – this influences demand.

- The government has a role in driving demand due to housing shortages and the need for solutions.
- Factors influencing adoption and demand:
    - Weather conditions.
    - Material preferences (e.g., Nordic countries have a stronger understanding of timber).
    - Government incentives, as seen in the UK.

Architects and Engineers

- The perception of demand for offsite construction varies across regions.
    - The urgent need for low carbon construction in France is driving demand. However, the expected cost reductions have not yet materialised.
    - The demand in Ireland is driven by labour shortages and housing priorities.
    - In Ireland, housing demand is the primary driver, particularly for social housing, student housing, and schools.
    - Large-scale social housing projects are a key focus in Ireland.
    - The Ukraine housing scheme exceeded its budget by €100 million.

Suppliers

- Demand driven by social housing, schools, and hospitals.
- Differentiated between needs and actual building activity.
- UK government pressures local authorities to adopt offsite construction.
- Schools and hospitals often see offsite as a quick solution.
- Spain's offsite sector is driven by public projects (schools, hospitals, housing).
- Scandinavia and the Netherlands have long histories of prefabricated construction.
- Public initiatives alone do not necessarily drive demand (e.g., UK experience).
- Labour shortages and cost increases make offsite more competitive.
- Demand is expected to grow as traditional onsite construction becomes less viable.

Time and budget gains

Contractors

- Offsite implementation is currently not faster; the implementation is faster, but the planning phase is longer than onsite.
    - It takes more time for offsite development of projects, but once this is done the implementation is faster.
- Public procurement laws are tailored for traditional design-build models, creating barriers to offsite adoption and slowing down the process.
- Full volumetric (3D) construction has the highest cost and time-saving potential.
    - However, there is currently not enough capacity for it.

    - 3D modular construction also faces logistical challenges (e.g., transportation of large units).
    - Challenges in scaling:
        - Spain: Factories lack capacity for 3D modular units.
        - UK: 2D panels are preferred due to lower investment costs and easier transport.
- However, 2D construction is currently more viable because:
    - It requires less upfront investment.
    - Components can be built separately and transported efficiently.

Suppliers

- There is a lack of transparency and benchmarks in traditional construction, making it difficult to compare with offsite methods.
- Offsite construction can save 20-50% in time and 10-20% in budget compared to traditional methods.
- Discussed the lack of transparency and benchmarks in traditional construction, making it difficult to compare with offsite methods.

Cross border operations

Contractors

- Different national building codes hinder international or European expansion.
- Standardisation would facilitate cross-border operations.
- Difficult for manufacturers to determine market suitability for their products outside their home markets.

Architects and Engineers

- Cross-border operations face challenges due to differences in legal systems and national regulations.
- The impact of Brexit on Ireland and the need for boots on the ground to navigate local rules.
- The slow process of making products complies with local regulations is a significant constraint.
- Ireland is open to cross-border collaboration but faces legal challenges due to differing legal frameworks.
- National regulations complicate supplier compliance across borders.
- Ireland has a €5 billion housing fund.
- Ireland uses 50% timber frame construction; Scotland uses 75%.
- 50% of construction in Ireland is currently modular.
- There is only one fire test laboratory in Ireland.

Suppliers

- The challenges in cross-border operations, including the need for local collaboration and standardisation.
- Cross-border operations face challenges due to different regulations and the need for local adaptation.
- Importance of local contacts to navigate regulations and ensure compliance.
- The difficulty of high-category industrialisation across borders and the need for local factories
- Most offsite production (70%) remains within national markets.

Technology & Offsite Construction

Contractors

- Technology enhances financial viability:
    - Banks can better understand investments with digital tracking.
    - Improved monitoring, accountability, and project management.
- Innovation in materials:
    - Offsite construction allows for the use of innovative materials.
    - Provides opportunities for experimentation with new building technologies.

Architect and Engineers

- The link between technology and offsite construction, which allows for better quality and customisation.
- The use of information modelling, digital product passports, and the need for digitalisation to meet future demands.
- Ireland
    - By 2028, all public sector projects in Ireland must use 3D modelling.
    - Ireland is advancing but has not yet fully embedded digitalisation.
    - A digital building passport initiative is being promoted in Ireland.

Suppliers

- Importance of digitalisation for industrialisation and the need for investment in software and robotics.
- Technologies such as BIM, CNC robotics, AI, and advanced materials are expected to impact offsite construction significantly.
- Importance of digitalisation in industrialisation, including investment in software and machinery.
- Bio-based materials are more viable in offsite processes.

Good Practices & Recommendations

Contractors

- Procurement models should integrate offsite construction better.
- Social housing projects can drive offsite adoption through collective approaches.
    - Development of collective buy in schemes.
- Government incentives can accelerate market growth as they push and incentivise development schemes.
    - Government schemes that mandate a percentage of offsite components in developments.
- Offsite construction complements but does not replace traditional construction.
    - Traditional methods will remain the primary approach in the industry.

Architects and Engineers

- Benchmarking against the best companies and sharing information.
- Importance of gathering data on building permits and offsite manufacturing to measure growth and trends.
- A better understanding of offsite construction trends is required.
- The need for a European framework for bio-based materials and harmonized regulations.
- Offsite construction is often not classified as "construction" in EU statistics, but classified under manufacturing, especially the prefabrication of components.
    - Building permit data should be tracked to measure offsite construction growth.

Suppliers

- Streamline planning and building permit processes and public procurement policies.
- Normalise categories of industrialisation at the European level.

Annex D: Illustrative responses on regulatory and building code barriers to offsite construction

1. Regulatory fragmentation and lack of harmonisation

“Each Austrian federal state has its own building rules. This lack of harmonisation adds significant compliance costs and limits scalability.”

“Eurocodes are interpreted differently across EU cities, resulting in a fragmented regulatory landscape that deters market entry for new players.”

2. Inflexibility of traditional codes

“National codes were developed for conventional methods and fail to recognise the unique characteristics of offsite solutions, such as modularity and factory-controlled quality.”

“In Spain, the CTE does not sufficiently accommodate offsite construction, complicating compliance and raising project costs.”

3. Barriers to facade and external equipment

“For renovations, increasing facade thickness or adding external heat pump units is often not permitted due to spatial or aesthetic restrictions.”

“Panels with integrated PV are difficult to certify due to DSO limitations on grid connection and installation on wood-based materials.”

4. Disproportionate fire safety and acoustic standards

“Fire resistance demands for timber above four storeys (e.g., 120 minutes) are excessive and misaligned with actual risk levels.”

“Acoustic regulations are tailored to heavy structures, making it harder for light prefabricated elements to comply.”

5. Permitting complexity and time delays

“Approval processes are slow and not adapted to offsite solutions. In Austria and Spain, permitting still follows on-site logic, adding time and uncertainty.”

“Façade upgrades that slightly extend building dimensions can require full planning permission, despite minimal visual impact.”

6. Lack of type approvals and standardisation

“There’s no system for type approval of entire buildings like in the car industry. Every new design requires separate certification.”

“Current EN standards do not yet cover key materials like light gauge steel, 3D printed concrete, or mass-engineered timber.”

7. Public procurement and tendering mismatches

“Tender specifications are built around traditional items. Offsite solutions, with their different performance and lifecycle value, are excluded or undervalued.”

“Germany’s procurement law requires splitting into lots, which conflicts with the integrated delivery model of offsite construction.”

8. Insurance and financing challenges

“Insurers perceive offsite construction as high risk due to lack of long-term data and unclear responsibility frameworks.”

“French credit insurers offer little to no coverage for modular platform developers, stalling market development.”

9. Legal attribution and outdated roles

“Spain’s building law still assigns responsibility based on traditional roles. In offsite, new industrial agents emerge, but liability and compensation rules haven’t adapted.”

10. Planning and urbanistic constraints

“Local zoning laws often impose outdated height or footprint limits that disqualify standardised modular designs.”

“Urban development plans are based on manual construction, ignoring efficiencies and logistics of industrialised systems.”

11. Mismatch with sustainability and circularity regulations

“Circular construction rules in France and the Netherlands lack clarity on how offsite methods can contribute, making compliance ambiguous.”

“Ecological studies in the Netherlands delay projects significantly, particularly when timing is crucial to factory scheduling.”

12. Inspection and control processes

“Building inspection frameworks are designed for site-built structures. They do not distinguish between what’s already certified offsite and what needs checking on-site.”

13. Limitations in transport and logistics

“Transport constraints (e.g., max width 2.2m) limit prefabricated unit sizes, forcing redesign and driving up costs.”

14. Resistance to innovation due to insurability gap

“New technologies lack ‘deemed-to-satisfy’ standards. Without these, insurers consider them high risk, stalling adoption.”

“Regulation follows failure—it doesn’t lead innovation. The system penalises new methods by default.”

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