CONSTRUCTION BLUEPRINT

# SECTORAL STRATEGIC APPROACH TO COOPERATE ON SKILLS IN THE CONSTRUCTION INDUSTRY

## WP2
## STATUS QUO AND SECTORAL SKILLS STRATEGY

## D.2. PESTLE ANALYSIS

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| PARTNERSHIP | | |
|---|---|---|
| VET providers | Sectoral representatives | Country |
| FLC (Coordinator) | CNC | Spain |
| IFAPME | Confédération Construction | Belgium |
| SATAEDU | -- | Finland |
| CCCA-BTP | FFB | France |
| BZB | ZDB | Germany |
| BFW-NRW | | |
| AKMI | PEDMEDE | Greece |
| LIT | -- | Ireland |
| FORMEDIL | ANCE | Italy |
| VSRC | LSA | Lithuania |
| CENFIC | -- | Portugal |
| SCKR | CCIS CCBMIS | Slovenia |
| | BUDOWLANI (Trade union) | Poland |
| **EU Sectoral representatives** | | |
| **FIEC** | | |
| **EFBWW** | | |
| **EBC** | | |

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# Introduction

One of the tasks to be implemented in WP2 of the Blueprint project (WP2. Status Quo and Sectorial Skills Strategy) is the analysis of different external factors that may affect the construction industry and its evolution in terms of professional skills and competences. These factors are:

- Political: local, regional, national or international factors that may affect the construction industry in the future.
- Economic: current or future economic issues that may affect the strategy to be created.
- Social: socio-cultural elements that may affect the construction industry. It is recommended to pay attention to current social trends in order to know how they are changing.
- Technological: this is an essential factor, since technological changes are currently happening very quickly. All technological factors developed today will doubtless affect the construction industry tomorrow.
- Legal: these factors deal with the obligations to comply with national and European legislation. Changes in the law will lead to changes in markets and industry.
- Environmental: these factors are directly or indirectly related to the natural environment and may influence the construction industry.

These conform what is known as PESTLE analysis. The revision of these factors is a key to understanding the construction industry context, because it provides relevant knowledge about current and future trends. It therefore makes it possible to define in advance the sectorial skills strategy to be followed. The study of these six macro-environmental influences affecting businesses, products, or industries strategic analysis technique for the description / definition of any given environment (and it does not consist of analysis of target group needs).

This analysis has made possible to identify and reflect, in a systematic way, the different factors studied which offer a clear overview of the context in which the Blueprint project is moving, and subsequently to be able to strategically act on this basis. That is, the consortium has been working to understand what will happen in the near future that will shape the construction industry, making use of opportunities and anticipating risks.

# Methodology

## Stage 1. Questionnaire development

In order to structure the development of the questionnaire that was to be used by the partners involved in this task (i.e., VET centres), it was decided to design a methodology that could consistently support PESTLE analysis, which has been the basis, along with the Status Quo, for the Sectorial Skills Strategy. It has also helped partners to conduct and support the interviews conducted.

## General sectorial context analysis

For each country, the designated partner (VET provider) identified the main trends, barriers, challenges and opportunities in the construction industry (with a maximum of 2) in their countries concerning each 'letter' of the PESTLE approach, based on analysis of the reference documents, such as:

- Skill building projects, information that is available on the European Portal for Energy Efficiency in Buildings[1]:
- Other national and international reference projects in which partners may take part.

Based on the identified trend and subsequent barriers, challenges and opportunities, partners proposed 1-2 questions per trend to be included in the questionnaire. To analyse the trends and the question proposed, a specific template (below) was circulated among the partners involved:

### Factsheet Template

POLITICAL FACTORS: Political factors determine the extent to which a government/policy may influence the economy or a certain industry.

| | |
|---|---|
| **Trend** | |
| Barriers | |
| Challenges | |
| Opportunities | |
| Related question/s for the questionnaire: | |

ECONOMIC FACTORS: These factors are determinants of an industry's performance that directly impacts companies and have resonating long term effects.

| | |
|---|---|
| **Trend** | |
| Barriers | |
| Challenges | |
| Opportunities | |
| Related question/s for the questionnaire: | |

SOCIAL FACTORS: These factors scrutinize the social environment of the construction industry, and gauge determinants like demographics, population analytics, etc.

1. http://www.buildup.eu/en/skills/bus-projects

| | |
|---|---|
| **Trend** | |
| Barriers | |
| Challenges | |
| Opportunities | |
| Related question/s for the questionnaire: | |

TECHNOLOGICAL FACTORS: These factors pertain to innovations in technology that may affect the operations of the industry and the market favourably or unfavourably.

| | |
|---|---|
| **Trend** | |
| Barriers | |
| Challenges | |
| Opportunities | |
| Related question/s for the questionnaire: | |

LEGAL FACTORS: These factors refer to laws that affect the business environment at a national and European level. Legal analysis takes into account both of these angles and then charts out strategies in the light of these legislations. For example, consumer laws, safety standards and labour laws etc.

| | |
|---|---|
| **Trend** | |
| Barriers | |
| Challenges | |
| Opportunities | |
| Related question/s for the questionnaire: | |

ENVIRONMENTAL FACTORS: Factors arising from sectorial environmental analysis, including global climate changes, environmental offsets and, their impact on the economy, etc.

| | |
|---|---|
| **Trend** | |
| Barriers | |
| Challenges | |
| Opportunities | |
| Related question/s for the questionnaire: | |

## General sectorial context analysis

Based on the previous trend analysis, please identify 3-4 concrete future skill needs, and one related question for the questionnaire

| | |
|---|---|
| **Future skill needed 1** | |
| Current situation | |
| Barriers | |
| Measures to be undertaken | |
| Related question for the questionnaire: | |
| **Future skill needed 2** | |
| Current situation | |
| Barriers | |
| Measures to be undertaken | |
| Related question for the questionnaire: | |
| **Future skill needed 3** | |
| Current situation | |
| Barriers | |
| Measures to be undertaken | |
| Related question for the questionnaire: | |

After this analysis, a complete list of questions was proposed by the partner, and they were collected by the WP2 lead partners (Formedil -IT- and Sataedu -FI-). The list of proposed questions is shown in Appendix 1.

## Final questionnaire

Based on the partners' contributions, the most relevant questions were selected and a common questionnaire was designed and circulated among partners involved in the task (VET centres). Each questionnaire was divided into different sections, each of which contains several questions.

The final questionnaires defined per factor are shown in Appendix 2.

## Stage 2. PESTLE Analysis interviews

In each participating country (except Portugal and Poland) at least one respondent per factor was interviewed (at least 6 per country), from the following types of organisations (among others):

| Factor | Respondents from... |
|---|---|
| Political | National Public Administration |
| | Think tanks |
| | Political consultants |
| Economic | Local and national government |
| | Economic and social councils |
| | Representatives of the construction industry (companies, trades, etc.) |
| Social | Social research centres |
| | University |
| | Consumers associations |
| | Economic and social councils |
| Technological | Research centres |
| | Public bodies for R&D |
| | Professional networks for technological innovation |
| | Construction technology platforms |
| Legal | University |
| | Legal consultants |
| | Public bodies |
| Environment | University |
| | Key associations and private bodies |
| | Public bodies and national administration |

The complete list of national respondents is shown in Appendix 3.

## PESTLE analysis

The following pages show the main opinions of and statements by those persons who responded to the interview in each country. It is important to notice that the contents included in this PESTLE analysis reflect only the personal views and opinions of the individuals involved, and that they do not necessarily reflect the opinions of the Blueprint partners or the global vision of the construction industry's representatives, workers or VET centres involved in the sector.

# Political factor

## General remarks

In general, the responses provided by the interviewees in the different countries highlighted the key role that public authorities have to play, as it is important to have a stable and forward-looking political framework at all administrative levels.

In fact, the construction sector often suffers because of the pursuit of short-term interests which follow electoral cycles. The long-term strategic planning of public investment is perceived as a necessity, especially in times of economic downturn when private sector investment decreases.

Moreover, public authorities should set clear goals for building and infrastructure projects, in order to maintain stable economic activity in the construction industry. These goals should be achieved by planning appropriate financial/funding: unclear political priorities as well as budgets that are not consistent with these priorities are perceived as obstacles by the sector. As the **Finnish** respondent said, 'forward-looking policy is the preparation of long-term infrastructure legislation.

## Reactivation of the construction industry

*Incentives and other political measures currently implemented or that should be implemented by the governments to facilitate the reactivation of the construction industry*

After a long financial crisis, the European construction market has entered a phase of recovery. Nevertheless, reaching pre-financial crisis levels is still a long-term goal that will be reachable only with an adequate regulatory and financial framework. Thus, political and financial incentives are crucial to ensure the recovery and growth of the construction sector. At the national and local levels, public procurement is seen as a key tool to lead the sustainable recovery of the construction sector. However, more funding and financing should be accompanied by an efficient organisational plan involving all public authorities to realise the needed projects.

Moreover, respondents pointed out that more financial support for sustainable buildings is needed, especially for the energy-efficiency retrofitting of the existing building stock. Financial support should be coupled with fiscal reductions (e.g. tax incentives) for energy retrofitting interventions. As regards the role of the European Union, respondents highlighted the need to ensure a level playing field (i.e. fair competition).

It seems that in every country assessed, burdensome bureaucracy in the public sector is perceived to slow down construction processes. Respondents indicated that legislative and technical rules impacting construction should be assessed and review processes should be launched in every country. This would lead to the potential reduction of legislative or administrative barriers and will increase economic growth and contribute to the recovery of the construction sector.

Boosting private and social housing demand can also play a crucial role in the recovery of the construction sector. For example, policy measures and incentives can increase the rental housing sector and thus better address the increasing growth of population in urban centres. At the same time, public policies should address the rising costs of rental activities in urban centres in order

to make living in cities affordable. In order to do this, stimulating social and private housing construction as well as increasing urban development are the key factors. Good housing policy and proper zoning, coupled with long-term infrastructure development, will address the challenges linked to the increasing population of cities.

According to the respondents consulted, the recovery of the construction sector should also be boosted by supportive policies aimed at increasing investments in research and development. In fact, more investments in R&D, especially in the field of digitalisation, the circular economy and energy efficiency, would increase the productivity of the sector as well as offering sustainable solutions to the construction sector. Some country-specific incentives detailed by respondents for their countries are listed below:

In **Ireland**, the shortage of housing and energy inefficient housing have led the Government to publish its Climate Action Plan. This sets out a number of incentives and scaling up of grants and funding to enable the following:

- Retrofitting 500,000 homes by 2030 to reduce fuel poverty.
- Homeowners will be able to choose to pay for the cost of retrofitting their homes to make them more energy efficient through higher property tax or electricity bills.
- Phase out fossil fuels by 2025, and 70% of all electricity will come from renewable sources by 2030 (up from 30 per cent).
- A retrofitting programme to install 400,000 heat pumps in homes and businesses.
- A pilot scheme to allow homeowners to sell electricity generated by solar panels back to the national grid, to be rolled out across the country by 2021.

BIM Level 2 may be required on complex projects from 2019, with medium and simple projects being phased in over the coming years. However this is under review.

In 2015 the **French** government enforced several housing construction incentives. The two main measures are a zero-rate loan for first time owners and a fiscal incentive ("Pinel") for landlords (new buildings). Social housing has also benefited from subsidies, reduced rate loans and reduced VAT rates. Moreover, the Government created a specific tax refund mechanism for renovation works aiming at energy saving (CITE).

These housing allowances contributed substantially to overcome the crisis in 2015. However, the French government has reduced their scope for the last two years, even if most of these measures remain necessary according to company representatives. As a consequence, since 2018, the use of zero-rate loans dropped by 50% (from 40% to 20% of the total amount of loans). Therefore, the number of new housing projects has fallen by 15,000 units. This clearly shows that supportive public policies for housing are crucial and must be maintained.

In **Germany,** the government has implemented policies aimed at having special additional depreciations for investors, to complement regular depreciations (at 2% for every 50 years). However, stable financial schemes guarantee more long-term planning. For this reason, respondents prefer higher regular depreciation (at 3% every 33.3 years) instead of special depreciation rates that are only granted for 3 or 5 years.

Respondents also demanded a reduction in the **German** real estate transfer tax (to 3.5% instead of 6.5%) to foster private home ownership. Moreover, more tax concessions for investments in energy efficiency renovation are needed.

In **Belgium**, the public authorities should set clear and ambitious goals for public investment and in particular infrastructure investments. Moreover, sustainable infrastructure goals (SIG) should be set, which support and redirect investment to sustainable infrastructure. Lastly, lower VAT rates for rebuilding old houses of low architectural value should be implemented.

**Lithuania** is facing cyclical developments in credit and the real estate markets. The housing loan portfolio posted the highest growth, with an annual growth of around 8% in 2018. Due to this the Bank of Lithuania decided to apply a counter-cyclical buffer as credit growth continued. Moreover, projected EU funding for the period 2021-2027 decreases by 24% compared to 2014-2020 period, and this might negatively affect the construction industry. **Lithuania** has to foster higher productivity and inclusiveness which requires additional reforms to ensure that the education system provides the right skills to meet evolving labour market demands and reduce large skill mismatches.

In **Italy** the national legislation provides various tax incentives aimed at the construction sector. These include regulatory provisions that allow individuals and companies to recover part of the expenses incurred for interventions to construct safe homes and buildings for areas of high seismic risk (Sismabonus), and for interventions for the energy requalification of existing buildings and common parts of condominiums, as well as for expenses related to professional services (Ecobonus). Other important measures relate to the recovery of expenses incurred for the renovation of private homes (Building bonus) and the facilitated taxation regime for the transfer of buildings to be subjected to building recovery interventions through demolition and reconstruction, in order to favor the renewal of old national building stock and increase the performance and safety of buildings.

Provision is also made for the allocation of funds for the redevelopment of the suburbs, degraded areas and the real estate assets of public residential buildings, as well as town planning rewards for the upgrading of private buildings.

The national legislation also allows companies to request a reduction in the Inail (National Institute for Occupational Accident Insurance) rate following interventions aimed at improving the working conditions adopted by companies. In the relevant application form there is a section dedicated to the construction sector with regard to intervention concerning the assertion process (this is the voluntary choice made by a company to apply the UNI standard to the adoption of an organizational and management model for health and safety at work).

Furthermore, the Guarantee Fund for SMEs, by issuing a public guarantee on loans granted by banks, represents a fundamental industrial policy tool for accessing bank credit, because it makes it possible to mitigate the risk of transactions in the construction sector, which is considered to be too risky. The reform of access to the Fund, which came into force recently, introduced a specific rating for construction companies, thereby overcoming the difficulties of accessing the guarantee that were encountered with the previous scoring system.

Regarding building, many **Spanish** policy measures focus on building rehabilitation. Legal and regulatory measures are being developed by the Public Administration, that eliminate barriers and generate a favourable framework for rehabilitation, as well as promotion and stimulus measures, where aid plans are combined with actions that facilitate access to credit and development of an adequate taxation policy.

Another important aspect is the process of industrialization and digitalization that the sector will have to undergo. Although the construction companies that survived the economic crisis are more solvent and highly developed technologically and competitive in general, it is still necessary to digitize all of the actors in all phases of the building process, from the project and execution to management and maintenance. A clear example of this is the implementation of BIM in building strategies. In this regard, it is worth highlighting the support and impulse supplied by the General State Administration with the constitution of the Interministerial Commission for the Incorporation of the BIM Methodology in public procurement, and the esBIM platform, a group open to all of the agents involved (administrations, engineering and construction companies, universities, professionals ...) whose main mission is the implementation of BIM in Spain. Innovation in processes and products is also necessary, and this can be derived from specific ICT applications.

The capacity of the different agents in the sector to respond to new sustainability challenges and to adapt the sector for the circular economy will be decisive for its development and reactivation. Construction is one of the sectors that uses the most natural resources and generates the most waste, so there is a huge margin for change within the sector. All of this will require the elimination of legal and administrative barriers, as well as raising the awareness of general society.

Finally, in all areas of construction it is necessary to develop public-private collaboration mechanisms.

Investments in housing, infrastructure projects and all kinds of business facilities are one of the key drivers for accelerating the growth rate of the **Greek** economy. The essential steps for securing and enhancing the contribution of the construction sector to the development process of **Greece** include the following: accelerating the implementation of already-planned projects, removing disincentives for investment in housing and other buildings, the promotion of private investment in infrastructure using the appropriate Public-Private Partnerships (PPP) tools, ensuring healthy competition in the public works market to optimize the cost-benefit ratio of infrastructure projects over their life cycle and setting priorities on the basis of a long-term strategic plan for infrastructure.

The **Slovenian** construction industry is strongly dependent on state infrastructure as well as housing investment. Both together represent approx. 60% of the total construction market. But there are major oscillations in the size of public procurement in construction, which together with a relatively rigid labour market generates big challenges for companies, which employ a large number of workers to allow them to adapt to such conditions. A big decline during the crisis was followed by intensive annual growth (nearly 20%) in 2017 and 2018, while in 2019 growth will probably be less than 5%. We expect the market to stabilise in the next three to five years at close to 2019 values. Many infrastructure projects are in the pipeline and there is high demand for new apartments. The problem is that the final decisions for execution of these projects could very easily be postponed due to a range of reasons (changing political decisions, financing, building permission and long public procurement decisions, etc.).

Although the construction industry is always active, the question is how effective it is or how it will respond to changes in the current situation. It would be best to define the proportional sizes of the craftsmanship and industrial spheres, determining their needs and importance.

## Sustainable development

*How is sustainable development (social, economic and environmental) reflected in national politics? What related decisions or actions may have an effect on the construction industry? What are the national priorities and how do professional associations adhere to them?*

In most of the respondents' countries sustainable development is included in their policy programmes. However, in terms of the practical steps involved they are at very different stages, as the underlying background is their political culture and socio-economic situation, which vary greatly from country to country. Another common element amongst respondents is that sustainable development is mainly perceived in its environmental sense. Thus, sustainable development in their answers has to be interpreted according to this specific meaning.

The main sustainable development policies concern:

- The energy-efficiency retrofitting of the existing building stock.
- The circular economy of the construction sector.
- The upskilling of the existing workforce.

The respondents generally consider EU funds to be a key asset for achieving Sustainable Development Goals in Europe. On the other hand, some respondents indicated that EU, national and regional policies do not have goals and budgets that would be suitable for an ambitious sustainable infrastructure policy.

In **France,** decisions makers and sector representatives consider that the system could still be improved. However, national sustainable development policies tend to be created together with the various stakeholders: economic actors, environmental associations, unions, administrative bodies and local authorities. Thus, the draft 2020 thermal and environmental regulation draft combines both energy consumption and the carbon emissions of buildings. Moreover, the French 2019 circular economy law considers construction and demolition waste a priority.

Additional major challenges in terms of sustainable development for the construction sector in **France** concern energy savings in existing buildings. The low level of energy prices undermines the budgets allocated to energy-efficiency renovation work, and stakeholders (promoters, households, etc.) cannot obtain a return on their investment. To this end, public support for housing energy-efficiency renovation works would represent a major advantage.

In **Germany**, climate protection and the sustainable use of available resources are among the most important challenges for the coming decades. In the respondent countries, where sustainable development is an integral part of the policy agenda, sustainable construction is also one of the core topics in the construction industry. Most contributions emphasise cooperation between all actors. However, the technical or environmental requirements of new houses and flats are important to guarantee sustainable construction, but they should not lead to a rise in construction prices. Thus, policies should combine the need for sustainable construction with the need for affordable housing.

Besides, in **Germany**, many master craftsmen in the construction sector have further qualified as Building Energy Consultants and can provide quality advice to builders. The German construction industry builds or renovates buildings that meet all energy standards up to passive house standard. Construction techniques are innovative and meet all the necessary requirements in terms of sustainability, and they are constantly being developed.

Clear national targets, a strategy to reach them and a road map for concrete measures are needed to make a decisive contribution to sustainable development and to the achievement of common European goals. Although sustainable development is generally on the political agenda of all partner countries, the level of strategic planning varies. The national strategy could be described, for example, as follows (as expressed by the **Lithuanian** respondent): Lithuania's strategic priorities for sustainable development are in order to promote environmentally sustainable, resource-efficient, innovative, competitive and knowledge-based economic development. In addition, the country's professional associations are fully committed to the implementation of sustainable development goals.

In **Ireland**, Near Zero Energy Building, NZEB is mandated for all new buildings and existing buildings which are deep retrofitted (25% of the area) commencing November 2019. It is a legal requirement that the construction industry comply with these new building regulations. The national specification for NZEB is launched in November 2019 and subsidised training will be available for workers in the field of NZEB to assist with achieving these NZEB targets.

In **Germany**, many master craftsmen in the construction sector have further qualified as Building Energy Consultants and can provide quality advice to builders. The German construction industry builds or renovates buildings that meet all energy standards up to passive house level. Innovative and with all the necessary requirements in terms of sustainability, construction techniques are constantly being further developed.

According to the **Belgian** respondent, political priorities regarding sustainability are not clear enough. There is a need for Sustainable Infrastructure Goals to define convergent priorities. Objectives and budgets defined at national, regional or European level should be in line with these priorities. Besides, national and regional authorities feel blocked by public accounting rules.

For **Lithuania**, EU funds are a key asset for reaching sustainable development goals. It is therefore very important how the country is going to set national investment priorities to complement the Multi-Annual Financial Framework 2021-2027.

For some years now, **Italian** Government programmes have been increasingly focused on sustainable development issues, with particular reference to reducing carbon emissions and reducing the negative consequences of climate change (e.g. by making the territory safe, etc.). With the Budget Law for 2020, the government has indicated that it wants to make this commitment structural by allocating resources of 65 billion Euros for the next 15 years for sustainable development.

**Italy** has already put in place several measures aimed at energy efficiency, starting with Law 10/91 and subsequently transposing the European directives. With regard to energy efficiency in buildings, in 2015, Italy has implemented Directive 2010/31/EU, and the concept of the Nearly Zero Energy Building (NZEB) was therefore introduced. The methods for calculating the energy performance of a building and the new minimum requirements for buildings were defined, and the requirements for buildings with almost zero energy were established. The schemes of the technical project reports and the new national guidelines for the Energy Performance Certificate (EPA) were also defined.

In 2014 **Italy i**mplemented Directive 2012/27/EU, establishing a framework of measures for the promotion and improvement of energy efficiency aimed at achieving national energy saving targets by 2020. Some new features for public administrations, businesses and individuals were introduced, including the implementation of energy requalification interventions in central Public Administration structures for a minimum annual rate of 3% from 2014 to 2020, and the establishment of the National Fund for Energy Efficiency, a revolving fund to finance energy efficiency measures.

As regards the improvement of the energy performance of buildings, three main instruments were provided for: (1) The Strategy for the Energy Re-qualification of the National Real Estate Stock (STREPIN), aimed at mobilizing investments in the renovation of the national stock of buildings; (2) The National Action Plan for Near Zero Energy Buildings (PANZEB). From 2021 the new buildings will have to be almost zero energy. In view of this obligation, the PANZEB outlines the national guidelines and development lines to increase their number through the regulatory and incentive measures available; (3) The Plan for the Energy Re-qualification of Central Public Administrations (PREPAC).

The **Finnish** rules for energy efficiency of buildings in 2008-2012 and the latest year 2018 play a very important role. In particular, a very tight line has been taken in building construction, which has made new buildings extremely energy efficient. Sustainable development is a common theme in national politics. Moreover, legislation for guiding the circular economy is under preparation. The state (government) and cities have recognised their role in promoting sustainable development (the circular economy) in the real estate and construction sectors.

The acceleration of the rate of energy upgrading of the building stock in **Greece** could greatly stimulate economic activity and employment. In the same direction, it is estimated that the abolition of the additional housing tax (ENFIA) and the reduction of VAT from 24% to 13% on construction will also work. Such tax interventions enhance the value of real estate and household property, facilitating transactions by increasing liquidity in the real estate market and extending the robustness of the banking system. In addition, they change the relationship between building prices and construction costs, boosting incentives for new investment in buildings.

In this context, many countries respond that legislation already stimulates sustainable development. In particular, waste management is strictly regulated and sanctioned. The primary objective is therefore to fully comply with existing legislation and the strict enforcement of environmental regulations. Clear national targets are needed to support sustainable development principles. It can also be said that there are many similar national agendas (frameworks, programs, agendas, roadmaps and strategies...) to support sustainable development.

In **Slovenia** nearly zero energy standards for both new construction and renovation have been mandatory for all public buildings since January 1, 2019, and for all others, including private residential buildings, they will be mandatory two years later. Professional associations consider these new regulations to be advantageous for the development of new technologies and market growth. However, there is a lack of public incentives for the education and training of their employees as in Slovenia we do not have paritarian funds. There is also a risk of lack of contractor experience as well as in the whole value added chain in construction processes. To accelerate the process of sustainable construction the Government of Slovenia issued the special Regulation on Green Public Procurement in 2017.

Some countries' responses clearly highlight the need to link national and international policies. This is well reflected in the **Spanish** reply, where it was said that "according to international commitments and obligations, multiple initiatives related to sustainable development are being developed." Some of the most relevant are: The Spanish Urban Agenda, The strategic framework on energy and climate, The Long-term Strategy for Energy Rehabilitation in the Building Sector in Spain (ERESEE), The National Strategy against Energy Poverty 2019-2024 and The Spanish Circular Economy Strategy.

*What do you think that would be necessary to encourage companies to take into consideration environmental aspects such as energy efficiency, the circular economy and pollution in their production processes? What would be a necessary basis for not staying solely on a theoretical level?*

Sustainable development as a top-level concept is difficult to understand and therefore requires expert guidance from the public sector in project planning. Moreover, funding and financial incentives are needed to support implementation. Public incentives or environmental protection taxes also encourage and/or stimulate companies to find and develop new business concepts and strategies in line with the scope of sustainable construction.

In **France**, an experiment is under way to link the efficient use of natural resources (energy economy, waste management and raw material use) to financial savings. Company representatives consider that economic factors are the key to accelerate the development of the circular economy. Moreover, financial incentives and the "green value" of buildings would encourage the promotion of good practices such as energy efficiency and the circular economy in construction.

Many companies already take into account these aspects in the partner countries. Construction rules and EPB rules are very stringent in **Belgium** -and in particular in Flanders, where the standards are raised every two years-. These rules drive contractor as well as product manufacturer innovation. Moreover, waste is highly taxed, so that companies try to reduce it as much as possible in order to reduce costs.

All three environmental aspects such as energy efficiency, the circular economy and pollution are very important for **Lithuanian** companies in their production processes. In fact, energy efficiency improvement is one of the objectives set in The National Energy Independence Strategy which was approved in 2018.

The objective of information and awareness-raising policies in **Spain** is to change the mentality of companies, that is, so they take these issues into account and see them as an opportunity to modernise their manufacturing processes. All these policies will be reinforced by regulatory measures to prepare society and industry to develop sustainable development strategies.

Regarding **Greece**, it would be desirable for the State to provide additional incentives to households to accelerate investments in the energy upgrading of buildings. The implementation of investments in the energy upgrading of housing, according to the strategic planning of the Ministry of the Environment and Energy, may increase the growth rate of the Greek economy by up to 0.7 percentage points, as well as stimulating employment by up to 40,000 jobs and therefore encouraging companies to take environmental aspects in general into consideration. More specifically, it can bring significant developmental benefits over a period of economic activity via strategic policies such as tax-credits commensurate with the amount of expenditure on energy renovation work on buildings. Additionally, it must be noted that a new government policy that has already been passed offers tax reductions to individuals and private companies equal to the amount they have spent in order to enhance the energy efficiency of their households and buildings.

As expressed by the **Lithuanian** respondent, politics will hardly affect change if it is not accompanied by a change in the mind-set of capital owners in the economic superpowers. Raising the awareness of businesses in the construction sphere about environmental aspects would require networking with other stakeholders and the realisation that this is a benefit and not a hindrance. The question is whether this can only be achieved through awareness-raising or whether restrictive measures are also needed.

In **Ireland**, the respondent states that industry should bear some of the costs and responsibilities. Carbon budgets and tax work well with the industry, and emissions trading schemes have set targets for the worst polluters. The larger companies take responsibility for energy efficiency, recycling and reducing waste due to requirements set out in the green procurement process, this is also due to image concerns and environmental beliefs. The Construction Industry Federation has driven the agenda for lean construction, which enables a faster build and higher productivity.

It is also worth mentioning that the principles of sustainable development are already reflected in the strategies of the largest construction companies, especially in the **Nordic** countries.

In Italy there is the need for a circular economy pact in construction. Nowadays, construction and demolition waste accounts for one third of the waste produced in Europe. Yet recycling is still too difficult and too expensive for businesses. There are cutting-edge products and techniques to be exploited in a logic of excellence at European level. It is necessary to reward those who reuse materials and reduce the impact of their construction sites, not those who take everything to landfill.

*Some surveys show a trend towards the concentration of population in urban areas. Is this tendency confirmed in your country? If so, what action should be taken to relaunch urban policies aimed at citizens?*

Urbanisation is a common trend in all partner countries, and it was raised as an important issue that relates in many ways to sustainable development. There is a need for a special policy and plans to make urbanisation as balanced as possible while respecting people's well-being. In addition, specific measures are required together with financial support to implement them.

Urbanisation is a phenomenon that occurs in all partner countries, where people are moving from rural areas to urban centres. Another clear tendency is that capital cities and their surroundings are generally the fastest developing and growing. Due to this general phenomenon, it is considered necessary to prepare a master plan as a key instrument for ensuring inclusive and sustainable urban development, reducing socio-economic exclusion in cities and the negative impact of built-up territories on the environment, while also securing the protection of the natural and cultural heritage.

Respondents' replies paid much attention to the impact of urbanisation on citizens' daily lives, meaning that government should stimulate investment in dense urban areas and city centres to make living in there more positive. Therefore, the trend seems to be towards including end-users in the decision-making process. Citizens should be better involved in the preparation and planning of residential construction. Construction should be closely linked to the planning of public sector transport, combined with land use and zoning.

High concentration of the population poses particular challenges not only to the construction industry but also to public sector infrastructure planning. The **Finnish** respondent stated that planning for fast-growing cities (vs. urban areas) is a bottleneck. The political question is whether we really want cities to grow so fast. This tendency has also led to a sharp rise in house prices, especially in downtown areas. When demand and supply do not balance and production is insufficient, prices will rise. As a result of the high concentration of the population, the share of population in cities is growing and rural areas are experiencing strong population decline. Some national policies aim to redistribute public investments (EU funds) in favour of less developed regions. Some tax incentives are also provided to help rural areas to survive the urbanisation phenomenon.

According to the **German** respondent, policies must promote jobs in rural areas. The necessary infrastructure (schools, health centres, shops) must be provided; jobs and adequate infrastructure attract people to move from the cities and suburban areas to rural areas.

In **Belgium**, the Government should stimulate investment in dense urban areas and city centres to reduce mobility issues and improve the quality of life. Just like in the Netherlands and Denmark, there should be more investment in bike lanes and pedestrian zones.

**Lithuania** devotes much attention to the sustainable development of cities. The new general plan of the territory of Lithuania is being developed. It will become the key instrument for ensuring inclusive and sustainable urban development, reducing socio-economic exclusion in cities and the negative impact of built-up territories on the environment, while securing the protection of the natural and cultural heritage.

In **Italy**, there is a major debate among politicians and administrators on how to stop this phenomenon by improving living conditions in smaller inland towns, investing in sustainable agriculture and tourism. An Italian Urban Agenda is needed, to intervene in our cities with an organic policy and a strategic vision as explained in the next point.

In **Ireland** it is anticipated that one million extra people will be living in the State in the next 25 years. The National Planning Framework (NPF) aims to achieve balanced regional development, in particular in cities, towns and villages on infill and/or brownfield sites where 40% of all new housing will be built, and 30% elsewhere. A key decision is to increase density planning regulations, enabling compact urban development and growth while reducing transport use. The NPF sets out major infrastructural projects and a sustainability framework to assist Local Authorities to provide sustainable strategy plans by 2020, with strong engagement by communities, stakeholders and the main professional bodies.

According to the **Spanish** respondent, the main measures that should be adopted by public administrations to rethink urban policies for citizens -taking into account the territorial context- are related to the circulation of information, which will allow them to become aware of the impact that cities, their planning and development have on the quality of life of the people who live in urban areas. What is needed, as stated by the **Finnish** respondent, is the development of how zoning and plot delivery at local level (town planning policy) works. Public transport, combined with land use and zoning, all play an important role. End-users should be more involved in the preparation and planning of residential construction.

The territorial divide between a concentration of population in urban areas on the one hand and the abandonment of rural areas on the other are at stake in **France**. Thus, the actions to be initiated by public authorities are twofold:

- In urban and metropolitan areas, to facilitate access to land for building, together with incentives for an increased density of buildings (additional floors, more buildings in smaller areas, etc.) in order to enable the construction of housing and improve mobility;

- In other areas, to restructure declining cities (including housing, commercial buildings and routes, etc.).

At the most basic level, the national government should directly contribute to the operating budgets of metropolitan areas in **Greece.** National programmes affect cities in several ways:

- National housing programmes often determine density, patterns of urban growth and energy use efficiency;

- National support of transportation infrastructure may change the built environment and accessibility of entire cities and neighbourhoods;
- Investment in education and local R&D facilities can greatly improve the environment for innovation and entrepreneurship.
- National government may also support regional programmes where it becomes difficult to disentangle rural and urban impacts. This is particularly challenging when urban policy also applies to very small towns in rural locations.

In **Slovenia** this tendency has not been generally expressed yet, as Slovenia is a quite decentralized country and the vast majority of people live in their own houses or apartments and are not very keen to move. Beside that, all employees get their travel cost to their place of work reimbursed by their employer. Living in the cities is not the prevalent life style in Slovenia.

## Renovation

*A high proportion of the building stock is at the age when improvements are needed to structures or building technology. Are there national housing programs targeted at renovating buildings? Is renovation on the political agenda? What are the policy measures to promote renovation?*

Europe has been heavily built-up since the Second World War. On the other hand, especially in southern European countries, there is historic very old building stock that needs to be restored with cultural and historical values in mind. Maintaining an existing built environment is clearly a common challenge and goal. The activity of renovating old buildings varies from country to country and clearly depends on the overall economic situation, as does the amount of new construction. A good financial situation will increase private investment and thus contribute to the maintenance of new residential and commercial construction, to which resources for construction will also be allocated. In recent years most European countries have been in a good economic situation, and this has diminished interest in renovating old buildings.

Building rehabilitation and urban regeneration is one of the Government's priorities and they form part of the political agenda in Spain, where rehabilitation is also a specific objective for the Urban Agenda. The long-term strategy for energy-efficiency rehabilitation in the building sector in **Spain** (ERESEE) was developed in 2014, and several studies were carried out for the development of the Rehabilitation Law, Regeneration and Urban Renewal, adopted in 2013. This strategy consists of the following pillars:

- Information and society,
- Technical, professional and business,
- Policy development and administrative measures,
- Financing.

Building renovation in **Germany** is said to be the key to reach policy goals, and it is much more efficient to encourage renovation than it is to strengthen the regulations governing new buildings. Nevertheless, energy-efficiency renovation seems to be suffering from some uncertainty and a lack of clear national goals and plans. For example, at the moment, in Germany energy efficiency renovation is only subsidised by cheap credit (low interest rates) and not by tax reliefs so far.

There are different energy efficiency and asset improvement incentive systems that are periodically provided for by the state budget laws. The replies also stated that a possible positive impact might arise from extending low VAT rates for renovation to demolition and rebuilding projects for houses and buildings with low architectural value. The replies also stated that widespread ownership in the private residential sector makes renewal procedures complex.

The building stock of different ages and condition determines the national target that is established and the set of measures which are put in place. The amount of financial support required for renovation is also based, in principle, on the existing building stock and its condition. Renovation work to improve energy efficiency plays a key role in achieving sustainable development goals. The implementation of the EU Energy Efficiency Directive in the national political agenda is at different stages in different countries is ongoing.

In fact, the responses highlight many different factors that are seen to have an effect (positive or negative) on activating renovation. In **Lithuania**, high energy prices have an accelerating effect on energy-efficiency renovation, while in **France**, affordable energy prices, due to production based on nuclear power, restrain households from undertaking renovation works, considering their low return on investment. The price of energy can have a very strong effect on the willingness of building owners to invest, even if good financial incentives are available.

In **France**, the 2012 regulation for new buildings is considered to be enough to reach EU energy efficiency goals. However, according to the experts interviewed, energy renovation in France still suffers from a certain lack of clarity, even if the situation is improving. Therefore, the "Sustainable Building Plan", which has existed in various forms since 2009, was enriched in 2018 with an "Energy Renovation Plan" that will constitute the action plan for the forthcoming years. Its objectives are:

- Achieving the reduction in consumption for all buildings by 2050;
- Reducing energy consumption by 15% by 2022;
- The gradual disappearance of "thermal sieves", including housing for low-income households.

It is vital that these goals be achieved, given that renovation works account for more than 50% of the turnover of the building sector in the country.

In **Lithuania**, high energy prices have an accelerating effect on energy-efficiency renovation. The price of energy can have a very strong effect on the willingness of building owners to invest, even if good financial incentives are available.

There is a consensus amongst respondents that targeted public support supplemented with strong EU funding for the improvement of the energy performance of buildings is needed to achieve the objectives. In many responses, tax relief targeted at renovations is seen as a good and effective national incentive alongside grant funding. The private financial sector is also launching loans with sustainable development criteria. Some of the largest European banks and insurance companies are already offering cheap green loans.

In **Italy**, much of the housing stock was built before and after the Second World War using reinforced concrete, and it is characterised by progressive obsolescence. Although various programmes and incentives aim to improve the housing quality of this building stock, some problems must be faced: in the case of Social Housing there is a lack of adequate public facilities; widespread ownership in the private residential sector makes renewal procedures complex, as most of the population owns their own home.

Intervening in **Italian** cities with an organic policy and a strategic vision is urgent and indispensable if we do not wish to condemn our urban centres to decline and degradation. The approval of an Italian Urban Agenda is important. The value and public interest of urban regeneration must be enshrined, and this must also be promoted by identifying appropriate tax measures that are stable over time. An incentive must be given to those who sell houses to be demolished, on condition that, within 12 months, they buy back a new house that meets current anti-seismic and energy standards. Soil consumption must be contained and existing land regenerated with urban planning legislation that allows for the demolition of old buildings, the transformation of degraded areas and the promotion of a real process of replacement and regeneration of our cities. It is therefore necessary to provide tax rebates for the most energy-efficient houses - which consume 4 or 5 times less than the average of the old polluting ones - and which today are instead fiscally penalized.

The majority of housing in **Ireland** was built pre 2008, with 25% of this housing built during the boom to poor standards. It is estimated that the total market value of retrofitting will amount to over €35 bn between now and 2050. There are a number of national incentive retrofitting schemes such as SEAI Better energy homes[2] for shallow retrofit and deep retrofit programme such as Superhomes where 35% of the costs can be funded. Local Authorities also can make use of the DCCAE[3] deep retrofit scheme for private housing and public grants. The recent Climate Action Plan to scale up retrofitting by increasing private sector involvement will be pushed significantly by the Government and the Construction Industry whilst supported strongly by Communities and Property Owners.

In **Finland**, the only current tool to be mentioned are ARA grants[4]: the Housing Finance and Development Centre of Finland, ARA, has major responsibility for the implementation of Finnish housing policy. ARA belongs to the administrative branch of the Ministry of the Environment. ARA grants subsidies, grants and guarantees for housing and construction and controls and supervises the use of the ARA housing stock. Subsidies related to housing and construction are granted from state funds. Such subsidies are allocated to the renovation of the building stock and the improvement of housing conditions. Depending on the legislation governing the subsidy in question, subsidies are granted by municipalities, ARA and the State Treasury. Finally, Renovation subsidies granted by ARA include:

- Subsidies for the renovation of homes for elderly or disabled people
- Accessibility subsidy
- Lift subsidy

Regarding Energy Efficiency, the Government program (2019-2022) includes energy grants for residential buildings (Ministry of the Environment bulletin per 28.10.2019). A total of EUR 20 million in 2020 and EUR 40 million per year between 2021 and 2022 is proposed for renovation projects to improve the energy efficiency of residential buildings. The grant is awarded by ARA.

The national housing programs in **Greece** are targeted towards making the existing building

*2 SEAI. Sustainable Energy Authority of Ireland*

*3. DCCAE. Department of Communications, Climate Action and Environment (Ireland)*

*4. ARA. The Housing Finance and Development Centre of Finland*

stock energy efficient. The building stock is obsolete - about 84% was built before 2000 (i.e., before the most up-to-date Earthquake Regulation was implemented). For retrofitting the building stock and improving its quality, it is necessary to carry out modernisation or replacement projects of existing buildings, and in particular residential blocks of flats, by implementing fiscal incentives.

In **Slovenia** there are programmes designed to renovate buildings, but they are exclusively based on energy conservation. As Slovenia is located mostly on seismically active territory, for a long time there has been public dialogue about the necessary static reinforcement of existing buildings, before energy conservation measures would be applied. There is also the dilemma of whether it makes sense to carry out such expensive refurbishment of existing old houses, or whether it would be better to demolish them and build new modern ones. There is also the important matter of protecting historic housing heritage and architects' IPR.

## Companies

*What is the impact of European directives, on ensuring the security of energy sources, controlling illegal immigration, promoting cross country delivery of goods within the internal market, and digitalisation? What role do the National sectorial social partners play?*

One of the main challenges for the construction sector consists of the proper implementation of sustainable development principles in existing buildings; public support for housing energy-efficiency renovation should be reinforced, as was stated by the **French** respondent. Respondents have emphasised that the construction industry plays a key role in achieving the goals of sustainable development that is innovative and with all the necessary requirements in terms of sustainability, so that construction techniques have constantly to be developed further.

According to the respondents, although the challenges can be met, national professional associations and social partners should support actions which lead to the implementation of sustainable development goals. Challenges can be turned into strengths by changing the mentality of companies when they take these issues into account and see them as an opportunity to modernise their manufacturing processes.

As was pointed out above, legal requirements should be sufficiently balanced so as not to hinder activity, while continuing to raise awareness of the importance of sustainable development for the entire sector. There should be a balance between EU legislation (regulations and directives) and national legislation, to prevent undermining the construction industry while paying attention to the potential impact of regulation on businesses.

The role of national social and sectorial professional partners is important and manifold. They have to alert the national authorities to the risks of any new national legislation which could hamper construction activity. They also have a role in informing the national authorities about loopholes which could interfere negatively in the construction sector. Sectorial social partners should inform the construction companies about the legislation and their obligations in their daily activity.

Several large companies take already into account sustainable development when implementing their new strategies, and they expect the public sector to do the same. Many interviewees stated that the public sector does not have the necessary capacity or expertise to implement bidding processes that would unambiguously always support the policy agenda. There seems to be a lack of the planning capacities that would permit authorities to realise all necessary projects.

One notable point is the growing internationalisation of companies. There are a number of large companies operating in Europe with cross-border business activities. This activity also has an impact on the employment of local construction companies. Because the business is international, companies call for fair competition at European and national level (clear criteria in the public procurement and tender process).

The replies also refer to the responsibility of companies to produce good enough quality, which seems to have an effective link with sustainable development. The construction industry needs to contribute to the increase of the necessary quality and quality assurance systems, which are also linked to the skill of builders. Quality of execution is an essential prerequisite, especially with regard to the builders.

Some country-specific responses are detailed below:

To ensure **Irelands'** fuel security, promoting indigenous fuels such as wind, electricity and biomass to achieve CO2 targets is one of the main agendas in the Climate Action Plan. It is intended to have 70% of electricity fuelled by renewables and to shut down gas/oil burners by 2025. The installation of heat pumps and off-shore wind turbines are two of the main drivers. The supply and use of goods falls within EU directives and EN standards. Goods from outside the EU require EN and **Irish** certification through the National Standards Authority Ireland, NSAI. With the advent of Brexit, many products have recently been passed using the Irish Standard (IS), to reduce issues arising from cross country transportation and the supply of goods.

The "grey" market is still a challenging issue within the construction industry, as the national register for construction workers, CIRI, has yet to be approved. This leads to many workers carrying out construction work without complying with regulations, especially in the retrofitting area. Intensive negotiations with all social partners have led to many changes in the register, but it is hoped that CIRI will be in place in 2020. It will then be mandatory for all workers to register and upskill. Although upskilling programmes for the workforce with new training for nZEB and understanding renewable products are in place, in the form of nationally available nZEB programmes, unfortunately due to a mini boom in the industry, workers are unable to take time off to upskill.

**German** bureaucracy and ever-changing law hinder contractors from doing business and building houses and infrastructure. Growing regulation makes construction and buildings expensive. Furthermore, **Germany** often implements EU-regulation much more strictly than other EU-countries, leading to competitive disadvantages for **German** companies.

Security of energy supply is one of the crucial issues in **Lithuania**, due to that fact that **Lithuania** has adopted a National Energy Independence Strategy. The Strategy provides for four main directions of Lithuanian energy policy – energy security, the development of green energy, efficient energy consumption, and competitiveness and innovation. The Strategy reflects the vision of the **Lithuanian** energy sector – to provide reliable, renewable and environmentally friendly energy to the residents of the country at the most favourable price.

**Italian** legislation transposes the European directives and transforms them into regulations and incentive standards to favour the security of energy sourcing. The social partners are consulted at institutional level by political decision makers. National sectorial social partners are actively engaged in ensuring respect for national collective bargaining for all workers, in order to overcome contractual dumping and irregular work.

In **Greece**, governmental and public concern has focused on the risks associated with dependence on external sources, political uncertainty in external supplier and transit states, and the potential for disruptions to energy supplies. There is also growing recognition that transformations within

the EU energy system, due to shifting demand patterns and the expansion of renewable energy sources, raise new challenges for the continuous supply of energy to end-users at an affordable price. Adopting digital technology as a fundamental strategic pillar can and will reshape the wider **Greek** economy, driving innovation, growth and job creation. Under the recently established Ministry for Digital Policy, Telecommunications and Media, a forthcoming central platform for all digital and ICT initiatives will be launched by 2020.

European directives certainly have a great impact in **Slovenia**, as they increase competitiveness, expand markets and introduce new parameters in the operation of construction companies. There are still many irregularities and malpractices in controlling illegal immigration, undeclared work, education and labour awareness. It takes too long for the social partners to find ways to deal with these issues.

The impact of European directives on the **French** construction sector depends on their scope. However, the experts interviewed consider the criteria and conditions defined in the current national legislation sufficient to reach the target of high-performance buildings. **French** legislation currently aimed at transposing the EU regulations at the national level goes, in general, further than the EU recommendations and directives. It would therefore be wise not to systematically strengthen this legislation, which may undermine the construction industry in **France**. Indeed, any new regulation will have an impact on construction and renovation works costs, which, besides low energy prices, would continue to hinder energy efficiency investment in buildings.

## Driver for companies

The public sector plays a key role in showing the direction towards sustainability. This tendency can be demonstrated in practice by public sector procurement and planning-related criteria to guide the construction industry.

Businesses can be guided to the principles of sustainable development in different ways, although economic drivers and incentives are still considered to be key factors. Construction regulations are already very stringent in many EU countries and drive innovation by companies producing materials as well as contractors. It is very important for companies to take environmental aspects such as energy efficiency, the circular economy and waste management into account in their production processes.

Even if the environmental criterion is not always decisive, customers (both public and private agents, as well as individuals) are increasingly sensitive to it, and they consider it when making their choices of service providers. Although construction is usually a b-to-b trade, a homeowner can have a significant impact on the desired outcome. Consumer support has been identified as a factor contributing to sustainable development.

In many countries, legislation already directs business to be environmentally friendly. A good example of this is waste management legislation. For example in **Belgium** production waste is taxed, and companies want to reduce this expense as much as possible. In **France**, more and more often, the specifications stipulate that companies must comply with environmental standards, specifying in their offers how they intend to organise the on-site collection of waste, save energy, use recyclable materials and guarantee safety on site.

## Skills / Skilled workers

The shortage of skilled workers is said to be the primary and growing problem of the construction industry, and it will even affect sector competitiveness.

In order to meet the need for a skilled workforce, policy measures are needed to ensure education system' capacity and quality. There are differences in the education systems of different countries with regard to the demands of working life, curriculum flexibility, administrative structures, operating culture and also teaching methods. Some replies highlighted the need for additional reforms to ensure the education system provides the right skills to meet evolving labour market demands and reduce large skill mismatches.

On the other hand, it was also emphasised that basic education must provide high-quality fundamental skills, while also taking into account the need for new skills. Further education should be flexible enough and focused to serve businesses, so that the policy measures to be adapted are related to training and the circulation of information. One of the key principles for maintaining knowledge is the possibility to lifelong learning.

In **Germany**, the government plans to renew the "Meisterpflicht" for some crafts because the master is the most important person within German vocational training ("duale Ausbildung"). Master workers are also in high demand in the construction industry of other partner countries.

In **France**, specific legislation (Law of 5 September 2018 on the Freedom to choose one's professional future) places vocational training at the heart of economic and social challenges in order to, among other aspects, reinforce individual career paths instead of general training plans and lifelong training.

In **Italy**, the construction sector has difficulties in attracting young people, especially with those with a high level of professionalization. It is necessary to promote the development of new skills by investing in training courses related to technological innovation and the digitisation of products and processes. The instruments available to construction companies (mostly small) to provide skilled and continuing training for workers are largely derived from the bilateral sector system (which is self-financed). These resources are not, however, sufficient to ensure ad hoc training aimed at acquiring the skills of the future. Action is therefore needed to support the bilateral sector system and to allocate more resources to construction companies, including for the recruitment and training of young people in innovation and digitisation.

Finally, controlled labour mobility is one of the key factors that should be addressed at European level. Respondents also highlighted that the mobility (access) of the labour force should be controlled but still possible. A quality classification for professionalism and/or competence is required.

The easing of procedures for labour force immigration from non-EU countries has played an active role, and it has partially offset falls in the labour force and the employed population, especially, in the construction and transport services sectors. The suppression of black economy labour and bogus self-employment in the construction sector is necessary to protect all legal working contractors.

## Conclusions

- A **stable and forward-looking political framework** for construction is crucial to ensure the sustainability of the construction industry framework.

- Long-term political goals should be accompanied by **appropriate funding/financing**. However, more funding and financing for construction projects should be accompanied by an **efficient organisational plan that includes all of the public authorities** involved in executing needed projects.

- In every country, a **systemic assessment of legislative or administrative regulations** should be carried out with the aim of reducing burdensome barriers.

- Supportive policies aimed at **increasing investment in research and development** are needed, especially in the field of digitalisation, the circular economy and energy efficiency.

- The technical or environmental regulations governing new houses and flats are important to guarantee sustainable construction, although they should not lead to a rise in construction prices. Thus, **policies should combine the need for sustainable construction with the needs for affordable housing**.

- Although sustainable construction is generally on the political agenda of all partner countries, the level of strategic planning and implementation here differs from country to country. **Policies should mainly focus on accelerating energy-efficiency retrofitting of the existing building stock, improving infrastructure resilience and adaptation to climate change, boosting the circular economy of the construction sector as well as the upskilling of the existing workforce**.

- **Urbanisation** is a phenomenon that occurs in all partner countries with people moving from rural areas to urban centres. It is necessary to **boost the private and social housing offer** to address the challenges linked to an increasingly urban population. **Public investment** in favour of less developed regions should be increased, as well as tax incentives to help rural areas to survive the urbanisation phenomenon.

- **National associations and social partners, in the context of bilateralism**, play a crucial role in achieving the sustainability of the construction sector by acting as intermediaries between policy-makers and the sector itself.

- Public policies need to ensure that the **education system provides the right skills** to meet evolving labour market demands and reduce large skill mismatches. In this context, the Public Authorities in several partner countries tend to bring vocational training closer to companies by promoting innovation and more constructive contacts between training centres and companies. The main aim is to promote learning, the formative exploitation of work situations or even to build more bridges between initial and ongoing training.

- There is a real **problem in attracting young people to the sector** in the context of technological innovation, as well as in upskilling workers who are already employed by means of ongoing training

# Economic factor

## General remarks

From an economic perspective, the following section describes different factors, such as industrialisation, modular construction, energy efficiency or renovation works, that will have a big influence on the near future of the construction industry. Other factors are also likely to increase construction companies' competitive efficiency, such as a qualified workforce and their openness to innovation and digitalisation, etc.

On the other hand, the respondents consulted indicated a number of potential obstacles and risks that may hinder the positive economic evolution of the construction industry in the European environment, and possible solutions which may be implemented in order to minimise their negative impact.

The role of the public sector as a driver of change and effective and smooth cooperation between the public and private sectors may also be considered to be crucial in terms of the economic evolution of the sector, according to several respondents.

## Industrialisation and modular construction

*Factors that contribute to the industrialisation of construction. Future perspective regarding industrialisation and its evolution in the sector*

The key factors that currently influence the industrialisation of construction can be described as a rapid transformation due to the implementation of the Sustainable Development Goals (SDGs) and adaptation to digitalisation and standardization in accordance with the European Agenda 2020-2030. According to the Spanish respondent, this evolution will depend to a significant extent on governmental measures to be implemented.

In this regard, the replies expressed by different respondents in the participant countries highlighted two different points of view: some emphasise the construction industry's own needs for competitiveness, whereas others emphasise the central role of the public sector as a driver for development. In this context, it actually seems that both perspectives are complementary.

Increasing efficiency is a key trend for business competitiveness and a driver for technological and operational change. The need for development has been described by the **French** respondent as "the need to build better, faster and with reduced costs."

Viewing construction as a total production system sub-divided into a number of individual production processes, implies that each of these processes has the potential to be industrialised. This means that innovations can be applied in:

(a) The process of construction design, engineering and specification;

(b) The process of project execution, i.e. the actual building process;

(c) The process of producing building materials, elements and systems, as well as integrating this in the total construction process.

On the latter point, building product and material manufacturers have been the largest construction industry sector to actively develop or look for new technology to improve their products, given the fact that they can profit from economies of scale, leading to a technological opportunity. Finally, on construction sites, industrialisation involves both the installation of building components and data management.

Underlying industrialisation there is a need to streamline the process of construction as a whole and in its various stages. According to the **Lithuanian** respondent, modular construction as a process of industrialisation is going to have a big impact for the construction sector in the very near future.

Furthermore, industrialisation will also involve changes in workers' skills. The manufacture of building components under industrial conditions and in the production process is, in practice, simpler and does not necessarily require the same skills as those needed on construction sites. In addition, it should be noted - as the **Spanish** respondent highlighted- that ongoing worker training is essential in the construction industry to supply the necessary skills for the new occupations that will appear throughout the future industrialisation process. Moreover, the **Greek** respondent indicated that the aging and shrinking of the construction labour force in many Western countries is also an important factor that will stimulate industrialisation in the sector.

Many respondents highlighted the fact that one of the most important changes to increase the effectiveness of the construction industry is digitalisation, which clearly supports industrialisation; industrialisation will grow exponentially, and it is massively determined by factors such as Building Information Modelling (BIM). This will be a key driver and tool for efficiency enhancement, and its use will increase dramatically over the next few years.

The vision for the future of the construction industry can be modelled using the business concept of the logistics industry. Industrially manufactured (prefabricated) modules evolve into ever larger assemblies that are transported ready to the site. Construction project management begins to resemble industrial production control and material management, with the focus on goods and component logistics management. Development work will focus on data and project management, where comprehensive utilization of the BIM tool plays a key role. A clear change in business strategy is required, together with significant development efforts. As the **French** respondent emphasised, there is a basic need for the market to accept industrialised products, because industrialisation needs large volumes to be profitable.

Digitalisation may also be a key driver for the construction products manufacturing industry, which the **Finnish** respondent said will play a major role in the development of new innovative solutions in the sector. The vision for the future of the construction industry can be modeled using the business concept of the logistics industry. Industrially manufactured (prefabricated) modules evolve into ever larger assemblies that are transported ready to the site. Construction project management begins to resemble industrial production control and material management, with the focus on goods and component logistics management. Development work will focus on data and project management where comprehensive utilization of the BIM tool plays a key role; a clear change in business strategy is required, together with significant development efforts.

As the **French** respondent emphasised, there is a basic need for the market to accept industrialised products because industrialisation needs large volumes to be profitable. According to the **Finnish** respondent, innovation funding may therefore be a way to promote the development of the new technologies, manufacturing methods and business models that are needed to implement industrialisation of the construction industry. Compared to other industries, the construction industry uses less innovation funding to develop its production methods.

According to the **Belgian** respondent, industrial solutions for large housing schemes could contribute to make construction more affordable. However, on the negative side, "mass-production" in construction could lead to a fall in the architectural value of buildings.

As the **Slovenian** respondent said, the economic factor and the concept of building design are the most important factors in the industrialisation of the construction industry. There is a growing tendency for buildings to become an industrial product, which is contrary to the specifics of the space in which we live. The future lies in adapting industrial logic and understanding the specifics (tradition, climate, natural conditions) of space and its evaluation.

According to the **Italian** respondent clear objectives for energy regeneration and security for buildings are needed: these could be achieved by looking at the positive experience of incentives for private resources in Italy. In the construction sector incentives (such as Ecobonus) should be implemented in order to promote entrepreneurs' best practices.

## *Hindrances or obstacles perceived for the growth of industrialisation in construction*

Many different challenges and possible hindrances are seen for industrial development. According to the respondents, challenges may be technical or economic, although they may also be human-based. Potential security risks for data processing were also highlighted.

According to the **Italian** respondent, national budget constraints may continue preventing an effective strengthening of the sector. In fact, the risk of increasing real estate taxation, an uncertain and chaotic legal framework and the persistence of the credit crunch may hinder development.

For the **Lithuanian** respondent, industrialisation happens as a revolutionary process which should be supported by the whole sector. It needs capital investment, and there may not be any guarantee of an early return on this. The **French** respondent emphasizes this approach while considering the lack, on the one hand, of standardization in construction processes and, on the other, of exchanges between branches within the construction sector. However, in the opinion of the **German** respondent, it is likely that not all actors will change their strategy towards technological innovation, and traditional manufacturing companies will remain within the industry. Decision-makers are often not up-to-date about the latest technical developments and prefer traditional business models, methods and technologies.

One of the drivers of the construction market is the great need for renovation. However, in the opinion of the **Belgian** respondent, renovation work is a growing share of the market, and here the potential for industrialisation seems to be less than it is for new buildings.

Industrially manufactured products should be designed appropriately. The production methods and technologies used in manufacturing differ from traditional construction. According to the **Finnish** respondent the industrial fabrication of buildings requires a new kind of design expertise. The modularity of buildings must be taken into account in the design as well as industrial manufacturing methods. The design must also take into account the transportability of the prefabricated building modules. Designers therefore need additional training to acquire the skills needed in industrialization.

The **Spanish** respondent indicated that another major obstacle is the training of human capital, due to low-skilled workers and companies with a low level of innovation. Also, ability and willingness to take financial risks is a major factor in making a significant change. Industrial manufacturing requires large investments, so obstacles are determined by financial limitations and limited budgets.

This attitude was confirmed by the **French** respondents, who stressed a lack of digital skills and resistance to the adoption of digital tools and processes with no appropriate ad-hoc and continuing training.

According to the **Greek** respondent, the construction industry is characterised by a high percentage of small and medium sized firms. This means that much of the technology and knowledge –at least in the contractor business- is tacit, not codified, and project experiences are often undocumented, which makes industrialisation more problematic. In **Greece**, another obstacle has to do with the lack of young people entering the industry and the high unemployment rate in general and as far as the construction sector is concerned. The number of on-going jobs there was limited until recently.

The **Irish** respondent states as an example that the lack of supply chains for products and materials is the biggest concern for mass production, as Ireland does not have previous experience in this field and shortages of stock are inevitable, as there is currently no direct connection to the European mainland. Modular schools and some social housing have been constructed by large companies with support from the government, but there is no general acceptance within the Irish construction industry by the majority of companies (SMEs and Micro). The cost of investing in modular construction is too high for most companies as their priority is to compete to survive and upskill their workforce.

There are also some specifically national challenges, for example in **Belgium**, where there are issues linked to different phases of the construction process and particularly the production as well as the design phases. Legislation seems to give architects and their work a special status: Industrial construction is perceived to weaken the position of architects as designers, impacting on the development of a modular construction market with “mass customization” possibilities.

According to the **French** respondent, a lack of appropriate legislation and regulation systems is another hindrance for the growth of industrialization.

## Competitiveness of the construction industry

### *Economic factors increasing the efficiency of construction companies*

The competitiveness of companies can be influenced by internal and external factors. Some of the companies in the same market perform better than others, and good profitability helps them in different economic cycles. The public sector can help companies through economic downturns by providing construction projects through public tenders, but cannot directly influence how efficiently the industry delivers construction services. However, business development can be indirectly supported by publicly funded projects in the fields of product development, research projects, competence development, investment or internationalisation, etc.

It has been stressed that companies have to invest in new technologies and human capital in order to increase their efficiency, especially by applying new digital technologies such as BIM. The advance of digitalisation seems to have an indirect and strong impact on the competitiveness and efficiency of businesses of all size or position in the value chain. Thus the **Finnish** respondent considers that the advancement of digitalisation has such an impact.

According to the **Belgium** respondent, the industry's market must be ready and open to new innovative solutions. Organisational effectiveness, on the one hand, and qualified workforce, on the other, were said to be important factors for the competitiveness of companies. Skilled workers are very important to companies, but good leadership is also required for successful projects.

The way in which companies are able to operate in the market is of increasing importance for success. In Germany customers prefer construction companies that can prove the expertise of their workers with formal educational qualifications, master's qualification and advanced work certificates. In this respect, according to the **French** respondent, the main economic factor for increasing the efficiency of construction companies is clearly employee training and competence. It is therefore crucial to maintain professional skills and to enable workers with an opportunity to be trained (ongoing and lifelong training).

The **Italian** respondent considers that in the public and private sectors specialization, innovation and special attention to human resources are the key factors for efficiency and competitiveness.

The main driver in **Ireland** is to enable companies to access assistance for training and upskilling schemes to improve competiveness and innovation. Various government grant schemes are available, especially in the field of digitalisation and lean construction. This enables SMEs and workers in larger companies to upskill, to provide quality construction services and to become more competitive.

National respondents also stressed the importance of external factors such as the public sector and policy measures for sector competitiveness. This aspect was mentioned by the **Spanish** respondent, who said that the economic factors that increase construction efficiency must stem from policies in areas such as energy and mobility in cities. There is scope for the improvement of innovative construction activity, which must assume important challenges for the future, almost all of which require a high level of innovation and application of new technologies. That is why training in new technologies is so important. Equally, there is also room for improvement to eliminate existing barriers in the application of tax incentives.

Moreover, for the **French** respondent, a stable legislative framework and a pause in regulatory activity would offer a good environment for companies to focus on their activity instead of having to adapt to new administrative and regulatory requirements.

There are also opportunities for efficiency deriving from light and reasonably swift administrative formalities, as expressed by the **Belgian** respondent.

*Uncontrollable economic and financial influences create potential risks for the construction sector; what effects would be most damaging and how can these be reduced or alleviated?*

Economic cycles can nowadays be monitored very closely and reliable information on changes is openly available. On the other hand, unpredictable changes can occur in the global economy, and it is challenging to prepare for them. The construction industry has a significant impact in terms of economic changes at national level. Answers to the question on the effects of uncontrolled economic development were provided, looking at the role of the public sector in balancing the economy and, on the other hand, the changes in private consumption that underlie economic development.

According to the **German** respondent, construction companies are mainly dependent on the volume of public investment, which is usually the case given the size of the contracts to be awarded, so that it would be a major financial risk if the public sector were to limit its investment resources accordingly. However, the interviewee considers that the probability of such a scenario is relatively low, as infrastructure in particular has to be maintained by the public sector. Here, for example, the road networks, transmission and electricity grids, etc. for which the state has to assume responsibility and which must be made available to future generations for use must be described and evaluated.

According to the **Italian** respondent, one of the main obstacles is the strong credit-crunch that prevents reinforcement of company organization. Moreover the actions aimed to control soil consumption, without a framework of rules on urban regeneration, may block important development initiatives.

According to the **Belgian** respondent the sudden withdrawal of incentives by public authorities to boost renovation works is also a potential source of market disruption. Public investments should be systematic and predictable and not, as has been said, 'stop-and-go investments' — referring to the current trend by authorities to develop incentives to promote certain types of investments and then to block them. Such negative unpredictability has been seen in some rapid changes in housing or energy efficiency support measures.

The **French** respondent claims that one of the main risks for the construction sector is restricted access to credit. This is the case for construction companies, where it would lead to cash flow issues, and for customers, who are not be able to finance their projects (the construction of new housing, renovation works or increasing energy efficiency, etc.).

Furthermore, measures affecting real estate values are likely to have a significant impact on construction demand and even the whole economy. According to the **Lithuanian** respondent, rapid growth of housing loans may lead to imbalances in the Real Estate market. A sharp increase in interest rates and house price adjustment could have a negative effect on domestic demand, and it would probably be a risk to the sustainability of the financial system.

According to the **Spanish** respondent, to mitigate the impacts of a bad economic situation over the long term, it is necessary to have a consensual planning system involving the different social actors that addresses a series of priorities that are consistent with major public policies in terms of training, research, employment and the economy, etc.

The **Finnish** respondent stressed the role of the public sector, stating that big infrastructure projects work well as buffers for balancing the bad effects of the economic situation.

According to the **Greek** respondent, sudden price changes represent the greatest economic risks in **Greece**. Another economic risk that has to be taken into consideration when planning a large construction project is currency fluctuation. Also, late payments, breach of contract and poor designs need to be taken into consideration when addressing economic risks.

For **Ireland**, maintaining and sustaining solid capital investment, especially in the public sector over the next 10 years, is essential to ensure a level of certainty and confidence for private investors. The public sector in Ireland sets the precedent for future initiatives, and private investment usually follows. The construction industry is the main factor for all other industries and employment, as there is a direct relationship between citizens' wealth and their health.

The possibility for companies to pass on unexpected changes in commodity prices, particularly in public procurement markets, also mitigates shocks and discourages speculation. Excessive employment rigidities also have the perverse effect of discouraging hiring, particularly for SMEs, as stated by the **Belgian** respondent.

## *Political and economic measures available to prevent the loss of workers and improve existing market behaviour with regards to quality*

Several contributions raised concerns about the poor image of the construction industry and suggested measures to improve it. According to the **Belgian** respondent, there is a clear need for awareness-raising about the attractiveness of construction professions and their evolution, which makes them less physically demanding, less repetitive, more technological and fulfilling than in the past. According to the **German** respondent, national financial resources should be provided to support this 'image-improvement campaign' in the media. Additionally, opening up voluntary social service into the construction industry activity could be considered. After finishing school and before choosing a career path, young people have the possibility of spending a year doing voluntary social work. The purpose of voluntary work is that the volunteer obtains knowledge and experience by working for the community. Moreover, it helps volunteers to orient themselves professionally by giving them a year to think about their career path while performing voluntary tasks. These voluntary services are usually carried out in social professions. An opening for the construction industry should be considered, so that young adults could gain an insight into construction industry jobs which could lead to the decision to choose a career path in the building sector.

Action must be taken to maintain the skilled workforce in the sector and to improve the quality of training (in particular basic workers' training). In general, responses were interconnected, on the one hand to improve cooperation between businesses and employment services, and on the other to further focus on training development.

According to the **Italian** respondent, the reduction of labour costs, that are the highest in industry as a whole, could be a political and economic measure that would promote the construction sector.

The **Belgian** respondent called for better collaboration between public employment services and enterprises (skill shortage detection, the identification and orientation of job-seekers to be re-trained) and simplification of the training and education landscape, as well as so-called dual training. Negative effects can be prevented by better anticipating labour market needs, which is in line with cyclical economic activity. A possible solution could be the possibility of using temporary unemployment schemes in times of economic downturn, to make it possible to keep skilled workers in the sector despite the fall in activity.

The **Finnish** respondent suggested that government investments are needed in VET and upper level education, as well as continuous learning possibilities in construction.

According to the **Irish** respondent, in order to attract more apprenticeships and encourage the development of professional careers in the construction sector, the construction industry requires major image improvement. There is a need to attract the national and local workforce to the sector, together with the need to provide good flexible employment pathways.

The **Belgian** respondent stated there is a need to upgrade the curricula according to current and emerging technologies, making the schools that prepare people for construction professions attractive spaces. Furthermore, dual education systems would contribute to a better image of the sector and better preparation for construction professions. In general, good collaboration between training operators, education institutions and companies is a must.

According to the **Greek** respondents, the construction industry should focus on making the sector attractive to skilled young people, by setting certification standards and by establishing VET and upper level education as well as continuous learning possibilities for construction. It would be helpful for the construction industry to find a system under which employees can more reliably gain the skills that will allow them to be successfully integrated in the sector. Within this context, it is important for workers to comprehend that skill development will ensure their effective career development in the construction industry.

For the **French** respondent and from an economic point of view, taxation policy should evolve in order to lower production taxes, as these affect companies whether or not they are profitable (unlike VAT or income taxes).

### *How the notion of customer need is understood in the changing economic context with strong competition, especially concerning SMEs and how companies prepare to respond to new client needs*

First and foremost, one should describe and define the type of customer you are dealing with, whether the buyer is in the public sector or a private company. In addition, it is necessary to consider the end-users of buildings, such as citizens as apartment owners. Defining the customer sector at all times avoids misleading interpretations. The responses received through the questionnaires mentioned both consumers and the public sector as customers.

According to the **German** respondent, companies are increasingly being asked to provide turnkey solutions in the context of the construction industry. On the other hand, the public sector also has an interest in taking SMEs into account when awarding public contracts. For this reason, the public sector often attaches particular importance to awarding individual contracts. In this respect, it can be said that companies are already reacting to new customer wishes and are also well-prepared. However, the public sector, as the tendering institution, has some issues to deal with in this area.

According to the **Lithuanian** respondent, the accelerating pace of technological change puts pressure on companies to reinvent themselves, transform their business models, and move into new markets faster than ever. With regard to these changes, workers will need to acquire new skills due to automation and other technological advances. For example, in **Lithuania**, SMEs and especially new firms contribute greatly and increasingly to the innovation system by introducing new products and adapting existing products to customer needs.

According to the **Spanish** respondent, information will be the key tool. People will increasingly demand sustainable cities, and decisions will be made on the basis of two factors: businesses and citizens. Future digitalisation and 5G will generate an enormous amount of information that will help all economic processes, and consequentially the construction sector, too.

Increasing competition and data availability are forcing **Slovenian** companies to reach out to customers. However, due to inertia and the past regime, there are still situations where some feel that the client may be happy to do business with them and have no other alternative. As a result, they do not find it necessary to gain customers' confidence.

The **Italian** respondent indicates that changes in the use of real estate are modifying the life cycle of goods, leading to changes in spaces and how they are used. In order to meet the needs of consumers, business should adapt supply to demand by ensuring quality and flexibility. SMEs should combine their strategies with other players in the supply chain to be more competitive.

In **France**, to adapt to customer needs, more and more building companies collaborate with so-called "platforms", which are intermediaries between the provider and the final customer. These platforms are set up by big companies such as energy suppliers and prioritise individuals and households.

A **Finnish** economist stated that financial restrictions determine which customer needs can be met.

*In the absence of an industrial policy plan, how can companies assure the development of the sector and of the economy? How can the EU support enterprises by making bank credit accessible to them, in particular for small businesses?*

In the **German** construction industry, this question seems not to arise as much as it does in other sectors because for the building sector it seems that construction in existing buildings will always secure sufficient orders, even for smaller companies. In this respect, a political guideline or an industrial policy plan may only be required for major investments, from which SMEs are generally excluded.

It has also been stated that the evolution of construction enterprises and the sector in general is following its own (slow) rhythm but may speed up if supported and encouraged by a (public) industrial plan, as expressed by the **Belgian** respondent.

In **France**, at least nowadays, bank credit is still accessible for companies, even SMEs. Only appropriate and prudential banking regulation will maintain this trend.

However, as the **Lithuanian** respondent emphasises, development in the construction sector may be accelerated by state-financed measures in order to support companies (SMEs) at the stages of activity origination, implementation and development, to create and/or retain jobs and improve competitiveness. In **Lithuania**, an important source of finance for SMEs comes, for instance, from the European Union Structural and Investment Funds (ESIF) Program.

The **Spanish** respondent stated that development of the construction sector involves revising and adapting the Spanish Urban Development System to the new reality. The Sustainable Development Goals must also be considered in order to make an orderly transition that should be carried out under the umbrella of territorial connection, digital networks and sustainable town planning by applying the elements of the circular economy. Moreover, EU support should always be linked to the EU objectives of the 2020-2030 Agenda, with fiscal incentives and more competitive credit lines to achieve the objectives set by the European Commission. According to the Spanish respondent,

small businesses are the best able to swiftly make changes in their management and adapt to new circumstances.

The Spanish view is shared by the **Greek** respondent, highlighting the demand for revising and adapting the Greek Town Planning System to current needs and trends.

According to the **Italian** respondent, public guarantees for bank credits to construction SMEs are needed to enable the sector to invest.

According to the **German** respondent, EU funding is considered necessary to launch major infrastructure projects, although business is measured by the ability to adapt to changing market situations. As well as a political guideline, an industrial policy plan is also required (that may only be required for major investments, from which SMEs are generally excluded). A warranty guarantee could certainly be the appropriate means of encouraging development.

For the **French** respondent, the EU Investment Plan, also known as the Juncker Plan, constituted a good support for the construction sector by financing various energy-saving renovation works in social housing and public premises. This program should be pursued and adapted to smaller projects, in order to involve more SMEs.

The **Slovenian** respondent indicates that it is necessary to create profitability over the short term, together with stable long-term growth of companies. It is here that the EU could set guidelines with its development policy and management guidelines for small businesses.

## Funding for renovation

*How to make renovation more attractive to companies and their business? Which financial instruments would best support renovation?*

Renovation of existing building stock is a clear development target in many countries. There is a huge need for renovation across Europe, and governments have set various financial incentives to accelerate project implementation to meet the goals of energy efficiency.

Tax relief has been seen as an incentive for renovation alongside subsidized financing: reduced VAT rates and financial support (subsidies, tax incentives, etc.) are still the best tools to reach this objective, according to the **French** and **Belgian** respondents. With regard to the modernisation of construction companies (whether SMEs or larger public limited companies), tax incentives are certainly the right instrument, as was stated by the **German** respondent.

In **France**, renovation accounts for more than 50% of turnover in the Building sector. Consequently, beside some recommendations aiming at forcing households to undertake energy-saving renovation work, the French respondent proposes favouring the use of incentives. Moreover, while tax credit is a benefit after works, grants should be prioritized in order to provide cash to households before them.

Another noteworthy key aspect raised by the **Belgium** respondent concerns boosting demand, for example by targeting financial support to building owners. The issue is not so much to stimulate the contractors to enter the renovation market, but rather to stimulate the demand for renovation as such (especially to improve the energy performance of the existing building stock).

For the **Lithuanian** respondent, in order to promote renovation, it is necessary to adopt effective simplification measures (introducing more flexibility, less rigidity, more flexibility for tailor-made instruments). More flexibility in procurement processes is also needed to stimulate renovation projects. The introduction of more flexible procedures in the public procurement of construction works would make renovation more attractive for construction companies, especially if the most economically advantageous tender evaluation method is used, rather than the lowest price principle.

It was also stressed by the **Spanish** respondent that worker training will be essential for the implementation of new standards of insulation and energy efficiency of buildings, etc. Providing education and training will require financial incentives.

According to the **Italian** respondent public guarantees for technological innovation – in particular for the application of BIM - are necessary to bring companies into the new market.

As public finance alone is not enough to make the clean energy transition happen - according to the **Greek** respondent- the Smart Finance for Smart Buildings Initiative (SFSB) initiative[5] is necessary, with the aim of facilitating the deployment of financial instruments across Europe, with better targeted subsidies for vulnerable consumers or specific market weaknesses. Financial instruments are of key importance in further mobilising private financing for energy efficiency and building renovation.

### *How to improve energy efficiency requirements and criteria in public grants and funding? How are they being allocated? Are the criteria improvable?*

Public sector measures and incentives were considered to be important by some respondents in this respect. According to the **Finnish** respondent, public procurement plays a key role in introducing both energy efficiency requirements and the criteria required by the circular economy. The conditions for carrying out building projects can be evaluated in relation to the set criteria.

According to the **Spanish** respondent, the way these criteria could be included in public procurement should be established by the different governments, since they will have to be established in accordance with the objectives set in Europe and according to the Sustainable Development Goals. This respondent believes that important resources will probably be budgeted in each Member State (MS) to help this important process of transforming the current housing stock. Due to a greater need for qualified human resources and a commitment to efficiency in the different programmes that will have to be implemented by all MS, grant and subsidy programmes will need to be oriented towards higher quality requirements in construction works and in the training and professionalism of workers and companies.

According to the **Italian** respondent, public demand is an important driver of industrial policy in the construction sector. In addition to quantitative targets for the renovation of public buildings, it is necessary to establish clear legal quality targets. Regulations for public buildings should be similar to those for private ones.

In **France**, the "eco-conditionality" of public support for energy-saving renovation works has applied since 2016. Households wishing to undertake energy-saving renovation works in their home and benefit from support (zero rate loans and tax credits, etc.) must resort to a company which holds a "Recognized Guarantor of the Environment" ("Reconnu garant de l'environnement" (RGE)) certificate.

5. *Smart Finance for Smart Buildings Initiative - Guarantee Facility –*

Implementing incentivising and stable real estate taxation allows owners to consider larger scale improvements with greater peace of mind, in the opinion of the **Belgian** respondent. Energy performance should be considered at a broader level than just single buildings, i.e. autonomy per block or district should be targeted by taking into account energy performance improvement measures at the scale of groups of buildings, together with the production of renewable energy off-site.

The **Greek** respondent indicated that the EU must improve financial support in the sector if it is to meet its 2020 energy efficiency target, since currently financial support mechanisms vary significantly across EU countries. There are barriers such as high initial costs, long payback periods and perceived credit risk that hamper energy efficiency improvements in buildings, and so far, there is limited information on the effectiveness of the currently available financial support mechanisms.

In **Ireland**, there is a need to improve the appeal of grants for building owners and contractors alike. There are a lot of risks attached to renovation projects and many suitable grants were available before the crash in 2008. The one-stop-shop retrofitting grant from the Sustainable Energy Authority of Ireland (SEAI)[6] for Energy Efficiency (EE) and Renewable Energy System (RES) installations requires substantial financial provision for the building owner, usually through bank loans. This process needs to be streamlined and the industry needs to become more involved as a whole. This requires wider marketing, such as 'Building Passports'.

## Skills

*Today, there is a systemic, constructive and evolutive customer approach: put the need at the heart of the system. However, the training courses specific to the customer approach in the construction sector are not sufficiently individualised. What are the main changes in the profile of customers today and how can a company (especially SME) adapt to them?*

The **German** respondent stressed that it is important to first differentiate between companies with direct final customers and those which are more dependent on orders from the public sector: there is a big difference between them that has to be known and taken into consideration, because a customer-centred approach is certainly not as effective for requirements that the public sector formulates in tenders as it is for a direct customer who wants to have a single-family house built. In this respect, a system of prior consultation is to be discussed in advance in the case of public sector contracts, in order to discuss possible customer-specific needs (including those of the public sector).

According to the **Lithuanian** respondent, construction sector customers can be private or public organisations, large private corporations, individual clients, consultants and specialised services or goods suppliers. Dividing construction customers into public and private has a huge benefit, since different construction customers have different needs. Maintaining and developing close customer relationships will enable the organisation to identify, satisfy or even predict the needs and expectations of the customer, and thus ensure the company's long-term viability.

The **Finnish** respondent believes that companies should invest in their customer expertise. In Finland, the on-going foresight study, regardless of the profession, has raised the so-called 'generic skills', which include customer service expertise. It was stressed that customer-oriented thinking is needed at all levels in construction projects.

*6. Sustainable Energy Authority of Ireland*

The **French** respondent emphasised that internet access has led to many changes in customer practices. It contributed to the development and success of online platforms as intermediaries between customers and companies, in order to address their needs in terms of adaptability, availability and swiftness.

According to the **Belgian** respondent, consumers are increasingly informed about building methods, and they also have specific requirements regarding energy performance. Moreover, they use the web and social networks to find their construction company. Finally, they can be sensitive to the environmental and social impact of construction and therefore to company positioning in this respect. In response, contractors should submit bids specifying which techniques will be implemented, in accordance with the latest trade regulations. Moreover, they should train in digital communication and strengthen their presence on the Internet and in social media. In this respect, business organisations often provide guidance and specialized training.

For the **Irish** respondent, there is a need to focus more on targeted training, especially specific training aimed at employed construction workers. There is a definite need for training at management level, so that managers and supervisors understand energy efficiency and cost optimisation. For most workers there is need for a varied choice of short, flexible training schemes which can be carried out through flexible blended or solely online programs and /or via on–site tools, enabling maximum outreach, access and availability for workers.

According to the **Italian** respondent, many companies that produce materials and technologies for sustainable construction take an informative and educational approach towards the final consumer, directing their choice towards sustainable products. In some territorial contexts the social partners, through Building Welfare Funds and Building Schools, in collaboration with municipalities and chambers of commerce, support the final consumer in the choice of qualified and legal companies.

Finally, the **Spanish** respondent thinks that the changes in customer profile will be established in terms of a better-quality industry, with increased energy efficiency and sustainable town planning. The Sustainable Development Goals will be increasingly present in the decision-making process of future customers, so that construction companies will have to adapt to them or disappear.

## Conclusions

- The **main competitiveness factors for construction companies** are efficiency (in marketing, management, processing and economics); the labour market (salaries, flexibility and availability); human capital (at all levels of business); a skilled workforce (training activities, motivation, lifelong learning); technological and methodological knowhow.

- The **involvement of all stakeholders in the sector** is considered to be particularly important in building a positive future for the sector. This means developing the image of the sector and ensuring the availability of a skilled workforce.

- **Modular construction as a process of industrialisation** is going to have a major impact on the construction sector in the very near future. Industrialisation will also mean changes in workers' skills. The manufacture of building components under industrial conditions and in the production process is in practice simpler, and it does not necessarily require the same skills as those needed in construction sites.

- Another **major obstacle to growth** may be the training of human capital, if there are many low-skilled workers and companies with a low level of innovation. Skilled employees are very important for companies, but good leadership is also required for successful projects.

- **Maintaining professional skills and offering workers training opportunities** (ongoing and lifelong training) are key aspects that should be guaranteed by law and specific funding, so as to update the workforce to meet evolving company and market needs.

- It is important to justify **training costs in terms of measurable investment**.

- There is a need to mobilise **private financing for energy efficiency and renewable sources of energy** in buildings.

- **Education and training require increased financial support** to face the challenges arising from the transformation of the sector (digitalisation, environmental concerns).

- The introduction of more **flexible administrative and fiscal procedures**, especially in public procurement, for construction works would make renovation more attractive to construction companies.

# Social factor

## General remarks

This section intends to examine the social environment of the construction industry regarding decisive aspects such as demography and population analysis, etc.

Currently, there is a perceived lack of qualified workers, which, in addition to the lack of attractiveness of the construction industry -especially for young people and women- makes it necessary to promote concrete measures aiming at the professional qualification of the sector's workforce, but also of the companies, which must also be encouraged to adopt innovative solutions that separate them from the traditionally conservative vision in this sector.

Different respondents gave their opinions about what measures and initiatives might be adopted and implemented by the different parties involved (employers' associations, trade unions, policy makers, training centres, etc.) in order to enhance the value of the European construction industry.

## Workers' qualifications

*How can the shortage of skilled workers be overcome? What kind of measures or good practices should be implemented?*

This issue was examined on the one hand with regard to the image and attractiveness of the sector and, on the other, with the need to develop the skills of the existing workforce to meet the ever-evolving needs of working life.

A proposal to reduce the shortage of skilled workforce made by the **Lithuanian** respondent was to liberalise laws and facilitate the recruitment of third-party employees, while mitigating labour migration policies would be one of the most important factors and ways to improve the labour market situation. Labour market factors and the effectiveness of public sector services were also raised when discussing the labour force in the construction sector. In some countries, such as **Lithuania**, a higher level of wages would help to attract employees, although at the same time it would reduce corporate profits.

The shortage of skilled workers can be overcome by a strong link between the public and private sectors by exchanging labour market data and information. The **German** respondents emphasized that there is a need to better anticipate labour market needs, and to do so in line with cyclical economic activity.

The following measures were proposed by one of the **Spanish** respondents to make the sector more attractive: comprehensive communication campaigns to enhance the value of the construction sector; promote the sector and increase its attractiveness through sectoral employment orientation programmes. On the other hand, the potential of development to increase attractiveness was highlighted. Construction work is not as arduous as it used to be, and it is an especially interesting topic for young people due to questions such as sustainability, energy aspects or digitalisation in work processes.

A number of contributions highlighted the need for practical further training and the importance of high-quality vocational (lifelong) training in general. It is important to invest in initial and continuing education, because basic training might not be enough to get the required number of skilled workers. Simple and standardized working practices will vanish within more complex higher level work, meaning that more knowledge and skills will be needed. The **Belgian** respondents commented that soft skills are also considered very important (attitude and punctuality, etc.), and are essential for managers, so that training centres should be able to adapt to offer these competences.

The **French** respondents pointed out that the construction industry had experienced workforce shortages depending on the level of economic activity. Therefore, companies have a responsibility to uphold and boost the skills of their employees and invest in training, particularly in periods of economic downturn, in order to prepare for the recovery. In any case, it is important to better anticipate labour market needs, in line with cyclical economic activity.

However, some actions should be undertaken to improve the image of the construction industry, to attract new people and develop a suitable training offer, such as:

- Make training systems more flexible, design skill development paths that are accessible at all times by any person at any level, considering transferable experience in the building or other sectors (the logic of building up skills rather than designing training paths);
- Develop training actions that correlate better with economic activity;
- Justify training costs in terms of measurable investment.

In fact, **French** VET providers are about to build new strategies on how to pay more attention to current lacks in worker qualifications regarding digital talents that prevent them from adopting digital tools and processes, as well as from any kind of collaboration with other workers, suppliers and subcontractors acting on the same worksite and more specifically work situations where digital means are used.

Training development and developing the capacity of trainers were seen as opportunities to secure the labour supply. A more flexible training system was suggested by the **Lithuanian** respondents in order to meet the demands of the labour market: design skills development paths accessible at any time, by any person at any level, considering transferable experience in the building or other sectors. The recognition of professional qualification based on experience was also highlighted as a required measure to be adopted. The **French** respondents mentioned that VET providers should also pay attention to current lacks in worker qualifications regarding digital talents that prevent them from adopting digital tools and processes. Workers must receive adequate professional training, and their qualifications must be recognised.

The **Greek** respondents mentioned that a range of programs should be developed to increase the number of people participating in traineeships and increase the number of employers taking on trainees in their companies, in order to build a skilled workforce in the country. Moreover, rapid technological changes in the production process, as well as the digitalisation of the sector, require significant changes in the skills required by the affected industries – consequently, there is a need for flexibility in the skill supply mechanism to respond to changing skill requirements.

The **Irish** respondents suggested improving and diversifying the use of apprenticeships, since these have been neglected over the last 15 years, providing an incentive or attractive features so that young people take up apprenticeships. The Services Industrial Professional and Technical Union (SIPTU) have assessed the issue of apprenticeship rates of pay recently.

The measures proposed by the **Spanish** interviewees are:

- Promote the accreditation of qualifications through experience.
- Offer training courses to qualify workers who are already in the sector and also offer training programs to young people who are looking for their first job.
- It is necessary to promote more practical training that is adapted to the reality of the sector and to new technologies.
- Take advantage of the older workers in the sector who have the experience to train the youngest.
- Review training modules to include digital skills (e.g. in relation to BIM).

A proposal to reduce the shortage of skilled workforce made by the Italian respondents was to strongly link public and private services at work by exchanging labour market data and information; analysis of market trends from sectoral economic studies and trends in skill requirements; census of unemployed workers or the requalification of workers into specific skills that are demanded and their accompaniment/integration by bilateral sector bodies.

### *What is the relevance of the recognition and accreditation of competences derived from prior knowledge and labour experience? How could this recognition and accreditation be fostered?*

According to several respondents, the importance of competences stemming from prior knowledge and work experience, in other words, the recognition and assessment (accreditation) of non-formal competences, increases work opportunities in the construction sector. This issue also raised by the French respondents, who stated that the system should be redesigned to be based more on the recognition of the experience acquired on building sites through concrete observations of work situations (competence approach) rather than on official certifications.

Besides, the **French** respondents added that a well-functioning competence recognition system was also seen to have a positive impact on the image of the industry. In fact, a system allowing the formal recognition of non-formal competences, as well as consistent career perspectives, could also contribute to a better image of the construction industry among younger people and all the other groups potentially interested in professional reconversion.

This is particularly true if one considers that many formal certifications need to be updated, because they no longer apply to current market needs and thus are not really useful in assessing whether a worker is fit for a job or not. However, some accreditation is essential, especially when it is linked to training in fields with legal obligations (working at heights, asbestos, etc.).

In **Ireland,** Recognition of Prior Learning (RPL) and Recognition of Prior Experience (RPE) are highly relevant and required within the sector. The Quality and Qualifications **Ireland** institution (QQI) supports education and training bodies in developing and applying such policies with a view to aligning recognition with the EQF (European Qualifications Framework). Respondents, including those in SOLAS (the Further Education and Skills Service) indicated the need to develop systems and approaches which cater to specific needs of the sector in the future.

In **Germany**, nearly everything related to the recognition and accreditation of competences is based on written testimonies. A more practical approach could be of more benefit for both sides, workers and the labour market. Certifications from 10 or more years ago no longer correspond to current necessities and thus, they are often not suitable for really finding out whether a worker is appropriate for a job or not. The means of certifying knowledge and skills has to change, since it seems that formal qualifications do not really describe workers' abilities and skills. The most modern approaches - e.g. applications for jobs via video – could be used to demonstrate practical abilities and/or competences in construction, too. However, the German Chamber of Crafts and Industry does not seem to take them into account.

The **Italian** respondent described how identification and recognition should be organized: The recognition of skills acquired through life and work experience is a very important condition today, because it facilitates labour mobility and job placement. It is in line with European Union guidelines on the validity of the competences acquired in a formal and non-formal way. The methods and tools for non-formal and formal recognition have been created by the building training system (Formedil - training schools) and can be used by individual companies or by the building schools system. These tools and the recognition process, however, must be shared with public administrations and employment services, for recognition not only within the sector but also valid at national level.

Some other brief opinions expressed were the recognition/accreditation of competences requires a more practical approach. Moreover, some respondents suggested that professions (trades) need to be divided into the more specific skills needed for certain jobs (still founded on basic VET) and a more individual approach is needed.

The **Lithuanian** respondents shared their recommendations on how recognition and accreditation could be promoted:

- Raising public awareness of the tools, benefits and opportunities of implementing the recognition of competences;
- Disseminating examples of good practices, especially on how to ensure that as many people as possible are able to benefit from recognition tools;
- Implementing quality assurance systems for the recognition of competences that guarantee the credibility of recognition processes;
- Ensure public funding for the recognition of competences, since today the recognition procedure is often financed by the candidates themselves and this can constitute a serious barrier.

## Image of the sector

*Who would be the main key actors in charge of creating a more favourable image of the construction sector, and what measures should be implemented to achieve that aim? What actions, measures or good national practices would you bring up?*

There is consensus among respondents on the fact that all stakeholders should take part in improving the image of the sector. The main stakeholders should support the improvement of the sector in terms of its attractiveness and good wage opportunities, etc.

According to the **Irish** respondents, all stakeholders need to work together, as at the moment the process is disjointed. But this is slowly moving forward with all stakeholders within the sector finding the need to cooperate further to enhance its image. This can help by increasing recruitment into the sector, with better retention and improved training provisions.

The **Belgian** respondents proposed the need for an objective study to be carried out in order to analyse the current image of the sector and recommendations for improvement. Another proposal from the **Finnish** respondents was to gather the best practices from other sectors that were able to improve their image, attracting women and youngsters.

The industry should market itself as one that provides sustainable and financially rewarding employment in an environment characterized by good working conditions and opportunities for professional development and lifelong learning, according to **Finnish** respondents.

Work on stereotypes is essential in order to change the images of construction and work on site. The **Finnish** respondents' reply suggested and encouraged more disruptive customer orientation. Their response stated that the image of the industry is based on the fact that its production process is publicly visible. An unfinished construction site is like an unfinished product, which can raise more questions than answers in people's minds. So it would be better to create an image of the end product (a home, office, warehouse or shop), that is, what the paying customer ultimately gets.

The responses from **Germany** highlighted useful ways to improve the image of the industry. There are many different ways of promotion and tools to do so, such as "open construction sites", campaigns, thematic campaigns on specific themes (health and safety...), via social networks, information fairs, events for young people, etc. Permanently visible interesting positive measures in the sector will attract people to consider entering it to work. The **Lithuanian** respondents added that worksite visits as well as communication campaigns would give a better picture of the current reality of the construction industry. Moreover, raising the prestige of the building profession and creating better working conditions for employees would also contribute to a better image of the sector. They also mentioned that the image of the industry is based on many different factors, so that it is therefore also necessary to improve the image of vocational schools, this being essential in order to attract youth and strengthen the construction sector.

Systems that make it possible to formally recognise skills and competences as well as consistent career perspectives could contribute to a better image of the construction industry among younger people and all the other groups potentially interested in professional reconversion, according to the **Belgian** respondents. Technological progress is very important in the sector, and will naturally improve its appeal when implemented.

The respondents noted the importance of taking into account the different target groups and the importance of the specific channels used to reach them. The right communication channels must be chosen for each audience (e.g. social networks for young people, etc.). The **French** respondents considered parents to be a specific intermediate target group in communication actions, as they must be reassured about careers in the construction industry for their children. Collaboration with the appropriate services in charge of professional guidance should be reinforced, especially at local levels.

Therefore, the experts interviewed consider that communication about building trades must be updated to be based on the reality of each craft concerned, and work on stereotypes is essential. Worksite visits could be integrated in communication campaigns, to offer better knowledge of the reality and modern nature of the construction industry.

In the same way, it is necessary to improve the image of the construction industry among specific target groups and demonstrate, for example, how certain trades are easily accessible for women, thanks to technological progress or better legislation about worksite health and safety. Overall, new behaviours on worksites should be promoted by various stakeholders to facilitate the integration of people of different gender, nationality and experience.

The **Spanish** respondents identified several measures to achieve a better sector image: improving working conditions, disseminating the benefits that the sector brings to society, guaranteeing the quality of products -whether housing, reforms or infrastructure and public works-, unequivocal commitments to continue protecting the health and safety of workers, information campaigns that present a true image of the sector and its professionals and possibilities for citizens, sectoral scholarship programmes for students with good academic performance, while also supporting companies which promote a better image of the sector.

The **Italian** respondents believe that to restore the sector's image, it is necessary to invest in training and safety to create "quality work". It is also necessary to regain the competitiveness and efficiency that was lost in the last years of the economic crisis in Italy. It is also necessary to reduce the bureaucracy that slows down the construction process and leads to inefficiency and degradation.

*How can we foster the engagement of women in construction in terms of attracting them, promoting them in their careers and motivating them to remain in the sector?*

The ongoing developments of the construction sector in terms of digitalisation, energy efficiency and the circular economy create the potential for attracting more women to the sector.

Regarding technological developments, some aspects could give rise to good opportunities for attracting young people and women, such as building robotics, automation and digitalisation. On the other hand, energy efficiency and sustainability in terms of new building materials could also attract female workers, according to the **German** respondents.

For the **French** respondents, the action should be twofold. On one part, it is necessary to improve the image of the sector and demonstrate that certain trades are easily accessible for women. This statement will be confirmed in the future thanks to the use of certain equipment, machines and digital tools, which will make some jobs less arduous. On the other hand, corporate culture should evolve, through management training for instance, in order to facilitate the integration of people of different gender, nationality and experience.

In the partner countries specific attention was also paid to the importance of working conditions and how to organise work. An important issue raised by the **Lithuanian** respondents was work-life balance. For instance, in **Lithuania** the participation of women in the labour market (construction) is supported by flexible working conditions. The **Irish** respondents believed this could be achieved by providing flexible training schemes, equal pay rates and adaptable working conditions. In **Ireland** today less than 1% of on-site construction workers are women, who work in 46% of off-site roles. The current drive by the industry is to address gender imbalance at senior management level more rapidly rather than on-site, with concerted efforts over the next three years, including a mentoring programme to assist women to progress to senior positions. The Construction Industry Federation (#BuildingEquality campaign) is committed to achieving a more diverse and inclusive workforce that drives innovation as well as attracting and retaining key talent. The shift towards new technologies

within the construction sector should encourage more women on-site. Engagement should also be fostered by the implementation of equal opportunities for women and men in the labour market, gender equality and non-discrimination.

The **Italian** respondents expressed the need to communicate successful stories regarding women who are already present in the construction sector. This can be done in cooperation with companies that have invested in women's career development.

One **Spanish** respondent mentioned that the engagement of women can also be promoted by providing training with a gender perspective to potential workers and by developing social and labour insertion programmes for disadvantaged women (immigrants, victims of abuse, etc.), thus offering instruments for empowering them. Increasing interest from young people and women in the construction sector would result in a better image for the industry.

The **Greek** response provided a clear list of recommendations which highlight the importance of equality:

- Adopting a gender inclusive recruitment policy.
- Use of gender neutral job advertisements.
- Introducing female role models to act as advisors for young women considering entering the sector.
- Ensuring that all interview panels include a mix of men and women.
- Training on unconscious gender bias for all staff involved in recruitment.
- Mentoring programme to assist women to progress to senior positions.
- Articulating the company's commitment to diversity on the website.

*Which measures may be implemented to involve young students into the sector? (Apprenticeships, trainees, job contracts, a sustainable career path, incentives)*

Respondents proposed several measures for young people and stressed the importance of long-term labour contracts to make the construction sector more attractive. On the other hand, it is important to consider how and by whom the message is transmitted to young people.

The role of teachers was understood to be crucial to promote the image of technical professions among young people. In particular, the **Belgian** respondents suggested encouraging teachers from primary school upwards to introduce the technical professions to the youngest children. Schoolteachers play a key role in this, but since there are many other elements that compete to catch their attention, the responsibility of "selling" construction job opportunities to teachers lies with the construction industry itself.

There are success stories of other sectors that have campaigned in primary schools. The operation is described as a long-term process which should be started early and be properly targeted at children. A successful example is given by the **Finnish** technology industry, which

designed its own campaign for schoolchildren and offers practical access to companies in the field. The Federation of Technology Industries of Finland has set up a fund https://teknologiateollisuus.fi/en/federation/centennial-foundation, one of the tasks of which is to cooperate with primary schools and to promote the technology industry for children.

In this context, emphasis was also placed on better targeted communication for young people (social networks) as well as to their parents, sending out a message of a better image of the sector for the whole society.

Another proposal by the **German** respondents was to customize experience in the construction sector for newcomers according to their background. For example, higher educated young people and those with fewer school qualifications should carry out their apprenticeships at different speeds. This approach would offer the "better" ones a quicker route to success in VET, with a good speed for the others to cope with their needs.

On the other hand, it was also noted that there is room for improvement. The sector needs to pay attention to the recognition of training, job security, adequate salaries and professional promotion. This would help workers (and thus youngsters) in the sector, according to the **Spanish** respondents, to feel proud of belonging to an industry that is of key importance for the economic and social development of their country. They also highlighted the need to reinforce the image of better employment stability in the sector, and the potential for a successful professional career within it. It was also considered important to project an image of safety at work and especially to appreciate qualifications. According to the respondents, there are areas where the sector could be developed, such as to improving working conditions during training contracts. Internal professional promotion, improvements in job positions and the corresponding salaries were also mentioned as good ways of attracting young people to the sector.

With regard to career aspects, the **German** respondents noted that young people are interested in jobs which provide a certain level of responsibility. An approach based on guided autonomy and self-reliance was said to be favourable, such as choosing how to carry out a task as long as a certain result is achieved. It was also considered that using new technologies (BIM, Construction 4.0, etc.) in construction can attract young people´s interest. Moreover, apprenticeships should be organised and incentives should be given (such as higher wages or a sustainable career path) in order for the students to consider following a career in the construction sector, according to the **Greek** respondents.

The respondents highlighted that more efforts should be made to help young people acquire the knowledge, skills and experience needed to prepare for their first job, to successfully pursue their professional career. Vocational training and companies play a key role here. Apprenticeship is a very effective form of VET learning in the workplace, helping in the move from the educational world to the labour market. Internships in a real work environment play an important role in learning-by-doing. However, improvements should be made at the level of apprenticeship contracts by encouraging and improving the role of in-company tutors, as well as promoting hiring after the apprenticeship period.

Confirming this trend, the **French** respondents pointed out the need to adapt the communication (more specific, use of appropriate social networks...) aimed at attracting young people to the construction sector. Professional and institutional websites should better take into account their interests and adjust contents to their specific needs. In addition to this, companies that welcome apprentices, trainees and other young people should be promoted and benefit from a stronger support and valuable recognition at the national level.

The **Irish** respondents state that better health and safety and increased use of technology are two trends making construction more attractive to young people, male and female. The school educational system is now encouraging students to take up apprenticeships and form solid and sustainable future careers. Moreover, there is a need to attract youth /outreach groups, i.e. early school leavers and those disinterested in education or from disadvantaged areas. Putting emphasis on green energy and IT may make construction professions more interesting. A particular issue to be addressed is gender balance within the sector, with a specific need to implement measures and policies to encourage young men and women to enter the sector. Future initiatives will focus on youth and young women in particular.

## Vocational Education and Training

*What incentives could be used in order to encourage society and particularly young people to realize the importance of vocational education and training in the construction industry?*

The attractiveness of VET is enhanced by improving its quality in order to match labour market needs. The main focus should be on enhancing the flexibility of VET, improving its quality, improving trainees' readiness for practical activities, enabling VET teachers to update and improve their skills, increasing access to VET and enabling learners to improve their interpersonal skills. The quality of VET is mainly determined by the training programs offered, and it has to be flexible (modular) to make tailored learning paths possible.

The **Lithuanian** respondents highlight that public awareness of the benefits of VET should be raised by bringing together: education and training providers, civil society organisations, public authorities, business organizations, trade unions and the community. So once again, all stakeholders should be involved.

The **French** responses summarised their approach to learning as follows: "it is necessary for young people to train with a view to lifelong learning and to define their own skill development paths." In fact, in the French education sector, young people's orientation is mainly based on grades and scores. The best pupils are systematically directed towards general training while the less talented are oriented to the vocational field, which devalues the latter group. This culture is deeply entrenched and it is shared by families and teachers, making it difficult to undertake actions to improve this system. However, French social partners undertake initiatives aimed at promoting the VET system in the construction industry through appropriate communication, contacts with the national education system, performance training centres and reinforced contacts between VET providers and companies. Besides, apprenticeship in the construction industry is strongly supported by both public authorities and social partners.

The respondents from **Italy** highlighted some useful incentives to implement logical training outcomes and individual professionalization. For example the national collective agreement has set up a national fund to foster the employment of young workers. This is paid for by construction companies. It has not yet been established whether the fund will be national or territorial.

The **Belgian** respondents also pointed out the importance of attracting young construction professionals to work as VET trainers and to focus more on pragmatic learning methods in all VET courses, including management ones. There is also a need for more consistency between theoretical, practical and in-house training.

According to the **Spanish** respondents, training contents must be adapted to employment needs over the short and medium terms. An agile system for need detection must be created. Training should be flexible, as currently it is framed in educational programmes and predetermined itineraries, which in many cases lead students to study subjects that will not help them at all. Likewise, the current system does not allow a rapid adaptation of the training programme to the needs of the labour market.

The **Greek** respondents elaborated useful recommendations to encourage society and particularly young people to realize the importance of vocational education and training in the construction industry:

- Promotion of work-based learning in all its forms, with special attention to apprenticeships, by involving social partners, companies, chambers and VET providers, as well as by stimulating innovation and entrepreneurship.
- Promotion of the advantages provided by Vocational learning such as positive impacts on wages, employment, mobility and employment opportunity.
- Promotion of VET to reduce the unemployment of construction workers, as they will be have new skills and competences that ultimately impact the company's overall productivity, growth and culture. Additionally, VET promotion will also assist in the overall improvement of the economic conditions in disadvantaged regions, overcoming skill mismatches between workers and companies.
- VET appears to be the most effective when it accompanies changes in the workplace.
- Enhance access to VET and qualifications for all through more flexible and permeable systems, notably by offering efficient and integrated guidance services and by making the validation of non-formal and informal learning possible.
- Introduce systematic approaches to, and opportunities for, the initial and continuous professional development of VET teachers, trainers and mentors in both school- and work-based settings.

*How should the main orientations in training for trades and for skills evolve? How should the policy-makers and companies switch from the logic of formal training paths (based on training contents) to the logic of training outcomes and individual professionalization?*

One of the key considerations was that before one can consider any evolution, it should be stressed that basic knowledge and skills have to be achieved by all individuals who want to be qualified construction workers. Only when this pre-requisite is met can evolution of the system be considered, according to the **German** respondents.

The **Spanish** respondents mentioned that the structure of training for construction jobs must be appropriate to the functions to be performed, and it must be directly related to the professional category in question. The content must be appropriate to the needs of the labour market.

The **Lithuanian** respondent also mentioned how important is to make VET systems more responsive to the changing needs of the labour market, to maintain closer links with the business world and to further develop workplace/ apprenticeship learning. More efforts are needed to develop effective tools to anticipate future skills. Education and training systems should become much more open and more responsive to the needs of citizens, the labour market and the general public. Important ways of building a personal future were seen in early vocational guidance, long-term career counselling, qualification upgrading and retraining, which are all associated with the promotion of individual professionalism. There is a need for investments in supporting young people so that they can pursue a career in the sector.

New learning contents will have to change according to technical advances in work organization and machinery, as well as new materials that are produced in the sector. Training itineraries must therefore, according to the **Spanish** respondents, offer work experience in order to provide knowledge of the actual situation in the sector. In addition, health and safety training should be offered to the workforce, and workers should be allowed to manage their training by choosing the options that best suit their professional career.

**Finnish** vocational education reform makes on-the-job-learning more clearly a part of official studies, and it also emphasizes individual learning paths. Moreover, continuous dialogue between the educational world and the construction sector is of key importance. As best practice, the Finnish National Agency for Education (OPH) Anticipation Forum brings together industry organizations, companies and the public sector as well as the educational administration to discuss expert skills in the future of the various fields of expertise.

The **Slovenian** respondents added that it is necessary to find credible training respondents and to adapt the contents to practical experience rather than to theoretical knowledge that has not been tested yet.

As an interesting model for the future, the **Belgian** respondents emphasized the suggestion to create a sector-funded sectoral school sponsored by companies, with state-of-the-art equipment. This model is used in Switzerland.

In **France**, either because the production process requires staff presence in companies or due to the lack of effectiveness of some training paths, companies find it hard to free their employees for face-to-face training. Therefore, the French respondents proposed developing alternative teaching methods such as the exchange of practices, training in a work situation (AFEST – Formation en situation de travail), tutoring or working as journeymen, etc.

## Skills

*What are the specific roles of VET providers and companies in minimizing skill gaps and ensuring high quality training services for the construction sector?*

The **German** respondents think that VET trainers should have the opportunity to stress local and regional specificities, in close cooperation with companies. The formal curricula should contain the knowledge and skills that are needed for learning a profession and execute works on site, while leaving a certain degree of free interpretation to allow for regional needs in building technique and/ or materials.

The **Lithuanian** respondents stated that, first of all, VET-providers and companies should be in frequent communication about the skills that are needed. Enhanced cooperation with employers in developing individual vocational training processes is important to ensure that they meet the needs of the modern labour market. Moreover, according to the **Lithuanian** expert, there is a need for a legislative framework that clearly defines the role of companies in the practical training process for VET students. Company representatives identify various issues that can be compensated through special provisions: tax deductions, compensation for in-company trainers, for training materials and social security contributions for learners and trainers. However, financial support seems to be a less important factor for companies than the quality and motivation of apprentices or other non-financial aspects. The non-financial incentives include:

- flexibility and prompt reaction in VET provision to changes in the industry, including the opportunity to develop new training programmes/modules for occupations in high demand or for new emerging occupations;
- Information system and promotion campaigns;
- recognition of companies providing high-quality learning;
- availability of a mediation service for matching apprentice candidates with companies, including motivation tests, identification of specific interests and apprentice learning needs.

Alongside good professional skills, the **Lithuanian** respondents stressed the importance of working life skills. Collaboration with companies in developing VET programs and in-company training should be geared towards developing not only trade-related skills, but also key competences for lifelong learning, helping them to understand the principles of successful integration and competition in the labour market. Taking into account the rapid technological development affecting construction enterprises, the material base and facilities of VET schools should be updated accordingly, the qualification of trainers should be improved and cooperation with enterprises in the preparation of practical training programs should be developed in order to ensure that the VET training provided corresponds to the needs of the labour market.

On the other hand it is necessary to teach everyone the importance of learning, to train themselves within a lifelong learning perspective, to define their own skills development paths. The **French** respondents said that within such a framework, VET providers cannot limit their action to teaching or designing training paths, as they should evolve towards a more individual professionalization of individuals that should take into consideration, among other factors, work-based learning and the recognition of all kinds of learning outcomes. At the heart of competence development are teachers' professional skills and the ability to continuously update.

VET providers should also guide and support companies in the evaluation of individual skills, including the use of self-assessment procedures before any training, to know the initial skill level and thus be able to compare it with the level acquired at the end of training. The fact that individual needs are heterogeneous and that each company situation is specific, should oblige VET providers to propose more flexible training schemes based on modularisation in terms of objectives, contents and length.

At the heart of competence development are teachers' professional skills and the ability to continuously update.

The **Italian** respondents think that is necessary to support and motivate construction companies to improve their culture of lifelong learning, and vocational education and training centres should be encouraging in the allocation of qualified trainers and tutors who can increase employer's

confidence in learning on the job. The Italian social partners have defined the discipline of the apprenticeship framework for construction companies through the national collective agreement in the sector. The training paths for the acquisition of professional skills will also be recognised by the bilateral sector system.

### *What are the main obstacles in transferring knowledge about modern technologies, materials and skills?*

There are no "main" obstacles, according to the **German** respondents, and rather it is a matter of learners' personal/individual capacities to reflect the VET content being offered. In **Germany** everything is oriented to practical needs to a very high extend, to meet companies' needs need in the dual system. Hence, there are hardly any obstacles in transferring knowledge about modern technologies, materials and skills.

The role and skills of teachers are also at the centre of this issue, as the **Spanish** respondents said. In particular, vocational teachers must have mastered modern technologies to actively use them in the educational process. Information and communication technologies in the teaching process must be used purposefully, moderately and intelligently, although this cannot be achieved without well-trained teachers. A problem was also detected in older people's lack of interest in acquiring new knowledge related to new technologies and to obtain new skills.

A clear list was found in the **Spanish** reply:

- The fact that these technologies are not immediately available for use in worksites means that users are not aware of their necessity (nobody will learn how to use a given device if it is not available).
- The lack of initiative and investment by some companies that do not use new techniques or materials.
- The lack of flexible training programmes.
- Lack of interest of older workers to acquire new knowledge related to new technologies and to obtain new skills.

The **Belgian** respondents highlighted the need for constantly evolving training programmes which take into account not only new technologies but also the continual evolution of the construction companies' environment.

The culture of enterprise, mainly in small companies, was also considered to be an obstacle by the **Italian** respondents. The main obstacle in transferring knowledge about modern technologies, material and skills are, according to the Italian respondents, insufficient resources to allow the Italian construction companies, which are mostly small (with on average 3 or 4 employees) to invest in such training.

In **Ireland**, digitalisation and IT have been embraced in the professional fields in the construction industry, with investment and subsidies for flexible training programmes. This is now filtering into the main construction industry, especially in the larger companies, due to the use of BIM in schools and the policy drive in Ireland. Although SMEs still lack skills, a number of flexible on-site

and in-house training programmes are starting to prepare workers for the digital change and lean construction.

The **German** dual system is generally considered to be good when it comes to the effectiveness of vocational training and working life cooperation. Other observations were that there is not enough investment in RDI and training, and no flexible training programmes are available.

For the **French** respondents, the lack of basic knowledge constitutes the main obstacle against transferring the knowledge about modern technologies, materials and skills. It is necessary to teach everyone how to learn, how to train oneself within a lifelong learning perspective and how to define their own skill development paths. Within such a framework, VET providers cannot limit their action only to teaching or designing training paths, as they should evolve towards the more individualised professionalization of individuals which should take into consideration, among other aspects, work-based learning and recognition of all kinds of learning outcomes.

From the **Greek** respondents' perspective, a major issue is that rapid technological evolution constantly generates new skills, skill gaps and mismatches, making it hard for the labour market to respond to this fast evolution in time. With that said, all of the key stakeholders and employees in the construction sector have to be on the alert to keep up with this rapid pace and respond to these demands effectively and in time. Within this context, all of the activities of all the stakeholders/ individuals involved are considered to be crucial for transferring knowledge about modern technologies, materials and skills.

## Conclusions

- The shortage of skilled workers can be overcome by a **strong link between the public and private sectors**, exchanging labour market data and information.
- More efforts are needed to **develop effective tools to anticipate future skills.** It is necessary to set up "**Anticipation bodies**" that bring together industry organizations, companies and the public sector as well as the educational administration to discuss expert skills in the future of the various fields of expertise.
- It is important **to invest in initial and continuing education**, because basic training is not enough in a constantly changing construction sector.
- The **role of companies in upskilling and reskilling** is of key importance.
- It is necessary **to reorganize the education system to meet the demands of the labour market** by making training systems more flexible
- A **well-functioning competence recognition system** was seen to have a positive impact on the image of the industry.
- Systems should be redesigned to be based more on the r**ecognition of the experience acquired in building sites through concrete observations of work situations (competence approach) rather than on official certification**.
- **Systems allowing the formal recognition of non-formal competences, as well as consistent career perspectives**, could also contribute to a better image of the construction industry among younger people and all the other groups which are potentially interested in professional reconversion.

- All **stakeholders** should take part in improving the image of the sector through campaigns on good wage opportunities, "open construction sites", thematic campaigns on specific themes (health and safety...), via social networks, information fairs and events, etc.

- To attract young people to sector, the **role of school teachers was understood to be crucial** to promote the image of technical professions among children and families.

- To improve the image of the sector, **communication channels must be chosen according to their target audiences** (e.g. social networks for young people, etc.).

- The ongoing developments in the construction sector in terms of **digitalisation, energy efficiency and the circular economy** create the potential for attracting more women to the sector. In order to do this **the main recommendations were**:

  - Ensure work-life balance by providing flexible training schemes and working conditions

  - Adopt a gender-inclusive recruitment policy

  - Introduce female role models to act as advisors for young women who are considering entering the sector

  - A mentoring programme to assist women to progress to senior positions

- More efforts should be made to help young people acquire the knowledge, skills and experience needed to prepare for their first job and to successfully pursue their professional career. For this purpose **vocational training and companies play a key role**.

- The main focus should be on **enhancing the flexibility of VET**, improving its quality, improving trainees' readiness for practical activities, enabling VET teachers to update and improve their skills, increasing access to VET, enabling learners to improve their interpersonal skills.

- VET systems should more responsive to the changing needs of the labour market, to maintain closer links with the business world and to further develop workplace/apprenticeship learning.

- VET trainers should have the opportunity to **stress local and regional specificities**, in close cooperation with the companies.

- In particular, **vocational teachers must have mastered modern technologies** to actively use them in the educational process.

- A problem was also detected in the **lack of older workers' interest** in acquiring new knowledge in connection with new technologies and obtaining new skills.

- It was also pointed out that it is important to **attract young construction professionals to work as VET trainers**. There is also a need for more consistency between theoretical, practical and in-house training.

- Some **measures** were identified:

  - Promote accreditation of qualifications through experience.

- Offer training courses to qualify workers who are already in the sector and training programs to young people looking for their first job.
- It is necessary to promote more practical training that is adapted to the reality of the sector and to new technologies.
- Taking advantage of experienced older workers in the sector to train the youngest.
- Review digital training modules (BIM, REVIT).

▼ Within such a context, the organisations involved agree that new areas of collaboration are open between construction companies and training centres in the partner countries. This creates the following additional opportunities:

- New joint communication campaigns in the territories concerned in favour of local, regional and national training provision.
- Better use of the complementary nature of initial and continuing training.
- Stronger development of work-based training/learning in companies.
- More individualized training, not only for young people (initial vocational education), but also for other company employees (lifelong training), including formal recognition of learning outcomes.
- Make training courses even more attractive, for example by including a European component in training paths.

Build more concrete bridges between initial and continuing training as part of lifelong learning, by further modularising professional development paths (not only training, but also accompanying professional careers).

# Technological factor

## General remarks

It is commonly considered that the construction sector is one of the most traditional industries. Nevertheless, in recent years it has become fully involved in digitalisation and automation by implementing different technical innovations and advances. The companies which want to be competitive are now incorporating the advantages of digital tools.

Building Information Modelling (BIM) is one of the innovations which is revolutionising the construction industry, due to its collaborative approach; other tools such as Virtual Reality, 3D printing or industrialisation are also affecting the sector by making it more industrial and technological.

An overview of the current status of digitalisation in the European construction industry is provided below, according to the opinions expressed by different national respondents.

## Digitalisation / Automation

*Digitalisation and automation are a crucial trend. Companies in the construction industry must adapt if they are to survive in the market and do not want to leave the field just to the big construction companies. How will digitalisation and automation be integrated into professional processes? Which parts of the construction industry's value chain will more likely be affected?*

As pointed out by the **German** respondent, it is first of all necessary to be clear about the terms 'digitalisation' and 'automation': a lot can be digitalised in the construction crafts, but far less can be automated.

The **Slovenian** respondent indicated that in the first phase, digitalisation and automation are almost entirely present in the field of design and documentation. However, the construction industry is also facing digitalisation and automation in the field of development and sales.

According to the **Spanish** respondent, it is increasingly evident in all sectors that digitalisation and automation has a very important impact on the business model of companies. Today, in many sectors there has been a migration from labour-intensive industries to the reduction of the labour force in order to make companies more specialised.

Increasing automation will mean a reduction in the unskilled labour force and the emergence of highly technological SMEs that will provide services to large and medium-sized enterprises (construction robots, 3D printing systems for construction, specific consultancy).

However, if traditional SMEs in the sector do not embrace these technologies, they are bound to lose competitiveness and market share. Due to the limited innovative activity of the construction sector, this automation will impact all levels of the value chain, with more impact on edification and especially execution.

Most responses highlighted the importance of digitalisation for the future of construction. There are many new key issues linked to construction and digitalisation: BIM will be the brain and

database for many construction projects, according to the **Belgian** respondent. This opinion was shared by the Irish respondent: digitalisation will come through BIM and its expansion in this area: it will focus on building design and will expand into other areas such as H&S and energy analysis.

Planning can be processed digitally, while the work itself is mostly carried out manually, according to the **German** respondent.

Construction sector process digitalisation and automation is an essential component of the modern construction process. The Lithuanian respondent sees this as an inevitable necessity irrespective of company size. Moreover, even small businesses can perform vital functions in major construction projects. Although it is hard to state which field is affected, SMEs have greater difficulty as they lack the skills, capability or vision to adopt BIM in their everyday work.

However, traditional SMEs in the sector should integrate these technologies in order not to lose or to increase competitiveness, margins and market share, according to the **Spanish** respondent.

Production processes are mainly associated with modernization of hardware and production schemes in **Slovenia**. This usually represents a large financial investment and a surplus of manual labour for large companies. Digitalisation and automation will have the greatest impact in the field of high-tech facilities (smart and low-energy houses, unconventional technical facilities). For renovation work, however, it will be a barrier for craftsmen who are usually based on traditional and proven skills, and their learning is often not based on digital principles.

More concrete specializations and the need to coordinate all production phases with the various operators will increase. Operations that are repetitive, machining with load displacement, earth moving and precision levelling will see worker intervention limited to the control of the machinery that will perform the work, leaving the tasks with greater added value to workers, according to the **Italian** respondent's reply.

The **French** respondent indicates that the use of cloud-based solutions will enable all participants in design and production processes to access information from any communication device with Internet access, e.g. on a file-sharing collaboration platform for viewing, managing, distributing, and collaborating on construction documents in real time. This will be a key enabling technology for BIM. Thus all parts of the construction industry's value chain are going to be affected.

According to the **Lithuanian** respondent, in order to ensure the full benefits of digitalisation the involvement of all actors in the process is necessary. The Lithuanian respondent also believes that the ability to work in the digital environment and the application of innovations in activities are essential. Digitalisation is also seen as having effects that go beyond the construction phase itself. It is important to think about the entire life cycle of a building and the value that is generated by innovations during the life cycle of a building, although the working phase is important, too, together with the role of the developer (customer) in project requirements at the very beginning of the project (information management throughout the process).

There will also be an effect on the skills that are needed on-site, as stated by the **Spanish** respondent. Increased automation will mean a reduction in unskilled labour and the emergence of technology-linked SMEs that will provide services to large and medium-sized enterprises (construction robots, 3D printing systems for construction, specific consultancy services).

Digitalisation in the **Greek** construction industry is more evident at the design and feasibility phase than it is during the construction phase. The major construction processes where digitalisation

is mostly visible are: construction cost control, cost planning, preliminary cost estimation, building system analysis and the production of materials. A great achievement would be if the maintenance (schedule - list of actions etc.) of constructions became as digitalised as the construction process itself.

*Which role will public/private funding play in fostering business innovation and staff training in digital skills? Will a European strategy be necessary? How will foreign technological competition (China, etc.) in connection with the construction sector affect European leadership?*

According to the **French** respondent, Government and public sector organisations can provide leadership to encourage the sector to move towards the untapped opportunity of digitalisation. To achieve this, they will have to work together with the construction industry at European and national levels. Incentives such as tax credits or tax deductions could be considered. The same views are shared by the **Greek** respondent.

In **Finland**, public funding plays an important role in the development and implementation of new technology and know-how. Together with private funding, Finnish public funding[7] will speed up and enhance the take-up of expertise, knowledge, skills and competence.

Regarding **Slovenia**, the private sector is undoubtedly more fragmented and inhomogeneous than the public sector. A European strategy for digitalisation would therefore be absolutely necessary in the opinion of the **Slovenian** respondent: the habits and mechanisms of public/private funding also vary across European countries, and harmonization at EU level is required for orderly functioning. Due to its specificity (size, dumping and independent raw material consumption), China will, as with today's entire industrial sphere, present a competitive problem.

This common European strategy is seen differently according to the opinions of the different respondents: for example, the **Italian** respondent believes that the sector is shaped by a very large number of small companies that have difficulties in dealing with training processes (both because of their small size and because training is expensive). For this reason we need a strategic European plan for innovation and training for these small businesses that has as its objective the support and development of the companies in question. On the other hand, the **Spanish** respondent emphasised that more than a European strategy, it would be more important to change the treatment of tenders by the Administration, perhaps taking into account not only the cost of execution, in order to allow companies to justify their innovative solutions. The **French** respondent considers that a European strategy should include the proactive training of a new generation of teachers within the various education systems (public and private), as well as through apprenticeships.

The **Irish** respondent considers EU strategy to be essential and necessary for the general uptake of BIM. There is currently a lack of legal requirements, and the client generally dictates which architects will be involved and, in turn, which construction companies and to which level of BIM will be used. If this is left to the industry, then it will not invest in digitalisation, as it is perceived by many to be too expensive and the benefits of BIM are not understood by the majority.

7. https://www.businessfinland.fi/en/for-finnish-customers/services/funding/research-and-development/

In the opinion of the **Lithuanian** respondent, international markets also contribute to the pressure to develop. Foreign technological knowhow undoubtedly has -and will have- a significant impact on European leadership, and it is therefore imperative that innovation, digitalisation and automation, skills and abilities be developed as a matter of urgency in order to maintain a competitive edge.

The **Belgian** respondent states that production may happen abroad (mechanisation in China, for instance) and afterwards be mounted on-site by national fitters; the BIM would make this possible through its precision, and this is obviously considered a danger.

Adapting to foreign technological competition has to fit into national norms and rules. Innovation levels are relatively conservative in construction companies, as stated by the **Irish** respondent, and they are not interested in innovation, as they focus mainly on building; it is up to other private companies to innovate and set an example.

*Do you believe that digital innovation is the key to creating a competitive construction industry, and how can this be achieved for SMEs?*

The **Lithuanian** respondent indicated that policy must undoubtedly be focused on promoting innovation, quality and value-creation throughout the lifecycle of a building. Only by applying this kind of policy will it be possible to become competitive and internationally valued, thus enabling the growth of construction service exports. The Finnish respondent also considered that digitalisation will lead to the effectiveness of the construction industry, and that it will be a key and crucial factor for more economical and efficient projects.

On the other hand, digital innovation was as seen just one more element by the **German** respondent; customer orientation appears to be more important, and in this context, digitalisation is not an important factor before deciding on a project. This means that digitalisation should be shown to be a solution with real benefits.

It was said by the **Lithuanian** respondent that each small or medium-sized enterprise can be a part of a very large project and a key player in the process, and it is interesting to implement digital innovation in all types of company, even small businesses. This is a critical factor.

However, digital innovation is of key importance for all industries, and construction is no exception according to the **Spanish** respondent. SMEs will have to specialise in these techniques to 'survive', because budget will no longer be the decisive element in contracting, which will be based on quality, reliability and execution time, all of which are aspects where automated solutions clearly surpass the traditional workforce. While medium-sized companies invest in innovation, small companies are more reluctant to change.

Digitalisation is certainly one of the strategic factors in making industries more competitive, but this is not enough: it is a methodology, a tool to operate more efficiently that cannot replace knowledge and people's way of working. In order to achieve progress, **Italian** companies need to integrate both ways of working, in the opinion of the Italian respondent.

One of the key tools for digitalisation in the construction industry will be BIM, which is emerging strongly in Belgium. The expected development of BIM in the near future will enable it to be better adapted to SMEs and to fit better with special construction techniques, which are used more by SMEs. Prices will increase but it will have a positive impact on expenses, which will be lower. BIM can also reduce the cost of construction, and the idea is ultimately to reduce costs by 15%.

In fact, digital innovation such as BIM, simulators (tools & models, augmented reality, virtual reality, mixed reality), cloud & mobile computing appear to be the keys to creating a competitive construction industry in the opinion of the **French** respondent. Identifying relevant data and its effective collection, appropriate communication channels between all stakeholders and suitable management methods are essential to digital transformation. However, the effect of size may play a role for small and very small enterprises, making it necessary for them to adapt their capacity and take appropriate measures, such as adapting tools, training and policies. It is a challenge.

Similarly to the **Spanish** representative, the **Greek** respondent highlights that adaptation to digital innovation is a condition for SMEs to be competitive. Specialization, along with providing timely high-quality services are additional parameters that ensure survival in a competitive market. The smaller the company is, the harder it is for it to respond to digital innovation trends, considering its limited resources both in human and financial terms.

Disengagement is an issue in **Ireland**, as companies and workers do not see the advantages of BIM. The expense of BIM is often seen as the main challenge for companies to invest in it, but in reality they do not understand how BIM can benefit the industry in the opinion of the Irish interviewee. BIM is not expensive if it is viewed as a long-term investment. It is important to understand that project efficiency and management are greatly improved, as BIM saves time in construction and reduces the number of unnecessary rechecks. Awareness initiatives are required such as R&D to bring the workforce and building owners up to speed, through upskilling and supporting the industry, especially in SMEs and Microcompanies.

### *Which policies could be proposed to foster R&D in the construction industry? How could the construction industry get more public investment?*

The **Finnish** respondent believes that there should be a sector-based innovation system, well organised and specialised in the development of new technologies for construction, which as a key player in industry is easy to identify by public authorities.

In **Belgium** the number of companies using BIM is increasing. In Flanders there has been a legal obligation to support companies using BIM in large public procurements. Besides this, there are now discussions in the other two Belgian regions to extend this obligation. Financial support is harder to implement in the private sector, since there are no legal obligations for this kind of support. At national level, the best place to invest money is in the BIM cluster as it is a central research organ where all stakeholders are represented.

The **Spanish** Administration has several tools, such as Innovative Public Procurement, CDTI (Centro para el Desarrollo Tecnológico Industrial -Centre for Industrial Technological Development-), R&D&i financing, etc. The excessive atomisation of the sector means that a significant part of it is neither aware nor interested. In this sense, participation in sectoral platforms and associations is of great interest to get to know all the financing options and grants for innovation within the sector.

Although **Ireland** has no specific R&D policies related to BIM as yet, large private construction companies have adopted BIM and are deciding how to use BIM for large construction projects. The Green Procurement process states that the workforce should have BIM knowledge, but there is no legal requirement to enforce this. The smaller entities (40€/50€ million or less) SMEs are struggling to keep up due to expense, lack of expertise and lack of upskilling, so partial funding initiatives are in place by educational bodies to provide BIM training through Lean Construction for the entire workforce. R&D is generally left to educational bodies only, where funding is available.

In **Greece**, policies to foster R&D in the construction industry could centre on tax incentives and encouragement for SME investment. More specifically, new innovation laws are needed which could enable subsidies to R&D companies and a more favourable tax regime with incentives for R&D. Moreover, generous tax reduction for firms involved in R&D in certain areas of new technology or investing in key areas such as Bio-tech, ICT, etc. is a key incentive for the sector's growth.

For the **French** respondent, the funding of relevant programmes under Horizon Europe should be opened up to construction industry partners, including SMEs. Moreover, a complementary scale-up of the most innovative start-ups should be promoted at national or European level (e.g. the Accelerator concept of the European Innovation Council).

According to the **Italian** respondent, the construction industry could get more public investment through European Structural Funds. Moreover, it would be necessary to adapt public initiatives already in place specifically to the construction sector.

## BIM

*Over the last decade, BIM methodology has been progressively implemented in different countries, following the recommendation of European Public Procurement Directive 2014/24/EU. As BIM is the tool that will shape the sector, how will its implementation affect day-to-day on–site working?*

The situation in different countries varies considerably for many reasons. It is not just a question of the practical implementation of BIM, as there are also differences in attitudes about its effects. In particular, there are differences in the implementation of new technology, of which BIM is seen as one of the key elements of digitalisation.

In **Spain**, according to the respondent, BIM is already a tool that is commonly used in projects, although it lacks the necessary implementation in the rest of the life cycle. In order to ensure the use of BIM in the rest of the life cycle, the respondent's opinion is that Public Procurement should change its functioning by adopting the DBOT (design, build, operate, transfer) formula, which will find its practical use in the development of BIM models that incorporate both the needs of the work and those arising for future exploitation.

In the digitalisation process all of the actors involved must become familiarised with the usage of digital tools. These tools must give access to useful information for each user, information that makes it possible to anticipate risks or uncertainties, based on virtualisation and the simulation of real situations. The most interesting thing is to train all the workers at the different levels. This training should be practical, combining traditional methodology with BIM.

The **Finnish** respondent said that the BIM database is used for financial calculations, project progress planning, material quantity calculations and for generating construction drawings. Site managers and site foremen already use the data model when planning and supervising work. BIM is also used for quality assurance purposes on sites.

In **Germany**, for works in existing buildings (renovation/refurbishment), BIM is difficult to get used to due to the lack of standard works and very small task units. For new building construction, BIM is also used at the highest level for financial calculations, the project process and planning, etc.

In **Italy**, BIM will certainly help to reduce design errors and defects that create delays in construction operations. Therefore it will be useful in making decisions quickly whenever the site has anomalous situations that require corrective action. BIM will allow the continuous monitoring of site progress and it will collect data related to payments in an automated form, simplifying the procedure.

In **France**, the implementation of BIM will require new skills for on-site workers and it will change the way they collaborate, with the on-site use of digital devices, for instance. This always up-to-date model will allow everyone to work on the same blueprint, facilitating collaboration and the realization of assets. Moreover, thanks to BIM, interface management and construction site safety may improve.

The **Belgian** respondent said that the largest companies use BIM and that their profit has clearly increased. Small businesses are reluctant but will be obliged to implement it, or otherwise they will lose markets. Awareness and change will be fast, and everything will move at once. Construction has a big handicap compared to other sectors: it is not possible to make a prototype to test and put on the market at the cheapest price and with good quality, because every construction site is a 'prototype'; we do not know how to do this, but BIM can help.

Many people think that BIM is just a 3D image of a building, although BIMANAGEMENT should be preferred - a model to manage the construction site (with most of the information). Many major companies use BIM to save time, money and to better anticipate the future. As it is the central brain of data management, there are a lot of different levels and topics: BIM e-commerce for all stakeholders (sellers, architects, manufacturers...); Optimization tools – apps and the development of Artificial Intelligence; Virtual reality to flag up problems; Facility management; Industrial construction: it will make it possible to build a building as you build a car. Everything could be manufactured in advance and erected directly on-site.

The implementation of BIM will fundamentally change construction site processes. The case of Belgium is worth studying and considering as a whole when it comes to BIM. There is an organisation (BBRI – the Belgian Building Research Institute) specialising in construction issues and development in the country.

The **Irish** respondent states that BIM will shape the construction sector in the next few years, and issuing paperwork and hard copy drawings will become a thing of the past. Management needs to be ready to access reliable data quickly and efficiently. An example of embracing BIM and on–site digitalisation was the issue of iPads to all the main workers in a large construction company. Following training induction, each team leader and main worker received directions and information

digitally, and sent back information, photos etc. to verify completion of works or changes required. The management process and quality of works improved and all works were completed before time and below budget. Other large companies are now following this example due to the well-publicised success of this process.

It is important to note that the challenge of implementation of BIM is being faced at European level, according to the **Slovenian** respondent. BIM in its true sense is a good basis, but it is far from useful. It is tied to the development of computer hardware that is beyond the reach of the average PC user. Even with extremely high power equipment, it is usually problematic due to the existence of different protocols. Currently, all documentation is still printed and paper-based, and construction supervisors still have a 2D plan and interview designers.

In **Greece**, BIM is currently used in a restricted number of private sector construction projects. Nevertheless, the **Greek** construction industry is taking steps towards getting to know it and is trying to widely integrate it in the construction process. The first impression is quite good, but there is still a long way to go before it is fully understood how its implementation will affect day to day on–site working. Within this effort, BIM VET programs are a new trend in Greece, aiming to make it familiar to stakeholders in the construction industry. As a general note, BIM is now applied in large scale private construction sector projects. The Greek public sector is moving slowly towards incorporating new technologies in public works, such as BIM.

*How will BIM affect the site manager and those that are under his direction? What can be done at this level to anticipate the upcoming new model implementation?*

The **German** respondent stated that site managers will adopt BIM and their professional role will increase due to their knowledge of BIM technology. In the case of Lithuania, all participants in the process will have to acquire additional competencies, ranging from ordinary workers to project managers or experts. While preparing for the implementation of the new model, it is necessary to place strong emphasis on the education of everyone involved in construction. Non-formal education is also required, through retraining existing construction participants to work in the digital environment.

In **Finland**, site managers already use the BIM model on construction sites, and there is already a free of charge mobile application, so that anybody can use BIM to look at an existing model on a mobile phone (the use of the data from a project is based on an agreement between the contractor and subcontractor). Smooth use of the BIM model would require fluent basic use of mobile devices as well as special training in the use of the BIM model.

In **Spain,** BIM implementation will improve communication and project definition, and it will resolve possible doubts faced by the workers. It will also ensure that the same information is available to all the work teams on site, and that there are no problems with outdated documents that could lead to unnecessary costs or delays.

The **French** respondent said that BIM may allow a general enhancement of logistic aspects. Thus, off-site and on-site materials will be far better controlled, as well as logistic flows and workers daily time, thanks to monitoring and tracking systems such as the IoT (Internet of Things).

According to the **Italian** respondent, it is necessary to anticipate phases of construction in order to promote this new model of implementation.

*Challenges of implementing BIM for SMEs are substantial: high cost of purchasing BIM, training own staff or paying for an external company, the development and adoption of ISO 19650, etc. In your opinion, how can these challenges be overcome by SMEs?*

In this respect, both the challenges and opportunities for SMEs have been considered. Actually, it seems that regarding company resources the major companies are the ones that invest, so that SMEs face great challenges to investment in proportion to their regular activities, as was stated by the **German** respondent. Assuming that SMEs in this case are also representative of a particular profile or specialisation, some experts would not agree that implementation is high burden for SMEs. With regard to small construction companies, many of them lack awareness and knowledge about software solutions and their potential, and thus have no urgent need to buy expensive products. Therefore, one of the challenges is the need to convince small businesses (SMEs) of the advantages of digital construction, as stated by the **Lithuanian** respondent.

In **Italy**, implementing BIM is a big challenge for SMEs: the main problem concerns the transition period because schools and universities are in the process of bringing BIM methodology into their training courses. Training is the solution, both in large and small enterprises, and it will help sectoral growth. It is important for companies to have public support to promote the transition, and it will be possible to provide fiscal incentives or vouchers.

Practical solutions are also available for the challenges, such as ¬free mobile applications, as is the case in **Finland**. The BIM database can be opened to the parties in the value chain of the construction project as appropriate. An SME does not in principle need to invest in expensive software, because utilising a BIM model can be part of a business-to-business agreement.

According to the **Spanish** respondent, the fundamental challenges for an SME are in the return on investment; for this, public policies must be directed towards the setting of contracting objectives that include BIM requirements, by sending a message of progressivity and continuity that allows for a greater amortisation of initial investments, especially in technology and training. Other measures would be to regulate contracting with BIM in order to clarify what is expected from the productive field and facilitate implementation strategies at company level, helping to establish their objectives; promote the training of professionals to facilitate their upskilling.

The challenges and costs of implementing BIM in SMEs could be overcome in many ways according to the **French** respondent. All actors and stakeholders could be convinced by relying as much as possible on testimonials and feedback in terms of returns on investment. Besides, the development of the necessary means for vocational training and tools adapted to SMEs and evolving management methods that would include the added value offered by BIM should be encouraged. Moreover, co-financing for hardware, software, qualification and consulting actions in favour of SMEs would be facilitated by fostering the compatibility of software solutions and avoiding inflexible closed systems. Networks could be created to disseminate good practice across appropriate and well-monitored chains.

In **Greece**, the Government plays a crucial role in the early stages of BIM adoption in SMEs. Issues such as high education-related cost and high-economic investment in facilities must be resolved through adequate legislation where appropriate, as well as supervision. Clear compensation mechanisms must be provided to mitigate apprehensions, such as that implementation and maintenance costs outweigh the usefulness of the system. Apart from costs, the interest and willingness of project managers and engineers to use BIM are important. Following this principle, government should strengthen BIM training.

In **Ireland**, BIM training can be expensive, but there are currently funding grants available for digital upskilling, mainly at EQF level 6 and above. There is some funding assistance for general workers, although training schemes are not taken up or managed well by companies. Many SMEs hire external BIM companies to prepare and set up a management and transfer process. Unfortunately this does not help SMEs in the long run as they do not gain any expertise on BIM, and SMEs and their workers will not understand how to use the process correctly

## *At what stage do you see the implementation of BIM technology in your country?*

As can be seen from the following country-specific responses, the use of the BIM method is at very different stages in different countries. It is also partly an open question whether a body or an actor that would take development work forward nationally can be identified.

In **Germany**, BIM is currently and pre-dominantly concentrated at the level of architects and their works. Until now it is more of a planning instrument than it is a practical on–site tool.

In **Belgium**, the Belgian Building Research Institute (BBRI) is pushing towards a greater focus on the use of BIM by SMEs. Indeed, although they may not need BIM skills on a day-to-day basis, they do have to work for contractors who are using it.

BIMio is a BIM viewer developed by the BBRI which will provide construction SMEs with a free and simple digital tool. With this tool each profession can focus on its specificities. The use of BIMio is free and quite simple, and it can also be used on smartphones. This is a concrete example which helps with the demystification of BIM for smaller companies. Today, the number of projects created in the BIM environment in **Lithuania** is well ahead of other central European countries, but, nevertheless, it is still lagging behind the Scandinavian countries, where such a design method is already considered standard. This is due to the different treatment of this process, which creates problems that are easily resolved by state-approved standards or requirements for BIM.

In 2014, the Lithuanian Builders Association (LBA) created a public institution called Digital Construction (Skaitmenine Statyba) to coordinate the digitalisation process in the Lithuanian construction industry and enhance BIM and the National Construction Classification. In total, 106 specialists from the construction sector, academia, IT and public institutions are involved in implementing this Digital Construction initiative in Lithuania.

BIM technology is already widely used in **Finland**. Some technology companies are developing data model-based applications for the construction industry. Also, a number of design offices provide services to the industry utilising this technology. It is assumed that all the major companies in the industry make extensive use of BIM for various purposes. Universities and polytechnics provide BIM training, which is mainly intended for construction industry experts. BIM is not included in upper secondary vocational education so far, even though some teachers have already been trained.

From the **Spanish** Administration's point of view, the implementation of BIM is at an early stage. In recent years, a wide range of dissemination work has been carried out to improve knowledge, as well as generating subsidies for training. Public procurement using the BIM methodology has already reached more than 400 contracts and represents more than 5% of the total public contracting in building.

Nevertheless, the degree of knowledge is very low. The **Spanish** respondent states that nowadays the use of BIM is limited to the elaboration of a project in a format other than the traditional one, adding the fact that Administrations continue to request a traditional project structure, which forces the private sector to prepare projects in duplicate, in BIM and in traditional formats.

On the other hand, the use of BIM outside the project phase hardly exists. In the majority of cases, maintainers or infrastructure managers do not use BIM.

In spite of a certain progress, the implementation of BIM technology in **France** can still be considered to be at an intermediate stage: major companies are clearly advanced compared to SMEs. However, most BIM technology is implemented within the same company and there are few data exchanges between different independent units. A dedicated plan was launched by the professional organisations in 2014, and another plan has now been put forward with the goal of making BIM current practice in 2022, even if it appears to be a great challenge for smaller companies.

In **Greece**, the Stavros Niarchos Foundation was the first construction project to be designed in a BIM environment. Greek companies have slowly begun to show interest in new technologies. However, the development of BIM use in the country is slow.

In **Ireland** there is a slow acceptance of BIM, except in large companies. With some financial assistance and support (already in place) and legal requirements for SMEs to sign up to a national construction companies register (which is underway), the uptake of BIM will increase gradually. It will be a requirement for construction workers and companies to carry out Continuous Professional Development each year, and BIM is one of the fields to be addressed.

Currently in **Italy** there is a low level of BIM implementation, but recent legal requirements will raise the level in coming years. A report in December 2019 by ANCE, Fondirigenti, and Sistemi Formativi Confindustria found that only 21% of companies use BIM technology.

## New Materials

*Properties of new materials (bio-based, nanomaterials...) provide a lot of new opportunities for construction; knowledge, know-how and knowing how to use them properly, are indispensable. What will be the impact of new materials on construction?*

In **Spain,** the revolution in construction materials will serve to reduce execution times, simplifying use and facilitating placement. Similarly, there is a trend towards the industrialisation of elements in order to reduce execution times and ensure homogeneous performance independent of the human factor. As far as innovative materials are concerned, there is a general tendency to valorise waste or to incorporate new characteristics into construction elements. However, most manufacturers use application procedures similar to those for traditional materials, to ensure that users accept new materials without reluctance. The impact of these materials is very relevant, both from the point of view of sustainability and the performance obtained in execution.

In **Lithuania**, innovative building materials and products are one of the options that provide a much higher quality for buildings, while at the same time it enables faster and more reliable construction as well as the durability of modifications.

Important questions are whether working methods are changing. On the other hand, there is always a question about the health and safety effects of new materials. Several respondents agree and note that new materials used in the construction industry will have a greater impact on the development of more sustainable greener buildings. As an example, insulation can require the use of new materials made with natural or recycled components. New materials can also reduce the scarcity of some resources that have been widely used in the construction sector to date.

New materials could also change the way that buildings are now conceived and built, as was stated by the **French** respondent, with the use of natural or recycled materials. They could also reduce the scarcity of some resources widely use in the construction industry. Therefore, new materials would help the construction industry with one of its main challenges: sustainable development. However, the economic factor (cost-benefit ratio) is essential. These new materials will not be purchased and used if they are too expensive. To make them accessible, they must be considered as economically profitable and easily adjustable to existing and new practices on worksites.

According to the **German** respondent, although new materials must definitely be used, it is necessary to know how they will affect building life- cycles in general and the people living in the premises. There is to date no experience regarding their long term effects. Craft companies are considered to be the subjects for warranty. Investigation about new materials should basically be implemented in initial VET.

In **Italy**, new materials make it possible to meet new construction requirements or to meet existing requirements in an innovative way, reducing the consumption of raw materials and the weight of buildings, and increasing the strength and durability of the works. This also has important repercussions on the cost and time of construction. The combination of new materials with digital technologies allows for a better evaluation of the entire life-cycle of the works, while also optimising their management and maintenance phases.

The **Slovenian** respondent remarked that it is likely that new materials will enable new principles in construction. However, it will take some time to check how they behave over time and to correct any irregularities. It is very important not to 'throw away' all the knowledge and experience gained in the processing of classical materials, which were collected primarily in a non-digital way. These materials are often ignored when engaging and favouring new materials.

The construction industry in **Ireland** is conservative and slow to take up and invest in new materials or products. Often, the installation of new products is carried out without knowledge and know-how and they are rarely tested in the field. Although the certification of materials is approved through the National Standards Authority of Ireland (NSAI), installation is still an issue with little or minimal training or quality assurance. Tool-boxes on site is the normal process, or viewing installation techniques on YouTube using unofficial short videos. Workers tend to pretend they know what to do and look up videos on line rather than admit they do not know something.

In **Greece**, new concrete material solutions will help concrete structures last longer than before. These innovative building materials will reduce the carbon emissions of buildings, reduce the energy needed to operate businesses, and last longer. Therefore, new materials create a win-win situation for both the environment and the construction industry as a whole.

*What changes are they going to demand from the sector, and at which level?*

The **German** respondent said that the way of working will change; starting with initial vocational training to the further training of foremen in relation to materials, the use of technology and interdependencies between material and technology.

The **Belgian** respondent suggests creating a Data dictionary to improve the exchange of information about construction products. It would require clear language that could be understood and used by anyone.

The **French** respondent stated that besides an increasing effort in R&D, a dialogue between academics, the private sector and communities would contribute to the co-design of new products that are attractive for end-users and economically viable for manufacturers.

According to the **Italian** respondent, new materials require continuous training for all those involved, from designers to company technicians, including those in the purchasing sector, while always working closely together to avoid improper use that can cause effects contrary to those which are desired.

The **Irish** respondent indicates that certification is required for products and installations for all products (new or old) as the NSAI (the National Standards Authority of Ireland) demands certification. Architects and engineers oversee the design and supervise the construction works. To comply with the building control process they act as the assigned designers/certifiers and are required by law to sign off on the correct choice, detailing and installation of materials and products used in the construction process. Demand for sustainable products, services and materials is on the increase from the general public and this is starting to filter through to the construction industry, with more products being certified by the NSAI each year.

Finally, in **Slovenia** it will require continuous learning and retention and transfer of the experience already gained at all levels

## Skills

*Which will be the key skills and competences related to digitalisation and technologies in the construction industry?*

The development and success of appropriate online platforms accessible to any worker profile could contribute to the systematic updating of skills and knowledge that is necessary to follow changes. In the opinion of the **French** respondent, integrating platforms into individual professionalization processes could contribute to a more flexible mind-set (problem-solving, curiosity, creativity, communication, etc.), more systematic data management (collecting, using, storing and sharing) and broader digital literacy (knowledge of how specific technologies, tools and data work).

The **German** interviewee comments about methodological competence, which has to be learnt; workers also have to investigate materials, processes and on-site situations themselves (accompanied by trainers).

The **Lithuanian** respondent said that it is important to gain skills and competences related to understanding the processes in the life-cycle of a building, stages in the same and the roles played by its users. Workers have to be able to use software in their field, with general computer literacy and accepting innovation, among other qualities.

Regarding new and emerging job roles, according to the **Greek** respondent these could include robotics engineer, assembly technician, 3D visualizer and drone pilot. More innovative training methods are now in use: from Virtual Reality headsets which make it possible to perform simulated tasks in low-risk environments, to game-based courses that provide more engaging and flexible ways to learn and gain relevant skills and qualifications.

On the other hand, the **Italian** respondent said that it is necessary to have specialized technicians in the sector: materials technologists – a professional figure who researches and studies, using chemical, physical and mechanical methods, the structures and properties of materials and their interaction with the environment; Project Managers, who evaluate and appropriately manage the risks associated with a project, managing resources and integrating all business processes, making a detailed analysis of benefits, controlling project quality of the project and maximizing its yield; finally, Data Analysts collect data from different market sources, organizing and structuring them and then analysing them to obtain useful information for the company.

The **Slovenian** respondent considers that the most relevant skills would be knowledge of computer science and understanding of the basic principles (Philosophy, Chemistry, and Physics) of construction technology. And finally, the Irish respondent stressed that computer and IT usage needs to be addressed, there is a need to understand how to transfer knowledge and use databases (so users can access the system easily), understand data security, (preventing use by hostile 3rd parties, GDPR etc.) and how to store information correctly (accessibility to all). Augmented digitalisation and storage of data will be driven by the industry and new skills will be required to carry out these tasks efficiently.

### *What will be the main obstacles in transferring the knowledge about modern technologies, materials and skills?*

The **German** respondent thinks that knowledge transfer is above all a question of the ability for lifelong learning. It is becoming increasingly important for trainees and/or employees to think abstractly. In vocational education and training, construction is taught as a holistic structure and not just a series of individual tasks.

The main obstacles for the **Lithuanian** respondent are the lack of motivation, the absence of traditions of lifelong learning and the dominance of the lowest price principle, which does not create the basis for innovation and the development of skills.

The **Italian** respondents talked about scepticism regarding new solutions that do not provide the client or the company with sufficient guarantees about the validity and durability of new technologies.

The non-existence of this knowledge in the sector will prevent knowledge from being transmitted directly in the working environment, according to the **Spanish** respondent; this makes it necessary to train employees more frequently and even to incorporate staff who have received training that has nothing to do with the usual training in the sector (computer or telecommunications engineers, statisticians, etc.).

In **Ireland,** it is important to convince the construction industry to embrace and interact with computers and IT data. New products are often reviewed and researched by educational bodies and then adopted once they have been tested in the public sector. Ireland is renowned for embracing new technologies and materials, even though they are initially often installed or used incorrectly.

In **Slovenia**, the obstacles would be data credibility and the possibility of verification. Almost all useful information is largely inaccessible due to "trade secrets". In the Internet you often come across harmful data (you can find perpetuum mobile and other false tech tips on YouTube).

### *How can digital methods and instruments be learned "playfully" and easily to overcome fear of them?*

The **Lithuanian re**spondent thinks that modern learning methods provide a variety of opportunities for visualizing learning materials, providing distance learning opportunities, various kinds of interactive tests, game-based learning, tasks or forums that would transform the teaching and learning process, taking it into a new dimension.

The **German** respondent considers that digital workplace laboratories will be needed in order to test new technologies and their application possibilities by means of simulation, according to occupational training.

The **Spanish** respondent said that new technologies make learning more enjoyable than traditional classes, as well as being more flexible and easier to follow. To this end, several technologies are being used in the sector that have a great future; on the one hand, gamification allows complex knowledge to be transmitted in a very enjoyable way, while at the same time maintaining the interest of the audience for long periods of time. Also, virtual and augmented reality makes it possible to obtain -especially for courses with a very important practical component- the same sensations as during real work, making it easier to incorporate knowledge in a practical way. Finally, the use of online training platforms greatly facilitates access to training that otherwise would not be accessible.

The **French** respondent also considers that digital methods and instruments can be learned "playfully" and easily to overcome any fear of them. Thus, virtual, augmented & mixed reality could be used, especially on construction sites. Scenarios of different options of "building evolution in a changing urban landscape" could be helpful to imagine desirable and feasible futures, if end-users, manufacturers and R&D actors could play interactively to discover pros and cons and forge a consensus. The Government should implement appropriate policies likely to foster more individual professionalization processes, adjusted to individual needs. Therefore, the capacities of adaptation of small and very small enterprises versus medium enterprises should be investigated and tested. Within such a framework, a size-effect could require appropriate measures and governmental aids.

The **Finnish** interviewee stated that the strategy should include the proactive training of a new generation of teachers within the various education systems (public and private), as well as through apprenticeships.

The **Slovenian** respondent indicates that it is important for the younger generation to recognise computer technology as a tool for work and not only as a game.

The **Irish** respondent mentioned the 'Try it and buy it approach', which will give an opportunity for companies to review and see the advantages of BIM. On-site initiatives will help SMEs and sub-contractors. Another method would be training: people fear change but once they start training they see the progress of change and see how digitalisation is useful. Digitalisation takes away the mundane work and the most added value lies in the transfer of knowledge and learning new skills and techniques. For the older workers in particular, IT literacy and basic knowledge of IT are essential. Training key personnel in each company to advise and assist others is essential as well. They are not used to schooling, so find it difficult to get back to the old fashioned way of teaching, and they also find it difficult to use IT. It is also important to employ young people for IT purposes as well as on-site training. This could entice young people into the industry. A big gap in communication between certain trades still exists.

Finally, the **Greek** respondent stated that construction technology transfer should be planned and co-ordinated by a central government body such as a unit in the ministry responsible for construction. They should incorporate utilisation of the transferred technologies, and their dissemination, adaptation, integration with existing ones, and further improvement. Various technologies would require different considerations as to the most suitable source, with an effective transfer mechanism, a form of agreement, an administrative system and support services.

## Conclusions

- **Digitalisation and automation** of processes in the construction sector is an essential component of the professional field of modern construction. This is an **inevitable necessity irrespective of company size, as** small businesses can also perform vital functions in major construction projects.

- Digitalization and automation will have the **greatest impact on new buildings in the field of high-tech facilities (smart and low-energy houses, unconventional technical facilities).** For renovation work, however, it will be an obstacle for craftsmen who usually use traditional skills, and their learning is often not based on digital principles.

- **Public funding** plays an important role in the development and implementation of new technology and know-how.

- The use of **cloud-based solutions** will enable all participants in design and implementation processes to access information from any communication device with an Internet connection, e.g. over a file-sharing collaboration platform for viewing, managing, distributing, and collaborating on construction documents in real time. It will be a key enabling technology for BIM.

- A **European digitalisation strategy may be needed** in order to coordinate all national efforts linked to the transformation of the sector. However, important steps should also be taken at national level, e.g. to integrate innovative solutions in public tenders.

- **Foreign technological knowhow** undoubtedly has and will have a significant impact on **European leadership**, and it is therefore imperative that innovation, digitalisation and automation, skills and abilities be developed as a matter of urgency in order to maintain a competitive advantage.

- Challenges and costs of implementing BIM in SMEs may be substantial: the high cost of purchasing the system, training staff or paying subcontractors and the development and adoption of ISO 19650, etc. are all money- and time-consuming.

- **Facilitation for SMEs**, it is essential to also focus also on companies that do not have BIM skills but must work as subcontractors for companies using BIM.

- The **development and success of appropriate online platforms accessible to all worker profiles** could contribute to a systematic updating of skills and knowledge that is necessary to adapt to the transformation of the construction industry.

- It is going to be important to **gain skills and competences related to the following**: understanding building life cycle processes, its stages and the functions of its actors, the ability to use software, general computer literacy and the acceptance of innovation, etc.

- **Digital skills will be essential to de-compartmentalise crafts and to elaborate long-term developmental strategies** that would include increasing numbers of energy audits, the circular economy or specific industrial programs for all kinds of professionals.

- **Some of the new and emerging job roles** may be: robotics engineer, assembly technician, 3D visualizer and drone pilot. These professions will use more **innovative methods for training**: from 'Virtual Reality' headsets which allow to perform simulated tasks in low-risk environments to game-based courses that provide more engaging and flexible ways to learn and gain relevant skills and qualifications.

- New materials used in the construction industry will have a greater impact in the development of more **sustainable and greener buildings**. However, new materials will require continuous training for all actors involved.

- **New technologies will make learning more enjoyable than traditional classes**, as well as being more flexible and easier to follow. Gamification allows complex knowledge to be transmitted in a very pleasant way, while at the same time maintaining the interest of the audience for long periods of time. Also, virtual and augmented reality make it possible to reproduce the same sensations as during real work, making it easier to incorporate knowledge in a practical way. Finally, the use of online training platforms greatly facilitates access to training that otherwise would not be accessible.

# Legal factor

## General remarks

The European Directives establish the objectives that must be achieved by the Member States; In order for the principles set out in Directives to take effect for citizens and the industries, national legislators must adopt domestic legislation that conforms to the objectives of the Directives.

These directives set a deadline for transposition into national law; Member States should have time enough to take into account their national peculiarities.

When replying to the questionnaires, several interviewees consider that excessive legislation and insurance requirements could impede innovation in the construction industry. Thus, the effect could be contrary to the intention.

In this respect, it is important that Public Authorities are exemplary in enforcing the new legislation and that they show the way to all the other contracting bodies (e.g. private clients). However, legal requirements should be sufficiently balanced so as not to hinder building activities, while continuing to raise awareness of the importance of sustainable development for the entire sector.

## National transposition of Energy Efficiency in Buildings Directives

*The aim of these directives is to facilitate the transformation of all buildings into buildings with almost zero energy consumption, provided it is technically and economically feasible. What is the current status of the transposition of these directives in the different countries?*

The main legislative instrument for improving the energy efficiency of European building stock is Directive (EU) 2018/844 of the European Parliament and of the Council of 30 May 2018, amending Directive 2010/31/EU on the Energy Performance of Buildings and Directive (EPBD) 2012/27/EU on energy efficiency. Member States have until 10 March 2020 to transpose the new and revised provisions of this Directive into national law.

In **Greece**, EPBD transposition was enacted by national law N.3661/2008. The Regulation on the Energy Performance of Buildings – KENAK outlines the general calculation approach that is in accordance with European standards. Implementation was initiated by mandating the energy performance assessment of new buildings to obtain a building permit as of October 2010, and issuing energy performance certificates as of January 2011.

The directive has also effectively been transposed into **Belgian** law in the Law of 17 June 2016 and in the Royal Decree of 13 July 2014. There is therefore an obligation for central governments (the federal state, regions and communities as well as public bodies that are mostly subsidised by these entities) to tender with a green approach. On the other hand, there is no obligation for other entities (municipalities for example) even though they are encouraged to obey the directive.

The EPBD sets three main requirements for the public sector in terms of setting an example for the rest of the country:

- earlier transition to building nearly zero-energy buildings,
- having and displaying energy performance certificates,
- defining cost-optimal minimum energy performance requirements.

**Lithuania** is already applying transposition measures of the directives into national laws. The country has tied nearly zero-energy buildings to energy classes and energy performance indicators. In the already updated Technical Building Regulation (2016) the additional rating definitions of low energy buildings, which are applicable to buildings of energy efficiency class B, A and A+ and nearly zero energy buildings as A++ class buildings had been introduced. All new buildings starting from 2021 shall fulfil nearly zero-energy building (nZEB) requirements and all new public buildings starting from 2019 shall fulfil nZEB requirements.

**Finnish** society is well-known for respecting agreements literally. The issue is in applying the Directive in relation to existing national legislation based on national good practices. Finnish construction building regulations experts express their concern over the lack of knowledge in the preparation of directives. However, compulsory legislation and a roadmap to support it by 2025 are under preparation. A lot of research is being carried out to identify where there is the best potential for improvements of energy efficiency and also for the way to implement it. nZEB should be defined and agreed more carefully, including both energy efficiency (kW) and emissions ($CO_2$).

The **Italian** building stock to be converted into nZEB is very large. Often the costs are disproportionate to the benefits and in some cases it is impossible to operate due to the presence of constraints (e.g. historical-architectural). It will be necessary to avoid defining targets that are too high, as this would discourage interventions aimed at improving energy efficiency, even though they do not reach nZEB targets. It would be interesting to also provide several kinds of incentives for owners, aimed at the renovating buildings instead of demolition (Ecobonus 65% recovery of fiscal expenses incurred).

In **Ireland**, the Building Regulations, Technical Guidance Documents (TGD) Part L – conservation of fuel for housing and other buildings have been signed into law. All occupied new buildings and deeply retrofitted buildings (where more than 25% of the surface area of the building envelope undergoes renovation) of all types must comply with nZEB standards from 1st November 2019. Initially, the public sector set the precedent by enforcing compliance in 1st Jan 2019. The Energy Performance Certificates (EPC) known as the Building Energy Rating Certificates BER are based on the overall energy efficiency of the building.

For new non-housing a BER equivalent to a 60% improvement in energy performance over the 2008 Building Regulations is required. This means an improved energy performance for the fabric, services and lighting specification. It also introduces a mandatory requirement for renewable sources. Renewable sources must in general provide 20% of primary energy use, however there is flexibility where the building is more energy efficient than the regulations stipulate.

Existing non-housing buildings that are major retrofitted or renovated will require that the building is brought up to cost optimal level, which is defined in the building regulations as:

- Upgrade Heating Systems that are more than 15 years old
- Upgrade Cooling and Ventilation Systems that are more than 15 years old
- Upgrade lighting that is more than 15 years old.

- New housing BER is set at 45 kWh/m2.
- Existing housing – deep retrofitted or renovated requires the BER to meet >125 kWh/m2.

The National Standards Authority of Ireland, NSAI have set out guidelines for retrofitting; NSAI SR:54 Code of Practice for the energy efficient retrofit of dwellings to work alongside the Standard Building Regulations.

For the **French** respondents, the criteria and conditions defined in the current national legislation for the energy performance of buildings are considered as sufficient to reach the target of high-performance buildings. Moreover, the French legislation goes, in general, further than the EU regulations (recommendations and directives). Therefore, they recommend a systematic evaluation of the impact of any new national legislation aiming at establishing new indicators, in order to avoid any risk of undermining the construction industry in **France**.

## *What will condition the effectiveness of the regulation?*

Regarding this aspect there were a few interesting points of view. A clear set of objectives and detailed guidance to be put into practice at different levels of government are needed to support effective legislation. The commitment of building users and owners to take care of buildings was also considered important.

In **Ireland** monitoring and assessing works on site are self-regulated. This means that all final works are assessed by an Assigned Certifier (registered architects, building surveyors and chartered engineers) under the Building Control Amendment Regulations, BCAR, (S.I. No. 9/2014) and not by a regulated statutory Irish body. The Assigned Certifier is a statutory appointee under the regulations. This person has a duty of care and can be personally liable should a case of negligence arise. On completion of the project, a certificate of compliance is produced jointly by the assigned certifier and the builder. The certificate confirms that the planned inspection regime has been implemented and that the finished product meets the required building regulations. However, one-off housing and retrofitted works are exempt from this system and no statutory obligation exists to ensure the effectiveness of the regulations.

Strict regulations play an important role in **Lithuania**, as the respondent's answer states. Starting from 2021 for all new buildings, construction permission will be issued only if they comply with A++ class (nZEB) requirements. The obligation to build only nearly zero energy buildings to enable sustainable use of energy resources.

The effectiveness of the regulation will be limited in the **Spanish** administration because all administrative levels (national, regional and/or local) have to exercise their competences and transpose the Directive 2018/844 into their rules, ordinances and licences. However, the **Spanish** respondent suggests that this should not be seen as an extra cost but rather as a medium and long-term advantage, which will also favour other sectors of the economy.

The need to involve/convince users to commit themselves to improve the performance of buildings is also highlighted by the **Italian** respondent. In this respect, a decisive role is played by the State, which must show its commitment by continuously carrying out retrofitting interventions on its buildings, thus also creating a widespread technical culture in this field.

Needs are also expressed in a concise manner by the **Slovenian** respondent, who thinks that there is a need for awareness at all levels, quality of intervention, subsidies and precise definition of parameters.

The **German** public debate on climate protection measures has so far not focussed on the building sector. According to the respondents, around a quarter of the total savings of $CO_2$ emissions in the building sector can be tapped. Nevertheless, the effective implementation of this opportunity will require tax incentives. In this context, a funding scheme has been under discussion for years, and therefore, according to the respondent's opinion, it is now time to follow words with deeds. The ZDB therefore strongly supports the fact that the Federal Minister of Building Horst Seehofer wants to promote the renovation of old buildings through tax incentives. However, ZDB rejects the tightening of the energy requirements in the direction of passive house.

The **French** respondents consider that the effectiveness of the EPBD directive and its national transposition could be evaluated in terms of the return on investment of energy efficiency works, which is only possible with appropriate governmental support, given the low level of energy prices. The pressure for energy efficient buildings is currently economic rather than technical.

## *What skills should be updated to deal with this new trend?*

In general, respondents in different countries felt that education was needed at all levels of the construction process, but they indicate that it is also necessary to better understand the need for and the importance of educational reforms. Respondents also called for stakeholder communication, where in practice a list of verified contractors is needed, and the need for quality control was underlined.

It is necessary to emphasise the importance of vocational training in the construction sector, in order to update worker knowledge and the correct execution of recent modifications. The implementation of the European Directives will involve the use of new or improved building materials, construction techniques and technologies, as well as requiring high quality works. Therefore, there is a need for new knowledge and skills in all of the participants at all levels of the construction process, with particular emphasis on the preparation of employees to perform high-skilled building construction installation works and the production of energy from renewable sources.

Skills and competences require improvements at all levels, from project management to practical on-site implementation. Developing training programmes on a regular basis is essential, with the collaboration and cooperation of universities, Technology Institutes and vocational schools. It is equally important to train the clients and occupiers on how to use their house or building, as was indicated by the **Irish** respondent.

Concerning **Greece**, training in the construction sector should be targeted not only on developing existing skills, but on enhancing the skills generated by new technologies, digitalization and so on. All individuals and stakeholders in the construction ecosystem should have a chance to improve their skills and competences, and to update them according to new trends. It is important to include the training needs of digitalization, as well as of the circular economy and green technologies. Certified technicians and those who monitor energy efficiency projects are among the list of jobs that appear to have pressing needs for skill development.

According to the **German** respondent, because of the abundance of known and innovative technical possibilities, it is difficult to find the perfect solution to retrofit the building stock. In fact, the market also offers a range of construction products and solutions that are potentially unmanageable, even for experts. This means that it is often hard to make the right decisions for an existing building or a planned construction project. Due to this, the basis for a successful energy strategy should be a viable concept in which different solutions are methodically evaluated according to different criteria, such as the cost-effectiveness of energy-saving measures, system engineering, legislation/standardisation, etc. Before energy-efficient building renovation, the right energy strategy must be defined and the technical options in question must be clarified. As an example, for training in construction companies the 'building energy consultant in the craft' was launched. Here it is important that construction companies can be familiarised with methods and put their acquired know-how into practice.

Moreover, according to the **Lithuanian** respondent, the achievement of implementation of the Directives will involve the use of new or improved building materials, construction techniques and technologies, as well as requiring a high quality of working. There is a need for new knowledge and skills of all participants at all levels of the construction process. Therefore, engineering personnel and qualified workers installing new products, equipment and technology, which ensure a high quality of working, will need new knowledge and skills.

For the **French** respondents, it is highly important to de-compartmentalise crafts and elaborate long-term renovation strategies in order to reach the 2050 target for general renovation. Some tools have already been created for this purpose, such as energy audits and appropriate industry programmes for professional upgrading (PACTE - Action programme for Construction quality and energy transition; modernisation of the rules of the Art; PROFEEL – technical innovation programme for the energy renovation of buildings; etc.). A database of required skills has also been developed.

## Legislative framework

*Do you consider that taking into account the lowest price in deciding on project acceptance will still be the most important decision-making factor, given the facts that are reflected in the findings in the field of nature conservation, circular management, energy efficiency and climate change?*

Most replies stated that unfortunately the lowest price is still the determining factor in the evaluation of projects, and that a country's economic situation still affects the way in which policy is implemented. However, a great deal of attention is now shifting towards other criteria, such as the principles of sustainable development, climate change and energy efficiency, etc.

In **Greece**, for example, since the economic crisis is still going on strongly, the lowest price is definitely going to be a very strong decision-making factor, if not the only one in the country. In this respect, there should be economic incentives set by the government so that companies are able to present projects with higher costs due to the fact they are environmentally friendlier. Additionally, certification of implementation of environmentally friendly procedures by companies is required in order to bid for tenders. Such requirements could definitely shift construction enterprises towards energy efficiency and circular economy management concepts.

Respondents also highlight this issue by describing the existing challenges in this complex matter; according to the **Slovenian** respondent, talking about the lowest price is always problematic. It can be misleading, especially if the starting points and parameters are not precisely defined. There is such a wide range of offer in the market that it takes time -which is not usually available-, to make the right decision. Also, working on finding the best solutions is usually too expensive in comparison with the contract value of the work in question.

The **Belgian** respondent indicates that the price criterion is still the most important in the public and private markets. As for public procurement, the economic operators respond to calls for tenders according to the criteria set by the public body in question. If the public body does not stipulate environmental criteria, the economic operator will not integrate them into its offer due to the risk of losing its market opportunity.

The main obstacle to sustainable construction and demolition waste management, according to the **Lithuanian** respondent, is that standards barely exist (even at EU level) which would make it possible to legally reuse construction and demolition waste in the production of new construction materials.

When talking about the circular economy, many replies took waste management as a starting point and called for stricter compliance with existing legislation. For the Italian respondent, **Italian** there are technical aspects that need to be better defined to allow the reuse of waste materials.

Country-specific responses show a clear trend in public sector investment, which calls for the so-called 'most economically advantageous tender' solution in procurement, which is a term for the balanced evaluation of different factors. For example in **Lithuania**, since 2018 all new public investment projects have to be screened with a cost-benefit analysis. Therefore, many construction market participants are in favour of applying the most economically advantageous tender evaluation method versus the lowest price principle: the lowest price does not guarantee the highest quality. It is necessary to consider the entire life-cycle of a building, which would definitely correspond with the field of nature conservation, circular management, energy efficiency and climate change.

The emphasis will be on the most sustainable constructions, which have repercussions on the economic, environmental and social benefits for everyone connected with the life of the building (renters, users, developers, owners, etc.), according to the **Spanish** respondent.

The **Finnish** respondent indicates that it has also been seen that public sector actors need new skills to make purchases; the answer to this very important question is that money continues to steer these purchases. The lead of public procurement could be a way to show the direction that is required, although there is not enough competence, courage or resources to change the tendering process so far.

For the **French** respondents, the lowest price may unfortunately remain the major determinant of decision-making considering that environmental value cannot be proved when tenders are received. The enhancement of environmental requirements surely impacts new construction/ renovation works and should therefore benefit from incentives and support. Sometimes a financial incentive helps new or efficient technologies to develop and to reduce their costs.

*Can we expect measures in legislation that would prevent industry and other stakeholders from entering the market if they do not show their business is moving in the direction of energy efficiency and circular management?*

There were differences in the responses of different countries regarding the potential role of legislation in steering the market. Some countries did not see any need for special measures; but it would be important to take into account and comply with existing legislation in the field of energy efficiency and the circular economy.

According to the **Slovenian** respondent, such a measure does not seem possible, since legislation is not an instrument that brings about strategic shifts in the transformation of companies and their business strategies. Economic measures are likely to be more effective, with greater benefits for businesses.

In the opinion of the **Irish** respondent, there do not seem to be any very easy solutions to this issue, although the Government now requires all Local Authorities to provide a Public Sustainability Strategy for their region. The level and type of sustainable strategy are decided by the Local Authority itself, as they can set their own agendas and timeframes.

In **Greece**, although government policies are trying to become more environmentally-friendly, since the huge economic problems of the sector still exist, the steps are really slow.

In **Belgium**, the interviewee said that in terms of selection criteria, a certain number of requirements can be imposed on private operators who bid for tenders (labelling and ISO standards for example, together with environmental management systems, etc.). This may therefore favour economic operators who have included an ecological approach in their processes. Environmental considerations can now be considered when determining the best offer. Unfortunately, in practice, it is hard to integrate environmental criteria in tenders because they might be considered to be discrimination under the law. For example, the distance between company facilities and the location of the works cannot be taken into account when awarding a tender. This is one of the major drawbacks of the Belgian regulations. However, the legislation allows certain environmental requirements to be imposed in terms of market execution conditions (such as waste recycling, for example). Life-cycle cost can be incorporated into the award criteria, making it possible to consider the environmental impact of all stages of building / infrastructure construction / renovation (from the acquisition of raw materials to end-of-life) However, this award criterion is fairly recent and has little impact. The **Belgian** legislation is quite well done when it comes to imposing requirements like labels or standards, but not everything can be controlled (like the origin of materials or the distance between company facilities and the site of works) from a legal point of view, because it could be discriminatory.

According to the **Lithuanian** respondent, the "EU Clean energy for all Europeans package represents an example of a regulatory measure that is able to prevent industrial and other stakeholders from entering the market if they do not shift their business in the direction of energy efficiency and circular management.

This question was also seen as a cross-sectorial challenge by some respondents. The biggest problem seems to be broader legislation (e.g. on chemicals, eco-design, HVAC) which affects the construction industry and can complicate the way the sector operates. Therefore, according to the **Finnish** respondent, there is no precise way to show how requirements are met. This opinion is shared by the **French** respondent, who considers that some legislation and insurance requirements could impede innovation.

*Green tenders: the Green Public Procurement (GPP) enables public administrations to use their purchasing power to choose environmentally-friendly goods, services and works, making an important contribution to sustainable consumption and production. How has the GPP been introduced in the construction industry in your country? How will this circumstance affect the construction industry?*

In **Greece**, the GPP is being introduced slowly but decisively through environmentally friendly procedures, and certification and effective waste management requirements are in place.

Regarding other countries, in **Belgium** the GPP is not widely used because of the high standard of requirements. In **Lithuania** the GPP national action plan and strategy are currently in force, and the implementation measures for 2016–2020 were approved in 2015. The strategy covers four priority areas of environmental protection policy: the sustainable usage of natural resources and waste management, the preservation of ecosystem stability, environmental quality improvement, climate change mitigation and adaptation. In **Spain**, the respondent said that it will decrease the weight of the price when assessing the offers presented in public procurement processes.

In **Finland**, there is a general public procurement handbook https://ec.europa.eu/environment/gpp/pdf/handbook_fi.pdf including, among others, guidelines on the environmental aspects to consider in the public tendering process of building projects. This Handbook is a guidance document prepared by the EU Commission services. Public procurement officers are well aware of the GPP Handbook and work to apply it as far as possible. The implementation of the GPP principles is in progress but requires further knowledge and training. The knowledge required by Life Cycle Assessment (LCA) is currently and mostly used by experts in the field and by consultants providing expert services. The LCA tool for reviewing construction projects is not yet widely used.

In **Germany**, the GPP was introduced as part of the changes to the law in 2016/2017 by amendments to the Public Procurement Law Modernization Act, the Public Procurement Law Modernization Ordinance and the Underlying Enforcement Act (UVgO). The focus is on regulations for environmentally-friendly procurement. Public procurement will thus play a pioneering and role model function. Due to the increasing volume of construction in the public sector it will have a positive impact on the entire construction industry.

The level of compliance with green public procurement criteria in Slovenia accounts for 17.3% of all public procurement, so it is necessary to increase its share in order to keep up with developed countries (e.g. Austria, Germany, the UK, Denmark, Sweden and the Netherlands, which already comply with these criteria and account for almost half of total funding). In Ireland, the policy governing the use of the GPP is left to the industry; in public tenders the Local Authority is required to use the GPP, but it is used mainly for larger public building works only. The **Irish** respondent considers architects and engineers to be the key actors to encourage clients to ask for sustainable construction. If the GPP is used by private clients, it is not necessary to use locally sourced products, although many contractors do source locally.

In **France**, the respondents consider that public Authorities should be exemplary in the field concerned, but some efforts are still necessary. The awareness of public contracting authorities in terms of GPP is considered to be fundamental.

*Do you think that a redesign of the rules and regulations for construction and demolition waste is necessary from the point of view of the construction industry? How can the framework conditions (legal, planning, etc.) regarding recycling management and resource protection be adapted and how will they impact the industry?*

The respondents mentioned a couple of interesting points here. The answer is not always to set new rules, but rather to ensure compliance with existing guidelines. Again, this issue shows country-specific differences in how regulation works.

The implementation of the legislative framework concerning construction and demolition waste from the point of view of the construction industry is definitely necessary, in the opinion of the **Greek** respondent: Today, most of the waste generated ends up in landfill sites or even worse, as it is uncontrollably disposed of in the environment. As an alternative, waste management has been taking place in recent years, as well as recovery and recycling operations where the competent authority in accordance with legislation is the Hellenic Recycling Agency (HRA). There is a need to increase information, to speed up regulatory actions, to increase human resources, to impose sanctions, to speed up the implementation of legislation and to create financial incentives. In this field, a legislative initiative to enhance construction waste management was recently announced for 2020.

On the other hand, other national respondents, such as the **Spanish** or the **Belgian** ones, do not see the need for new regulations. According to them, the rules are quite complete and essentially a change of mentality rather than an adaptation of the rules is needed.

Furthermore, regulations imposed on the basis of legislation should not impede business operations, as the **French** respondent stressed; legal requirements should be sufficiently balanced so as not to stop building activities, while continuing to raise awareness of the importance of sustainable development for the entire sector. For example, various initiatives, including regulatory ones, have recently created a framework for worksite waste management in **France**. Moreover, new legislation against wastefulness has been adopted to boost waste collection and recycling. However, the issue is still an economic one, and the respondents consider that the use of recycled materials will expand only if it is economically competitive.

Construction waste has always been specifically addressed in **Slovenia**, and it represents a major cost in demolition and in general construction, even though several ways have been tried to reduce it. It is very important that the rules for the management of construction waste prevent the pollution of the environment and stimulate its reuse. The industry is also adjusting to this, and it is striving to develop recyclable or reusable materials.

Respondents also saw the need to develop standardisation at EU level; in **Lithuania**, the rules of construction waste management were updated several years ago. According to many stakeholders, the rules regulating construction waste management are very strict, but after several years the construction companies got used to that, and now they are even starting to consider applying circular economy measures. However, the main obstacle against sustainable construction and demolition waste management is that standards barely exist (even at EU level) which enable the legal reuse of construction and demolition waste in the production of new construction materials.

In **Ireland**, there are no specific regulations for the reuse of waste/materials, although waste disposal is strict and requires disposal in designated sites. The construction industry is currently driving the need for recycling management, especially for concrete and soil, and many larger

companies are complying with new guidelines set out by the construction industry federation CIF towards lean construction. Demolition is hot on the agenda, and planning laws require a substantial argument for the demolition of buildings rather than retrofit.

**Germany** has launched a systemic reorganisation of the regulations for construction and demolition waste, in order to achieve nationwide regulations and standards. From the point of view of the construction industry, groundwater protection has become so prominent that this is at the expense of the previously good recycling rates for construction and demolition waste. These new framework conditions could have a significant impact on the entire construction industry, in particular due to a shift of recyclable waste towards landfill and the increased use of natural materials for RC material. This would be associated with cost increases for the construction industry.

Problems were identified in **Finland** a long time ago, but there is still room for improvement. According to the **Finnish** respondent, it is not easy to recover materials for reuse because the construction sector uses CE-marked products that require certain features. The big question is, in particular, the crushing and use of concrete, because although the technology is available, the amounts of waste to be recycled are huge. The Finnish Ministry of the Environment has a clear roadmap, but legislation alone is not enough because public purchasers play a key role in implementing regulations. Public-private partnerships are needed to develop technology, methods and operating models.

## Innovative financial instruments

*There is a real need for investment in the energy renovation of old buildings. Financial instruments combine EU financial support with finance from the private sector and other public financial sources in order to promote investments in the area of building energy retrofitting. Such instruments may take the form of loans or guarantees and other risk-sharing instruments (equities and quasi-equities), and may, where appropriate, be combined with grants. Do you think that new financial instruments will be consolidated as key renovation boosters?*

The EU provides support for the creation of funding instruments, especially Financial Instruments (FIs) supported by ERDF (European Regional Development Fund) funds and integrated with EC (European Commission) funding initiatives. Thanks to these initiatives there is definitely a boost in energy efficient renovation in buildings. The availability of financial instruments to support the efficiency and renewal of the building stock is essential. To this end, some good practices have been put in place in Italy: tax credits and charges to large energy companies that do not burden consumers.

In **Germany**, new financial instruments are seen as a major impetus for the energy renovation of buildings. In particular, tax incentives, as well as the existing loans from KfW Bank and BAFA (the Federal Office of Economics and Export Control) and subsidies for the use of alternative energy sources are advocated.

Incentivising financial instruments are multiple, complex and cover a wide range of situations, from the customer's point of view or in connection with projects. A streamlining of these supports would be welcome, particularly when various stakeholders (EU, national and local authorities) provide these incentives with different eligibility criteria. However, according to the **French** respondent, the priority should be to maintain the range of supports for customers and companies, in order to avoid any loopholes.

Some innovative financial instruments are starting to be used in **Belgium**, such as the one set up by a cooperative society (Energiris), which works with third-party investors. In the scheme, the third-party investor invests in the property of an individual, and will be re-paid through the energy savings that will be achieved. For example, an individual uses a third-party investor to carry out work in his/her home and will re-pay the third-party investor through the energy savings it achieves in his/her bill. This is mainly used for co-ownership properties and large buildings.

In **Lithuania** -as the national respondent said-, financial instruments are seen as complementary to the traditional grant-only financing, due to their revolving nature and the ability to attract additional capital from financial institutions and other providers (i.e. the leverage effect).

According to the **Spanish** respondent, the current idea/objective of Directive 2018/844 is precisely that new financial instruments will be consolidated as key renovation boosters, so that they should be implemented/transposed in this way.

Affordable and at the same time appropriately targeted funding will certainly contribute to the implementation of renovation projects. It also seems that private sector financiers (banking, insurance) have set sustainable development criteria in their funding. For example, **Finnish** banks and insurance companies have so-called 'green bond loan' financing, and such financial products are increasing. Special expertise and expert advice are needed to combine the different forms of financing.

In **Ireland**, national grants are available to assist with the in-depth retrofitting of homes. This requires the client to claim a grant of 30-50% of the costs when compliance with regulations is confirmed. Although financial Instruments such as green mortgages have recently been introduced, providing a slightly lower mortgage rate, the difference in the rate is not enough to encourage clients to participate. The Government has recently proposed that 500,000 homes are to be energy retrofitted, so increases in uptake by clients and possibly grants are expected in the next few years. This proposed housing increase will also require the upskilling of a significant number of contractors.

### *How could these financial instruments be promoted? Is there a legal framework that could contribute to its development?*

For the **German** respondent, promotion will derive from the creation of tax incentives for energy-efficient building renovation. On the other hand, for the **Slovenian** respondent, the best promotion would certainly be popularisation, transparent investment policies and allocation mechanisms, as they are too often closed and accessible only to a few.

The legal framework exists in **Belgium** for this type of initiative. There is therefore no need for new regulations. Some political parties also plan to launch a loans rate 0 scheme. But it is rather the responsibility of the political world than it is the legal world.

In **Lithuania**, the Government supports the Modernisation Programme through the Law on Support for Renovation, as amended from time to time. This support for Final Recipients currently includes a subsidy equal to 30% of the value of the investments in energy efficiency measures, which is used to pre-pay part of the outstanding debt of the Final Recipients at project completion. However, many financial instruments mainly designated for multiple apartment buildings face the following obstacles:

- apartment owners are poorly organised,
- a large proportion of owners are on fixed incomes,
- many low-income people were eligible for heating bill compensation and had no incentive to join the programs.

In the case of **Spain**, there is currently no specific legal framework. However, financial instruments should be promoted legislatively, especially for tax purposes, so the private sector is also involved. In **Ireland**, this is a cultural issue and not a legal one: it is important to convince people of the potential benefits.

## Conclusions

- There were **differences in the responses of different countries regarding the potential role of legislation in steering the market.** Some countries did not see any need for special measures while others considered legislation to still be important to achieve targets in the field of the circular economy and energy efficiency. More particularly, excessive legislation and regulatory requirements in the field of energy efficiency and the circular economy could impede innovation in the construction industry. **Legal requirements should be sufficiently balanced so as not to stop building activities, while boosting sustainability in the construction sector.**
- For example, the French regulation denominated "RT 2012" makes "Low-energy building" (BBC) certification mandatory when new buildings are delivered. However, producing BBC, i.e. producing almost waterproof buildings, requires building without thermal bridges and checking the perfect coordination of the trades at each stage of construction. This approach requires the reorganisation of the traditional construction sector.
- **Vocational training** in the construction sector was underlined as an **important factor concerning the transposition of Energy Efficiency in Buildings Directives.** More specific knowledge and skills of all the participants at all levels of the construction process are needed.
- **Public Authorities have to play a role in the field of energy efficiency and the circular economy** by continuously carrying out retrofitting interventions in public building optimisation and by considering **Green Public Procurement**. In public procurement, the lowest price is still the determining factor in project evaluation, although the principles of sustainable development criteria are used in many countries. The 'most economically advantageous tender' and life-cycle can be useful principles for implementing sustainability in the construction industry, although they would have to be applied in a suitable manner.
- It has been stated that one of the main obstacles to sustainable construction and demolition waste management is the **lack of standardisation and traceability for recycled materials and re-used products**.
- **Blending grants with financial instruments and tax incentives** has been recommended as the most crucial way of boosting energy efficient renovation in buildings and the circular economy in the construction sector

# Environmental factor

## General remarks

Regarding the environmental impacts caused by the construction industry, in recent years there have been steps towards reducing its environmental footprint. The introduction of sustainable construction is increasingly present in all phases of the construction process. Due to this, it is planned to reuse a large proportion waste, thereby improving energy efficiency and reducing environmental impact.

It is expected that in the coming years, the continued increase in the number of sustainable buildings will allow the environmental impact associated with the construction industry and the built environment to be significantly reduced. The introduction of new techniques and technologies in the construction processes will help the industry to follow the path of respect for the environment.

## Decentralised energy production

*Decentralised energy production models are being developed in Europe. In some countries, private households can also sell their energy for public use. However, this requires responsible and regulated operations and appropriate technology. How is this new legal framework shaping new business opportunities?*

Decentralised energy production (DEP) seems to be a way Blueprint partner countries are moving forward. However, legislation and the measures used to implement DEP differ. In all cases, however, the changes mean new work and business in the construction industry. The circumstances vary greatly between the different parts of Europe, which strongly affects the national measures that enable and support the emergence of new business. However, decentralised energy production models were widely seen as enabling business and shaping new business opportunities.

This is a very important and fundamental question as a driver for a positive development in energy efficiency. There is a need for regulations, suitable technology (two-way energy transfer), tax benefits and incentives. Financial support and new business models are needed to build a new production model. Once the operating environment and technology are ready, bidirectional energy transfer between the producer and the customer requires appropriate contracting and a fair price that the energy company is prepared to pay to the customer, according to the **Finnish** respondent.

In **Germany**, decentralised energy supply, which is often used by private households, naturally requires conversion work and infrastructure measures, such as cable ducts, cable connections and foundations for wind turbines, etc.

Decentralised energy production was said to be already the case up to a certain limit in **Belgium**. Following the changes in legislation concerning photovoltaic installations, which have seen a reduction in the advantages granted to households that install photovoltaic panels, this sector is experiencing a slowdown. However, it is essential to disseminate renewable energies as much as possible in order to reduce primary fossil fuel energy consumption.

In **Lithuania**, State support was seen as having a positive impact. Consumers are allowed to use energy coming from renewable sources for their own needs and to receive a reward for surplus energy supplied to the network. Together with some State support this would increase private investment in solar energy production capacity, so the construction sector would benefit from constantly increasing work on installations to increase capacity and renovate energy systems in buildings.

The above situation favours the creation and diffusion of intermediate operators (between the energy community and the network operator) who manage production, consumption, costs, the surplus produced, sales revenues, the functional efficiency of technological installations and, finally, the development of specialist management software.

In some cases, national legislation and regulations governing the production or distribution of energy may at the very least slow down development. This is the case in **Italy,** where at the moment it is forbidden to distribute energy from renewable sources produced inside residential and non-residential buildings.

On the other hand, legislation can have the effect of promoting change, as in **Spain**. Since 2007 the installation of Solar Photovoltaic and Thermal Energy Systems is mandatory in new buildings to provide heated water, giving rise to business opportunities for installers. Now the regulation has changed, making it possible to sell energy for public use, so that perhaps the demand for renewable energy systems will rise.

All in all, energy production is strictly regulated by law. There is a precise legal framework that governs the purchase of electricity production from private individuals at attractive prices in **France**. In addition, aid is granted to private individuals to enable them to purchase equipment to generate energy. The trend is towards self-consumption, and any surplus can be resold at regulated rates. However, there is an obligation to resell only to certified companies that belong to energy buyback programs. In addition, the photovoltaic panels used to produce energy must be installed according to regulations. The challenge is to encourage local authorities and citizens to participate in energy transition projects.

In some countries, the implications and potential of decentralised energy production are still under consideration, as is the case in **Slovenia**. Such appropriate technology already exists; the question is whether a given electricity distribution pricing policy makes it worthwhile. In **Slovenia**, the prevailing opinion is that it costs too much to invest in an individual solar power plant, or that the price of electricity is so low that it is not worth it.

Energy prices and costs generally drive evolution in **Greece**. The main question here is to identify opportunities and challenges for the implementation of business models for self-consumption, direct consumption, direct marketing, demand response, community electricity storage and net metering at the municipal level. The profitability of various decentralised on-site business models depends primarily on current statutory cost exemptions and compensation.

## *What is key to prevent DIY ('do-it-yourself') and unprofessional installations?*

Strict legislation and building control by local authorities as well as regulation are the main factors for the **Finnish** respondent. An effective legislative framework as well as the supply of analytical information to the public are the key factors to prevent unwanted installations, according to the **Greek** respondent. In **Spain** this does not apply, as the legislation is very strict and the sector is highly regulated. In any case, the important things are awareness, the dissemination of information and training and professionalization to avoid installations of this type.

The energy sold by private individuals essentially takes the form of electricity production in **Belgium**. The quality of the installations must be checked by network managers, who define the regulations to be respected.

One proposal would be to establish certifications for those builders who carry out specific works. However, there has to be an up-to-date register of certified builders that can be verified by the contractor. In the case of **Lithuania**, the Builder's Card developed by the Lithuanian Builders Association would be an answer to this question. This association is strongly advocating making the Builder's Card obligatory for all construction workers at a national level. The Card is linked to STATREG registry, which stores information about an individual's skills, qualifications, workplace, experience and other important data. STATREG is a register of the skills and qualifications of construction sector employees. It enables immediate proof of qualifications, and will prevent unprofessional construction and installation.

For the **Slovenian** respondent, the accessibility of professionally designed and manufactured devices, as well as the availability of data (instructions, plans and installed systems) and the transfer of experience with such devices is the key to prevent DIY and unprofessional installations.

## Increasing scarcity of raw materials and natural resources (water, energy) / Effective use of natural resources in the construction industry.

*Water management on site: Water use efficiency has also become an environmental trend in the construction sector. Which trades will be specially concerned by the new environmental demands concerning water management?*

Responses here were even more focused on the need to reform operating models that would have an indirect positive impact on the construction industry. Given that water will be strategically more important than oil in the future, according to the **Slovenian** respondent, this should be taken into consideration today. In addition, the state of water supply varies greatly from country to country. In **Slovenia**, for example (especially in households), they do not separate drinking and untreated water: cars are washed with the same drinking water as the one used to fill kettles, whereas in some countries, the collection of untreated water is already mandatory.

In this context, Two different views were observed in this context: one was more in line with northern countries, where there is no water shortage – even if this does not mean that water management should not be addressed -, while the other was perceived more by the southern countries, where there will be an ever-increasing need to build dual water networks in new buildings for the recovery of rainwater, in order to be able to reuse it for the uses permitted by hygiene regulations (irrigation, toilets, car wash, etc.).

This challenge is universal, but how can local conditions be taken into account when setting common and general goals? In **Germany**, for instance, the construction industry is not yet involved as an operative partner due to the implementation of the new Water Management Act. However, this means that the local water industry has to invest, which the construction industry can of course be the first to implement (hydropower plants, pressure pipelines, sewage treatment plants). The capture and reuse of rainwater is essential for the rational consumption of water in **Belgium**. Plumbers and roofers are the two trades most impacted by this in the construction industry. They control catchment, storage in the rainwater tank and the double network (drinking water and reclaimed water). For industrial use, the recovery of non-potable water is more complicated because the water must very often meet highly demanding standards (for example for the manufacture of concrete, it is necessary to avoid water acidity, which must be of a certain pH).

A similar trend is also observed in **France**, where the challenge is to encourage local authorities and citizens to participate in energy transition projects, including the systematic treatment of reused water by construction companies. To reinforce good practices in this field, in January 2017 the French Environment Agency and Energy Management (ADEME) published an appropriate guide.

There will be an ever-increasing need to build dual water networks in new buildings for the recovery of rainwater in order to be able to reuse it for the uses permitted by hygiene regulations (irrigation, toilets, car wash, etc.). Moreover, it is increasingly urgent to find economic solutions for the installation of small domestic/communal purifiers, so as to be able to extend the use of grey water without prejudice to health, according to the **Italian** respondent.

The new trend is to consider water-use efficiency during the whole life cycle of a building. This affects the architects and designers of the building. Efficient water management is fundamental in all sectors. With regard to the jobs that will be particularly affected by new environmental requirements in water management, the specific aspects of the same should be analysed and identified, as the **Spanish** respondent pointed out.

In **Ireland**, water efficiency and conservation is either not generally specified, or it is overlooked by planners and architects, so that many plumbers still install inefficient fittings, especially in the domestic sector. In larger commercial projects greywater installations are often specified within the green public procurement process, as they endeavour to achieve sustainability or an energy efficiency rating. Designing and installing water conservation measures is often left to plumbers, electricians and site managers on site, or which trades make decisions in this area. More needs to be done to promote awareness in this field, although energy efficient and water conservation fixtures are becoming increasingly available.

According to the **Greek** respondents, the main water users in construction sites are considered to be site cabins and temporary accommodation; general site activities including tool washing; wet trades, such as brickwork, screeding, concreting and plastering; groundworks, including grouting and drilling; dust suppression, including road and wheel washing; hydro-demolition; cleaning of tools and plant equipment, lorry washing and commissioning and the testing of building plant and services.

### *How will companies, and more particularly SMEs, be affected by the growing scarcity of available resources? How could they manage this?*

Management of the scarcity of raw materials is inseparable from the notion of the circular economy. While there are many approaches to the circular economy, it aims to change the paradigm from the so-called “linear” economy, by limiting resource waste and environmental impact.

The **German** respondent stated that for construction industry member companies, this is not the primary question; regarding raw materials, the country already has a shortage of binding agents (i.e. sand and gravel), which in turn leads to higher transport costs because these binding agents have to be transported from further away to construction sites. This results in a higher price, which is then passed on to the client accordingly.

This issue can also be seen as a possibility for new activities and businesses, as in **Finland**. The growing scarcity of available resources could be a market economy driver. Certainly there will be companies (and also SMEs) that will identify the opportunity and start developing new businesses.

The Ministry of the Environment is currently collecting a national material bank and has prepared a road map for low-carbon construction. Legislation is under preparation to support the development of the circular economy.

The growing scarcity of available resources may also inspire companies to develop new methods and technologies that consume less material. The **Belgian** respondent has stated that sand for concrete is becoming scarce, so there is a need to question the techniques that were used beforehand, and to reduce the use of raw materials that are disappearing. It is necessary to be inventive, and this is the responsibility of designers and material manufacturers. The same opinion was expressed by the **French** partners. These respondents note that the new materials that are increasingly used in the construction industry will have a greater impact on the development of more sustainable and greener buildings. As an example, insulation can require the use of new materials made with natural or recycled components. New materials can also reduce the scarcity of some resources that are widely used in the construction sector to date.

In **Lithuania**, many companies are aware of the scarcity of available resources and in this regard are encouraged by the Government to implement actions to save them. Moreover, **Lithuania** is taking further steps to shift to the circular economy. However, waste management remains a challenge.

The **Greek** respondent believes that resource scarcity can have a positive effect in the form of incremental but not radical innovation in SMEs. Thus resource-constrained SMEs, especially those that struggle with limited finances, should concentrate their innovation activities on incremental rather than radical innovations.

The **Italian** respondent talked about certain concerns regarding water shortage. Many industrial processes need large quantities of water. Companies that use such amounts of water are at risk and must first draw up an adaptation plan, and must also invest in research to maximize water recovery systems.

Many of the challenges of sustainable development are intertwined. The sufficiency of raw materials is also linked to the potential of the circular economy to reuse building waste or demolition materials. This issue was highlighted, inter alia, in the **Spanish** reply. From a legislative point of view, the reuse of certain materials is very complex, mainly because the Ministries of Environment and Housing and Public Works often apply what is known as the 'precautionary principle': guaranteeing safety and the protection of health and the environment; the difficulty derives from the fact that there is no single entity that guarantees that recycled materials have exactly the same properties as new materials. Moreover, legislation differs from one region to another, which makes it even more complex to reuse construction materials. It is essential to work on the certification of recycled materials; without this certification it is difficult to work with them in construction.

### *What can be done to anticipate the effects of the ongoing decarbonisation process in the construction industry?*

First of all, the source of CO2 emissions in construction must be analysed. If we exclude the emissions of the buildings themselves (which constitute the vast majority of total emissions), we can consider the materials used. As such, manufacturers have a vital role to play. It is also necessary to review the organisation of enterprises, particularly with regard to their fleet of vehicles and the movement of workers, but also with regard to the consumption of the buildings they occupy or

the source of the materials they use, for instance. If companies want to anticipate legislation, they must first perform a CO2 emission assessment, site by site, and see how they can reduce their overall emissions. In any case, the emissions due to transport are still too often forgotten when calculating carbon emissions, according to the **Belgian** respondent.

National legislation is also being prepared, as was explained by the **Finnish** respondent; the Ministry of the Environment has a roadmap for low-carbon construction, and legislation is under preparation to support the implementation of decarbonisation in the construction industry. The industry has its own interest in low-carbon construction and is constantly developing. The direction of development has changed and the future looks better. Development work is being carried out at many different levels: legislation, trade unions, research and development, industry associations and companies themselves. BIM can play a crucial role as a tool in calculating the CO2 footprint (over the long-term/entire life cycle of a building).

In **Lithuania**, cutting industry's carbon emissions will require significant investment and coordinated effort among businesses, government, and other stakeholders. It is necessary to build-up renewable-energy capacity to cope with the decarbonisation challenges in energy-intensive industry such as cement production.

The **Slovenian** respondent indicates that training is needed to produce lasting change. It is necessary to think about it from the design process onwards. These topics should also be covered at all levels of education. Most can be achieved through quality education and individual awareness, as they have to understand the issues arising from the carbon footprint of activities and the importance of protecting and preserving the natural environment.

The Irish respondent believes it is necessary to upskill the workforce in low-carbon construction and decarbonisation, making sure that trades and the construction industry itself are ready for what will come next. Ireland is acknowledging decarbonisation and is moving in this direction through innovation and research. Life Cycle Assessment (LCA) is becoming more widespread in larger projects, as public bodies and international organisations are pushing for LEED or BREEAM ratings to improve and achieve a green corporate image.

According to the **Greek** respondent, an all-embracing roadmap to decarbonise construction could be implemented, and could show the way to the stakeholders involved on how to work together to deliver a net zero carbon environment by 2050. Industry points to some successful examples in challenging traditional ways of working, such as in the quarrying industry through developing new concept machinery (electric machines), working methods and site management systems which together form a complete solution.

The **Italian** respondent said that it is necessary to reorganise the sector so that it becomes a core actor in responding positively to this challenge and not, as it was until now, opposing any such reaction. In particular this would involve the management of aggregates from the building industry, making them more suitable for reuse, and setting up industrial alliances with recycling sectors.

Finally, it is already planned to implement Directive 2018/844 for 2050 in **Spain**, in line with the report Bringing Embodied Carbon Upfront by WGBCE. The **French** respondents said that this topic must be tackled in greater detail by all of the stakeholders concerned, including the conditions under which the European directive can be implemented.

## *What will be the key factors in order to foster more energy renovation projects?*

This question was dealt with in a number of different ways in the answers of the professionals who were consulted. At a general level, a clear plan at national level and public funding to support implementation were seen as key measures. There is the need for a national renovation program and an action plan to implement, while financial incentives will play a major role. Energy renovation projects should be commercially viable for construction companies as well as attractive for property owners.

Currently relatively little energy renovation work is taking place in **Finland**. Previously there were energy tax subsidies, but not at the moment. The national renovation programme and action plan are under preparation.

The **Lithuanian** government supports the renovation and modernisation of multi-apartment buildings through various financial instruments and state aid support. However, since apartment owners are reluctant to take out loans, municipalities should act in more proactive way and promote quarter-renovation projects, as this will help to gradually phase-out heating bill compensation payments.

The **German** construction industry is dependent on the public sector for this, and it is certainly up to the politicians to increase the benefits of new methods and innovations in energy efficiency.

The **French** respondent said that it is necessary to have clear objectives. The construction sector is largely involved in the ambitions in this field. For instance, in terms of waste management: reducing the quantity of household waste by 10% by 2025, stabilising the quantity of industrial waste and reaching a 65% rate by 2025 for recycling so-called non-hazardous waste are all pragmatic goals.

The **Belgian** respondent also emphasised that the cost of renovation will always be lower than new construction. Renovating a building in Belgium costs a maximum of 1000 €/m2, whereas a new building costs from 1500 €/m2 to 1800 €/m2. People should be encouraged to invest in their own building, even though everyone cannot afford this. Energy costs could be reduced drastically.

In **Italy**, the keystone is the possibility of installing and distributing off -grid systems, which are now out-of-the-ordinary, and also giving certainty to incentives for energy requalification, so as to guide the sector towards a profound change in technical skills and abilities.

The **Irish** respondent stated that Local Authorities find it difficult to justify renovation rather than demolition, but they are beginning to accept that cost decisions should be balanced with energy efficient, healthy buildings and community integration. It is stated in the recent climate change manifesto that public bodies are to set a precedent in the market for deep renovation. For private home owners a deep renovation project can be funded by carrying out a financial review and combining this with public or private funding. A number of financial institutions are now providing the option of attaining green mortgage assistance for deep renovation works. A phased deep retrofit approach is also available using building renovation passports (BRP) and these will be piloted in Ireland in 2020. Additionally, deep renovation requires a change in mind-set, not just in the construction industry but also by homeowners. For the trades it is recommended to identify

what can be done to achieve construction quality, how to get the right skills and know where to find them. It is important to show homeowners how to reduce their energy bills and usage, describing how to create an energy efficient deep renovated home within an affordable budget.

Finally, the **Spanish** respondent said that it is of key importance to change minds and not talk only about energy-efficiency renovation, because people associate this with energy saving as the only reason to renovate: to save money. But the reality in many European countries is that energy/money savings come in the long term. If instead of talking about energy renovation, we talk about renovation in order to improve comfort, health, accessibility, safety, etc., energy renovation is not seen as an investment that needs to be recovered, but rather as an investment in well-being. Moreover, construction would be seen as a sector that improves people's quality of life, making renovation more attractive for investors. In any case, awareness, ease of financing and a guarantee of the implementation of effective energy efficiency measures are needed.

*To encourage retrofitting of green energy efficient buildings, do you believe Building Renovation Passports (BRPs) will be decisive? If so, which factors will be of key importance for their deployment? If not, which other strategies could be implemented?*

According to the **German** respondent, the introduction of a BRP will not be decisive in promoting the retrofitting of green energy-efficient buildings. A passport (in addition to the existing energy pass) is at most another argument for the sale of a building, and only then does it bring benefits. For existing buildings that are not to be sold, the owner would therefore have to be offered other incentives for energy-efficient retrofitting. These could take the form of, for example, of tax or insurance-related advantages, which would, however, have to amortize the investment costs.

The **Belgian** respondent indicated that BRPs are quite relevant, as they provide an inventory of the consumption of the building and its evolution over time. This should encourage owners to manage their own buildings. What will be interesting for owners is to renovate gradually, so as not to have to invest a large amount at the beginning. The cost of renovation remains the main brake.

The **Lithuanian** respondent also stated that BRPs will be decisive. Therefore, the implementation of "Level(s)" (a common EU framework of core sustainability indicators for office and residential buildings) methodology as minimum sustainability requirements should be the first step in EU member countries. Tax payments should be reduced for all project stakeholders when good results are achieved. During the evaluation of public procurement tenders an additional point should be awarded for the introduction of innovations related to Green building Sustainability.

However, even though the **Italian** respondent considers BRPs to be useful for, in Italy problems still arise due to uncertainty, as there is no strategy of skills development in the sector capable of guaranteeing with the performance to be achieved.

The **Slovenian** respondent said that the introduction of BRPs must also be consistently implemented; it is a bureaucratic obstacle without any benefit. If energy taxes were also based on energy performance certificates and land policies, this would help to enforce them.

For the **Irish** respondent it is very important that BRPs are linked to awareness campaigns, financial support, transparency and available resources and advice: "people would buy a car by checking it out first, and yet they do not do the same for a house". The key component for the acceptance and success of BRPs is to ensure that a clear awareness campaign is strongly supported

by the Government, with easily accessible relevant links and advice that is easily available. Future building owners will gain great support from this.

The **Spanish** respondent believes that BRPs are really important and should be integrated with the Technical Building Inspections.

The **French** respondent indicated that currently it is not easy to measure the impact of the BRPs, but this is the way to go. The existing indicators must become still more precise and specific to each activity.

In **Finland**, BRPs have not been tried and therefore there is no experience of them, although it could be a useful concept. Finland's building stock is mostly new and was built after the Second World War. Nevertheless, the need for renovation and improvement of energy efficiency in old buildings has been identified.

## Circular economy

*What kind of national initiatives or measures could be put in place to encourage the circular economy in the construction industry? What is hindering its development?*

Management of the scarcity of raw materials is inseparable from the notion of a circular economy, according to the **French** respondent. While there are many approaches to the circular economy, it aims to change the paradigm from the so-called 'linear' economy by limiting resource waste and environmental impact. The aim is therefore to produce using less material and to promote the reuse of raw materials by recovering them. In this context, waste management takes on a new dimension. In addition, the law provides for the drastic limitation of plastic production, the penalisation of programmed obsolescence and the fight against food waste, etc.

Benchmarking to support the circular economy should be included in public procurement in **Finland**. More know-how and knowledge are needed in order to have sufficient subscribers in the future. Experts must also be trained. The growing scarcity of available resources could also be a market economy driver.

The **Greek** respondent enumerated a series of initiatives: the creation of a National Road Map for the Circular Economy; the need for public and private cooperation; citizens' education towards cultural change and special emphasis on consumer education. It was also stated that the legislative framework for the circular economy in Greece has to align with European directives to address the resulting problems. It would be beneficial to set up a material management network with an aim to reuse materials and market them, avoiding the unsustainable landfill solution as much as possible. Other measures could include the creation of an electronic platform for recyclables, where it is possible to search and bid for materials; reduce taxation and provide incentives to facilitate the waste management process. Finally, the construction industry should shift to cheaper materials that break down more easily (e.g. steel structures) replacing traditional materials (e.g. concrete).

**Lithuania** supports the EU circular economy package and the shift to the circular economy in general, although it needs to take further steps in this direction. As of 2018, there is no national strategy or roadmap on the circular economy. New circular economy targets on waste will be integrated into the National Waste Prevention and Management Plan for the period 2021–2027.

Encourage waste recycling but also always encourage renovation, since renovating reduces the amount of waste compared to demolition. In **Belgium**, an environmental performance measurement tool (TOTEM - Tool to Optimise the Total Environmental impact of Materials) has been created.

The **Italian** respondent commented on regulatory aspects. Professionals need to improve their knowledge of the materials derived from recovery processes so that they can be used for new projects. The company must be authorised by the designer to use materials derived from certified recovery processes. The problem in **Italy** is linked to the fact that the disposal of inert waste without recycling is still prevalent, and much of the waste is disposed of illegally. It is necessary to intervene here and as well as on specifications, increasing the minimum targets for the use of materials from recycling in order to have a product offer and a market.

The **Spanish** respondent said that although the circular economy aims to save natural resources (non-renewable raw materials), management must be sector-specific, that is, each sector must identify exactly what it needs in terms of both resources and costs. Difficulties are considered from the technical and legal points of view, and the Administration should speed up the pace of working on what is called 'End of waste condition' in asphalt paving and concrete milling.

The circular economy is based on the concept of a positive material cycle, which aims to reuse, repair and recycle existing materials and products. This claim is often cited in theory, but in practice it is misunderstood and underused. In this context, the **Slovenian** respondent believes that the main obstacle is that the term 'circular economy' is interpreted in different ways in construction, and it is also misunderstood. So one possible measure would be to explain and popularise it.

*In terms of business opportunity, what facilities, infrastructure, technologies and legislative support will be needed to make use of its potential for growth and employment?*

Although this question is very practical in principle, the drivers for the various measures seem to be based on fundamental values. This is especially so for those that do not damage the environment and are still economically viable, as was stated by the **Slovenian** respondent.

Business opportunities in the field of the circular economy are considered to be unlimited by the **Finnish** respondent. Developing a new business is risky, but the public sector can reduce the risk through its own support measures and risk funding. Demand can be created by the public sector. Political guidance can also enable new business, with the concrete example of tax incentives (tax benefits for products). Training is needed at all levels and trades.

The concept of the circular economy is still a new business model, and as a multidimensional and large concept it is quite challenging to comprehend. Good practical examples are needed to demonstrate the circular economy in practice. In the field of construction, it may be easier to work in 'short circuits' rather than a circular economy (recovery of construction waste, reusing the bricks from one building site in another). But it is already highly valued now by the **Belgian** respondent.

The most practical way to tackle the circular economy seems to be to look at waste management and to start developing it as part of a larger drive. According to the **Spanish** respondent, there is a need for waste management facilities, although regional administrations are not making things easy (Regional administrations, in many cases due to lack of knowledge, do not allow construction companies to improve construction and demolition waste management, making it easier to reuse

materials). Sometimes environmental/social aspects clash with economic ones that generate employment: it is necessary to look for balance at this respect. With regard to European funds, there are also difficulties, since in Spain co-financing is applied, which makes things difficult, because due to the crisis, many Spanish public administrations are not able to pay their share of co-financing. An important aspect is public-private cooperation in terms of investment.

In **Ireland**, end of life and Life Cycle Assessment (LCA) often creates new products and new growth. The Climate Action plan 2019 recently included Environmental Product Declarations (EPDS) in the Green Procurement Process GPP, and LCA is required on a voluntary basis. In larger projects, a waste management plan has to be implemented to ensure minimum wastage and maximum efficiency, and this has led to the development of a new role within organisations. The encouragement of lean construction within the construction sector has also led to the drive in innovation and employment within new construction businesses, and this has also promoted other drivers such as those within agriculture.

In the context of various factors, some respondents emphasised the importance of cooperation in promoting development, as in the case in **Lithuania**, where there is a need for strong collaboration between business, education, research and public institutions. Therefore, business and research organisations need new competences, which could be supported through Public institutions and Government aid (including the use of developed solutions and strong financial support). Moreover, SMEs need more and simpler support for growth and expansion. The Government could play a more active role.

In general, public sector guidance and expert assistance were seen as important by the **Italian** respondent. The role of the public will be decisive, as CAM too could be if it is strengthen, to orient procurement and push for innovations in processes capable of creating a driving effect, in the private sector, too.

Finally, the **French** respondent indicated that although opportunities of this kind potentially exist, infrastructures may vary from one region to another, preventing uniform growth in terms of business opportunities. Public policies exist, but their local translation into concrete actions must become more efficient.

## Climate change

*Climate change may imply a significant risk for buildings and infrastructures. The construction industry can play a key role in adaptation and mitigation to prevent and reduce its adverse effects. What kind of national initiatives or measures could be put in place to encourage the role of the construction industry in fighting the adverse effects of climate change?*

The **Finnish** respondent indicated that building will never be carbon-neutral. This major question should be considered nationally and internationally as a whole, taking into account different possibilities of compensation (emission trading). Reducing emissions should take place where it is sensible and possible and produces the best result. It is useful for the real estate and construction sector to establish cross-sectoral partnerships and cooperation to address these challenges.

Because of the major the role of the construction industry in this issue, measures at national level are highly justified. Political framework conditions must be created which financially support

this objective and which are profitable enough to encourage investors in this regulation, in the opinion of the **German** respondent.

The **Lithuanian** respondent stated that climate change is directly linked to emissions: higher energy efficiency or sustainability in projects, will result in less Greenhouse Gas Emissions. Moreover, the Government has to apply additional incentives within its procurement process for companies that have achieved higher energy efficiency or sustainability in their practice within construction projects. The Government has to encourage BIM methodology implementation and use.

However, policies at a national level need to be put into practice. This requires effective cooperation with different actors. Adaptation and mitigation plans should be developed with an integrated approach, i.e. including the management of urban, building, but also socio-economic, digital and cultural aspects. According to the **Italian** respondent, owners of buildings should be rewarded if they have good practices. It would be more effective to set up a system of surcharges (social security, tax, insurance, etc.) for companies in the event that they construct buildings that perform worse than the standards. Cities should be urged to approve adaptation plans, with specific attention to buildings, public spaces and infrastructure, which are increasingly at risk, while today it is possible to implement projects to make spaces safer.

It is good to remember that climate change is a global phenomenon that is influenced by choices other than our own. The **Belgian** respondent remarked on the climate, indicating that, for instance, **Belgian** climate change will lead to a more continental climate (colder winters and hotter summers). In fact, the choice made in Europe for very good thermal insulation of buildings makes them less sensitive to heat and cold.

The most important thing, in the opinion of the **Spanish** respondent, is to raise awareness and adapt the way buildings are constructed. The problem is that the construction industry is a very traditional sector. An example of a measure that could be put in place to encourage the role of the construction industry in fighting the negative effects of climate change is road maintenance: if they roads in poor condition vehicles emissions increase by 30%; thus, although electric car use is encouraged, road repair should be the first measure to take, since if they are in poor condition car use, even if they are electric, is much less efficient. Another measure would be that it is important that sustainability is not perceived to be an extra cost by companies, so there should be incentives for them.

According to the **French** respondent, stronger environmental requirements are needed, including the use of low consumption and more energy efficient buildings to mitigate climate change, as well as development of the circular economy to lower raw material consumption. These would be the right route for evolution of the sector.

The **Irish** respondent said that various initiatives in the recent Climate Change Plan should be implemented:

1. Mitigation –

- The need to increase the energy skills of construction workers through upskilling the existing workforce and training new workers in energy awareness and skills.
- Ensure that NZEB constructions (a legal requirement since Nov 2019) are compliant and of suitable quality, by managing site supervision and monitoring.
- Encourage the uptake of energy efficient deep renovation by building owners.

2. Adaption –

- Creating balance as to prevent local or national negative impact, by updating sustainability plans regularly and enforcing proposals.

The **Greek** respondent mentioned more concrete measures, such as choosing materials with lower embodied carbon and sourcing materials from suppliers that are transparent in regard to the composition of their products; better design; using waste and recycled materials; extending the lifespan of buildings; a longer lifespan delays and reduces the embodied carbon associated with deconstruction, demolition, waste processing and rebuilding; and increased use of prefabricated elements and offsite manufacturing.

The **Slovenian** respondent said that it is important to bear in mind that the biggest problem is the industrial logic of thinking (based on mass production and unification) which leads to environmental incompatibilities. Although technological possibilities, digitalisation and computerisation (virtual reality) are increasingly used for buildings, this may lead to a collision with the logic of the natural environment and the qualities of space.

*In terms of business opportunity, what facilities, infrastructures, technologies and legislative support will be needed to seize all its potential for growth and employment?*

Modern technological solutions are already on the market and new ones are being developed all the time. It is beyond the scope of this document to discuss individual technologies. There is no doubt that more knowledge is needed. There is a growing market for expert services in this field: a range of consultancy services, including those for design, evaluation, calculations and technical solutions, etc., according to the **Finnish** respondent.

The **German** respondent indicated that the representatives of the construction industry can only demand measures in the industry by creating new and innovative opportunities in vocational training and education. The German respondent also believes that the government should increase the use of digital technologies throughout Germany.

The **Lithuanian** respondent believes that the government should encourage the adoption of digital technologies while paying due attention to their economic and social impact, such as the Internet of Things, cloud computing, Artificial Intelligence (AI), robotics and blockchain, etc. Companies more than ever before need to place the climate challenge at the heart of their business strategy, investments and operations. In this regard, finance for low-emission and emission-free technologies and resilient energy systems plays an important role.

**Ireland** needs a long-term commitment to renovation, not just a short term approach, in a way that will incentivise people to renovate in an integrated energy-efficient manner. After the crash in 2008, many believed that their jobs would not be long term, so renovating their buildings was not a priority and this therefore reduced any incentives for business opportunities. Local Authorities did not choose to renovate their buildings, as it was more cost effective to demolish them instead. However, a recent move to renovate and reduce construction waste has reversed this trend. This flexible approach is due to the recommendations in the Climate Action plan 2019.

The **Greek** respondent said that Business opportunities are expected to arise mainly for: enterprises engaged in the production and marketing of solar panels; enterprises producing and marketing energy-saving equipment and materials; enterprises in the non-metallic mineral production industry making insulating building blocks; construction companies and related service companies.

The **Italian** respondent indicated that adaptation and mitigation plans should be developed with an integrated approach, i.e. including the management of urban areas and buildings, as well as socio-economic, digital and cultural aspects; these should be mandatory at the municipal level, such as they are in the Master Plan, and there should be a public state fund to provide municipalities with the resources necessary to develop them.

The **French** respondents express similar opinions and point out that the circular economy is recognized as one of the objectives of the energy and ecological transition. This concept was introduced in the Energy Transition for Green Growth Act of 2015. This will certainly create additional opportunities in terms of economic growth and employment.

## Skills

*How could integration between different trades be improved to achieve more effective interventions in energy efficiency?*

It is well known and generally proven that innovations are created at the interface of different skills. Cooperation between different levels of education and different sectors will be important to keep up with development, especially when it comes to major fast industrial changes. However, the implementation of new competences requires both experience and know-how to ensure the effectiveness of the training in new skills. Increasing knowledge and awareness has been seen to have a positive impact on the cause of environmental problems. The **Lithuanian** respondent believes that public awareness campaigns that provide clear information on how to save energy in a cost-effective way and encourage consumers to act can be effective in changing attitudes and encouraging action. The **Slovenian** respondent thinks that stakeholders should be shown the importance of their work and contribution to the energy efficiency intervention process. In addition, everyone should have a certain level of understanding of the principles of energy efficiency and the importance of connections between sectors in order to achieve a common goal.

Know-how and special skills need to be increased. The question can be approached from two different directions, according to the **Finnish** respondent: 1. Vocational training provides an opportunity for individual studies that provide the basis for combining the necessary (multidisciplinary) skills, or 2. Partners involved in construction projects are contractually guided to work more closely together to achieve key goals. Cross-sectoral project management would be the way to put new contract models between partners into practice. On the education side, a good way is to connect students from different fields to work in collaborative projects.

Education and training can play an important role in strengthening energy efficiency principles. Awareness-raising campaigns for the population, as well as specific training courses on how to improve the energy efficiency of companies, can be given as examples according to the **Lithuanian** respondent. The **Spanish** respondent added that platforms for sharing sectoral knowledge could be put in place to identify the most urgent training needs. In addition, always take BIM into account, as a key element in the coordination of activities during the construction process.

It is very important to integrate the concepts of energy saving in the basic training of designers or entrepreneurs. Training must be present at all levels to attain effective achievements on the ground. In addition to training, there should be monitoring of field work. As long as the work is not checked, entrepreneurs may not feel concerned, in the opinion of the **Belgian** respondent: in Belgium the energy laws and regulations do not require a control of the finished works.

In order to be more practical it was emphasised by the **German** respondent that the BIM method in particular is a cross-discipline tool that is able to compare and coordinate working between different trades.

A database of the skills required for energy transition has been developed in **France.** Digital methods and instruments can also be learned 'playfully' and easily to overcome any fear of them. Thus, virtual, augmented & mixed reality could be a way of including energy efficiency, especially on construction sites. Scenarios of different options of building evolution in a changing urban landscape could be helpful to imagine desirable and feasible futures, if end-users and manufacturers could interact to find the pros and cons and forge consensus.

*Which improvements will VET need to deliver updated and effective training for the circular economy needs? And the energy efficiency-based construction industry?*

From the replies provided by national respondents, it can be concluded that the different education systems and their current situations vary widely. Inevitably, the question arises of how the development of competence can be adequately implemented in the education and training systems of different countries. According to the **Finnish** respondent, new educational and training programs have to be developed, together with cross curriculum skill diversification , increasing building technology (HVAC) and automation, collaboration between different educational structures and levels (VET vs. Colleges vs. Universities vs. Applied Sciences vs. RDI).

The **German** respondent stated that educational institutions are to place increased emphasis on sustainability and environmental compatibility within vocational education and training. This starts with waste separation and does not end with optimised logistics, i.e. bringing the materials to the construction site just in time. What can be seen is that trainees are much more likely to accept and pay attention to these problems and tasks than was originally assumed. This is a topic that is of great interest to young people, especially those in training, and they are enthusiastic about it.

These notions have already been incorporated into technical and vocational training in **Belgium**. The **Belgian** respondent thinks that young people must understand the importance of the actions they take and their consequences in terms of airtightness and thermal insulation, etc. But additionally, it would be necessary to impose continuous training for all active entrepreneurs. This reality is even more important for SMEs.

VET will inevitably have to adapt to the needs of the circular economy and energy-efficient construction. The application of BIM methodology will allow modelling of the energy consumption of buildings, according to the choice of materials and elements in their design and/or renovation. VET is soon going to face the transition from the current so-called linear economic model to the circular economy, the principle of which is the efficient use of resources. VET needs to address these challenges by upskilling the staff members, upgrading training programmes and methods and strengthening the potential of work-based learning, in the opinion of the **Lithuanian** respondent. Systematic changes are needed to enable vocational training institutions to respond qualitatively to

labour market needs. First of all, the burden of regulating the teaching process should be reduced. Secondly, there should be a reliable system for monitoring external changes. This is not about monitoring initiated at school level, but about a national system involving all vocational schools.

According to the **Italian** respondent, it should be obligatory to plan at least one public procurement for each construction category every year (one for the road category and another for the infrastructure category, etc.), in order to organise worksite-schools. In this way, Vocational Education and Training would be more practical, more effective and more participatory.

Some practical replies arose in answer to this question. For instance, the **Spanish** respondent stated that it would be good to implement specific modules on waste management, energy efficiency, sustainable materials, etc., in all vocational training in the sector. Furthermore, as NZEB and lean construction courses are available in Ireland, the **Irish** respondent commented on the need for training in CE with more training on LCA, renovation BRP and understanding new materials (body impact). It should be noted that energy efficiency, sustainability and CE training should be within the core of the course, while additional specific modules should be introduced that are relevant for specific trades. Additionally, trainers/lecturers should also be upskilled in these fields. Workers need to be incentivised to train and upskilled by trusted training bodies, but this needs to be enforced through GPP or the Sustainable Energy Authority of Ireland, SEAI Grants.

The **Slovenian** respondent said that everyone who teaches and participates in the learning process should have similar backgrounds and attitudes towards the circular economy. We should integrate acquired knowledge and adapt it to the needs of the circular economy and energy-efficiency in the construction industry.

The **French** respondents point out that digital skills will be essential to elaborate long-term development strategies that would include increasing numbers of energy audits, the circular economy or specific industrial programs for all types of professionals. Modularisation and individualisation of existing and future training programmes are also essential.

## Conclusions

- **Building Renovation Passports are seen as useful tools** to accelerate the retrofitting of the existing building stock. However, the cost of renovation remains the most important element in determining retrofitting decisions, so that financial support and new business models are needed.

- **Strict legislation is one way to prevent Do It Yourself (DIY) and unprofessional installations in construction**. These measures should be accompanied by actions aimed at increasing awareness and information in the sector.

- **Efficient water management is a key topic** in the whole life cycle of buildings. In the future, there will be an ever-increasing need to build dual networks in new buildings for the recovery and use of rainwater. Moreover, it is increasingly urgent to find economic solutions for small domestic/communal purifiers in order to extend the use of waste water without prejudice to health.

- **Many of the challenges of sustainable development are intertwined**. The sufficiency of raw materials is also linked to the potential of the circular economy to reuse building waste or demolition materials. The growing scarcity of available resources may also inspire companies to develop new methods and technologies that consume less material.

- **In the field of the circular economy, legislation differs from one region to another**, making it even more complex to reuse construction materials. It is thus essential to work on the standardisation of recycled materials and reused products, so that the installation market can consider them safe and reliable. Other measures could be the creation of an electronic platform for recyclables, where it is possible to search for and bid for materials; reduce taxation and provide incentives to facilitate the waste management process.

- **VET is soon going to face the transition from the current so-called linear economic model to the circular economy**, the principle of which is the efficient use of resources. VET needs to address these challenges by upskilling their staff members, upgrading training programmes and methods and strengthening the potential of work-based learning.

- **Updating the current training model is crucial to increase the sustainability of the built environment**. Specific modules on waste management, energy efficiency, sustainable materials, etc. should be developed in all vocational training in the sector.

## APPENDIX 1. RELATIONSHIP OF QUESTIONS PER FACTOR

The following questions have been proposed by the partners for each of the factors. From them, the WP leaders selected the most relevant to be part of the questionnaires that were finally conducted among national respondents.

### *POLITICAL FACTOR. Questions proposed by partners:*

- How does the government support actions in favour of sustainable development that could influence directly the conjuncture in the construction sector? What are the priorities?
- How do the professional associations adhere to the national priorities?
- What kind of political initiatives could contribute to the reduction of territorial fracture and how the construction sector could take advantage of it?
- How do the policy-makers switch form the logic of formal training paths based on training contents to the logic of training outcomes and individual professionalization?
- How should the main orientations in training for trades and for skills evolve?
- To what extent do you consider that incentives and other economic/political measures implemented by the governments may facilitate the reactivation of the construction industry?
- Can you think about any consequence derived from these type of programmes (State Housing Plan 2018-2021) that could negatively affect the sector?
- What could be done by the policy-makers to get countries to effectively adopt and implement initiatives such as the 2030 Agenda for Sustainable Development and similar initiatives that may have an effect on the construction industry?
- What are the policy options to ensure the availability of a skilled workforce in the construction sector on a sectoral basis?
- What measures and / or funding model can society promote structures for continuous learning? What obstacles should be removed to ensure flexibility in updating skills?
- What, in your opinion, should be done at a political level in order to regulate and manage the circular management and energy savings in practice, so that the movement towards circular management is more visible and that individuals (legal and physical persons) are compelled to act in this direction.
- Do you think that it would be necessary to introduce additional taxes on industry, which is now engaged in the production of less energy-efficient products in terms of energy waste and pollution and financially encourage companies that produce products on the way to a recycling. What would be a necessary basis for not staying solely on a theoretical level?
- How much soil consumption is a factor of influence s positively / negatively the activities of operators?

- Some surveys show for the next few years a trend towards concentration of population in urban areas. Is this tendency confirmed in all countries? If so, what action should be taken to relaunch urban policies aimed at citizens?

## *ECONOMIC FACTOR. Questions proposed by partners:*

- How should the deregulation of the construction market impact the vocational training market?
- How to ensure the visibility of activities developed by foreign companies that internationalize their activities by crossing borders and becoming subcontractors to domestic companies?
- How are companies preparing to win large contracts? The training system provides them with sufficient support?
- How is the notion of customer need understood in the changing economic context with a strong competition, especially concerning SMEs?
- What are the main obstacles that may hinder the industrialisation process in the in the construction companies?
- What is, in your opinion, the future perspective regarding industrialisation? How will be its evolution in the sector?
- What will be the role of modular, off-site and light construction? How do you imagine its evolution?
- How to improve energy efficiency requirements and criteria in public grants and funding? How are they been allocated? Are the criteria improvable? There are lagoons that may be weighing their effectiveness, for example: quality requirements and professionalism to undertake the funded works. Or the extension of the interventions: most of the financial aid is for limited works, while to reach significant energy savings renovations should be integral.
- Are craft businesses aware of the benefits of the internet? What can they do to improve the access to the internet? How is the situation in your country? How do craft businesses in your country use the internet?
- How to make renovation more attractive to companies and their business? Which financial instruments would best support renovation?
- What factors contribute to the industrialization of construction? On the other hand, what slowdowns or obstacles do you see for the growth of industrialization in construction?
- Do you think that the decision of an individual industry to direct its action to the principles of circular management is already sensible today, given that it is not legally stipulated that this is necessary (compared with linear management and increasing profits)?
- In the absence of an industrial policy plan how can companies assure the development of the sector and of the economy? How can support the enterprise the European Union in making the credit from the bank accessible for the small enterprises?

- If the trend is for population concentration in urban areas to be accompanied by the presence of people from other European and non-European countries, what policies for residence can be launched?

## SOCIAL FACTOR. Questions proposed by partners:

- What strategies could be developed to address the social imbalances that exist between countries?
- How would companies' production methods (post-industrialization, outsourcing, recruitment, use of temporary workers, etc.) evolve with the diversification of human resources (national and external)?
- Liberalization of VET market and its social consequences: does it lead to a reduction of unemployment rates?
- What strategies are possible to make learners more actors of their professionalization?
- What is the relevance of the recognition and accreditation of competences derived from prior knowledge and labour experience? How could this recognition and accreditation be fostered?
- What strategies could be implemented to involve young people in VET in the construction industry? Who should promote these strategies?
- Who would be the main key actors in charge of creating a more favourable image of the construction sector, and what measures should be implemented to achieve that aim?
- How can we foster the engagement of women in construction in terms of attract them, promote them in their career and motivate them to remain in the sector? How is the situation in your country?
- Are there instruments in your country how youngsters (pupils) can be attracted for construction and with which measures could you imagine to involve them into real actions (apprenticeship, trainee, job contract, sustainable career path, incentives)
- How is the built environment taking into account societal changes and the changing needs of citizens? By what means can construction support social change?
- In what way would the future workforce (young people who finish schooling) into the construction professions, even if construction wages are still too low (depending on the cost of living) and the working environment is not stimulating because of the cheap labour coming from the areas south-eastern Europe?
- How can we change the image of the sector? Which are the main actors that can contribute to the improvement of this process of change and how?

## *TECHNOLOGICAL FACTOR. Questions proposed by partners:*

- How can the skills needed for tomorrow be identified at national, regional and local level? Are current practices sufficient? Is the information collected to date useful for training organizations?
- Relationship with digitisation: how is it integrated into professionalization processes?
- What is the competency-based approach in vocational training?
- How do we learn to communicate with the machine, integrating it into the act of learning and producing?
- Being BIM the tool that will shape the sector, how will its implementation affect the day to day on the site? How will it affect the site manager and those that are under his direction? What can be done at this level to anticipate the upcoming new model implementation?
- What will be the impact of the new materials in the construction? What changes are they going to demand from the sector, at which level?
- Where can companies get information to help them to take measures towards digitization? Who assists companies during their transition?
- Do you think that more expert supervision of building construction should be undertaken in order to take more account of the recommendations and requirements for energy efficiency and the installation of materials that are subject to circular management?
- In the absence of a national strategy can companies move independently? How useful can a European strategy be? In the absence of a national strategy?
- Public funding has created business aggregation and stimulated technological advancement. What role can public funding play in fostering business innovation and staff training?

## *LEGAL FACTOR. Questions proposed by partners:*

- What feedback from the national systems that have positioned individual learners as major players of their professionalization: virtues and points of vigilance?
- What feedback from the national systems that have positioned work-study training in employment policies: virtues and points of vigilance?
- How do you measure a successful professionalization action? What indicators (quantitative and qualitative) of success?
- What will be the minimum aspects to be transposed to an effective implementation of the Directive? What will condition its effectiveness? What skills should be updated to deal with this new trend?

- Do you think that new financial instruments will be consolidated as key renovation boosters? How could they be promoted?
- What legislative changes are needed and / or what standards should be dismantled or modified to improve the conditions for wood construction?
- Do you consider that taking into account the lowest price in deciding on project acceptance is still the most important decision-making factor, given the facts that are demonstrated by the findings in the field of nature conservation, circular management and energy efficiency?
- Can we expect measures in legislation that would prevent industry and other stakeholders from entering the market if they do not show their business in the direction of energy efficiency and circular management?
- What policies could be put in place to attract young people to the sector and to train them through targeted training courses linked to the new needs of the construction sector.

### *ENVIRONMENTAL FACTOR. Questions proposed by partners:*

- How do companies, and more particularly SMEs, take into account the growing scarcity of available resources?
- How are the most significant changes in your environment?
- What systemic adaptation to these changes are observed?
- Will water efficiency also become an environmental trend in the construction sector? Which trades will be specially concerned by the new environmental demands concerning water management?
- How this new legal framework (New legal Spanish framework for energy self-production) will shape new business opportunities? What will be key to prevent DIY installations?
- What are the most effective ways to deliver sustainable development solutions? What are the ways to help decision-making of the owners of buildings?
- Do you think that the negative impact of industry on the environment is so high that policy should drastically change the conditions for industry in Europe and around the world? What do you think is the cooperation between environmentalists, the economy and the government in your country?
- In your opinion, do you think it is enough to promote the population's minds to use and invest in energy-efficient activities and products and to promote circular management?
- Why do we not abolish the harmful industry, but only move it to areas outside the EU? Do you think this is the right way to improve the state of the environment and the general health of people?
- What can be done to anticipate the decarbonisation process?
- What can be done to make the circular economy policies not only for the construction sector but also for the use of built-up areas effective for the sector?

### *Skills and training analysis. Questions proposed by partners:*

- What are the managerial training courses about? Are they in line with companies' expectations?
- What are the expectations of SMEs in this area?
- What are the main changes in the profile of customers today and how can a company (especially SME) adapt to them?
- How to learn how to combine skills on site?
- How to position each skill in its right place to make the system work?
- How can we acquire technical skills and then inject them into a system?
- How to develop the ability to analyse professional situations with finesse and choose the most appropriate solutions, build a relationship with artificial intelligence (proximity and distance)?
- How to find good interactions: move away from a decontextualized professional gesture and get closer to complex and lively work situations?
- How to cope with the existing resistance to change and start to incorporate digital tools?
- How to promote and boost the incorporation of digital tools in SMEs?
- In your opinion, what will be the H&S emerging risks in a digitalized sector?
- To what extent are the new materials being evaluated at a H&S level? Is a specific legislative framework necessary? What steps would be necessary to prevent these new emerging risks?
- How can integration between different trades be improved to achieve more effective interventions in energy efficiency?
- How could you imagine to raise the number and percentage of girls/women in construction in your country? Is the sector "open" enough for this? Is the demographic pressure high enough (male work force shortages)?
- What is the common strategy of companies to attract youngsters or skilled workers for hiring? Does this (still) work? What instruments do they use for human resources development/management?
- Are there other initiatives or programmes that provide information and guidance to companies? Which are the most frequently used digital tools in the construction sector at this time? Which technologies might gain in importance within the next 5 years, 10 years?
- Which social media channels could craft businesses use? What are the benefits and disadvantages? Where can companies get support in developing their own social media strategy? Which costs must be taken in account?

- How can you assure to change of the training paths towards the integration of the skills (new technologies and different task requested in the site)?
- How can you afford the awareness towards the digitization? Who are involved in this changing in the site? Are there any guide for the enterprise? And if not how can you involve them?
- Are there any training initiatives related to this issue? How do you involve the small enterprise to be aware of their responsibility in the image of the sector?

# APPENDIX 2. FINAL QUESTIONNAIRES PER FACTOR

## *POLITICAL FACTOR*

Political factors determine the extent to which a government/policy may influence the economy or a certain industry.

### Reactivation of the construction industry

What incentives and other political measures are being implemented or should be implemented by the governments to facilitate the reactivation of the construction industry?

### Sustainable development

How sustainable development (social, economic and environmental) is reflected in national politics? What related decisions or actions do you think that may have an effect on the construction industry? What are the national priorities and how do the professional associations adhere to them?

What do you think that would be necessary to encourage companies to take into consideration environmental aspects such as energy efficiency, circular economy and pollution in their production processes? What would be a necessary basis for not staying solely on a theoretical level?

Some surveys show a trend towards concentration of population in urban areas. Is this tendency confirmed in your country? If so, what action should be taken to relaunch urban policies aimed at citizens?

### Renovation

A big part of the building stock is at the age when improvements are needed to structures or building technology. Are there national housing programs in your country targeted at renovating buildings? Is renovation on a political agenda? What are the policy measures to promote renovation?

### Construction companies

What is the impact of European directives, on ensuring security of energy sources, controlling illegal immigration, promoting cross country delivery of goods within the internal market, and digitalisation? What role do the National sectoral social partners play?

## ECONOMIC FACTOR

These factors are determinants of an industry's performance that directly impacts companies and have resonating long term effects.

### Industrialization and modular construction

In your opinion, what factors contribute to the industrialization of construction? What is the future perspective regarding industrialization? How will be its evolution in the sector?

On the other hand, what slowdowns or obstacles do you see for the growth of industrialization in construction?

### Competitiveness of the construction industry

In your opinion, what economic factors increase the efficiency of construction companies?

Uncontrollable economic and financial influences create potential risks for the construction sector, what effects would be most damaging and how can these be reduced or alleviated (for example, housing crash, sudden construction boom, price increase of housing and land, unstable industry, etc.)

The construction industry is dependent on a skilled qualified workforce and the loss of this workforce has negative impacts on the quality of construction. What political and economic measures are available to prevent the loss of workers and improve existing market behaviour with regards to quality?

How is the notion of customer need understood in the changing economic context with a strong competition, especially concerning SMEs? How are companies preparing to respond to new client's needs?future perspective regarding industrialization? How will be its evolution in the sector?

In the absence of an industrial policy plan, how can companies assure the development of the sector and of the economy? How can the EU support the enterprise in making the credit from the bank accessible for the enterprises, in particular for the small ones?

### Funding for renovations

How to make renovation more attractive to companies and their business? Which financial instruments would best support renovation?

How to improve energy efficiency requirements and criteria in public grants and funding? How are they been allocated? Are the criteria improvable? There are lagoons that may be weighing their effectiveness, for example: quality requirements and professionalism to undertake the funded works. Or the extension of the interventions: most of the financial aid is for limited works, while to reach significant energy savings renovations should be integral.

### Skills

Today, there is a systemic, constructive and evolutive customer approach: put the need at the heart of the system. However, the training courses specific to the customer approach in the construction sector are not sufficiently individualized. What are the main changes in the profile of customers today and how can a company (especially SME) adapt to them?

## *SOCIAL FACTOR*

These factors scrutinize the social environment of the construction industry, and gauge determinants like demographics, population analytics, etc

### Workers' qualification

How can the shortage of skilled workers be overcome? What kind of measures or good practices should be implemented?

What is the relevance of the recognition and accreditation of competences derived from prior knowledge and labour experience? How could this recognition and accreditation be fostered?

### Image of the sector

Who would be the main key actors in charge of creating a more favourable image of the construction sector, and what measures should be implemented to achieve that aim? What actions, measures or good national practices would you bring up?

How can we foster the engagement of women in construction in terms of attract them, promote them in their career and motivate them to remain in the sector?

Which measures may be implemented to involve young students into the sector? (apprenticeship, trainee, job contract, sustainable career path, incentives)

### Vet

What incentives could be used in order to encourage society, particularly young people, to realize the importance of vocational education and training in the construction industry?

What are the main obstacles in transferring the knowledge on modern technologies, materials and skills?

## *TECHNOLOGICAL FACTOR*

This factor pertains to innovations in technology that may affect the operations of the construction industry and the market favourably or unfavourably.

### Digitalisation /Automatization

Digitalisation and automatization are a crucial trend. Companies in the construction industry must adapt if they are to survive in the market and do not want to leave the field just to the big construction companies. How will digitalisation and automatization will be integrated into

professional processes? Which parts of the construction industry's value chain will be more likely to be affected?

Do you believe that digital innovation is key to creating a competitive construction industry and how can this be achieved for the SMEs?

Which policies could be proposed to foster R&D in the construction industry? How could construction industry get more public investment?

### BIM

Over the last decade, the BIM methodology has been progressively implemented in different countries, following the recommendation of the European Public Procurement Directive 2014/24/EU. Being BIM the tool that will shape the sector, how will its implementation affect the day to day on site?

How will it affect the site manager and those that are under his direction? What can be done at this level to anticipate the upcoming new model implementation?

Challenges of implementing BIM for SMEs are substantial: high cost of purchasing BIM, training own staff or paying for an external company, the development and adoption of ISO 19650, etc. In your opinion, how can these challenges be overcome by SMEs?

At what stage you see the implementation of BIM technology is in your country?

### New materials

Properties of new materials (bio based, nanomaterials...) provide a lot of new opportunities for construction; knowledge, knowhow and how to use them properly, are indispensable. What will be the impact of the new materials in the construction?

What changes are they going to demand from the sector, at which level?

### Skills

Which will be the key skills and competences related to digitalisation and technologies in the construction industry?

What will be the main obstacles in transferring the knowledge on modern technologies, materials and skills?

How can digital methods and instruments be learned "playfully" and easily to overcome the fear of it?

## *LEGAL FACTOR*

### National transposition of Energy Efficiency in Buildings Directives

The aim of these directives is to facilitate the transformation of all buildings into buildings with almost zero energy consumption, provided it is technically and economically feasible. What will be the minimum aspects to be transposed to an effective implementation of the Directives?

What will condition their effectiveness?

What skills should be updated to deal with this new trend?

### Legislative framework

Do you consider that taking into account the lowest price in deciding on project acceptance will still be the most important decision-making factor, given the facts that are reflected in the findings in the field of nature conservation, circular management, energy efficiency and climate change?

Can we expect measures in legislation that would prevent industry and other stakeholders from entering the market if they do not show their business in the direction of energy efficiency and circular management?

Green tenders: Green Public Procurement enables public administrations to use their purchasing power to choose environmentally friendly goods, services and works, making an important contribution to sustainable consumption and production. How GPP has been introduced in the construction industry in your country? How this circumstance will affect the construction industry?

Do you think that a redesign of the rules and regulations for construction and demolition waste is necessary from the point of view of the construction industry? How can the framework conditions (legal, planning, etc.) regarding recycling management and resource protection be adapted and how will they impact the industry?

### Innovative financial instruments

There is a real need of investments to undertake energy renovation of old buildings. Financial instruments are made combining EU financial support with finance coming from the private sector and other public financial sources in order to promote investments in the area of building energy retrofitting. Such instruments may take the form loans or guarantees and other risk-sharing instruments (equities and quasi-equities), and may, where appropriate, be combined with grants.

Do you think that new financial instruments will be consolidated as key renovation boosters?

How could they be promoted? Is a legal framework that could contribute to its development?

## ENVIRONMENTAL FACTOR

### Decentralized energy production

Decentralized energy production models are being developed in Europe. In some countries, private households can also sell their energy for public use. However, this requires responsible and regulated operations and appropriate technology.

How this new legal framework is shaping new business opportunities?

What is key to prevent DIY and unprofessional installations?

### Increasing scarcity of raw materials and natural resources (water, energy) / Effective use of natural resources in the construction industry

Water management on site: Water efficiency has also become an environmental trend in the construction sector. Which trades will be specially concerned by the new environmental demands concerning water management?

How will companies, and more particularly SMEs, be affected by the growing scarcity of available resources? How could they manage it?

What can be done to anticipate the effects of the ongoing decarbonisation process in the construction industry?

What will be key in order to foster more Energy renovation projects?

To encourage retrofitting of green energy efficient buildings, do you believe Building Renovation Passports (BRPs) will be decisive? If yes, what factors will be key to their deployment? If no, which other strategies could be implemented?

### Circular economy

What kind of national initiatives or measures could be put in place to encourage circular economy in the construction industry? What is hindering its development?

In terms of business opportunity, what facilities, infrastructures, technologies and legislative support will be needed to seize all its potential for growth and employment?

### Climate change

Climate change may imply a significant risk for buildings and infrastructures. Construction industry can play a key role in adaptation and mitigation to prevent and reduce the adverse effects. What kind of national initiatives or measures could be put in place to encourage the role of construction industry in fighting against the adverse effects of climate change?

In terms of business opportunity, what facilities, infrastructures, technologies and legislative support will be needed to seize all its potential for growth and employment?

### Skills

How could integration between different trades be improved to achieve more effective interventions in energy efficiency?

Which improvements VET will need to deliver updated and effective training for the circular economy needs? And energy efficiency-based construction industry?

## APPENDIX 3. Respondents per country

The following table shows the personal information from the individuals who have responded to the questionnaires in each country.

| COUNTRY | FACTOR | RESPONDENT |
|---|---|---|
| BELGIUM | Political | Emmanuel de Bethune<br>Advisor and Coordinator for the sectoral committees<br>Central Council of Economy |
| | Economic | Jean-Pierre Liebart<br>Head of Economic Departement<br>Confederation Construction/ Confederatie Bouw |
| | Social | Fabrice Meeuw,<br>Managing Director. Constructiv |
| | Technological | Bart Ingelaere<br>Deputy General Director. Belgian Building Research Institute |
| | Legal | Mathieu THOMAS<br>Lawyer. Schoups |
| | Environmental | Jean-Marie Hauglustaine<br>Professor. University of Liège |
| FINLAND | Political | Director, Mr Juha Kostiainen, Society Relations, YIT |
| | Economic | Chief Economist, Mr Jouni Vihmo, Confederation of Finnish Construction Industries RT |
| | Social | Professor, Mr Markku Sotarauta, University of Tampere, Urban and Regional Development |
| | Technological | Technical Director, Mr Mikko Somersalmi, RAKLI The Finnish Association of Building Owners and Construction Clients |
| | Legal | Mr Antti Koponen, Construction Regulations. Director Mr Pekka Vuorinen, Director of Environment and Energy, Construction Regulations, Confederation of Finnish Construction Industries RT |
| | Environmental | Senior Sustainability Specialist, Jessica Karhu, Finnish Green Building Council |
| FRANCE | Political | ZDB departments of Economy, Corporate Development, Legal Affairs |
| | Economic | Managing board of a construction company (name not provided) |
| | Social | Information not provided |
| | Technological | Information not provided |
| | Legal | ZDB departments of Economy, Corporate Development, Legal Affairs |
| | Environmental | University professor |

| COUNTRY | FACTOR | RESPONDENT |
|---|---|---|
| GERMANY | Political | ZDB departments of Economy, Corporate Development, Legal Affairs |
| | Economic | Managing board of a construction company (name not provided) |
| | Social | Information not provided |
| | Technological | Information not provided |
| | Legal | ZDB departments of Economy, Corporate Development, Legal Affairs |
| | Environmental | University professor |
| GREECE | Political | Mr. Christos Andreou. Ministry of Transport and Infrastructure, General Directorate for Strategic Infrastructure Design |
| | Economic | Mrs. Sia Labrou, Civil Engineer. Doxiadis Associates Ekistiks SA Infrastructure department |
| | Social | Mrs. Stevi Vafeiadou, University of Thessaly |
| | Technological | Mr. Giorgos Stampoulis. Research Center of University of Thessaly |
| | Legal | Mr. Nikos Theodorou, Lawyer – specialized in construction legislation |
| | Environmental | Mr. Dimitrios Gitsoudis. Ministry of Environment. Technical Projects Authority |
| IRELAND | Political | Sean Armstrong, senior advisor on building standards, Department of Housing, planning and Local government |
| | Economic | Jeanette Mair, Head of Economic and Policy Research, Confederation Industry Ireland CIF |
| | Social | John Regan, Assistant Industrial Organiser for Utilities construction division. SIPTU |
| | Technological | Paul Vesey, Lecturer in BIM, Project Management, Information Technology. Limerick Institute of Technology |
| | Legal | Sarah O'Dwyer, Vice Chair of the Sustainability Task Force STF. Architects of Ireland RIAI |
| | Environmental | Pat Barry. CEO. Irish Green Building Council |

| COUNTRY | FACTOR | RESPONDENT |
|---|---|---|
| ITALY | Political | Giovanni Carapella. Director of national sectoral observatory (CNCE) with experience in the commission of the public work as president in Lazio Region Director |
| | Economic | Flavio Monosilio. ANCE - Direzione Affari Economici e Centro Studi-Director |
| | Social | Social partners representative |
| | Technological | Expert in technological aspect, university professor. Master BIM |
| | Legal | Nicola Massaro. ANCE - Expert and manger director of innovation and technological department<br>Marcello Cruciani. ANCE - Direttore Direzione Legislazione Mercato Privato |
| | Environmental | Edoardo Zanchini. Vice President of Lega Ambiente<br>Carlo Patrizio. University professor of Master urban regeneration -bioarchitecture -energy efficiency |
| LITHUANIA | Political | Mr. Simonas Gentvilas, Member of The Parliament |
| | Economic | Ms. Jekaterina Rojaka,Vice-Minister of the Economy and Innovation of the Republic of Lithuania<br>Ms. Tatjana Kučeiko,Statistics Lithuania, Short Term Business Statistics Division, Chief Specialist |
| | Social | Dr. Boguslavas Gruževskis. Deputy director for public relations and development. Lithuanian social research Centre |
| | Technological | Dr. Darius Pupeikis, Head of centre of smart cities and infrastructure. Kaunas university of technology |
| | Legal | Dr. Sigitas Mitkus Vilnius Gediminas Technical University Faculty of Business Management, Head of Department of Law<br>Mr. Vitalijus Sosunovičius, Senior advisor, Construction and Policy Planning Grouped, Ministry of Environment |
| | Environmental | Dr. Tatjana Vilutienė, Department of construction management and real estate, Vilnius Gediminas technical university<br>Mr. Inesis kiškis, director of EU investment and economic instrument department. Ministry of Environment |

| COUNTRY | FACTOR | RESPONDENT |
|---|---|---|
| SLOVENIA | Political | Information not provided |
| | Economic | Joze Renar, GZS ZGIGM (CCIS CCBMIS) |
| | Social | Oskar Komac, sdgd slovenije |
| | Technological | Aleksander Srdič, ul fgg<br>Matjaž Likeb, pilon aec d.o.o. |
| | Legal | Information not provided |
| | Environmental | Janja Leban, gzs: Environmental Department<br>Ana Mladenovič, zag |
| SPAIN | Political | Representative from the former Ministry of Development (currently denominated Ministry for Transport, Mobility and Urban Agenda) |
| | Economic | Almudena Semur Correa. General Secretary. Instituto de Estudios Económicos (Institute for Economic Studies) |
| | Social | Mª José Leguina. Labour Department Director. CNC<br>José Luis Colomer. Secretary of Labour Health and Safety. CCOO Construction and Services |
| | Technological | Carlos Aragón Carrera. Centre for the Development of Industrial Technology |
| | Legal | David Cabello Escofet. Construcciones Rubau. Director of Legal Services |
| | Environmental | Eva Gutierrez. Representative from the Spanish Confederation of Employers' Organisations (CEOE) |

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