



European
Construction
Sector
Observatory

Analytical Report
Improving the human
capital basis

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1. Introduction

“As the EU emerges from the 2008 economic crisis, the issue of skills offers a new angle under which the challenges facing the EU can be addressed in a pragmatic way: an ageing workforce, a mismatch of skills supply and demand, technological change, global competition, as well as a post-crisis legacy of youth and long-term unemployment.”

Michel Servoz on the Social Agenda 41 in 2015, Director General of the European Commission’s Employment, Social Affairs and Inclusion department

The economic crisis of 2008 had a significant impact on employment in Europe, with negative repercussions on the demand for new jobs, especially for youth, considerably reducing their employment opportunities. The doubling of the long-term unemployment rate between 2008 and 2014 at EU level has led to concerns about the potential skills atrophy of the long-term unemployed¹. Furthermore, there has been a sharp drop in the amount of skilled manual jobs in the manufacturing and construction sectors during the recession, making the recovery for those sectors slower².

The post-crisis labour market in Europe is characterised by several major trends. First, demand is skewed towards high-skilled workers with tertiary education. According to a recent survey, close to **eight in ten adult workers in the EU employed in professional occupations** and 56% of managers report a need for a tertiary education qualification to be able to perform their respective jobs³. Second, although the demand for jobs has been rising over the last years, employers experience difficulties in filling the positions with the skilled workers. Thus, **two in five companies claim to have difficulties recruiting people with the required skills** to fill their open vacancies and many employees have difficulties finding a job which matches their qualification level, indicating existing skills shortages and mismatches⁴.

The tightness of the labour market in Europe differs geographically, ranging from a shortage of workers in Austria, Belgium, Germany and the United Kingdom to a surplus of labour force in Greece and Spain⁵, indicating a geographical labour mismatch. Despite high unemployment levels in Europe, there are no indications of the quantitative gap in terms of human resources to fill in existing vacancies. The shortage of the workforce, instead, has a qualitative nature, indicating mismatch of jobseekers’ skills and the vacancies on the market.

The construction sector has been severely affected by labour shortages after the crisis. This is particularly the case in Germany and Luxembourg, where shortages are reported mainly for low and medium skilled jobs. Skill shortages are often affected by skill mismatch, the difference between the qualification level of jobseekers and the job requirements. Skill mismatches can take the form of over qualification or under qualification. The construction sector in Europe has one of the highest levels of over qualifications, with about **one third of workers being overqualified for the job they**

¹ Eurostat, Long-term unemployment rate.

<http://ec.europa.eu/eurostat/tgm/table.do?tab=table&plugin=1&language=en&pcode=tipslm70>

² Cedefop, Skills, qualifications and jobs in the EU: the making of a perfect match? Evidence from Cedefop’s European skills and jobs survey. 2015. http://www.cedefop.europa.eu/files/3072_en.pdf

³ Ibidem.

⁴ European Parliament, Labour market shortages in the European Union. March 2015. [http://www.europarl.europa.eu/RegData/etudes/STUD/2015/542202/IPOL_STU\(2015\)542202_EN.pdf](http://www.europarl.europa.eu/RegData/etudes/STUD/2015/542202/IPOL_STU(2015)542202_EN.pdf)

⁵ Ibidem.

do⁶. Skill shortages and mismatches in the construction sector are associated with several **structural barriers**, as discussed in detail in the chapter on Obstacles to skills development:

1. **The decrease in the number of young skilled workers** in the sector constitutes a threat for the development of the industry. The steady decline of young workers is linked to the bad image of the construction sector, low(er) wages compared with other sectors, safety risks and unattractive working conditions. The decline in the number of students for skilled manual professions in some countries in Europe creates future expectations of additional labour needs of these professions, as the amount of young workers is not enough to replace the aging workforce in construction as the construction sector revives.
2. **The ageing of the construction sector's workforce** has been recorded as a continuous issue. The average age of construction workers is increasing (in Germany for instance, the majority of construction workers are in the 35-50 year age group), providing additional barriers for the integration of new skills in the industry. The ageing itself is linked to the decline of young workers in the sector and bad image of the sector.
3. **Migration** is becoming an important factor in the labour distribution in Europe. Indeed, migration of highly-skilled workers from countries with lower wages to countries with higher wages can create a shortage of high-skilled workers in the former, whilst filling the gaps in the more developed economies in the latter. For example, some countries (Estonia, Romania) highlight difficulties in retaining highly skilled construction workers. In parallel, Nordic countries (Sweden, Norway, and Finland) have been reporting an increase in the number of foreign workers in recent years. In Ireland and Spain, on the contrary, the number of foreign workers has dropped due to the economic crisis striking the sector⁷.
4. **The misalignment between VET trainings** and the demand for skills on the construction labour market slows down the upgrade and development of the sector, leaving workers with often outdated skills. Although construction is one of the sectors with the highest needs in new knowledge, only 45% of construction workers were involved in some form of training at their work place, relying mostly on their knowledge obtained in the educational institution⁸.

At the same time, technological developments are pushing construction workers to obtain new skills. Innovation in the sector and EU regulation are creating **new drivers for the development of the sector** and desired skills for its workers, as discussed in detail in the chapter on Drivers of skill needs.

1. **Energy efficiency** remains one of the main drivers of skills development in the sector. The construction sector represents about 40% of energy use in the EU and has the largest potential for cost effective savings. With the EU planning for nearly zero energy buildings by 2020, the construction sector is confronted with the urgent need to update the energy efficiency skills of its workforce. In this context, BUILD UP Skills is a strategic EU initiative aiming to increase the number of qualified workers (craftsmen and other on-site workers) by developing national qualification platforms and roadmaps and providing trainings in the field of energy efficiency and renewable energy in buildings. The scope of the initiative has been expanded to other building professionals under the Horizon 2020 Research and Innovation Programme, with projects developing multi-country qualification and training schemes.
2. **Digitalisation** also brings new skill requirements for workers. Automation and computerisation of processes and the increasingly widespread introduction of BIM, are

⁶ Cedefop, Skills, qualifications and jobs in the EU: the making of a perfect match? Evidence from Cedefop's European skills and jobs survey. 2015. http://www.cedefop.europa.eu/files/3072_en.pdf

⁷ BUILD UP Skills – EU overview report, Staff working document, June 2014. <https://ec.europa.eu/energy/intelligent/files/library/doc/overview-report.pdf>

⁸ European Parliament, Labour market shortages in the European Union. March 2015. [http://www.europarl.europa.eu/RegData/etudes/STUD/2015/542202/IPOL_STU\(2015\)542202_EN.pdf](http://www.europarl.europa.eu/RegData/etudes/STUD/2015/542202/IPOL_STU(2015)542202_EN.pdf)

constantly increasing the efficiency of construction processes. However, the sector is lacking the knowledge of these instruments, and will need to develop new competences and methods of working.

Construction 2020, the strategic policy agenda for the construction sector in Europe, focuses on skills under the Thematic Objective 2 “Improving the human-capital basis of the construction sector”. The related policy measures, foreseen in the Construction 2020 action plan, include promotion of VET programmes in energy efficiency, programmes for integration of digitalisation skills into construction processes, as well as initiatives to improve the image of the sector for youth. The issues of skill shortages and skill mismatch are high on the agenda at Member State level as well. A variety of policy responses have been introduced, taking the form of initiatives and government programmes aimed at supporting upskilling and skills assessment in construction.

Within this context, the purpose of the present Analytical Report is to draw a snapshot of the current skills situation in the construction sector in the EU-28. Namely, **Chapter 2 provides a high level analysis of the workforce in the sector**, focusing on the quantitative analysis of the population, employment and education data. **Chapter 3 provides an analysis of the main drivers of skills in construction**, namely energy efficiency and digitalisation trends, as well as their impact on skills development. **Chapter 4 provides an overview of the obstacles for skills in construction**, zooming at the issues of image of the sector, structural barriers to human resources development, lack of VET and mobility. Finally, **Chapter 5 focuses on the main policy responses to the skills barriers and drivers in the EU**, highlighting best practices and lessons learned from various national and regional programmes.

2. Characteristics of the workforce

This chapter focuses on the characteristics of the workforce in the construction sector through an analysis of key performance indicators related to demographic dynamics, the level of education across the population and the level of skills shortage in construction activities at EU level. In addition, future projections on demographics are discussed, taking into account emerging trends in population bands and geographical specificities.

Demographics

Overview of the current state of play of the EU population

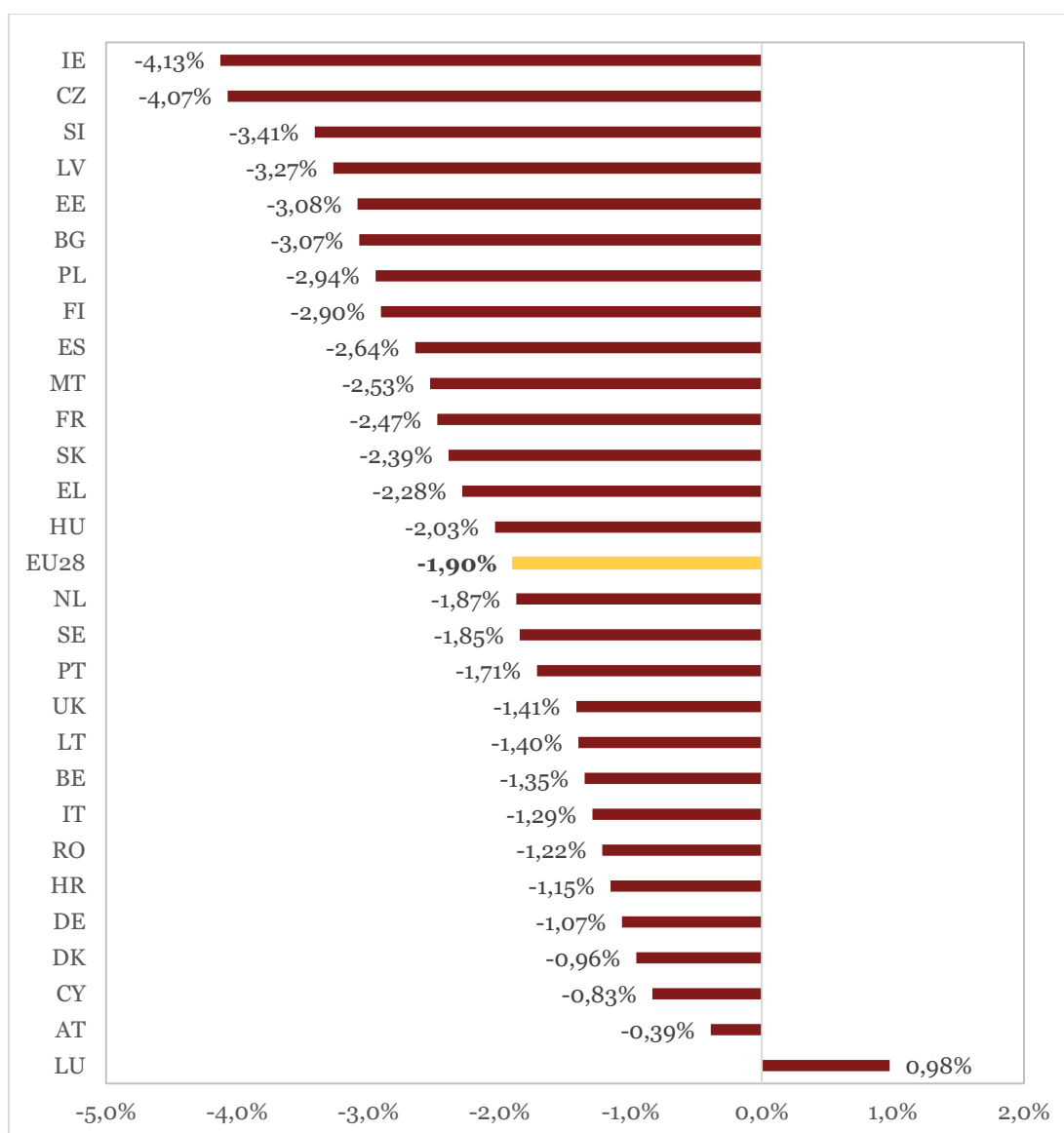
The current structure of the European population is defined by **lower birth rates** and **increasing life expectancy**. These population dynamics imply an aging population across EU28 countries, paired with a shrinking proportion of people of working age (age band 15 to 64 years old). This transfer of proportionality between the working population and the post-retirement and aging population implies an increase in the burden borne by society, since the demand for social expenditure and public services related to the aging population will increase, whilst the base of the population generating the necessary wealth and contributions will be difficult to meet by the decreasing proportion of active population.

At the beginning of the period studied in the present report (2008), the EU28 population was estimated in average at 500.2 million individuals, with 64% of working age population (15-64 years) and 21% of retired or near retirement people (over 64 years old). The total population in the EU reached 508.4 million in 2015, a 1.62% increase compared to 2008 values. However, tangible disparities have been identified between Member States. For instance, the population of

Luxembourg increased by 16.4% since 2008, particularly due to the important increase of immigration over the past years.

In 2015, the median age of the EU population was 42.4 years, meaning that half of the EU-28's population was older than 42.4 years. The median age had increased by 2 years during the period 2008-2015 (from 40.4 years in 2008). Countries with the largest differential in the median age during the period were Greece, Lithuania, Portugal Spain and Ireland, with over three years of increase indicating a faster progressive increase of the older half of the population, perhaps due not only to ageing effects but also migration. On the other side of the spectrum, countries with the lowest change in the median age of their population in 2008-2015 were Finland, the United Kingdom, Belgium, Luxembourg and Sweden.

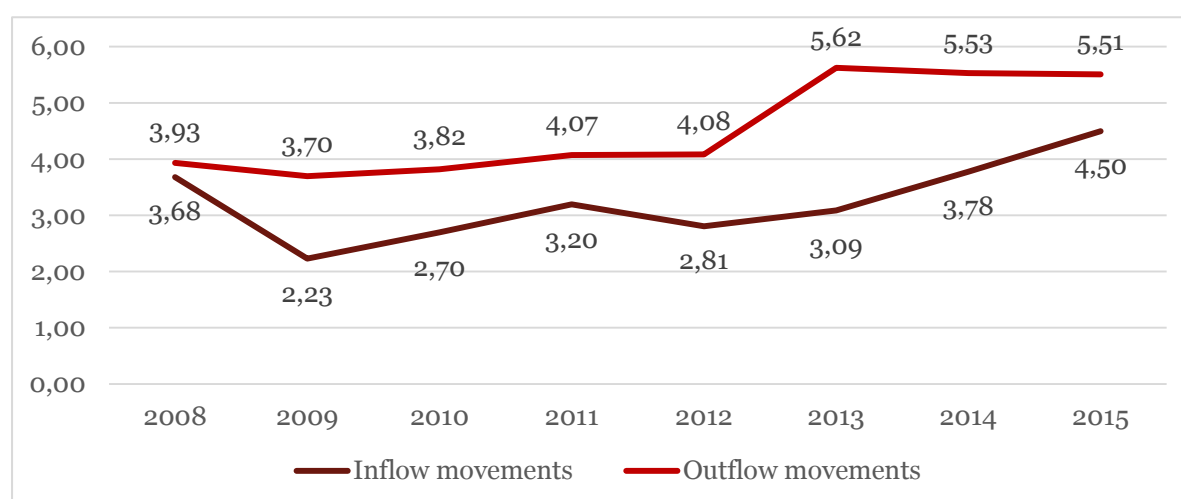
Figure 1: Changes in the working population (aged 15 to 64) during the period 2008-2015



Source: Eurostat, 2017.

Finally, an overview of changes in the population structure observed during the period 2008-2015 also needs to take into account **migration and mobility trends** in the EU28. As illustrated in Figure 2 below, declared immigration and mobility movements across the EU accounted for an inflow range between 2 and 4.5 million individuals per year (including both extra and intra community movements). The evolution of such movements across the EU has increased each year at a relatively constant pace, with two exceptions in 2009 and 2012, which correspond to two major crises faced by the region. Overall, several countries, namely Poland, Cyprus, Estonia, Slovakia, Germany, Austria, Malta and Latvia, have experienced a boom in immigration and mobility inflows, which increased by over 100% over 2008-2015. On the other hand, other MS observed a relative decrease in immigration and mobility inflows of more than 50% (Slovenia, Sweden, Lithuania, and Czech Republic) during the same period. It is important to note that even if these official figures are increasing in the long term, they only represent **a marginal fraction of the current population**. Further research into the effects of immigration and mobility inflows by age groups and their employability across industries in the short and long term may provide insight on the effects of such movements in the construction sector. Similarly, emigration and mobility outflows across the EU ranged between 3.9 and 5.5 million individuals per year (Figure 2). Emigration and mobility outflows remained relatively stable over 2008-2012, subsequently peaking at 5.6 million individuals in 2013 and stabilising ever since. Overall, over the 2008-2015 period, almost half of the Member States experienced a surge in emigration and mobility outflows of over 100%, including Cyprus (+668.1%), Hungary (+478.6%) and Poland (+430.8%), whereas others reported a decrease, such as the UK (-0.2%), Germany (-24.1%) and the Czech Republic (-35.6%). Overall, during the period 2008-2015 **net migration and mobility was negative in the EU**, i.e. outflows exceeded inflows.

Figure 2: Evolution of inflow and outflow movements in the EU (extra and intra community movements) over 2008-2015 (millions of individuals)



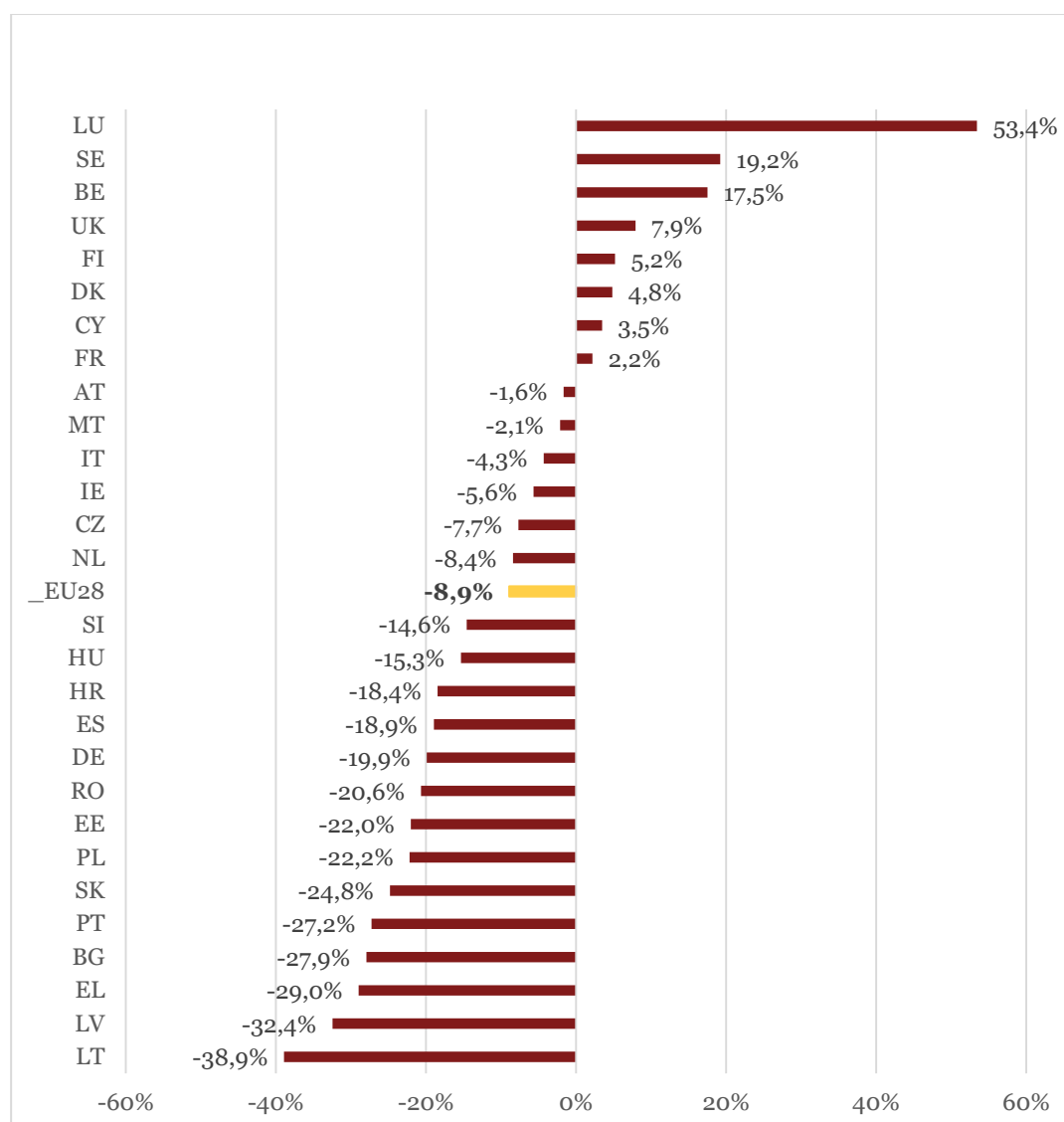
Source: Eurostat, 2017.

Overview of future demographic perspectives in the EU

As the ageing population increases across the EU28, an estimation on population dynamics in the long term indicates that imbalances between the active and the retiring population will continue to accentuate during the next decades, with a potential peak towards 2050. Estimated figures in the short term (for 2020) indicate that the EU28 population will reach 510 million individuals, distributed over the main age groups as follows: 79.7 million individuals up to 14 years of age (i.e. 16% of the population), 328.2 million working-age individuals aged 15 to 64 years, representing 64% of the total, and 104.4 million individuals aged over 64, accounting for 20% of the total.

In contrast to this short-term projection, it is expected that by 2050 the total population in EU28 will increase by nearly 15 million individuals, amounting to 525.5 million (Figure 3). By 2050, individuals up to the age of 14 would represent 15% of the population (i.e. 1 percentage point lower than the 2020 projection). Furthermore, the working population will account for 57% of the total, whilst the population over 64 is expected to increase, making up 28% of the total.

Figure 3: Projected net changes in the working-age population (between 15 and 64 years old) over 2020-2050



Source: Eurostat, 2017.

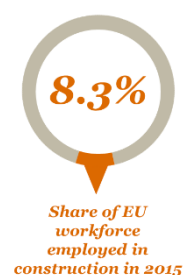
Employment in the construction sector

The workforce employed in the construction sector is defined in the present study by all construction related activities within EU28 economies (construction related manufacturing activities, narrow construction, real estate activities, and architectural and engineering activities, collectively referred to as the broad construction sector).



According to Eurostat, the total number of persons employed in the broad construction sector at EU level reached **21.1 million in 2015**. This represents a 1.2% increase since 2011 and 3.4% increase compared to 2014 alone, the highest net increase since the beginning of the economic crisis, signalling the recovery of the sector. The sum of the persons employed in Germany, United Kingdom, France⁹, Italy and Spain represents 60.7% of the total workforce of the EU construction sector.

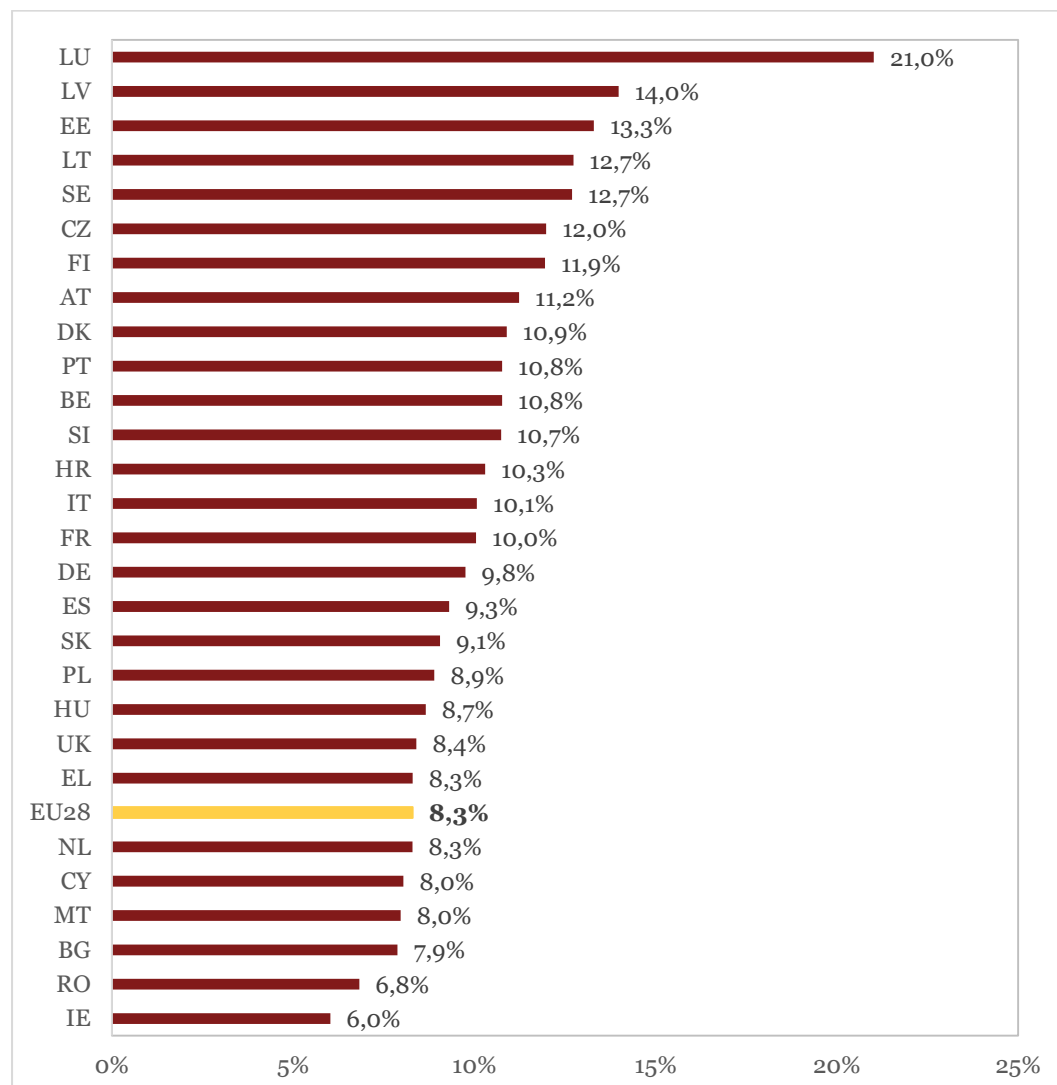
Figure 4 below provides an illustration of the labour share of the construction sector across national economies. With regards to the total population, construction-related industries represent 8.3% of the total number of persons employed in the general economy (2015), being the major source of employment in many EU countries. For instance, the proportion of construction sector workforce is the highest in Luxembourg (21.2%), Latvia (14%) and Estonia (13.3%), with respect to the rest of the economy. To be noted that the Baltic States and Scandinavian countries rank among the countries with the highest proportion of construction-related industries as a share of total workforce. On the contrary, Ireland¹⁰ (6%), Romania (6.8%) and Bulgaria (7.9%) report the lowest shares of the construction sector employment in their respective economies.



⁹ Latest data available for France is 2014.

¹⁰ Latest data available for Ireland is 2013.

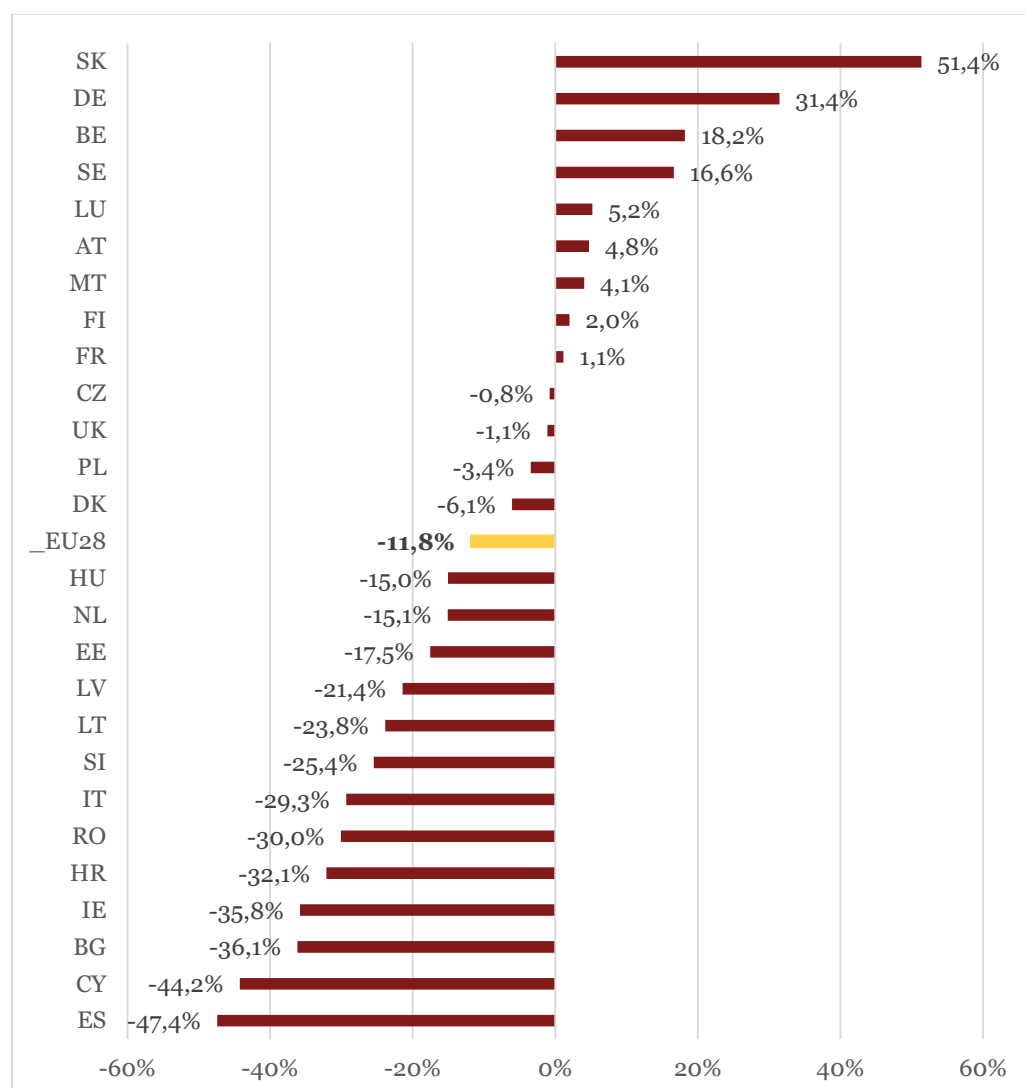
Figure 4: Labour share of construction-related industries in the total economy in 2015



Source: Eurostat, 2017.

In addition to the distribution of the proportion of the construction sector workforce across national economies in 2015, it is important to note that employment in the construction sector suffered from a net decrease over 2008-2015, due to the conjunctural context of the economic slowdown. However, it is important to note that the construction sector typically reports a delayed reaction to changes in the economic context, whether it be a shock or a revival of the economy. Therefore, variations in the employment trends in the sector displayed a later onset compared to other industries. The evolution of such employment changes presents several differences across Member States. Indeed, several countries experienced a considerable increase in the number of employees in the sector, such as Slovakia and Germany, whereas others experienced important losses (e.g. Spain, Cyprus and Bulgaria) (Figure 5). These key observations indicate that the construction sector has experienced a certain recovery in some Member States following the economic slowdown, even though structural differences still prevail across several EU countries.

Figure 5: Changes in the size of the construction sector workforce (employee headcounts) between 2008-2015¹¹

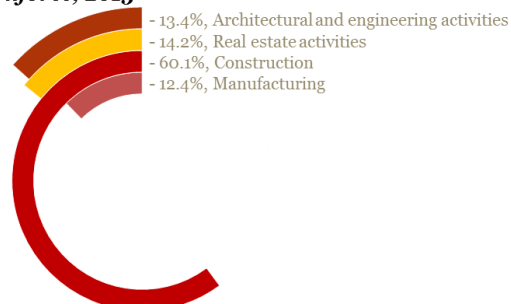


Source: Eurostat, 2017.

In terms of the evolution of the workforce across construction sub-sectors, Member States which experienced an important decrease in their workforce, such as Spain, Cyprus, Bulgaria, Hungary, Romania or Italy, mainly saw a fall in the number of workers in the narrow construction sector during the period 2008 to 2015.

Table 1 provides evidence on this common behaviour across these economies, whereby workers in manufacturing, real estate and

EU construction sector workforce, 2015



¹¹ Please note that data for Portugal and Greece for NACE F is incomplete and has therefore been excluded. The calculations for France are based on 2008-2014, while the calculations for Ireland are based on 2008-2010.

architectural services often increased in contrast to the decline experienced by broad construction sector, while the workforce of narrow construction decreased.

Table 1: Distribution of workforce by construction sub-sectors by country in 2015

	Manufacturing		Construction		Real Estate		Architectural activities	
	2008	2015	2008	2015	2008	2015	2008	2015
Austria	15.19%	13.51%	63.11%	62.49%	9.60%	10.96%	12.10%	13.04%
Belgium	10.99%	11.62%	72.10%	64.18%	7.61%	14.06%	9.30%	10.13%
Bulgaria	14.11%	14.84%	70.75%	62.85%	9.51%	14.69%	5.63%	7.62%
Cyprus	12.00%	18.56%	78.08%	67.66%	4.24%	6.19%	5.68%	7.59%
Czech Republic	9.93%	17.02%	69.28%	62.32%	9.69%	10.37%	11.10%	10.29%
Germany	14.18%	10.81%	54.44%	57.89%	16.90%	16.28%	14.48%	15.02%
Denmark	11.03%	10.20%	64.24%	60.28%	11.98%	12.31%	12.75%	17.21%
Estonia	23.82%	26.26%	57.91%	54.50%	12.22%	12.81%	6.05%	6.43%
Greece	46.29%	10.95%	NA	66.71%	7.24%	3.01%	46.47%	19.33%
Spain	12.36%	10.65%	71.27%	64.00%	7.48%	12.15%	8.89%	13.20%
Finland	14.95%	11.45%	64.26%	66.12%	6.82%	8.03%	13.98%	14.40%
France	NA	NA	NA	NA	NA	NA	NA	NA
Croatia	17.12%	19.18%	68.85%	61.97%	4.38%	7.03%	9.65%	11.82%
Hungary	14.77%	13.35%	57.98%	55.98%	17.62%	18.84%	9.63%	11.83%
Ireland	10.10%	NA	61.25%	NA	11.81%	NA	16.84%	NA
Italy	16.08%	16.22%	64.27%	59.50%	10.43%	12.84%	9.23%	11.44%
Lithuania	14.19%	15.18%	65.20%	63.53%	14.23%	13.28%	6.38%	8.01%
Luxembourg	4.75%	3.99%	78.70%	78.76%	6.29%	6.45%	10.25%	10.80%
Latvia	13.33%	16.34%	57.77%	53.11%	23.66%	24.68%	5.24%	5.87%
Malta	7.63%	13.89%	71.71%	63.29%	8.62%	11.91%	12.05%	10.91%
Netherlands	9.79%	8.68%	64.71%	63.96%	10.85%	10.90%	14.65%	16.46%
Poland	18.29%	18.33%	63.88%	60.37%	10.60%	12.85%	7.23%	8.44%
Portugal	48.21%	15.83%	N/A	63.92%	25.40%	10.78%	26.39%	9.47%
Romania	15.96%	16.05%	70.29%	66.69%	6.18%	8.00%	7.57%	9.25%
Sweden	9.90%	7.44%	60.89%	62.41%	14.31%	13.56%	14.89%	16.58%
Slovenia	16.34%	17.01%	69.10%	63.60%	3.86%	5.06%	10.70%	14.33%
Slovakia	20.68%	14.55%	58.63%	64.36%	12.02%	12.18%	8.67%	8.92%
United Kingdom	8.42%	7.16%	59.26%	53.96%	16.45%	20.97%	15.87%	17.91%
EU28	13.99%	12.35%	62.60%	60.12%	11.84%	14.16%	11.57%	13.37%

Source: Eurostat, 2017.

According to the table, narrow construction activities employ the largest share of employees (60.12%), followed by real estate activities (14.16%), architectural and engineering activities (13.37%) and construction-related manufacturing (12.35%). Further information from the European Builders Confederation on construction activities indicates that the sector accounts for more than 3 million firms across the EU, although the vast majority of them (91.9%) are small companies with fewer than 10 employees¹².

Further analysis of the composition of the construction workforce indicates that women represented 16.5% of the total in 2015, an increase compared to the 2008 share (15.1%), potentially indicating a

¹² European Builders Confederation, Key priorities and challenges for construction SMEs. March 2017. http://www.ebc-onstruction.eu/fileadmin/Publications/Presentations/2017/170207_WSED.pdf

general improvement in gender inclusiveness in the EU construction sector (Table 2). Countries with the highest share of women in their construction workforce in 2015 include France (19.1%), Germany (18.4%), the UK (17.1%) and Austria (16.8%), while the lowest proportions are found in Luxembourg (3.7%), Cyprus (7.4%) and Ireland (8.3%). As for the narrow construction sector specifically, the share of women in the workforce at the EU level amounted to 9.5% in 2015, an improvement compared to 2008 (9.0%) (Table 3). Notably, the Czech Republic reported the highest proportion of women in its narrow construction sector workforce in 2015 (13.0%), compared to merely 2.8% in Belgium.

Table 2: Share of population employed in the broad construction sector by gender¹³

Country	Women		Men	
	2008	2015	2008	2015
Austria	14.6%	16.8%	81.4%	78.7%
Belgium	10.7%	11.4%	86.8%	86.0%
Bulgaria	12.0%	11.6%	83.0%	82.3%
Cyprus	7.1%	7.4%	84.8%	86.1%
Czech Republic	16.6%	16.1%	83.2%	83.7%
Germany	17.3%	18.4%	82.1%	81.2%
Denmark	11.8%	9.9%	82.3%	83.1%
Estonia	8.6%	9.2%	84.0%	81.4%
Greece	7.5%	13.8%	91.5%	83.6%
Spain	12.0%	15.1%	87.9%	84.6%
Finland	10.1%	11.7%	85.1%	81.6%
France	18.0%	19.1%	81.3%	80.1%
Croatia	11.9%	12.5%	85.8%	86.2%
Hungary	10.7%	8.7%	86.2%	87.0%
Ireland	6.4%	8.3%	90.7%	87.2%
Italy	12.4%	13.4%	87.5%	86.4%
Lithuania	N/A	N/A	83.8%	70.5%
Luxembourg	11.0%	3.7%	75.1%	88.9%
Latvia	11.9%	13.9%	83.6%	80.3%
Malta	N/A	N/A	90.4%	85.6%
Netherlands	14.5%	12.5%	84.8%	85.5%
Poland	11.7%	13.3%	86.4%	84.5%
Portugal	8.4%	12.9%	88.9%	82.5%
Romania	12.0%	8.5%	84.0%	89.4%
Sweden	11.4%	15.1%	84.9%	83.7%
Slovenia	16.7%	12.0%	81.2%	85.7%
Slovakia	9.3%	8.8%	88.3%	87.7%
United Kingdom	17.2%	17.1%	82.3%	82.1%
EU28	15.1%	16.5%	84.8%	83.5%

Source: Eurostat, 2017.

¹³ Sharp variations between 2008 and 2015 for a number of countries (EL, LU, PT) are due to a break in statistical data

Table 3: Share of population employed in the narrow construction sector (NACE F) by gender

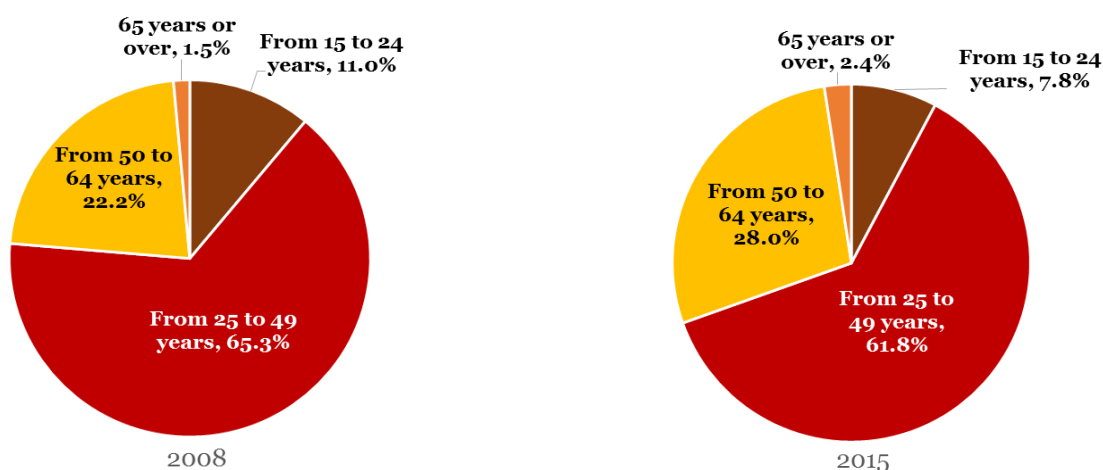
Country	Women		Men	
	2008	2015	2008	2015
Austria	12.2%	11.5%	85.4%	85.6%
Belgium	7.1%	6.0%	91.6%	91.7%
Bulgaria	6.1%	2.8%	90.7%	92.9%
Cyprus	4.7%	7.0%	89.8%	90.6%
Czech Republic	8.4%	7.6%	91.6%	92.0%
Germany	11.8%	13.0%	87.9%	86.9%
Denmark	6.8%	4.3%	91.3%	91.6%
Estonia	4.6%	4.3%	92.2%	91.4%
Greece	1.9%	5.3%	97.8%	93.8%
Spain	7.3%	7.9%	92.7%	91.8%
Finland	3.8%	4.7%	92.7%	92.0%
France	9.6%	9.8%	90.0%	89.6%
Croatia	6.2%	6.1%	91.4%	92.9%
Hungary	5.8%	4.4%	92.8%	93.6%
Ireland	3.2%	5.1%	94.5%	93.8%
Italy	5.7%	6.4%	94.2%	93.6%
Lithuania			91.1%	87.7%
Luxembourg	7.8%	0.0%	80.6%	92.4%
Latvia	7.1%	6.0%	89.2%	90.0%
Malta			95.0%	95.7%
Netherlands	9.1%	7.0%	90.4%	92.3%
Poland	4.3%	5.8%	94.4%	92.6%
Portugal	2.4%	3.2%	95.4%	92.5%
Romania	7.8%	5.5%	90.9%	93.2%
Sweden	5.8%	7.2%	92.5%	91.8%
Slovenia	9.4%	6.4%	89.7%	91.6%
Slovakia	4.0%	4.5%	94.5%	93.8%
United Kingdom	13.1%	11.6%	86.8%	88.3%
EU28	9.0%	9.5%	91.0%	90.5%

Source: Eurostat, 2017.

Beyond the analysis of gender distribution in the sector, the age distribution is analysed based on four main categories: young workers aged 15 to 24 years old who often provide low and medium skills with little or no experience, middle aged workers from 25 to 49 years old who may be assumed to provide all types of skill levels with considerable experience, elder workers from 50 to 64 years old assumed to provide solid experience in the field and handling middle management responsibilities, and finally old individuals aged over 64 year old who are also assumed to provide considerable experience in the field. Changes in the distribution of construction sector employees across these categories during the period 2008-2015 clearly show the age effects of the ageing population of employees. Indeed, the share of adults aged 25 to 49 years old, who represent the core of the sector's workforce, has shrunk from 65.3% in 2008 down to 61.8% in 2015, while at the same time the share of elder workers aged 50 to 64 years old has increased by 5.8 percentage points during the same period (Figure 6). Potential hypotheses on the explanations to these trends may include a reconfiguration of the age structure in the industry following the economic downturn, as well as generational effects and the lack of attractiveness of the sector in order to appeal to younger workers.

Regardless of the socioeconomic assumptions retained, it is evident that action needs to be taken in order to respond to the ageing effects on the employee population in order to ensure the competitiveness of the sector.

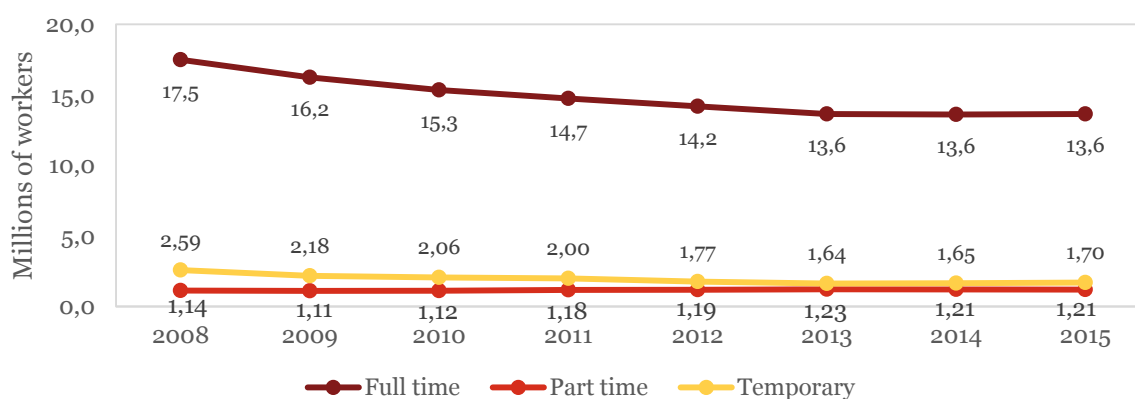
Figure 6: Distribution of employees in the broad construction sector by age category



Source: Eurostat, 2017.

Finally, an analysis of the **nature of employment in the construction sector** is provided in Figure 7 below, namely in terms of full time employment, part time employment and temporary employment. During the period 2008-2015, a drop in full time employment in the European construction sector can be observed, with the number of workers in full-time employment decreasing by 21% on average across the EU28. A similar, though not equivalent trend was observed in the case of temporary employment, which decreased by 34% over the same period. These trends may be explained by the unfavourable conjunctural economic situation at the beginning of the period, which was characterised by a decreasing use of full-time and temporary contracts over the period, although the situation started stabilising towards 2013. This observation also leads to comment on the marginal increase of part-time employment in the sector over the 2008-2015 period, which grew on average by 6% across the EU, from 1.14 to 1.21 million workers.

Figure 7: Evolution of employment types in the construction sector in the EU (2008-2015) in millions of workers



Source: Eurostat, 2017.

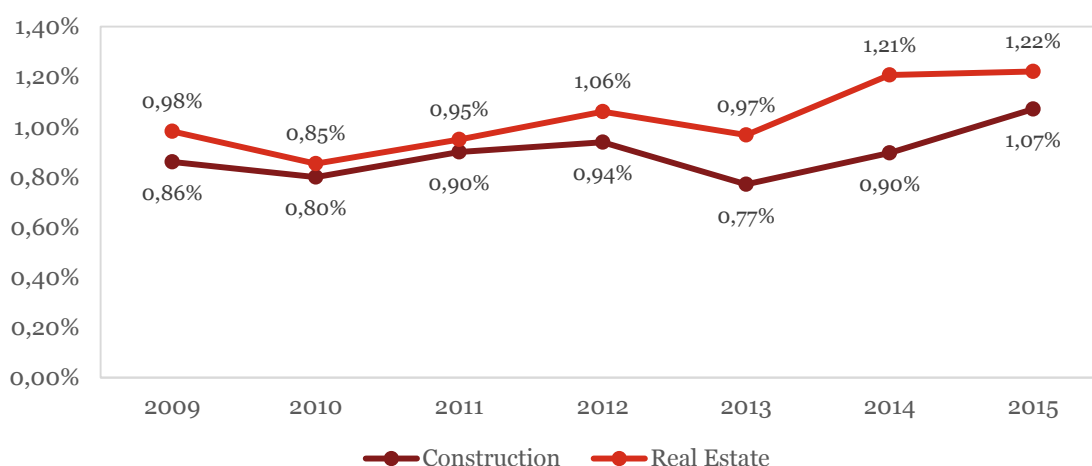
Vacancy rates in the construction sector

Vacancy rates in the construction sector define the extent to which demand for labour is unmet. Such levels of vacancies indicate a potential mapping distortion between the pool of existing skills available at a given period and location and skills sought by employers. In essence, vacancy rates show a natural inability to match the supply and demand of labour in the sector.

Average vacancy rates in narrow construction and real estate activities in the EU28 increased by 0.22 percentage points and by 0.21 percent points, respectively. Overall, this trend indicates that the mismatch between the supply and demand of labour in the construction sector is increasing and that the sector is indeed experiencing a skills shortage. Figure 8 below provides an illustration of the evolution of average vacancy rates in the EU28 for these sub-sectors. Table 4 below provides details on the vacancy rates for each Member State at the beginning and end of the period as evidence of the evolution of vacancy rates.

Note: Due to an important lack of coverage of vacancy rate figures for the year 2008 and for sub-sectors related to manufacturing and architectural activities, only narrow construction and real estate activities are analysed over the period 2009-2015.

Figure 8: Evolution of vacancy rates in the EU construction sector



Source: Eurostat, 2017.

Table 4: Vacancy rates in the construction sector (2009 and 2015)

Country	Construction		Real Estate	
	2009	2015	2009	2015
Austria	1,4%	1,8%	1,6%	1,2%
Belgium	0,0%	3,2%	0,0%	3,5%
Bulgaria	0,2%	0,3%	0,4%	0,4%
Cyprus	3,3%	0,6%	0,4%	0,2%
Czech Republic	3,0%	3,2%	10,2%	9,4%
Germany	0,0%	3,3%	0,0%	1,3%
Denmark	0,0%	0,0%	0,0%	0,0%
Estonia	0,4%	0,5%	0,5%	0,5%
Greece	4,5%	0,0%	3,9%	0,0%
Spain	0,7%	0,4%	0,5%	0,6%
Finland	1,5%	1,4%	1,8%	2,8%

France	0,0%	0,0%	0,0%	0,0%
Croatia	0,0%	1,4%	0,0%	0,3%
Hungary	0,7%	1,1%	0,3%	0,5%
Ireland	0,2%	0,8%	0,5%	0,9%
Italy	0,0%	0,0%	0,0%	0,0%
Lithuania	0,3%	0,8%	0,3%	0,5%
Luxembourg	0,2%	0,6%	0,8%	1,3%
Latvia	0,1%	0,0%	0,3%	0,0%
Malta	0,0%	0,0%	0,0%	0,0%
Netherlands	1,7%	1,7%	1,7%	1,7%
Poland	1,4%	1,0%	0,6%	0,4%
Portugal	0,4%	0,4%	0,2%	0,0%
Romania	0,6%	0,4%	0,2%	0,9%
Sweden	0,7%	1,4%	1,0%	2,1%
Slovenia	1,3%	3,5%	0,8%	3,0%
Slovakia	0,7%	0,4%	0,2%	0,1%
United Kingdom	0,8%	1,8%	1,3%	2,6%
EU28	0,9%	1,1%	1,0%	1,2%

Source: Eurostat, 2017.

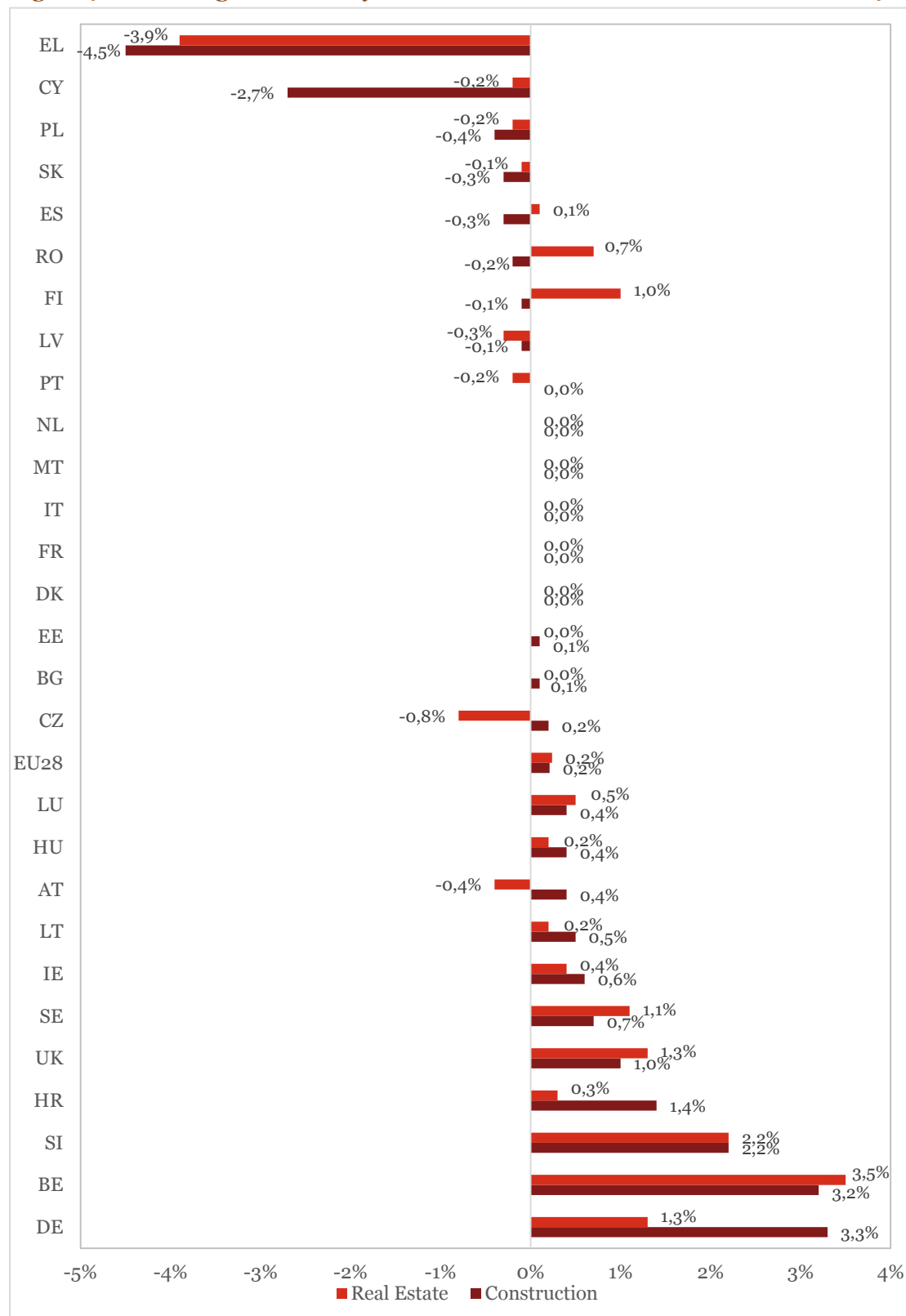
Differences between net changes in construction sector vacancy rates are also observed across EU Member States (Figure 9). Regarding narrow construction, Greece and Cyprus are the two countries that have decreased their vacancy rate over the period 2009-2015 by over 2.5 percentage points (-4.5 points for Greece and -2.7 points for Cyprus). These two countries were distantly followed by Poland, Slovakia, Spain, Romania, Finland, Latvia and Portugal.

On the contrary, Germany and Belgium are the Member States in which the vacancy rate grew the most, by nearly 3.3 percentage points during the same period. They were followed by Slovenia, Croatia and the United Kingdom, which increased by over 1.0 percentage point, increasing the mismatch between supply and demand of labour in the sector.

In essence, it is important to reduce the mismatch between the supply and demand of labour in the construction sector. Cross industry strategies that may help decrease vacancy rates and skills shortage include:

- Modernising and strengthening labour market institutions, notably employment services;
- Removing obstacles to worker mobility across Europe;
- Better anticipating skill needs, labour market shortages and bottlenecks through greater cooperation between industry and education providers;

Figure 9: Net changes in vacancy rates in the EU construction sector over 2009-2015



Source: Eurostat, 2017.

Level of Education

Overview of the tertiary education in the construction sector

The level of education in the construction sector is defined by the qualifications obtained by construction workers across the EU. These are often heterogeneous across countries, presenting important variations as reflected by the figures provided in Table 5 below. For instance, significant differences between the number of graduates with tertiary education in the architecture and building domains within engineering and construction are observed when analysing the relative numbers of tertiary graduates with respect to the overall level of employment in the sector.

In 2008, Greece (2.8%) and Portugal (2.5%) were the countries with the highest shares of tertiary graduates out of the total number of employees in the construction sector. However, in 2014¹⁴, the share of tertiary graduates in these two countries had fallen to about 1.0% of total employees in the sector.

Net percentage changes in the levels of tertiary graduates in the construction sector indicate that Cyprus (+702%), Malta (+285%), Austria (+137%), and Poland (+103%) were the countries accounting for the highest rates of net changes in tertiary graduates. In addition, the analysis of the data provides insight on the positive changes in tertiary graduates in the construction sector in several Member States, indicating that there is an increase of high skilled workers.

These observations seem to be in line and coherent with earlier reports that show that the number of low skilled workers in the sector had decreased on average in the EU construction sector workforce prior to 2008, while the numbers of medium and high skilled workers in the construction sector had increased.

Table 5: Graduates from tertiary education in architecture and building and PhDs in engineering, manufacturing and construction

Country	Graduates from tertiary education in architecture and building				PhDs in engineering, manufacturing, and construction			
	Tertiary Grads 2008	Employees 2008	Tertiary Grads 2014	Employees 2014	PhDs 2008	Employees 2008	PhDs 2014	Employees 2014
Austria	1860	0,43%	4413	0,96%	437	0,10%	510	0,11%
Belgium	3464	0,85%	3380	0,69%	184	0,04%	605	0,12%
Bulgaria	800	0,22%	1484	0,63%	103	0,03%	249	0,11%
Cyprus	40	0,08%	321	1,16%	0	0,00%	13	0,05%
Czech Republic	3800	0,64%	4429	0,75%	590	0,10%	517	0,09%
Germany	15209	0,52%	20812	0,55%	2541	0,09%	3129	0,08%
Denmark	2058	0,66%	3331	1,18%	241	0,08%	473	0,17%
Estonia	342	0,35%	392	0,49%	34	0,03%	35	0,04%
Greece	3594	2,78%	3438	1,17%	239	0,19%	350	0,12%
Spain	12381	0,40%	17513	1,11%	682	0,02%	1186	0,08%
Finland	1324	0,48%	2403	0,84%	286	0,10%	452	0,16%
France	17726	0,68%	23660	0,90%	1274	0,05%	1872	0,07%
Croatia	828	0,35%	1580	0,96%	68	0,03%	154	0,09%
Hungary	1212	0,28%	1855	0,53%	30	0,01%	128	0,04%
Ireland	0	0,00%	2082	1,89%	145	0,08%	151	0,14%
Italy	18481	0,59%	26950	1,19%	0	0,00%	2053	0,09%

¹⁴ No data available for 2015.

Lithuania	1975	0,91%	1787	1,10%	71	0,03%	97	0,06%
Luxembourg	0	0,00%	63	0,12%	0	0,00%	8	0,02%
Latvia	535	0,35%	582	0,46%	28	0,02%	64	0,05%
Malta	41	0,29%	158	1,41%	1	0,01%	9	0,08%
Netherlands	3813	0,48%	0	0,00%	563	0,07%	824	0,12%
Poland	9861	0,68%	20017	1,45%	968	0,07%	561	0,04%
Portugal	5413	2,50%	4704	1,03%	285	0,13%	795	0,17%
Romania	2478	0,31%	3718	0,67%	451	0,06%	1064	0,19%
Sweden	2173	0,42%	3660	0,63%	593	0,11%	920	0,16%
Slovenia	509	0,39%	681	0,71%	86	0,07%	169	0,18%
Slovakia	1747	1,21%	2315	1,02%	342	0,24%	452	0,20%
United Kingdom	29298	1,15%	18410	0,75%	2358	0,09%	3521	0,14%
EU28	140.962	0,71%	0	0,0%	12600	0,06%	20.361	0,10%

Source: Eurostat, 2017.

In addition, information on the numbers of PhDs working in this sector is also provided in Table 5. When measuring the relative levels with respect to the total number of employees in the sector at national level, it can be observed that very highly skilled workers represent a very small fraction of the total workers in the construction sector at national level. At the beginning of the period under study, the Member States with the highest levels of PhDs working in the construction sector were Slovakia (0.24%), Greece (0.18%), Portugal (0.13%), Sweden (0.11%), Finland (0.1%) and Austria (0.1%), while Member States with the lowest shares for which data is available were Malta and Hungary, below 0.01% of the total construction sector workforce.

Net percent changes in the levels of PhDs working in the construction sector during the period 2008-2014 indicate that several Member States have managed to expand the shares of PhDs in the sector two- and sometimes even more than three-fold. Indeed, Malta, Cyprus, Hungary, Belgium, Portugal, Bulgaria, Romania, Latvia and Croatia have dramatically increased their level of very highly skilled workers in the construction sector, with a net change greater than 100%.

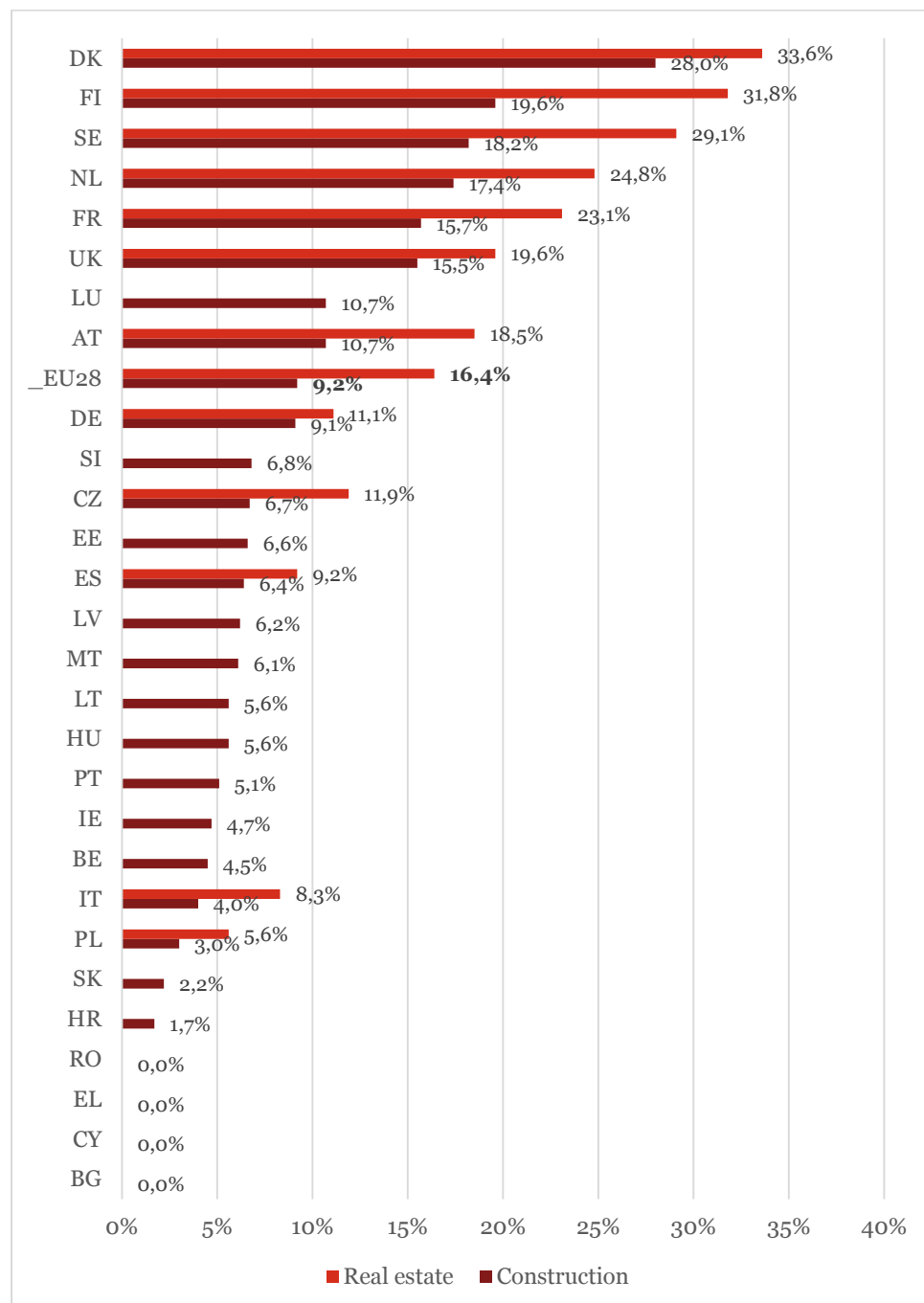
Malta, Cyprus, Hungary, Belgium, Portugal, Bulgaria, Romania, Latvia and Croatia saw a dramatic increase in their highly skilled construction workers, with a net change of over 100%

Participation in education and training

The present section investigates the participation of individuals, and specifically adults (aged between 18 and 64 years old), in education and training programmes.

Several countries present high shares of adult participation in education and training in two principal construction sub-sectors (namely narrow construction and real estate). For instance, Denmark, Finland, and Sweden led the top of the distribution in 2015, while Slovakia, Croatia, Bulgaria, Cyprus, Greece, and Romania were located at the tail of the distribution (Figure 10).

Figure 10: Share of adults aged 18 to 64 participating in education and training



Source: Eurostat, 2017.

Figure 11 below provides the evolution of adult participation in education and training over 2008-2015. In narrow construction, there was a stable share of participation in education and training between 8.2% and 9.3% of the workforce aged 18 to 64 years old, while in the case of real estate activities, the share of adults participating in educational programmes and increasing their levels of skills was steady at about 13% during 2008-2012, subsequently increasing to 16.4% of the population in 2015.

Figure 11: Evolution of the share of 18-64 year old adults (%) participating in education and training



Source: Eurostat, 2017.

Skilled and unskilled workforce

The skilled workforce in the construction sector is often represented by tertiary graduates with knowledge and mastery of science, technology, engineering or mathematics (known as the STEM skills). As described in the CEDEFOP report on skills¹⁵, qualifications and jobs in the EU, such skills translate into the capacity of highly qualified individuals to:

- Generate, understand and analyse empirical data including critical analysis;
- Understand scientific and mathematical principles;
- Apply a systematic and critical assessment of complex problems with an emphasis on solving them and applying the theoretical knowledge of the subject to practical problems; and
- Communicate scientific issues to stakeholders and others; ingenuity, logical reasoning and practical intelligence.

According to the report¹⁶, 48% of highly qualified employees in the EU construction sector hold a degree in a STEM field, making it one of the top industries (along ICT, water management, engineering, mining and quarrying) where the skilled labour is trained in a STEM field. Furthermore, as summarised in the European Monitoring Centre on Change report on the restructuring of the construction sector¹⁷, the workforce in the construction sector mainly comprises men aged between 25 and 54 years who are usually skilled manual workers such as builders, carpenters, painters or electricians.

On the other side of the spectrum, low skilled workers in the construction sector are mainly represented by younger and migrant workers, often on temporary employment contracts. These unskilled workers have been adversely affected by the downturn in the construction sector as employers have sought to retain skilled workers. As illustrated in Figure 12, the majority of the Member States had less than 30% of their workforce represented by low skilled individuals indicating that in most cases the construction sector comprises mainly medium and highly skilled workers, with the exception of Portugal (71.9%), Malta (68.3%), Luxembourg (56.5%), Spain (54%), Italy (51.3%), Greece (49.1%), and the Netherlands (33.6%). The negative evolution of this share of employees across all Member States indicates that the sector has made efforts to increase its appeal

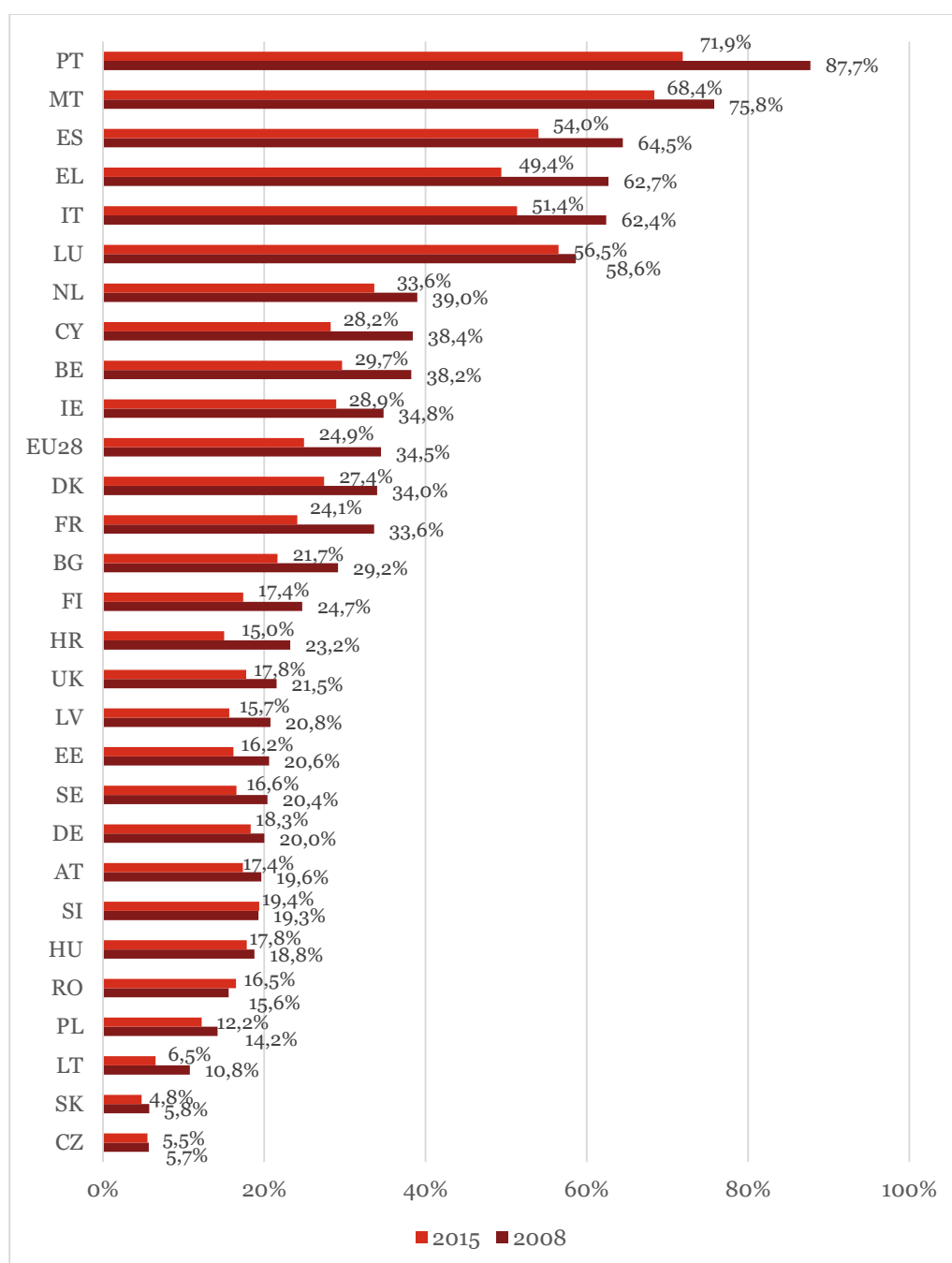
¹⁵ CEDEFOP, Matching skills and jobs in Europe: Insights from CEDEFOP's European Skills and Jobs survey. 2015. http://www.cedefop.europa.eu/files/8088_en.pdf

¹⁶ Ibidem.

¹⁷ EMCC. Restructuring in the construction sector. 2009.

to the more qualified profiles. This trend behaviour showed the highest net percent change in the share of low skilled workers during the period 2008–2015 in Portugal (-15.8%), Greece (-13.2%), Italy (-11%), Spain (-10.4%), and Cyprus (-10.1%).

Figure 12: Low skilled workforce in narrow construction activities in 2008 and 2015 (with less than primary, primary and lower secondary education levels ISCED¹⁸ 0-2)



Source: Eurostat, 2017.

¹⁸ International Standard Classification of Education.

Recognised skills shortage in Construction

Skills shortage in the construction sector

As described by CEDEFOP¹⁹, one of the consequences of the economic crisis of 2008 was a severe loss of jobs and a general rise in the duration of unemployment. These impacts on the labour market implied pronounced concerns about potential “deskilling” affecting millions of unemployed European citizens. Rising levels of skill mismatch across some Member States were accentuated by limited job creation, which compromised the job prospects of low skilled individuals in the job market.

In addition to the “deskilling” pressure on low skilled individuals, a complementary effect could be observed as the more skilled individuals engaged in additional education and qualification, prompting higher levels of graduate over-qualification. The construction sector had to experience a significant restructuring which implied a small raise of its structural unemployment and an acceleration of matching inefficiencies in its labour market. Part of these matching inefficiencies are related to an imbalance between the demand for and supply of skilled labour in the construction sector, as reflected by the evolution of vacancy rates described in the section above.

Bottleneck vacancies

As commented in the previous sections on vacancy rates, skills shortages appear when workers are unable to meet the needs of the labour market despite the high unemployment. However, the level of educational achievement and qualification of the workforce also plays a role in the misallocation of resources and mismatch between the supply and demand of the sectorial workforce. According to the CEDEFOP report on matching skills and jobs in Europe²⁰, a solution to overcome skills mismatching is to improve the existing skills and bring new ones to employees through investment in continuous education and training. For instance, research on the identification of skills shortages²¹ indicates that sectors with critical shortage or surplus have important effects on national education and training programmes.

Bottleneck vacancies are reported by national institutions, public employment agencies and other industry stakeholders, and they represent activities in which shortages are identified, usually measured by ratios between ready to fill vacancies and unemployment rates. Bottleneck vacancies are thus interpreted as labour shortage in specific activities and occupations. This labour shortage is often explained by low enrolment in relevant training, leading to insufficient available qualification for these occupations. Such situations of labour shortage can only be addressed through regular training and education.

Table 6 below provides an overview of the main construction related activities suffering from skills shortage and the main reasons leading to this situation for 18 Member States. The activities identified as skills shortages show a common trend in the EU, referring mostly to a lack of technicians in the construction sector, namely electricians and machine operators. This observation is in line with recent developments of regulations regarding energy efficiency and sustainability in the sector, which may have created a skills gap. Indeed, in most cases, the main reason explaining these skills shortages is the inadequacy of educational programmes and vocational training. Other streamline occupations in the sector, such as roofers, carpenters and stonemasons, are also

¹⁹ CEDEFOP. Skills, qualifications and jobs in the EU: The making of a perfect match? Evidence from CEDEFOP's European skills and jobs survey. 2015.

²⁰ CEDEFOP, Matching skills and jobs in Europe, Insights from Cedefop's European skills and jobs survey. October 2015. <http://www.cedefop.europa.eu/en/publications-and-resources/publications/8088>

²¹ CEDEFOP, Skills shortage and surplus occupations in Europe. Briefing note, November 2016.

experiencing shortages at national level, often due to unattractive working conditions, mobility, and emigration trends²².

Table 6: Main bottleneck vacancies in construction related activities and their main reasons

Country	Main bottleneck vacancies identified in construction related activities	Main reasons for bottleneck vacancies
Austria	Machine tool setters and operators, Mechanical and electrical engineering technicians Roofers, carpenters, and joiners	Decrease in the offer of vocational training, Applicant mobility, and Lack of practical work experience
Belgium	Engineers, technicians, designers, and electricians	Lack of supply of graduates, Up-skilling and technological development, and Lack of proper attitude, motivation, specific and linguistic skills
Cyprus	Electrical engineering technicians	Poor working conditions, Seasonal demand, and Rapid technological change
Czech Republic	Metal working machine tool setters and operators	Competition for qualified candidates, Insufficient interest in the type of work, and Low salary and poor working conditions
Germany	Electrical engineering technicians, Building and related electricians,	Lack of required formal qualifications, Unfavourable conditions such as low salary, and Replacement demand
Denmark	Carpenters, Specialised Carpenters, Soil and concrete workers	Lack of technical competences/skills, Rapid technological change, Mobility, and
Estonia	Welder and flame cutters, Metal working machine tool setter and operators, Electrical equipment installers and repairers	Poor working conditions Lack of technical competencies, Poor image of certain occupations, and Regional disparities and age issues
Spain	Energy performance salespersons	Lack of technical competencies, Lack of work experience, Salary considered too low
France	Roofers, Structural-metal preparers and erectors, Building designers, Plumbers	Lack of skilled candidates, Candidates unwilling to move, and Rapidly evolving technology
Hungary	Stonemasons	Lack of technical competencies and candidates, Competition from abroad and emigration
Lithuania	Metal and wood processing plant operators	Lack of technical competencies, Unattractive working conditions, and Emigration
Netherlands	High and medium skilled technical professionals in manufacturing and construction	Growing demand and insufficient supply, Negative image and unattractive working conditions, and
Poland	Building and related trades workers (excluding electricians)	Change in the kind of profiles sought Emigration of labour, Decreasing uptake of vocational training, and Lack of technical competencies and emigration
Portugal	Building frame and related trades workers, Process control technicians, Glass and ceramics plant operators, Crane, hoist and related plant operators	Salary considered too low, Lack of technical competencies, and Shift work/unsociable hours
Romania	Building finishers workers, Painters, and building structure cleaners	Emigration of labour, and Salary and working conditions
Slovenia	Carpenters and joiners; Plumbers and pipe fitters, Mechanical engineer; Electrical engineers	Lack of hard skills, and Working conditions in some sectors are regarded as unattractive
Slovakia	Metal working machines tools setters and operators, Welders and flame cutters	Low number of qualified candidates, Low interest in vocational training and technical studies, Benefits trap, and

²² European Commission, Mapping and Analysing Bottleneck Vacancies in EU Labour Markets. September 2014.
<http://ec.europa.eu/social/main.jsp?catId=993&langId=en&newsId=2131&moreDocuments=yes&tableName=news>

United Kingdom

Construction supervisors

Emigration of skilled labour
Lack of technical competencies,
Poor image of some sectors, and
Strong growth in low carbon sector

Source: Mapping and analysing bottleneck vacancies on EU Labour Markets. Ramboll.

Moreover, as discussed in the chapter on Drivers of skill needs, new technologies and digitalisation play an important role on the sets of skills required for the future. Emerging technologies related to green construction start to generate a need and demand for specific skills that are currently lacking in the labour force. These skills need to be developed through educational strategies involving both national and local levels allowing workers to learn and use the technologies that are increasingly embedded in the different operational processes. Consequently, tackling the skills shortage problem includes foreseeing investment in R&D and in the promotion of VET programmes. However, beyond tackling the problem with efforts to increase the levels of qualifications, it is important notice that Member State economies are heterogeneous, and that needs for specific skills in the construction sector in the short term need to be contextualised with regards to the demographic structure and dynamics of each Member State and in the light of the characteristics of their respective economy and labour market. As an example, according to the report on the cost effectiveness of apprenticeship schemes²³, future needs of skills in the short term will be characterised by different levels of skills qualifications and education across countries.

Skill surpluses and the reconversion towards future needs

Skill surpluses arise because demand for occupation falls. For instance, following the economic downturn, the construction sector experienced a decrease in the number of available jobs, and particularly those related to manual trades. The major concern regarding future needs for skills in the construction sector, rather than focusing on the emergence of new activities, seems to be critically oriented towards the issue of the transformation of the existing skills. In essence, the emergence of new activities requires the existing set of skills in the industry to adapt and transform to meet the requirements of the new processes, practices and technology. As described in the chapter on Drivers of skill needs, a transformation is already taking place both in employers and employees within the EU construction sector. The shift in the needs for skills due to technology, processes, and product enhancement as well as other external factors, such as environmental considerations, have created an emergent demand for new skills and a skills gap as the workers are unable to meet them with their existing skill-base.

3. Drivers of skill needs

Energy efficiency and digitalisation have emerged as two of the most influential drivers affecting the need for skills, requiring the construction workforce of the future to possess competences that will allow it to reap the benefits offered by sustainable construction and digital technologies. Thus, some of the skills acquiring greater importance include management, planning, numeracy and communication skills, as well as ICT, digital, renewable energy and energy efficiency skills. Aligning the competences of the workers to the requirements imposed both by policy drivers and market demand will ultimately result in a more productive, profitable and competitive construction sector. This chapter therefore

Energy efficiency and digitalisation have emerged as two of the most influential drivers

²³ UEAPME, Business Europe, CEEP. The cost-effectiveness of apprenticeship schemes. 2016. https://be-extranet-prod.s3.amazonaws.com/publications/2016-05-27_employers_final_report_on_apprenticeships.pdf


analyses the main trends and drivers for future skill needs in the European construction sector of 2020 and beyond.

Energy Efficiency and Sustainable Construction

Context - Policy drivers

The move towards an energy efficient and sustainable building sector constitutes one of the primary drivers for future skill needs. Energy efficiency and sustainable construction carry significant market potential, being expected to attract extensive investments and providing major opportunities for businesses in the general economy. The renewable energy industry alone is predicted to employ up to 2 million people by 2020, with the majority of new jobs being created in the construction sector²⁴. In order to create a conducive regulatory environment for the promotion and development of this area, action has been taken both at the EU and national level. Indeed, EU policies aim to encourage Member States to decrease the energy consumption of the national building stock and stimulate their conversion from energy consumers to energy producers through retrofit measures and renewable energy sources (RES). In this context, the main EU legislative instruments relevant to sustainability and energy efficiency, which will predominantly affect the need for specialised skills in the European construction sector, include the following:

- **The Energy Efficiency Directive (EED)** (Directive 2012/27/EU) sets a 20% energy savings target to be achieved by 2020. In accordance with the Directive, Member States are required to submit National Energy Efficiency Action Plans (NEEAPs) every three years starting from 2014, as well as establish a long-term strategy beyond 2020 for mobilising investment in the renovation of residential and commercial buildings. Ultimately, Member States have to ensure that 3% of the total floor area of buildings owned and occupied by its central government is renovated each year, starting in 2014. In November 2016, as part of the 'Clean Energy for All Europeans' package of proposals, the Commission brought forward a proposal for an update of the EED, which includes a new 30% energy efficiency target for 2030, as well as measures to make sure the new target is met. This target is expected to result in the creation of 400,000 additional jobs in the general economy by 2030, particularly in the construction sector, by increasing the demand for skilled manual labour²⁵.
- Another fundamental regulatory document is the **Energy Performance of Building Directive (EPBD)** (Directive 2010/31/EU), which introduces the concept of Nearly Zero Energy Buildings (NZEBs) and establishes that all new buildings be NZEBs by 2020. Moreover, it requires the definition of new minimum energy performance requirements (for new buildings and major renovations), applying a cost-optimal calculation.
- The **Renewable Energy Sources (RES) Directive** (2009/28) establishes a common framework for the promotion of energy from renewable sources. It recognises information and training gaps, especially in the heating and cooling sector, which are addressed through provisions regarding the information and training of all relevant actors, including builders and installers. Thus, under the Directive, Member States are responsible for ensuring the introduction of certification schemes for installers of small-scale biomass boilers and stoves, solar photovoltaic and solar thermal systems, shallow geothermal systems and heat pumps.



20% energy savings target to be achieved by 2020 (EED)

²⁴ European Commission, Analytical highlight – Renewable energy sector. May 2014. http://skillspanorama.cedefop.europa.eu/sites/default/files/EUSP_AH_Renewables_o.pdf

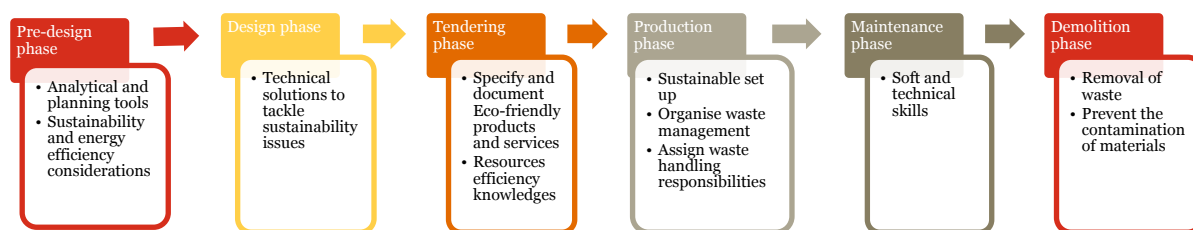
²⁵ European Commission, Proposal for a Directive of the European Parliament and Council amending Directive 2012/27/EU on energy efficiency. November 2016. <http://eur-lex.europa.eu/legal-content/EN/TXT/?qid=1485938766830&uri=CELEX:52016PC0761>

Impact on training and skill needs in the construction sector

Skill needs throughout the construction process

The stringent energy efficiency targets and increasing demand for sustainable construction solutions are expected to bring a transformation of the skills required during all stages of the building process, from planning to design, production, maintenance and renovation and finally demolition (Figure 13).

Figure 13: Skill needs across the construction process



Source: PwC analysis.

At the **pre-design phase** of the project, requirements and existing conditions are identified, and any essential information that will inform the design process is uncovered²⁶. Common activities include preparing a building programme and conducting a site analysis. Although sustainability and energy efficiency aspects have traditionally been incorporated in the design and operation parts of the building process, construction professionals involved at this stage will increasingly be required to develop skills related to the use of analytical and planning tools to take into account such elements, thus being able to assess and balance environmental, economic and legal factors that characterise a specific construction project. Therefore, professionals will be required to have knowledge about any relevant climate considerations, appropriate passive sustainable design strategies and environmental resources to be considered in the design phase, as well as an understanding of the energy performance goals of the final construction.

During the **design phase**, the specifications of the projects are defined by integrating inputs from all parties and from the previous stage. Given the increasingly sustainable orientation of this phase, it will be essential for designers to incorporate aspects such as energy efficiency, waste management, recycling of materials, resource management, climate change adaptability and health and safety in their decision-making process. Consequently, all professionals involved in this stage, from designers and architects to civil engineers, will need skills related to the technical solutions necessary to tackle and address such sustainability issues, for instance ensuring the final construction includes the necessary infrastructure to face long-term climate change challenges such as the increase in rainfall and flooding.

Being able to specify and document how sustainable and environmentally-friendly products and services are procured will be an important future competence for contractors in the **tendering phase**, particularly given the growing attention put on 'green' public procurement as a means of reducing the environmental impact of the construction sector. This trend is particularly evident in countries such as Sweden and the Netherlands, where contracting authorities put requirements on the specifications of contracted goods and services. Thus, to align with this tendency, contractors will increasingly need skills and knowledge related to resource efficiency during the design and construction phases, including waste minimisation and reuse of construction materials.

²⁶ Autodesk Sustainability Workshop, Project Phases & Level of Development.
<https://sustainabilityworkshop.autodesk.com/buildings/project-phases-level-development>

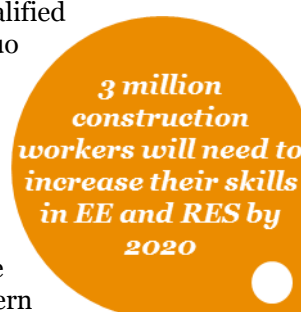
Similarly, during the actual **production stage**, the contractor will increasingly be required to be knowledgeable and skilled concerning the sustainable set up of the construction site and preparatory activities, being able to organise waste management and assigning responsibilities for waste handling to the workers. Moreover, following handover, the contractor will need to demonstrate that sustainability requirements have been met. Therefore, site workers need to be trained to develop the necessary skills to carry out sustainable construction practices on-site, whereas managers will be required to have the skills to be able to sustainably organise the logistics of the construction process²⁷.

The **maintenance/refurbishment phase** is the most crucial in terms of skill needs, due to the stringent renovation requirements and policies measures seeking to stimulate the transformation of existing buildings. Indeed, the size of the EU energy renovation market could increase by almost 50% until 2030, should the 40% energy savings target be adopted, being worth about EUR 122 billion, creating approximately 988,200 additional jobs and cutting down greenhouse gas emissions by 62.9% in the residential and by 73% in the non-residential sector²⁸. The increasing importance of maintenance and renovation in the construction market will therefore require a highly qualified workforce, both from a technical perspective but also in terms of soft skills. Thus, some of the key skill needs will include effective communication with clients regarding energy efficient renovation, installation of energy efficient building automation systems, post-installation follow-up services and enhanced cooperation among all professionals involved in this stage.

Finally, new skills will be increasingly needed at the **demolition stage** during the dismantling, reuse, recovery or disposal of building materials. Consequently, workers skilled in the removal of waste from the site and in detecting leakages, pollution and emissions will be particularly sought-after in order to prevent the contamination of materials while project managers should provide the overall strategy and strategic knowledge to instruct and train the workers.

Training needs by occupation

Given the policy drivers described above, and taking into account the fact that the building sector accounts for 40% of the final energy demand in the EU, it is evident that sustainable construction and energy efficiency open up significant market opportunities for EU construction companies. Nevertheless, these can be reaped only if a suitably skilled and qualified workforce is available. Indeed, according to the national Status Quo Analyses²⁹ conducted under the BUILD UP Skills initiative, over **3 million construction workers** in Europe will need to increase their skills in the building sector in relation to energy efficiency (EE) and renewable energy systems (RES) by 2020, stressing the pivotal role of dedicated training³⁰. Moreover, it has been estimated that retrofitting of existing homes could create around 280,000-450,000 new jobs for energy auditors, certifiers, inspectors of heating systems and renewable technology installers, with potential strong impact in Central and Eastern European economies, where the least energy-efficient buildings are located.



3 million
construction
workers will need to
increase their skills
in EE and RES by
2020

²⁷ Danish Technological Institute, Future Qualification and Skills Needs in the Construction Sector. July 2009. <http://ec.europa.eu/DocsRoom/documents/5046/attachments/1/translations/en/renditions/native>

²⁸ European Parliament, Boosting Building Renovation: What potential and value for Europe?. October 2016. [http://www.europarl.europa.eu/RegData/etudes/STUD/2016/587326/IPOL_STU\(2016\)587326_EN.pdf](http://www.europarl.europa.eu/RegData/etudes/STUD/2016/587326/IPOL_STU(2016)587326_EN.pdf)

²⁹ BUILD UP Skills, National BUILD UP Skills Projects. <http://www.buildup.eu/en/skills/bus-projects>

³⁰ European Commission, BUILD UP Skills - An initiative to boost the energy skills of Europe's building workforce. February 2014. http://ec.europa.eu/energy/intelligent/files/build_up_skills_publication.pdf

Specifically, looking at the demand by type of occupations, the trend at the EU level indicates that the highest numbers of workers needing to be trained on energy efficiency and renewable energy are found in the following professions:

- ✓ **Electricians**
- ✓ **Plumbers** (including installers of heat pumps boilers, biogas systems, central heating, sanitary and thermic equipment)
- ✓ **Carpenters and joiners**
- ✓ **Bricklayers**
- ✓ **Technicians** (including Heating, Ventilation, and Air Conditioning - HVAC)

A similar trend is observed at Member State level, although training needs can vary between countries, both in terms of the occupations for which additional training is required to meet 2020 energy targets, and in terms of the share of the total workforce requiring additional training. For instance, in countries such as Bulgaria, the currently low level of introduction of energy-efficiency buildings implies that the entire construction workforce should be trained on the basic principles of energy efficiency by 2020, without particular differences between occupations. Similarly, in Spain, up to 100% of the workforce is estimated to require extra skills in EE and RES until 2020.

In Greece, the professions with the highest amount of workers estimated to require training by 2020 to reach the EE targets are mostly aligned with the broader EU trend. Thus, up to 86,000 building frame workers, 98,500 building finishers - which includes roofers, plasterers, glaziers, plumbers and HVAC technicians – and 14,500 electrical equipment installers and repairers will need to be trained by 2020. Likewise, in Belgium, bricklayers, joiners, roofers, plasterers and glaziers report the largest EE and RES training needs (specifically 6,400 bricklayers and joiners and 2,800 roofers and 2,500 plasterers and glaziers). In the UK, the estimated numbers of the blue collar workforce requiring training are also in line with the overall trend, and include 52,000 plumbers and HVAC technicians, 39,000 electricians/electrical fitters, 28,000 carpenters and joiners, and 12,700 glaziers/fitters³¹.

Digitalisation of construction

The advent of digital technologies is set to bring about the ‘disruption’ of the construction sector, having the potential to drastically change the way of doing business. Indeed, according to a recent industry survey, 93% of construction companies believe digitalisation will affect each of their processes, although in different ways depending on the different actors in the sector. Indeed, for manufacturers of building materials, digitalisation will mainly be relevant for production and distribution, whereas for construction companies it primarily affects planning, construction and logistics, with Building Information Modelling (BIM) being one of the technologies with the greatest potential. As for building material traders, digitalisation is particularly focused on sales, with online trading becoming a crucial part of their operations³².

³¹ European Commission, BUILD UP Skills – EU overview report. June 2014. <https://ec.europa.eu/energy/intelligent/files/library/doc/overview-report.pdf>

³² Roland Berger, Digitization in the construction industry. June 2016. https://www.rolandberger.com/publications/publication_pdf/tab_digitization_construction_industry_e_f inal.pdf

Despite recognising the importance of digitalisation and the considerable benefits it confers, both in terms of productivity gains and cost reductions, the construction sector has been slow to adopt process and technology innovations. Indeed, according to the survey, less than 6% of construction companies make use of digital planning tools, whereas 100% of companies declared not yet having exhausted their digital potential. These results are in line with another recent report, which highlights that the construction sector is the second least digitalised, after agriculture³³. Moreover, 81% of European construction industry players declared not being ready for the advent of digitalisation, despite 82% of them acknowledging that having digital skills will be partially essential for getting a job³⁴. Technological advances constitute a wealth of opportunities for the sector, although their full potential cannot be achieved without a suitably skilled workforce.

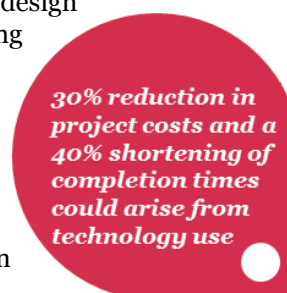


*81%
of European construction
industry players
declared not being ready
for the advent of
digitalisation*

Standardisation and industrial scaling – offsite construction

One of the most promising technological trends currently acting as a primary driver for skills is related to the standardisation and industrialisation of the building process. This is enabled by so-called Modern Methods of Construction (MMCs), a wide range of technologies including offsite construction (or off-site modular assembly), which consists in assembling buildings from prefabricated components manufactured offsite and employing standard and reusable product catalogues (i.e. libraries containing design templates like datasheets and equipment lists)³⁵. Offsite construction encompasses four main types of assembly, namely small scale components (e.g. light fittings, windows, etc.), large scale modules and panelised systems, individual units/rooms and complete buildings.

Offsite construction is increasingly technology-driven, relying on approaches and tools such as Design for Manufacture and Assembly (DFMA), Lean production, BIM and the Enterprise Resource Planning software. These digital tools are paving the way towards a real standardisation of construction and ensuring industrialisation of production. BIM links 3D design drawings to real-time scheduling, resource management and material pricing data, and is therefore a cost-effective way of planning, designing and controlling building projects. BIM can also be interfaced with tools like Enterprise Resource Planning software, which reacts to updates in a BIM model with inventory status, incoming materials and labour schedules³⁶. Therefore, the use of technology to allow for the standardisation and industrialisation of building processes and offsite construction entails important benefits, with some estimates pointing at a 30% reduction in project costs and a 40% shortening of completion times³⁷.



³³ McKinsey, Imagining construction's digital future. June 2016. <http://www.mckinsey.com/industries/capital-projects-and-infrastructure/our-insights/imagining-constructions-digital-future>

³⁴ World Highways, CECE Summit – is Europe ready for a digital construction worksite?. October 2015. <http://www.worldhighways.com/sections/eurofile/features/cece-summit-is-europe-ready-for-a-digital-construction-worksite/>

³⁵ Aspentech, Business Standard - Streamlining Projects with a Modular Approach. July 2016. <https://www.aspentech.com/Industry-Perspectives/Business-Standard---Streamlining-Projects-with-a-Modular-Approach/>

³⁶ Medium, The benefits of turning housing construction into housing production. December 2016. <https://medium.com/sidewalk-talk/the-benefits-of-turning-housing-construction-into-housing-production-2513fffea933#.1okkqvohv>

³⁷ McKinsey, Tackling the world's affordable housing challenge. October 2014. <http://www.mckinsey.com/global-themes/urbanization/tackling-the-worlds-affordable-housing-challenge>

Impact on skill needs – offsite

The transfer of site-based construction activities to an offsite ‘factory-like’ environment may even contribute to alleviating some of the industry’s skill shortages. Indeed, where offsite factories are built, there will be an increase in new employment opportunities for skilled trades in the nearby areas, as well as the creation of new apprenticeships. The offsite factory environment may enhance the appeal of the construction industry to both new entrants and experienced workers looking for an alternative to traditional site-based work. Moreover, the shift towards offsite construction may also provide the opportunity to fill the skill gap through other engineers and technicians working in similar factory-like environments across different industries, such as aerospace or automotive, since transferrable skills could be applied to offsite construction³⁸.



Where offsite factories are built, there will be an increase in new employment opportunities for skilled trades, as well as the creation of new apprenticeships

With regard to specific skills required by the advent of digital technologies and industrialisation, professions like carpenters and joiners will require honed assembly skills to assemble framed buildings to meet appropriate standards and achieve the adequate level of structural integrity and thermal performance. Similarly, plumbers and electricians will need to develop the ability to cut holes and channels without affecting the integrity and thermal efficiency of the structure and final building. As for managers and supervisors, they will need the competences to appropriately incorporate offsite components with processes taking place onsite. Finally, architects will be requested to have coordination skills to oversee increasingly collaborative design processes³⁹.

It is interesting to note that these particular skills are functionally relatively unchanged compared to the current needs. Industrialisation of the building process and offsite modular construction will rather require professionals working in these trades to adopt a more efficient, strategic and collaborative method of working, as opposed to developing completely new technical skills. For higher-level professionals in particular, managerial skills, and especially process management, will be progressively more crucial, with competences in site safety, risk management, sequencing and quality control being required as the building process becomes integrated with manufacturing functions. Furthermore, marketing and business development, planning and design will also be driven by offsite construction practices. Nevertheless, it will be particularly crucial for the workforce to develop the ability to use information technology and other automated tools. In France alone, estimates point towards the need to train up to 80,000 workers in BIM by 2020⁴⁰. Moreover, in countries such as the UK, the use of BIM Level 2 has been made mandatory as of April 2016 for centrally-procured public projects, thus being a considerable driver for the training of skilled BIM users, particularly in smaller companies, so as not to miss out on the opportunities opened up by the technology⁴¹. Appropriate skills are also needed to perform detailed and accurate 3D drawings in order for offsite construction to be carried out effectively.



In France alone, estimates point towards the need to train up to 80,000 workers in BIM by 2020

³⁸ A. Knight, The industrialisation of construction. February 2017. <https://www.linkedin.com/pulse/industrialisation-construction-adam-knight>

³⁹ UK Commission for Employment and Skills (UKCES), Technology and skills in the Construction Industry. September 2013. https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/305024/Technology_and_skills_in_the_construction_industry_evidence_report_74.pdf

⁴⁰ Batiactu, Il faudra former 80.000 salariés au BIM d'ici à 2020, selon Syntec-Ingénierie. September 2016. <http://www.batiactu.com/edito/il-faudra-former-80000-salaries-au-bim-ici-a-2020-selon-46393.php>

⁴¹ British Gypsum, BIM post-mandate: Where do we go from here? September 2016. <http://www.british-gypsum.com/blog/2016/09/where-do-we-go-postbim>

In general therefore, managerial and technical skills will need to be increasingly intertwined, especially in higher level occupations, with construction professionals of the future being characterised by a balance of core soft and technical skills, but also relevant knowledge and evolving behaviours. In fact, aside from skills, knowledge regarding the importance of accuracy and precision, as well as awareness and comprehension of other roles and their interaction, will also need to be enhanced with the rise of offsite construction. A detailed summary of the types of skills, knowledge and behavioural changes needed do respond to the digitalisation and standardisation of construction processes, and specifically offsite construction, is depicted in Table 7 below.

Table 7: Skills, knowledge and behaviours needed for offsite construction

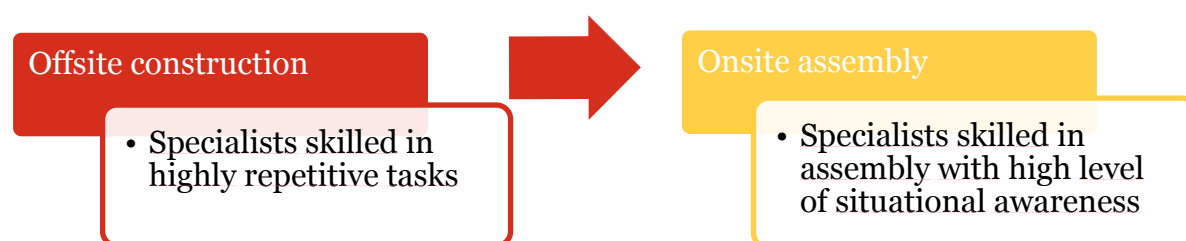
	Technical	Managerial/Soft	ICT/digital
Skills	<ul style="list-style-type: none"> - Onsite placement and assembly - Logistics - Maintenance and repair of offsite components - Carpentry - Joinery - Air tightness - Site preparation - Operation of machinery - Whole life costing - Just In Time systems 	<ul style="list-style-type: none"> - Project management - Planning and design - Risk management - Quality control - Management of interdisciplinary and diverse teams - Customer service and interaction - Process improvement - Supply chain management - Procurement - Negotiating and influencing - Problem solving 	<ul style="list-style-type: none"> - Building Information Modelling (BIM) - Computer-Aided Design (CAD) - 3D drawing
Knowledge	<ul style="list-style-type: none"> - Awareness other job roles - Integration of offsite components with onsite processes - Cross-disciplinary education - Business development - Waste minimisation - Time and sequencing allocations - Handling and storage of offsite products and components - Health & safety principles and legislation - Lean manufacturing principles - Design and assembly costs - Materials and components composition – applications and properties - System performance - Sustainability processes and materials 		
Behaviours	<ul style="list-style-type: none"> - Flexibility/adaptability - Communications - Collaboration and teamwork - Accuracy and precision - Speed and efficiency 		

Source: adapted from UKCES 2013.

Impact on skill needs – onsite

Another important aspect of standardisation and industrial scaling of construction processes is the distinction between the type of skills needed during offsite construction and the subsequent onsite assembly. The standardisation during the offsite stage will result in a need for specialists skilled in highly repetitive tasks. This can therefore lead to cost scaling in the future. Conversely, onsite assembly requires professionals able to assemble components manufactured offsite with a high level of situational awareness (i.e. knowledge of other jobs roles and their holistic interaction) (Figure 14).

Figure 14: Overview of skill differences between offsite construction and onsite assembly



Source: adapted from UKCES 2013.

Moreover, the division between offsite and onsite activities will have an indirect effect on occupations like construction engineering, mechanical and electrical trades. The duration during which they will be needed in the process will be shorter, since the onsite assembly stage will be considerably faster. On the contrary, traditional onsite skills such as drainage and foundation work for site preparation will not be subject to major changes.

New technology is blurring the boundaries between traditional trades, with disciplines becoming increasingly interwoven, thus disrupting the role of traditional occupations in the new construction process. Therefore, greater flexibility, broadening of the current skill-base and multi-skilling are necessary as offsite construction becomes more widespread, given the need for increased precision and higher quality standards. Indeed, possessing a blend of skills will ensure that the workforce is aligned with technological advances, better prepared for more managerial positions and better equipped to react to any demand shocks in construction owing to its transferrable skills, thus helping companies to withstand the cyclicity of the industry. In addition, a multi-skilled workforce has been shown to reduce total project costs by 5% and to decrease the requirement for labour by 35%⁴².

A multi-skilled workforce can reduce total project costs by 5% and to decrease labour requirements by 35%

4. Obstacles to skills development

While new technologies and energy efficiency requirements are driving the demand for skills in the construction sector, some of its inherent characteristics, such as its low attractiveness, structural specificities and the challenges in delivering vocational education and training (VET), pose obstacles to the development of skills needed to flourish. In addition, difficulties in skill recognition across countries limit mobility among workers as a possible solution for skills shortages.

⁴² McKinsey Global Institute, Reinventing Construction: a route to higher productivity. February 2017. <http://www.mckinsey.com/~/media/McKinsey/Industries/Capital%20Projects%20and%20Infrastructure/Our%20Insights/Reinventing%20construction%20through%20a%20productivity%20revolution/MGI-Reinventing-Construction-Full-report.ashx>

Structural barriers to skills development

The construction sector tends to be less engaged in the development of its human resources⁴³. Together with real estate, they are the sectors that provide least continuous vocational training hours in Europe, namely five hours per 1000 hours worked⁴⁴ while the finance and communication sector provide more than double the amount of continuous training. Furthermore, there are substantial variations among MS in terms of adult learning, ranging from a 28% share of adults participating in education and training in Denmark to no participation in Romania, Cyprus, Greece and Bulgaria. The overall low levels of continuous education and investment in skills and human resource development is linked to a number of structural factors typical of the industry, that foster a short-term approach to human skills development⁴⁵. Namely, construction is characterised by **low predictability**, as its business cycles depend on the ups and downs of the overall economy, with little possibility to steer the course of the trajectory. Such unpredictability leads to short-term employment, which in turn limits the incentives for long-term investment in the workforce. In addition the high share of project-based work including sub-contracting, a sizeable informal economy, high levels of migration and turnover are further detrimental to investment in training and skills development⁴⁶.

The **structural fragmentation** of the construction sector also plays a key role in limiting the skills development within the industry. Indeed, across the EU the construction sector is dominated by micro, small and medium-sized enterprises that often lack the financial and personnel capacity to invest substantially in the training of their employees. The training of apprentices is often viewed as costly and inefficient, instead of as an investment into future skills. Furthermore, the fragmentation of the industry's supply chain leads to a lack of ownership of common challenges, such as skills shortage⁴⁷. Indeed, the lack of integration of the supply chain characterised by the use of sub-contracting results in a heavy focus on costs as opposed to value, again with negative repercussion on investment in human resources. Training initiatives are often implemented as a result of some industry members' specific interest, but are rarely conceived as joined efforts to the benefit of the entire sector. This is likely to pose a barrier to the successful uptake of upcoming digital and technological advances, such as BIM, as they require greater collaboration from the industry as a whole⁴⁸.

Finally, there are a number of specific **barriers to the training of building workers**, which can be linked to the lack of public support to training, the limited supply as well as the uncertainty over the quality of training. The low educational attainment of a large part of the workforce may pose a challenge for participation to training, particularly regarding the implementation of new technologies, e.g. related to sustainable construction. Cultural and linguistic barriers may also pose a difficulty for attending training, in the case of migrant workers. In addition, the cost of training is considered too high, making it difficult to access for a number of smaller players in the industry. Available public funding for training, particularly for energy efficiency, often lacks a coherent

⁴³ World Economic Forum, Shaping the Future of Construction. 2016. http://www3.weforum.org/docs/WEF_Shaping_the_Future_of_Construction_full_report_.pdf

⁴⁴ McKinsey Global Institute, Reinventing Construction: A Route to Higher Productivity. February 2017. <http://www.mckinsey.com/~media/McKinsey/Industries/Capital%20Projects%20and%20Infrastructure/Our%20Insights/Reinventing%20construction%20through%20a%20productivity%20revolution/MGI-Reinventing-Construction-Full-report.ashx>

⁴⁵ Influence, To change the 'image of construction' first change construction. April 2016. <http://influence.cipr.co.uk/2016/04/22/change-image-construction-first-change-construction/>

⁴⁶ BUILD UP Skills – EU overview report. June 2014. <https://ec.europa.eu/energy/intelligent/files/library/doc/overview-report.pdf>

⁴⁷ The Guardian, At some point we will have no one coming into the construction industry'. June 2015. <https://www.theguardian.com/business/2015/jun/24/construction-industry-apprenticeships-skilled-workers-training>

⁴⁸ Mark Farmer, The Farmer Review of the UK Construction Labour Model. October 2016.

framework or national approach and consists of one-off support schemes. In addition, small and micro enterprises view training as a loss work hours and absence of work instead of an investment, due to the uncertainty over training results. In some countries, improving the energy performance of buildings is still regarded as a luxury rather than a necessity, with energy efficient construction techniques proving to be more expensive than traditional ones. Smaller companies are therefore reluctant to train their workforce since they are unsure about the payback time of the trainings. The economic crisis has put many SMEs in ‘survival’ mode, forcing them to prioritise short-term work over long-term investments. The quality of training may also be questionable in a number of cases, where courses do not keep up with the latest technical developments or are not sufficiently based on practice. Not least, procurement markets often favour ‘lowest price’ instead of quality, thereby limiting the incentives for the investment in a highly skilled and professionalised workforce⁴⁹.

Negative image of the construction sector

The construction industry suffers from an overall poor public perception of job security, tough working conditions and health and safety concerns. In part, the negative image of the industry derives from its structural characteristics, such as working hours and potentially harsh conditions, yet the sector is also plagued by negative stereotypes and on overall poor reputation depicted in popular culture.

The general public often perceives the construction industry as being inefficient, unproductive, low quality and having low service orientation. This poor image of the sector is shaped by consumer household experiences with small firms working on repair and maintenance of homes that drive the overall stereotype of the ‘cowboy builders’ as incompetent, dishonest and a tax evading construction workers⁵⁰. In the media such negative stereotypes are often reinforced. The real estate market also contributes to the negative perception by fuelling speculative construction. On the other hand, major achievements of the industry, such as for instance flagship buildings, the Olympic Games infrastructure or other high-level civil engineering projects are rarely celebrated as successes of the construction industry.

Furthermore, the industry is associated with a ‘macho’ attitude on construction sites, with anecdotes about racist, sexist, homophobic and foul language⁵¹. Not least, women’s participation in the industry has traditionally been very low, reaching about 9.5% of the workforce in 2015. On the other hand, increasing technological developments and the shift away from manual labour, there is an increasing opportunity for reducing the gender gap in construction⁵².

Data from a YouGov poll confirms the negative perception of the industry: construction work is seen as ‘strenuous’ or ‘dirty’ by over half of the survey respondents, while only 11% characterised it as ‘exciting’. Furthermore, 23% of the public considers construction work as nuisance since it is responsible for creating ‘mess, traffic and inconvenience’. Finally, academic and educational attainment are not closely associated with construction, as 41% of survey respondents consider that it is one of the least likely sectors to require further



⁴⁹ BUILD UP Skills – EU overview report. June 2014. <https://ec.europa.eu/energy/intelligent/files/library/doc/overview-report.pdf>

⁵⁰ http://www.arcom.ac.uk/-docs/proceedings/ar2000-073-081_Proverbs_Holt_and_Cheok.pdf

⁵¹ Influence, To change the ‘image of construction’ first change construction. April 2016. <http://influence.cipr.co.uk/2016/04/22/change-image-construction-first-change-construction/>

⁵² McKinsey Global Institute, REINVENTING CONSTRUCTION: A ROUTE TO HIGHER PRODUCTIVITY. February 2017. <http://www.mckinsey.com/~media/McKinsey/Industries/Capital%20Projects%20and%20Infrastructure/Our%20Insights/Reinventing%20construction%20through%20a%20productivity%20revolution/MGI-Reinventing-Construction-Full-report.ashx>

or higher education qualification⁵³.

A vast number of other professions linked to construction are often overlooked including some that have a creative side to them, such as professions connected to architecture and design of buildings⁵⁴. Rarely young people, and especially women, see the construction industry as a potential and attractive employer. For instance, in the UK a government survey reveals that the appeal of a career within the construction sector scores very low among 14- to 19-year olds (only 4.2 out of 10)⁵⁵. Even among top-talent engineers and experienced interdisciplinary managers, the construction sector has the reputation of being ‘dull’⁵⁶.

The industry is generally aware of these reputational challenges, and sees engagement with the broader public and with young people as response in a number of campaigns across the EU to address the image of the sector. Especially in the UK these challenges are taken very seriously and have received attention at highest policy level, as they have been recognised in the overall Construction 2025 Strategy launched by the UK government in cooperation with the industry⁵⁷. Other MS are tackling the image of the industry by engaging with youngsters through various online and offline activities (see chapter on Initiatives to improve the image of the construction industry). If it manages to recruit more young workers the industry will have the needed pool of skills for its development. However, stereotypical views are difficult to change, especially given the slow pace of change that is characteristic of the sector.

Suboptimal VET quality and participation in construction

Vocational education and training (VET) is key for skills development in construction. First, it is the main gateway to the construction sector and the entry to the labour market for young people. Second, VET provides aspiring construction professionals the necessary skills and knowledge to progress in their careers. In this respect, the alignment of the VET system with the needs of the industry is very important for its overall functioning. From a macroeconomics perspective, VET is often correlated with positive impacts on wages, employment and occupational opportunity. From the point of view of employers, VET can be beneficial in terms of productivity, innovation, employment growth and organisation cultures⁵⁸. Indeed, according to a survey launched for European Business Forum on Vocational Training, there is a consensus among respondents about the crucial role of quality VET in addressing the skills gap⁵⁹.

⁵³ Construction News, YouGov poll finds two-thirds of public would not consider career in construction. April 2016. https://www.constructionnews.co.uk/best-practice/skills/two-thirds-reject-construction-careers/10005659.article?utm_source=dlvr.it&utm_medium=twitter

⁵⁴ Construction Week, Why don't young people want to work in construction? March 2017. <http://www.ukconstructionweek.com/blog/skills/1105-why-don-t-young-people-want-to-work-in-construction>

⁵⁵ The Guardian, Millennials are the key to construction's skills shortage, we need to engage them. July 2016. <https://www.theguardian.com/lendlease-redesigning-cities-zone/2016/jul/26/millennials-are-the-key-to-constructions-skills-shortage-we-need-to-engage-them>

⁵⁶ McKinsey Global Institute, REINVENTING CONSTRUCTION: A ROUTE TO HIGHER PRODUCTIVITY. February 2017. <http://www.mckinsey.com/~media/McKinsey/Industries/Capital%20Projects%20and%20Infrastructure/Our%20Insights/Reinventing%20construction%20through%20a%20productivity%20revolution/MGI-Reinventing-Construction-Full-report.ashx>

⁵⁷ HM Government, Construction 2025. July 2013. https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/210099/bis-13-955-construction-2025-industrial-strategy.pdf

⁵⁸ CEDEFOP, The benefits of vocational education and training. 2011. http://www.cedefop.europa.eu/EN/Files/5510_en.pdf

⁵⁹ Preparation of the European Business Forum on Vocational Training, Survey of VET-business cooperation on skills, entrepreneurship and apprenticeships, September 2014.

Despite the recognition that VET provides key benefits to the industry and young graduates, enrolment of young people in VET programmes across the EU has been stable over the past 10 years. In 2014, about 10.5 million students participated in upper secondary education (48% of the total upper secondary student population)⁶⁰, 1.4 million students in postsecondary non-tertiary and 1.4 million students in short-cycle tertiary education.



share of students in VET at upper secondary level in the total upper secondary student population

There are substantial differences in the levels of participation and quality of VET training across the EU. In addition, the level of VET participation often correlated with its quality. Two key elements are generally associated with quality of VET, namely up-to-date curricula reflecting the industry's needs and priorities, and teachers that are knowledgeable of the latest developments in the industry⁶¹. Typically, Northern European countries characterised place a lot of emphasis on the quality of VET systems, including close collaboration with industry, and report high benefits from VET⁶². Conversely, in MS where VET is neglected, participation rates tend to be lower and the educational outcomes are reduced.

Another very common problem is the lack of cooperation between VET institutions and the construction industry including low levels of practical training. The **curricula are often not aligned** with the needs of companies in the construction sector, leading to mismatch between the skills required by construction companies and those available on the market. In a large number of

Many institutions continue to provide outdated forms of training, especially if there is no framework for updating the VET curricula.

MS, initiatives are underway to reform the VET system by making it more practical and aligned to the industry (see the chapter on Initiatives to improve VET and industry cooperation). Indeed, VET curricula often do not take sufficiently into account the shift in skills needed for new methods of construction, such as for instance off-site manufacturing⁶³. Some institutions may be proactive and adaptive, but many continue provide outdated forms of training, especially if there is no framework for updating the VET curricula. The German model is often hailed as a success story in this respect as the curricula for VET education are updated on a regular basis in collaboration between industry,

educators, social partners and the government, to ensure that VET students receive the same education across the country and it matches the expectation of industry.

Practical experience during VET education is well recognised as being very effective in providing relevant skills, applying theoretical knowledge and eventually facilitating the entry into the labour market⁶⁴. It can either come in the form of a **dual education system**, whereby apprenticeships are included within the framework the VET education, or through apprenticeships offered by companies independently from the educational path. Although apprenticeships are generally recognised as valuable schemes for meeting skills needs in the labour market, they also bring along costs for the

http://ec.europa.eu/dgs/education_culture/repository/education/library/study/2014/business-forum_en.pdf

⁶⁰ European Commission, Education and training monitor 2016.

https://ec.europa.eu/education/sites/education/files/monitor2016_en.pdf

⁶¹ Preparation of the European Business Forum on Vocational Training, Survey of VET-business cooperation on skills, entrepreneurship and apprenticeships, September 2014. http://ec.europa.eu/dgs/education_culture/repository/education/library/study/2014/business-forum_en.pdf

⁶² CEDEFOP, The benefits of vocational education and training. 2011 . http://www.cedefop.europa.eu/EN/Files/5510_en.pdf

⁶³ House of Commons, No more lost generations: Creating construction jobs for young people. February 2014. <http://www.ciob.org/sites/default/files/No%20more%20lost%20generations%20report.pdf>

⁶⁴ European Commission, Education and training monitor 2016. https://ec.europa.eu/education/sites/education/files/monitor2016_en.pdf

employer, such as administrative paperwork, the time and support dedicated to the apprentice as well as the cost of potential mistakes made by the apprentice. Providing the right incentives for **securing funding for apprenticeships** is thus often a challenge. Indeed, well-established apprenticeships often go hand-in-hand with funding models supported by the government. As a general principle, the government subsidises the vocational school elements of the training, while the company hiring the apprentice takes over the in-company training including the apprenticeship remuneration. Nevertheless, there are important variations in the funding schemes across the EU. As a general trend, it is considered that companies face short-term costs for hiring an apprentice, which are outweighed by long term gains⁶⁵.

Challenges in skills recognition and mobility of workers

“Despite our best efforts, mobility of professionals across the European Union is still low. Conditions for accessing certain professions can be complex, burdensome and very often vary greatly from one Member State to another. This discourages workers from seeking and finding employment in other Member States.

Michel Barnier on the barriers restricting access to regulated professions, in 2013, Internal Market and Services Commissioner

Mobility of skilled workers from areas of low demand to areas of higher demand can contribute to alleviate skills shortage in the EU. However, mobility is often restricted by the sub-optimal mutual recognition of professional qualifications among Member States. On the other hand, mobility of workers through the widespread practice of posting is also associated with issues, namely in terms of social dumping and unfair competition, as discussed in the section below.

Legal framework

In the EU context, two main instruments are intended to facilitate the mobility of labour and to promote the transferability and comparability of qualifications across MS, namely the **European Qualifications Framework (EQF)** and the **European Credit system for Vocational Education and Training (ECVET)**. The EQF acts as a ‘translation’ grid, helping bridge the gap between the various national qualification systems/frameworks and covering all levels of qualifications across all sub-systems of education and training (i.e. general and adult education, vocational education and training, as well as higher education). It aims to make qualifications more readable and understandable across the various systems in place in every Member State. Similarly, ECVET seeks to facilitate the validation and recognition of skills and knowledge acquired in different systems and countries, as well as to increase the compatibility between the different VET systems in Europe and the qualifications they offer.

In addition to the above, two EU directives make up the main legislative framework governing the recognition of professional qualifications. To reform and simplify the related administrative procedures, the **Professional Qualifications Directive (PQD)** (Directive 2005/36/EC) was adopted, aiming to increase the flexibility of the labour market and the liberalisation of the provision of services, promoting automatic recognition of professional qualifications in EU countries. The Directive was amended in 2013 by Directive 2013/55/EU.

⁶⁵ Business Europe, The cost-effectiveness of apprenticeship schemes - Making the case for apprenticeships. May 2016. https://be-extranet-prod.s3.amazonaws.com/publications/2016-05-27_employers_final_report_on_apprenticeships.pdf

The PQD enables the free movement of professionals within the EU by setting out the rules for temporary mobility, establishment in another EU Member State, knowledge of languages and professional academic titles, as well as systems of recognition of qualifications. In particular, three such systems are in place, namely automatic recognition, a general system and recognition on the basis of professional experience. All regulated professions generally fall under the scope of the Directive, including nurses, midwives, doctors, dentists, pharmacists and veterinary surgeons.



The Professional Qualifications Directive enables the free movement of professionals within the EU and sets out the rules for temporary mobility

With regards to construction-related professions, the Directive applies to architects, who benefit from automatic recognition of their qualifications, real estate agents (who fall under the general system of recognition), carpenters and upholsterers (with their recognition being based on professional experience)⁶⁶. Other regulated professions under the scope of the Directive include blacksmiths, building contractors, civil engineers, building engineers, building insulators, building site coordinators/surveyors, site mechanics, crane operators, electrical engineers and technicians, floor layers and glaziers⁶⁷.

In parallel, the **Services Directive** (Directive 2006/123/EC) complements the PQD by aiming to remove legal and administrative barriers to trade through simplification measures that increase transparency and facilitate the provision of and access to cross-border services in the Single Market. The services covered by the Directive include the activities of most regulated professions, such as architects, engineers, and surveyors, construction services and crafts, installation and maintenance of equipment and real estate services⁶⁸.

Finally, the European Professional Card (EPC) constitutes another element in place at the EU level to facilitate the recognition of professional qualifications within the EU. Launched in January 2016, it is an electronic certificate, rather than a physical card, which complements the recognition procedures set by the PQD for regulated professions. It can be used by professionals wishing to establish permanently or provide services temporarily in different Member States. It is currently available only for five highly mobile professions, namely general care nurses, physiotherapists, pharmacists, mountain guides and real estate agents.

Persisting challenges

Despite the existence of the legal framework described above and the considerable progress achieved with regard to the recognition of qualifications and mobility of workers, the situation in this respect remains challenging, particularly within the construction sector. Indeed, Member States often require recognition processes for accessing certain regulated professions in the construction sector, thus reducing the mobility of workers and lessening its impact as a potential means of tackling skills shortages. Moreover, different requirements across the EU contribute to making it difficult for qualified professionals to apply for vacancies in other EU countries. This situation is worsened by the frequent lack of information on the conditions that professionals have to comply with in order to apply for a position in another Member State, as well as difficulties in accessing whatever information is available.

⁶⁶ European Commission, Recognition of professional qualifications in practice. https://ec.europa.eu/growth/single-market/services/free-movement-professionals/qualifications-recognition_en

⁶⁷ European Commission, Regulated Professions Database. <http://ec.europa.eu/growth/tools-databases/regprof/index.cfm?action=professions>

⁶⁸ European Commission, Quick guide to the Services Directive. https://ec.europa.eu/growth/single-market/services/services-directive/in-practice/quick-guide_en

By way of example, despite the minimum training requirements set out under Directive 2005/36/EC, there is great variation between the actual requirements set out by Member States in terms of **required training, mandatory traineeships and national exams**. For instance, the duration of education and training for **architects** ranges from a minimum of four years in countries such as Liechtenstein and Iceland, to five years in Member States such as Italy and Greece, seven years in countries like Belgium, Croatia, Ireland and Poland, and up to nine years in Slovakia and Bulgaria. Similarly, the route to be followed to obtain the necessary qualifications to exercise the architectural profession varies from general or vocational education level, which can be post-secondary or higher. For instance, Belgium follows the vocational post-secondary method, Poland the vocational higher education and the Czech Republic, Spain and Germany the general post-secondary education, whereas countries such as Austria and the Netherlands can follow both the general and the vocational post-secondary route. In addition, professional traineeships are mandatory in some Member States (e.g. Hungary, Luxembourg and the UK) but not in others (e.g. France, Greece and Italy), with the same applying for the requirement to pass state exams and register as a member in professional bodies (which can be mandatory or not)⁶⁹.

Another important challenge is related to the **scope of activities** that construction professionals are allowed to carry out in a different Member State. Indeed, despite a broad general consensus on what the profession entails, some professions in the sector display significant divergences in terms of the interpretation of the activities that can be performed under their general category. This is the case with the **civil engineering** profession, which reports up to 99 different sub-categories across the EU, with Member States such as Austria, Estonia and Luxembourg recording only one, the UK and Poland four and Latvia six. The existence of such a fragmented system might create barriers to cross-border mobility and free movement of workers, especially in the case of civil engineers moving from a country with only one category (e.g. Austria) to one with a multi-category system (e.g. Latvia), since it would be unclear what type of activity he would be able to access⁷⁰. The multitude of categories, their sometimes unclear definition and ensuing overlap, issues which also affect other construction-related professions like electricians, therefore result in a negative impact on both access to the profession itself, as well as on workers mobility.

In terms of the **type of recognition**, despite the presence of precise rules set out in annex IV of Directive 2005/36 regarding the system to adopt based on the type of profession, Member States often fail to implement a common approach to the recognition of qualifications, thus resulting in diverging systems across the EU. For instance, taking the example of electricians, while most Member States apply the principle of automatic recognition based on professional experience, as per the requirements of the Directive, others rely on the general system of recognition (e.g. Cyprus, Greece, Slovakia, Spain and Portugal). This further challenges the ability of professionals to get their qualifications recognised, thus contributing to the restriction of mobility⁷¹.



Finally, temporary mobility of workers in the construction sector often helps in overcoming labour shortages between one Member State (or region) and another. Indeed, within the EU, construction companies may appoint some of their employees to a site as ‘posted workers’. The construction

⁶⁹ European Commission, Mutual evaluation of regulated professions - Overview of the regulatory framework in the business services sector by using the example of architects. October 2015. <http://ec.europa.eu/DocsRoom/documents/13382/attachments/1/translations/en/renditions/native>

⁷⁰ European Commission, Mutual evaluation of regulated professions - Overview of the regulatory framework in the construction sector by using the example of civil engineers. September 2015. <http://ec.europa.eu/DocsRoom/documents/12762/attachments/1/translations/en/renditions/native>

⁷¹ European Commission, Mutual evaluation of regulated professions - Overview of the regulatory framework in the construction/craft sector by using the profession of electricians as example. September 2015. <http://ec.europa.eu/DocsRoom/documents/12763/attachments/1/translations/en/renditions/native>

sector accounted for 41.5% of the total number of posted workers in the EU in 2015, followed by the services sector (32.7%). In particular, in Estonia, the construction sector accounted for 56.4% of the workforce posted abroad, compared to only 13.1% in the Netherlands. In Slovenia, 40.8% of the construction workforce is posted abroad, compared to 0.1% in Cyprus. In Luxembourg, posted workers accounted for 72.8% of the total construction workforce, the highest in the EU, compared to only 0.2% in Portugal⁷². However, there are a number of challenges associated with temporary mobility and posting of workers in the context of the internal market. An important issue in this respect is considered the risk of **social dumping**⁷³. In fact, companies may exploit wage differences among EU Member States, as EU rules⁷⁴ stipulate that posted workers must be paid at least the minimum wage of the host country, although this can be lower than local wages for the same activities. This often leads to downward pressure on wages and creates tension among the posted workers and the local workforce. Another issue related to the posting of workers is the circumvention of national rules on social security and labour protection by using fake ‘posting’ through so-called letter box companies that are only registered in the home country but do not have any activity there. To minimise the risks of such abuse, the Council adopted measures to improve and enforce EU rules on the posting of workers⁷⁵. In addition, the Commission is currently revising the legislative basis in order to provide for ‘equal pay for equal work’ when posting workers abroad. Indeed, in some cases posted workers are reported to earn up to 50% less than local workers, thereby distorting fair competition among companies in the Single Market⁷⁶. On the other hand, this will reduce the economic incentives for some of the mobility in the construction workforce.

5. Policy initiatives

Trends in policy initiatives

Given the multiple drivers and obstacles in the construction sector, Member States are taking action in addressing these through various policy instruments and initiatives. Indeed, there is a variety of schemes implemented either by the government or by industry associations, training providers or other similar bodies, which tackle the many skill-related issues in the construction sector. Training in energy efficiency stands out as a major area of policy activity, also spurred by EU funds. However, more specific policy challenges are also being tackled. Member States have implemented a range of initiatives for improving the image of the construction sector and attracting young workers, supporting the development of digital skills, incentivising apprenticeships and improving the quality of vocational education and training (VET). Not least, general schemes related to training in construction are often present in Member States.

By looking at the EU-28, the following key trends can be observed:

⁷² European Commission, Posting of workers – report on A1 portable documents issued in 2015. December 2016.

<https://www.google.lu/url?sa=t&rct=j&q=&esrc=s&source=web&cd=2&cad=rja&uact=8&ved=0ahUKEwjTv821mdnTAhXCXhQKHUyMBmkQFggqMAE&url=http%3A%2F%2Fec.europa.eu%2Fsocial%2FBlobServlet%3FdocId%3D17164%26langId%3Den&usq=AFQjCNFiCH8MYAxi9kYJdszoOEFEmtH2Q>

⁷³ Although there is no definition in EU law of social dumping it generally refers to “unfair competition due to the application of different wages and social protection rules to different categories of workers” (Parliamentary questions, 27 May 2015, E-008441-15)

⁷⁴ Posting of Workers Directive (Directive 96/71/EC)

⁷⁵ European Commission, Employment: Commission welcomes Council adoption of Posting of Workers Enforcement Directive. May 2014. http://europa.eu/rapid/press-release_IP-14-542_en.htm

⁷⁶ European Commission. Revision of the Posting of Workers Directive – frequently asked questions. March 2016. http://europa.eu/rapid/press-release_MEMO-16-467_en.htm

- Policy activity is concentrated in the area of energy efficiency and VET reform and is present in all MS;
- Energy efficiency initiatives are greatly supported by the EU co-funded BUILD UP Skills programme, which is present in all EU Member States, and is often the only action taken by Member States, particularly in Central and Eastern Europe as well as in Southern Europe;
- Digitalisation has considerable policy focus across Member States both in advanced and less advanced economies;
- Although apprenticeships are recognised as very important for market entry and development of key skills, only a limited number of Member States have implemented dedicated initiatives to apprenticeships in construction;
- The majority of Member States are reforming their VET, often to update curricula and increase collaboration with industry to align education with labour market needs;
- Over half of Member States have introduced initiatives aimed at improving the image of construction, which in most cases target young people but sometimes also address specifically women;
- Efforts for skills recognition revolve around the implementation of the skills cards, which include information on the qualifications of construction workers;
- General skills and training policies have been implemented in the majority of Member States, covering various activities including overall construction strategies, dedicated training institutions and ad-hoc programmes.

Table 8 provides an overview of the extent of coverage of policy areas through dedicated initiatives in every Member State. Each policy area will be discussed in greater detail in the following sections, outlining some of the key initiatives that Member States are taking to address the specific challenges affecting skills in the construction sector.

Table 8: Overview of policy initiatives by country

Country	Energy efficiency	Image of construction	Digitalisation	Construction-related apprenticeship	VET reform	Skills recognition and worker mobility	General skills and training
AT - Austria	✓	✓✓	-	✓	✓	-	✓
BE - Belgium	✓	✓✓	-	✓	✓✓	✓	✓
BG - Bulgaria	✓✓	✓✓	✓	-	✓	-	✓
CY - Cyprus	✓✓	✓	-	✓	✓	-	✓
CZ - Czech Republic	✓	-	✓	-	✓	-	✓
DE - Germany	-	✓✓	✓	✓	-	✓✓	-
DK - Denmark	✓	✓	✓	-	✓	✓	-
EE - Estonia	✓	-	-	-	-	-	✓✓
EL - Greece	✓	✓	-	-	✓	-	-
ES - Spain	✓	-	✓✓	-	✓✓	✓	-
FI - Finland	✓	✓	✓✓	-	✓✓	✓✓	-
FR - France	✓✓	✓	✓	-	-	-	✓
HR - Croatia	✓	-	-	-	✓✓	-	-
HU - Hungary	-	✓	-	-	✓✓	-	✓✓
IE - Ireland	-	-	✓✓	✓✓	✓	✓✓	✓✓
IT - Italy	✓	-	✓✓	-	✓✓	-	✓✓
LT - Lithuania	✓	-	✓✓	-	✓✓	✓	✓✓

LU - Luxembourg	✓✓	✓	✓✓	-	✓	✓	✓
LV - Latvia	✓	✓	✓	-	✓	-	-
MT - Malta	✓✓	-	-	-	✓	✓	-
NL - Netherlands	✓	✓	✓	-	✓✓	✓	-
PL - Poland	-	✓	-	-	✓✓	-	-
PT - Portugal	✓	-	✓	-	✓✓	-	-
RO - Romania	-	✓	-	-	✓	-	✓✓
SE - Sweden	✓✓	-	-	-	-	✓	✓✓
SI - Slovenia	✓	-	-	-	-	✓	✓
SK - Slovakia	✓	-	-	-	✓✓	-	✓
UK - United Kingdom	-	✓✓	✓✓	✓	-	✓	✓✓

Note: This overview is based on the data collected by ECSO

General skills and training initiatives

In light of the challenges faced by the construction industry, many Member States implemented specific initiatives related to skills and training. The spectrum of initiatives and policies is very broad, ranging from longstanding institutions dedicated to vocational training in construction to ad-hoc programmes implemented to address a specific challenge. Broadly speaking, the following types of initiatives can be found among countries:

- General strategies for the construction sector;
- Institutions dedicated to training in construction;
- Ad-hoc skill-related policies and programmes.

In terms of **general strategies for the construction sector**, the UK Government Construction Strategy 2016-2020 is a prominent example. The main goals are to develop the capabilities of the sector, focusing on the digitalisation of construction and improving its skills (see Initiatives to enhance the digitalisation of the construction industry). A further major goal of the strategy is supporting the creation of 20,000 apprenticeship positions by 2020⁷⁷. Similarly, Lithuania developed an overarching policy for the construction sector, namely the Lithuanian construction sector development guidelines for the period 2015-2020, which develops the vision of an integrated and competitive Lithuanian construction sector. With respect to skills development, the strategy encourages high-skilled training and continuous professional development, including the promotion of professional qualifications in accordance with market needs, as well as the use of EU programmes such as Build Up and Erasmus+ for developing effective trainings⁷⁸. In Ireland, the Construction 2020 Strategy outlines a package of measures to boost activity in the construction sector. Improving education and skills is one of the priority actions of the strategy and focuses on identifying future skill needs, addressing skills shortages particularly

20,000 new apprenticeship positions to be created in the UK by 2020

⁷⁷ Infrastructure and Projects Authority, Government Construction Strategy: 2016-2020. March 2016. https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/510354/Government_Construction_Strategy_2016-20.pdf

⁷⁸ State Territorial Planning and Construction Inspectorate, Patvirtintos Lietuvos statybų sektoriaus plėtros ir vystymo 2015–2020 metais gairės. November 2015. <http://www.vtpsi.lt/node/2595>

in sustainable construction, reviewing apprenticeship schemes, as well as supporting the long-term unemployed⁷⁹.

In a number of MS, **dedicated institutions** play a key role in developing the skills needed for a professional workforce. For instance, the UK's Construction Industry Training Board (CITB) is a key actor for supporting industry in training the workforce and improving skills to develop a professional and qualified workforce⁸⁰. To achieve its mission, the CITB provides a comprehensive range of services to companies and their employees, such as the CITB Grants Scheme that gives funding to train, upskill and qualify staff. Furthermore, CITB's National Construction College offers training courses on health and safety, supervision, plant, machinery and other crafts, as well as apprenticeships, awards and accreditation. The CITB also leads the National Skills Academy for Construction, a project-based and demand-led training concept, where the client and contractor determine the required skills based on a practical live project. In Sweden, the Swedish Construction Industry Training Board (BYN), as a joint body representing employers and employees, focuses on advancing vocational education in construction by providing training and facilitating apprenticeships⁸¹. Austria has a similar institution, namely the Building Academy (*Bauakademie*), which is a leading provider of VET education with locations throughout the country, offering specialised skill training to young people and adults⁸². French construction stakeholders have joined forces to create Constructys in 2010 as the paritarian body (*Organisme paritaire collecteur agréé – OPCA*) for the construction sector, namely the institution that collects fees from sectoral enterprises to support training, professional development and continuous learning⁸³.

In addition to overall strategies for the sector and specialised training institutions, a number of Member States have also implemented **ad-hoc measures for the development of skills** in construction. There is large variety in such kind of measures and policies, as most MS have introduced some sort of scheme to support training and skills in construction. These initiatives may be implemented by charities, as for instance the Construction Youth Trust in the UK, namely a charity working with young people to help them access employment opportunities in the construction industry⁸⁴, or may be sponsored by government, industry, European funds or a combination of these. Notable initiatives include those that have a specific policy focus, such as reinserting unemployed in the workforce. Notably, in Ireland, the programme MOMENTUM provided free education and training to approximately 13,000 long-term jobseekers in areas with occupational vacancies, in particular in the construction sector⁸⁵. In the Brussels region, on the other hand, companies receive financial incentives up to EUR 50,000 for employing workers registered as jobseekers. In Italy, the National Fund for Labour Policies (*Fondo nazionale per le politiche attive del lavoro*) aims to facilitate the reintegration of the unemployed workforce. In particular, EUR 3.6 million were granted to the Emilia-Romagna region to fund its Action plan for the professional reintegration of construction workers (*Piano di intervento per il reinserimento lavorativo dei lavoratori dell'edilizia e delle costruzioni*), encompassing measures to reskill unemployed construction professionals through apprenticeships and training courses⁸⁶. Furthermore, the portal

⁷⁹ Construction 2020 - A Strategy for a Renewed Construction Sector. May 2014. <http://www.merrionstreet.ie/en/wp-content/uploads/2014/05/Construction-Strategy-14-May-20141.pdf>

⁸⁰ Construction Industry Training Board (CITB). <http://www.citb.co.uk/>

⁸¹ Swedish Construction Industry Training Board (BYN). <https://www.byn.se/byn/docs/Tavlingsverksamhet/the-swedish-construction-industry-training-board-and-skills-competition.pdf>

⁸² Bauakademie. <http://www.bauakademie.at/CMSArtikel.aspx?LI1=2>

⁸³ Constructys. <http://www.constructys.fr/>

⁸⁴ Construction Youth Trust. <http://www.constructionyouth.org.uk/>

⁸⁵ Action Plan for Jobs 2017. <https://www.djei.ie/en/Publications/Publication-files/Action-Plan-for-Jobs-2017.pdf>

⁸⁶ Lavori Pubblici, Corsi e incentivi in edilizia: 3,6 milioni per dare un lavoro a chi lo ha perso. June 2015. http://www.lavoripubblici.it/news/2015/06/EDILIZIA/Corsi-e-incentivi-in-edilizia-3-6-milioni-per-dare-un-lavoro-a-chi-lo-ha-perso_15364.html

Job my friend (*Amico Lavoro*), launched by the Italian Federation of Construction and Related Workers, provides an online service aiming to match demand and supply in the construction labour market. It offers advice and guidance to potential candidates, helping them identify the most appropriate jobs improve their skills and knowledge through good training, create CVs and prepare for selection processes⁸⁷.

Key takeaways

- ✓ **General strategies for the construction sector** often tackle skill shortage and skill development as a key driver for the competitiveness of the sector;
- ✓ **Dedicated institutions** play a key role in developing the skills needed for a professional workforce by cooperating with industry on the development and provision of training, as well as contributing to its funding;
- ✓ There is a great variety in **ad-hoc measures for the development of skills**. Some of the initiatives may address specific policy objectives, such as facilitating the reinsertion in the workforce of long-term unemployed.

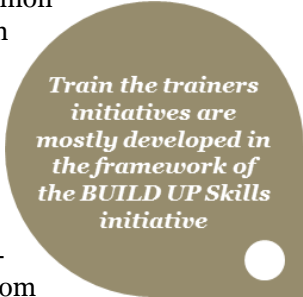
Initiatives aimed at strengthening energy efficiency

Member States are dedicating considerable efforts to the development of initiatives aiming to address the training and skill needs brought about by the stringent energy efficiency targets and required to embrace the opportunities that come with the shift towards a sustainable and energy efficient building sector.

A first remark that can be made is that the **targeted beneficiaries** of most of the initiatives aiming to impart energy-efficiency skills across the EU-28 are **existing construction workers**. Indeed, most Member States are addressing the issue of strengthening the energy-efficiency skill-base of their workforce by developing continuous education and training programmes that build on the current expertise of onsite workers and other construction professionals to hone and improve their existing knowledge or impart new skills. This is the case across most Member States, regardless of their geographical distribution. For instance, in Luxembourg, the Professional Association of Architects and Consulting Engineers (OAI) and the Luxembourg Chamber of Crafts are active in delivering trainings on energy renovation, passive house, ventilation systems and other related topics. Similarly, in Malta, the Building Regulation Office (BRO) offers courses to educate and qualify assessors of energy performance in buildings. Over the past years, it has qualified 160 officers for the residential segment and 30 officers for the non-residential segment. In the future, the BRO also intends to qualify assessors to determine the efficiency of air-conditioning and ventilation systems, as well as space heating systems. Moreover, energy efficiency awareness and skills can be developed through training initiatives that specifically target other stakeholders involved in the construction value chain, such as clients, developers and property owners. Indeed, instances of initiatives in this respect can be found in countries such as Sweden, and include the Swedish Construction Industry Training Board's Purchaser Skills scheme (*BeställarKompetens*), which aims to impart methods and tools for energy efficient renovation among clients, developers and property owners, as well as the Swedish Energy Agency's Energy Boost (*Energilyftet*), which provides training in energy efficient construction for architects, clients, construction managers and consultants.

⁸⁷ Amico Lavoro, Chi siamo. <http://www.amicolavoro.it/filca/chi-siamo/>

Another target of initiatives aiming to impart energy-efficiency skills are **trainers** themselves. However, such ‘Train the trainers’ schemes are currently not as common among national initiatives as the ones addressing the construction workforce. Indeed, ‘Train the trainers’ initiatives are generally mostly developed at the EU level in the framework of the EU-wide BUILD UP Skills initiative. For instance, in Bulgaria, the BUILD UP Skills EnerPro project resulted in the training of 319 certified workers and 114 certified trainers. Additionally, the project contributed to reducing the gap in continuing professional training of trainers in the construction sector. Similarly, as part of the BEEP project in Finland, a dedicated train-the-trainer scheme was developed and piloted with 40 trainers. Aside from BUILD UP Skills, ‘Train the trainers’ initiatives are also supported by other EU-funded programmes. As an example, the Building Green Skills in Slovenia, part of the European Union Programme for Employment and Social Solidarity – PROGRESS (2007-2013), aims to remove skill gaps in the professional growth in the construction sector, with actions including ‘training the trainers’ through specific professional training pathways in the rational use of energy in the building envelope and in renewable energy sources in buildings.



*Train the trainers
initiatives are
mostly developed in
the framework of
the BUILD UP Skills
initiative*

As for the **delivery mode** of energy efficiency training initiatives, the most widespread format across Member States is **classroom-style courses**, although other formats are also available. These are typically offered by national construction training providers or construction associations. In Spain for instance, the Spanish Building Labour Foundation (*Fundación Laboral de la Construcción* - FLC) aims to specifically promote vocational training in health & safety, sustainable construction, thermal renovation and R&D in the national construction sector. It therefore introduced a training to develop skills on innovative techniques and tools for energy efficiency in buildings. Specifically, it takes the form of practical courses lasting between 6 and 10 hours, where students learn to use thermographic cameras and thermal transmittance meters and perform a leak test through dedicated methods, including the Blower door test. Similarly, Qualit'EnR in France offers short training courses for construction professionals to provide them with the necessary skills for the installation of renewable energy systems (such as photovoltaic panels, solar-powered heating systems, biomass-powered heating systems, etc.).

Aside from training providers, the public sector is also often an initiator of these training programmes at the national level, setting the overall strategy for the training of the workforce with respect to energy efficiency. France is a good instance of this approach, with the Ministry of Housing introducing an Action Programme for Construction Quality and Energy Transition (*Programme d'Action pour la qualité de la Construction et la Transition Energétique* - PACTE) in 2015 with a budget of EUR 30 million until 2018 aiming to support innovation and training among construction companies. In particular, the PACTE seeks to foster the development of the energy efficiency skills of construction professionals and is structured around three main axes, namely supporting the development of skills, providing practical and modern tools adapted to the needs of professionals and strengthening cooperation among regions with respect to the actions and measures to build the skills of construction professionals. In Cyprus, the introduction of ‘Specialised Experts’ as a category of persons responsible for the energy efficiency certification of buildings provided an opportunity to further enhance the training to civil engineers dedicated to energy efficiency in buildings. Thus, over 2009-2013, a dozen of classroom trainings were organised by the Energy Department targeted at Specialised Experts, as well as engineers and architects.

Some of the classroom-style training initiatives also stem from the cooperation between the public sector and national trade associations, with such partnerships acquiring increasing importance in the development of schemes that tackle the need for an energy-efficient skilled construction workforce, particularly in light of the growing necessity to align skills to the practical needs of the

industry. An interesting case in this respect is the FEE Bat initiative, set up in France through an agreement between several industry actors (Électricité de France, the Ministry of Housing and various construction and training associations). It offers training courses on the thermal renovation of existing buildings, covering both technical implementation aspects, as well as those related to the overall energy performance of buildings, so as to allow participants to provide relevant advice to customers in terms of energy savings. FEE Bat has trained over 162,000 professionals since 2008, and aims to train a further 170,000 between 2014-2017, through its allocated budget of EUR 50 million.



Aside from classroom-style training courses, **other types of initiatives** are being introduced to improve the energy-efficiency skill base of the construction workforce. These encompass web-based trainings/e-learning, as well as seminars, summits and knowledge-sharing events, found across several Member States including Denmark, Portugal, Austria, the Netherlands, Sweden and Italy. For instance, the Future Leaders Programme in the Netherlands is organised annually by the Dutch Green Building Council to connect young ambitious professionals active in the field of sustainability of the built environment. The programme allows knowledge-sharing, coaching and networking with leaders and peers, thus shaping the next generation of sustainability leaders. As part of the Swedish BUILD UP Skills project SWEBUILD, the Swedish Construction Federation launched Energy Builders (*Energibyggar*)⁸⁸, a four-hour interactive web-based training in the field of energy-efficient construction and renewable energy tailored to all parties active on a construction site, including builders, installers, supervisors and managers. The programme includes areas such as thermal insulation, air-tightness, moisture control and installations. Upon successful completion of the training, the acquired qualification can be registered in the ID06 Skills Database. Some countries also organise awareness-raising summits for stakeholders to discuss the need for energy-efficiency skills. In Italy, Formedil, the national body for professional construction training, organises the National Days of Construction Training (*Giornate nazionali della formazione edile*). For 2015, these focused specifically on the need to impart better and new technical skills to construction workers to meet the increasingly stringent energy efficiency standards. The latest 2016 edition of the event focused on the need aligned the skills of the workforce with innovation in an evolving market. Finally, some countries are promoting the participation of the workforce in energy efficiency-related trainings through financial incentives. An interesting case is Belgium, where the Brussels government introduced a Support for Vocational training to entrepreneurs (*Steun voor opleding - Gewestelijke steunmaatregelen voor Brusselse ondernemingen*). It consists of financial support for SMEs operating in the construction sector, whereby employees are eligible for a financial refund up to 50% for the courses related to sustainable and energy saving construction. The workers that have acquired the knowledge are also encouraged to share the best practices related to sustainable living with their clients.

Key takeaways

- ✓ The majority of initiatives to adapt the skill base of the industry to energy efficiency requirements and sustainable construction target the **current construction workforce** (onsite workers) and **other construction stakeholders** (clients, developers, property owners, etc.). Examples include Luxembourg, Malta and Sweden;
- ✓ ‘**Train the trainers**’ schemes are equally crucial. Currently not as targeted by national initiatives, they are mostly developed within the framework of the EU-wide BUILD UP Skills project (e.g. Bulgaria, Finland and Slovenia);

⁸⁸ Energibyggar, <http://energibyggar.se/>

✓ **Classroom-based courses** are the most common in the EU, being organised mostly by national construction training providers or construction associations (e.g. Spain, Cyprus), as well as originating from partnerships between public sector and industry players (e.g. France);

✓ **Other types of initiatives** (web-based trainings/e-learning, seminars, summits, knowledge-sharing events and financial incentives) are also being introduced to raise awareness and strengthen the energy efficiency skill base in the sector (e.g. the Netherlands, Italy and Belgium).

Initiatives to enhance the digitalisation of the construction industry

As discussed in the section on Digitalisation of construction, digital technologies are drastically changing the way of working and therefore require the workforce to develop suitable skills to fully benefit from the opportunities opened up by the digitalisation of the construction sector. Considerable effort is therefore being put in by Member States to devise strategies and programmes that seek to integrate the use of digital tools, and particularly BIM, in the building process.

Improving skills through BIM promotion

Most Member States introduced national strategies to foster the promotion and adoption of BIM by the construction sector. Many of these consist of action plans that entail a component of R&D, development of BIM standards and the set-up of task forces and working groups of experts and stakeholders to exchange best practices and knowledge. Such strategies are often broader in scope and, although they recognise the importance of training, they do not specifically focus on the definition of training initiatives, but rather on stimulating the uptake of BIM and knowledge-sharing, therefore providing a general direction and the initial framework for the subsequent creation of dedicated training and education schemes.

The most prominent examples can be found in countries such as Denmark and Germany, where the use of BIM is even compulsory under certain conditions. Indeed, Denmark was an early adopter of BIM, with its implementation in public construction projects being mandated as of 2007. Moreover, as of 2013, BIM is also mandatory for projects that are fully and partially funded by the government and that exceed DKK 5 million (EUR 672,300)⁸⁹. Similarly, in Germany, the Federal Ministry of Transport and Digital Infrastructure announced that BIM would be made compulsory on all transport projects by 2020, whereas the German BIM Steering Group 'Planen Bauen 4.0' aims to set clear guidelines for the practical application of BIM methods by introducing the BIM Level Plan (*Stufenplan für BIM in Deutschland*), so as to raise awareness of BIM among relevant actors and address key questions such as the roles and responsibilities of each actors (what data has to be provided by whom, what the expectations are, etc.). Indeed, as part of this initiative, the establishment of a national BIM Competence Centre is foreseen, where the findings and experiences on the use of digital planning methods will be gathered into a new central point of contact⁹⁰.

*In Germany,
BIM will be
made
compulsory on
all transport
projects by 2020*

⁸⁹ CIOB, A BIM Mandate lesson from Denmark. June 2016. <http://www.bimplus.co.uk/people/bim-mandate-lesson-denmark/>

⁹⁰ Federal Ministry of Transport and Digital Infrastructure, Masterplan Building 4.0. <https://www.bmvi.de/SharedDocs/DE/Pressemitteilungen/2017/009-dobrindt-bim-gipfel.html?nn=214506>

In the Netherlands, the uptake of BIM is supported through initiatives that also aim to share information and best practices among the community. For instance, BIM Gateway (*BIM Locket*) is a national portal for information and management of open BIM standards in the Netherlands, thus stimulating their use. By bringing together open BIM standards into one coherent system, the BIM Locket will satisfy the need for a good information service which will answer the practical questions of users and facilitate knowledge sharing⁹¹.



In the Netherlands, the uptake of BIM is supported through initiatives that aim to share information and best practices among the community

Eastern European countries are also implementing initiatives to introduce BIM in the construction sector. In Lithuania, the Lithuanian Association of Builders, together with 12 other relevant associations, launched the Digital Construction action (*Skaitmeninė Statyba*) in 2014 to foster the development of BIM and introduce the National Construction Classification and Industry Foundation Classes (IFC) in the national building sector. In the Czech Republic, the Ministry of Industry and Trade set up an Interdepartmental BIM Expert Group comprising representatives from various stakeholders (ministries, universities, construction companies, design and pricing structures, etc.), so as to foster the exchange of best practices and bring about the implementation of BIM in the construction industry.

Therefore, although not strictly skilling initiatives, the schemes implemented in these countries aim to raise awareness, stimulate knowledge-sharing and boost the uptake of BIM, thus ultimately leading to higher levels of skills and knowledge of BIM among the construction workforce.

Specific focus on BIM skills

Conversely, some Member States are directly addressing the need for BIM skilling and training among the workforce, either by explicitly setting training targets in their national strategies, or by offering BIM trainings and learning resources.

The UK and France are leading examples of how the digital skilling of the workforce can be specifically initiated at the government level. One of the priority focus areas of the UK Construction Strategy 2016-2020, introduced by the Infrastructure and Projects Authority in March 2016, is the strengthening of the skill base in the sector, particularly with regard to digital skills. Namely, the Strategy seeks to support the creation of 20,000 new apprenticeships until 2020, ultimately aiming to integrating and increase the use of digital construction processes (e.g. BIM) through a skilled workforce. Likewise, in France the Building Digital Transition Plan (*Plan pour la Transition Numérique dans le Bâtiment* - PTNB) was launched by the Ministry of Housing to bring about the adoption and deployment of digital technologies in the construction sector, with a particular focus on improve the digital skill-base of construction professionals. To this end, and through a total budget of EUR 20 million for 2015-2018, the PTNB coordinates several actions. These include the assessment of the offer for BIM trainings and benchmarking of international initiatives, aiming to provide construction professionals with a comprehensive picture of all training opportunities available and thus guiding them in their digital transition, as well as providing training centres with the opportunity to further align their courses with the needs of the industry. A particular focus is also put on strengthening the competences and skills of trainers and teaching staff⁹².

Aside from the strategic direction set out by the public sector, the practical delivery of dedicated trainings on BIM relies on the active involvement of non-governmental institutions, as well as

⁹¹ BIM Locket, <http://www.bimloket.nl/>

⁹² Plan Transition Numérique dans le Bâtiment, Accompagner la montée en compétences et développer des outils adaptés. <http://www.batiment-numerique.fr/notre-plan-actions/convaincre-batiment-numerique.htm>

cooperation with industry itself. In Ireland for instance, the Irish Green Building Council offers the BIM International training (BIM Level 2), a two-day course aiming to train building professionals in BIM by introducing best practices, standards, methods, and procedures. Similarly, in Spain, the Spanish Labour Foundation for Construction (*Fundación Laboral de la Construcción*) opened up the Badalona training centre, aiming to become a benchmark for training in construction innovation with respect to the application of BIM and new construction techniques (e.g. lean construction), leveraging on tight partnerships with industry. Comparable initiatives are found also in Eastern European countries. The Latvian Association of Civil Engineers offers a series of seminars to enhance the skills of its members regarding BIM and digital technologies. Private companies are also playing a role in training and informing construction professionals about BIM. In Bulgaria, coBuilder and Nemetschek have started educating the Bulgarian construction industry about the advantages of using BIM by organising events, such as the ‘Second Scientific-Applied Conference with International Participation - Project management in Construction’ and ‘The different faces of BIM’, which attracted over 150 construction and architecture professionals.

Digital skills in EU-funded projects

Given the relatively recent start of many digital skill-related initiatives at national level, Member States are currently joining efforts to better understand and define the needs for digital skills in the construction sector and subsequently develop suitable curricula. In this respect, Member States are often participating in EU-wide projects, benefiting from EU financial support. Some of the most relevant projects are illustrated in the boxes below.

BIM4VET – assessing BIM skills

Standardised Vocational Education and Training for BIM in EU (BIM4VET) starts by assessing the BIM skills of all actors working together on a digital model project using BIM processes. The project aims to devise a skills matrix for BIM users, as well as standardising training and certification schemes across Europe. Indeed, the development of this matrix will allow the assessment of the skills of BIM actors, consequently resulting in the development of their skill-base by allowing for a recommendation of the most appropriate training courses to be attended based on the initial skill assessment. The project will enable the development of new and improvement of existing BIM training courses for construction professionals. In the long-term it is expected that such efforts will contribute to facilitating the recognition and certification of professionals involved in the use of BIM, as well as their mobility within the EU.

BIM4VET is being carried out between 2015 and August 2017 by a consortium of partners led by the Luxembourg Institute of Science and Technology and including the University of Cardiff and the French Atomic Energy and Alternative Energies Commission (CEA). The project is part-funded by the European Commission and by the Erasmus+ scheme, with a total budget of EUR 270,000.

BIM-TRAIN

Transfer of Building Information Modelling Training Tool for Increasing Competence of Building Sector Competence (BIM-TRAIN) is a project that encourages collaboration among Member States in the development of appropriate training that responds to the increasing need for BIM skills in Europe. BIM-TRAIN specifically aims to address the lack of relevant skills, knowledge and tools related to BIM both in vocational education and training (VET), higher education and industry,

issues which are currently preventing the construction sector in the Baltic States from exploiting the opportunities opened up by BIM during the building process. It focuses on the transfer of BIM tools and methodologies to increase the understanding and skills among individuals and organisations in the construction and educational sectors.

The project is financed by the EU Leonardo da Vinci Innovation Transfer programme, and led by a consortium of seven partners from Lithuania, Latvia and the Netherlands. Started in 2013 and ended in 2015 and resulted in a BIM training tool to be used both by education and training providers, as well as the private sector.

Under the Horizon 2020 Research and Innovation programme, the challenge of promoting BIM-related skills in construction has also been identified as a priority. Between July and September 2017, three EU-funded projects focusing on BIM qualification and training (BIMEET, BIMplement and Net-UBIEP⁹³) are expected to start. The first, 'BIM-based EU-wide Standardized Qualification Framework for achieving Energy Efficiency Training' (BIMEET), aims to foster the uptake of ICT and BIM through an upgrade of the skills of the EU construction workforce, by promoting the BIM skillset among decision makers, practitioners and blue collar workers to improve the energy efficiency of buildings, and establishing a platform for BIM for energy efficiency training⁹⁴. Similarly, the project 'Towards a learning building sector by setting up a large-scale and flexible qualification methodology integrating technical, cross-craft and BIM related skills and competences' (BIMplement) aims to train the new generation of BIM-skilled professionals and craftsmen to improve the overall quality of NZEB construction and renovation by setting up transferable training, continuing professional development and qualification schemes through a cross-crafts multidisciplinary approach⁹⁵.

Key takeaways

- ✓ The integration of BIM in the construction sector is being supported by national strategies with a knowledge-sharing and best-practice exchange component. Though not specifically training initiatives, these set the general framework for the creation of education and training, ultimately increasing the levels of BIM skills and knowledge among the workforce (e.g. Germany, the Netherlands, Denmark, Lithuania);
- ✓ In some countries, the digital skilling of the workforce can also be initiated explicitly at the public sector level (e.g. France and the UK), or through specific BIM trainings and learning resources offered by non-governmental institutions (e.g. Ireland, Spain, Latvia);
- ✓ Some Member States are also teaming up to define digital skill needs and create appropriate training programmes by participating in EU-funded projects (e.g. BIM4VET and BIM-TRAIN).

⁹³ [To be published soon on CORDIS]

⁹⁴ CORDIS, BIM-based EU -wide Standardized Qualification Framework for achieving Energy Efficiency Training. http://cordis.europa.eu/project/rcn/210091_en.html

⁹⁵ CORDIS, Towards a learning building sector by setting up a large-scale and flexible qualification methodology integrating technical, cross-craft and BIM related skills and competences. http://cordis.europa.eu/project/rcn/210066_en.html

Initiatives to improve the image of the construction industry

Member States have implemented policies and initiatives that are aimed at raising awareness and strengthening the overall image of the sector in order to encourage young people in particular to join the industry as their career path.

Engaging young people

The majority of policies dedicated to improving the image of the construction industry target young people, in particular **high-school students**. Typically, these initiatives aim at explaining career options in the construction sector to youngsters and making the sector more attractive as an employer. Popular schemes in this regard are **online portals** to improve the attractiveness of the industry, present VET trainings, as well as career paths. Notably, Denmark, Finland, Austria, Luxembourg and Germany have introduced such an online portal to engage with young people interested in the sector. For instance, in Austria, “Build Your Future” (*Bau Deine Zukunft*) provides an informational platform for students interested in a career in construction and aims at motivating them to start a traineeship in construction. A very similar initiative in Denmark is the website “Build the Future” (*Byg Fremtiden*), which gives information on the 16 vocational education programmes in the Danish construction sector.



Online portals
are popular
schemes to
improve the
attractiveness of
the industry

Some portals go beyond the provision of information and provide counselling or other types of services, such as facilitating the search for apprenticeships. In Finland for instance, the online platform MESTA.net offers career and training counselling in addition to providing information on possible careers across a broad number of professions in construction, real estate and design, as well as on all available training courses and training providers in the sector. The Danish portal has a test that enables visitors to explore which educational programme is most suited to them.

In most cases, these portals are **sponsored** by construction business associations, but funding may also come from by chambers of commerce or social partners. In Finland the online platform MESTA.net was launched by an association of all main construction and real estate stakeholders, including the Confederation of Finnish Construction Industries (RT), the Finnish Construction Managers and Engineers (RKL) and the Finnish Association of Architects. The Austrian portal is sponsored by the Austrian Federal Economic Chamber WKO, while the Danish platform is funded by the Labour Union 3F, in addition to the Danish Construction Association.

Promotional campaigns are also used to engage with young people and often include a competition to discover the various construction professions and trades. Member States such as Slovakia, Poland, Luxembourg, France and Latvia have launched interactive programmes where young people are invited to participate in competition, games, events and similar activities. These projects are usually yearly events, where youngsters compete in ‘Building Olympics’ or analogous actions. In France, the Serious Games project (*Jeux sérieux*) addresses young students and VET teachers by offering a set of interactive training challenges based on the construction of the high-speed train line Tours-Bordeaux. In Slovakia, students can get hands-on experience across various trades such as masonry, joinery, carpentry, bricklaying and floor fitting in the yearly competition of construction crafts (*Súťažnej prehliadky stavebných remesiel*). In Austria, the Federal Economic Chamber WKO launched a promotional campaign on television called ‘Master Builder Campaign’ (*Baumeisterkampagne*) designed to enhance the image of the industry with TV-spots as well as Youtube videos. In addition to national skill competitions, the EU-wide EuroSkills campaign brings together youngsters from across the Europe to compete for the European title in vocational skills. The campaign aims at raising awareness about vocational career paths, as well as stimulating

interest and promote the quality of VET training⁹⁶.

Women in construction

While young people are generally the main target of initiatives dedicated to the attractiveness of the industry, some Member States have implemented schemes that target either women in particular or are open to all actors in the construction sector.

With respect to women, some Member States have launched campaigns specifically aimed at increasing the **participation of women in the construction professions**. In Belgium the online portal "Femmes de metier" is dedicated to the recruitment of women who are interested in a career in the construction sector. The portal offers information on specific trainings and includes testimonials of women working in construction. In the UK, the Young Women's Trust, a charity organisation supporting young women, introduced the campaign 'Making apprenticeships work for young women', aimed at increasing the number of apprenticeships for women. The campaign encourages employers to pledge to recruit women as apprentices. A second activity of the campaign is related to lobbying and awareness-raising at government level.



*In Belgium the
online portal
"Femmes de metier"
is dedicated to the
recruitment of
women*

Furthermore, the EU-funded 24-month project 'High Heels: Building opportunities for women in the construction sector' was introduced in Bulgaria, Greece, Romania and Cyprus⁹⁷. The project trains women in strengthening their soft skills in order to improve their performance in the construction industry. The ultimate goal is to allow women to enter and advance in an industry that is traditionally male-dominated.

The ongoing Horizon 2020-funded project 'Meeting of Energy professional Skills' (MEoS) aims to increase the knowledge and skills of at least 1,800 building managers (engineers, architects, etc.) in NZEB design and construction, of which 50% are to be women or unemployed, through a series of accredited training activities⁹⁸.

Overall, and as shown in the section on Employment in the construction sector, stakeholders in construction are increasingly paying attention to gender diversity. This is also due to the fact that major industry associations at EU level, notably the European Builders Confederation, are engaging with national stakeholders to promote women's participation in construction.

Key takeaways

- ✓ The majority of policies dedicated to improving the image of the construction industry target **young people**, mainly through **online portals**, and are sponsored by business associations;
- ✓ Some Member States have launched campaigns specifically aimed at increasing the **participation of women in construction professions**;
- ✓ Online portals also provide counselling or facilitate the search for apprenticeships.

⁹⁶ EuroSkills 2016. <http://euroskills2016.com/en/about/>.

⁹⁷ High Heels- Building Opportunities for Women in Construction. <http://highheelsproject.eu/index.html>

⁹⁸ CORDIS, Meeting of Energy Professional Skills. http://cordis.europa.eu/project/rcn/194619_en.html

Initiatives to improve VET and industry cooperation

A well-functioning VET system is essential to ensure that a sufficient number of people have the right skills to enter professions and trades in the construction sector. However, VET curricula are often outdated and not aligned with the skill needs of the industry, as traditionally industry stakeholders have not been involved in their design, thereby reducing the value of the vocational qualification to enter the job market. Furthermore, VET education in many Member States does not include sufficient elements of practical training, also making it harder for graduates to apply their knowledge and skills. To counter these challenges, a number of Member States are reforming their VET systems with the goal of aligning curricula to industry needs, increasing cooperation with industry actors as well as introducing dual education systems.

VET curricula are often outdated and not aligned with the skill needs of industry workers

For starters, not all Member States have formalised systems to **forecast skill needs**, and are therefore implementing initiatives aimed at understanding their evolution in order to align the supply of vocational education accordingly. An instance of this is Portugal, where the System of Diagnosis of Qualification Needs (*Sistema de Antecipação de Necessidades de Qualificações*) was launched in 2015. The system makes use of quantitative and qualitative data to make predictions on the qualifications needed, allowing to prioritise VET training offer⁹⁹.

Reform activity is also taking place in **defining or updating qualifications** for vocational education. This is often the case for Member States where the attractiveness of VET is low and there is a mismatch between labour market needs and educational supply. Furthermore, updating the qualifications framework for VET allows to ensure greater comparability with qualifications across the EU, thus facilitating the mobility of construction workers. Incidentally, an important element of the EU-wide BUILD UP Skills initiative consists in setting up qualifications related to energy efficiency in buildings and including these in the respective national qualification frameworks, as it was carried out in Cyprus in the WE-Qualify project¹⁰⁰ or in Romania under Qualishell¹⁰¹.

Furthermore, **greater collaboration with industry** is considered a key success factor for the development of quality VET systems. A number of Member States have recognised this need and are implementing reforms to include industry stakeholders in designing vocational education. For instance, the Netherlands introduced the so-called Technology Pact (*Techniekpact*), a specific agreement between industry, education providers and the government, first launched in 2013 and subsequently updated in 2016¹⁰². The goal of the Technology Pact is to encourage students to choose a technological field of study and to strengthen the learning in technology jobs. Part of the rationale for the introduction of this measure comes from the foreseen retirement of 70,000 construction workers, installers, electricians, engineers and other technical professions by 2020. Along similar lines, Ireland implemented the Springboard initiative, whereby firms from the construction sector partner with education and training providers to offer a broad choice of courses across areas such as management and non-wet trades, ICT, Building Information Modelling (BIM), 'green' construction and chartered surveying¹⁰³.

In the Netherlands, 70,000 construction workers, installers, electricians, engineers and other technical professionals will retire by 2020

⁹⁹ System of Diagnosis of Qualification Needs (*Sistema de Antecipação de Necessidades de Qualificações*). http://sanq.anqep.gov.pt/?page_id=23

¹⁰⁰ Improve Skills and Qualifications in the Building Workforce in Cyprus (BUILD UP SKILLS WE-QUALIFY). <https://ec.europa.eu/energy/intelligent/projects/en/projects/build-skills-we-qualify>

¹⁰¹ BUILD UP Skills QualiShell, <http://www.iee-robust.ro/qualishell/en/>

¹⁰² Techniekpact <http://www.techniekpact.nl/>

¹⁰³ Springboard initiative. <http://www.springboardinitiative.com/>

Finally, **practical learning and apprenticeships** are considered other two key elements for the successful implementation of VET systems and preparation of VET graduates for entry into the labour force. As a result, many MS are emphasising **dual education** approaches as well as fostering the uptake of apprenticeships. For instance, Hungary is making efforts to increase the number of apprentices from the current 50,000 to 70,000 by 2018 by partnering up with enterprises. This is particularly needed because the Hungarian construction sector suffers from migration of skilled workers and thus needs to improve their retention. In Italy, work-based learning is underdeveloped, as only 10.4% of upper secondary students participate in traineeships¹⁰⁴. To address this weakness, Italy revisited its approach to vocational education introducing three different types of apprenticeships. First, it introduced a dual education programme consisting of either three- and four-year apprenticeships leading to a professional certificate. Second, access to professional apprenticeships aimed at young people was opened to adult workers in order to facilitate their reinsertion into the workforce. Finally, a third category of apprenticeship is open to students interesting in obtaining a higher level qualification.



Cooperation with industry is also key for developing successful apprenticeship schemes, in which both the employer and the apprentice benefit from the training provided. Given that hiring an apprentice is generally expensive for a firm, a number of Member States are introducing targeted measures to **incentivise apprenticeships** and to support them financially. There are various instruments that are being used to increase the take-up of apprenticeships, which can be mandatory (e.g. tax schemes, mandatory placements) or voluntary (e.g. online portals, financial incentives, etc.). In the German system, a training levy is paid by all companies in the construction industry to finance inter-company training as well as support the cost of in-company training of apprentices. Furthermore, the federal government contributes with funding to inter-company training centres. Similarly, in some cases, apprenticeship schemes are supported by industry associations either through financing or through brokerage services between employers and apprentices. For instance, in Austria, the Association of the Building Industry (*Fachverbandes der Bauindustrie*) pays a bonus of EUR 1,650 per year and per apprentice to their members for employing an apprentice. Furthermore, the Irish Construction Industry Federation SOLAS introduced the so-called ‘Shared Apprentice Scheme’, aimed at increasing the number and quality of new apprentices, particularly in trades such as plastering and concrete work. Furthermore, some initiatives aim at matching supply and demand of apprenticeships. Again in Ireland, the website *apprentices.ie* run by the Construction Industry Federation (CIF) brings together employers and job seekers to suitable apprenticeships across the country.

Funding of apprenticeships and training in Germany

Germany has a longstanding tradition of collective financing of training and apprenticeships in the construction industry. Since 1976, construction companies pay an annual fee to SOKA-BAU, the social fund for construction, for the funding of vocational training in construction. The principle underpinning the system is the recognition that the sector collectively benefits from a well-trained workforce. Every company (including individual businesses) pays a contribution worth 2.1% of its wage bill or EUR 900 at minimum. This fee finances inter-

¹⁰⁴ European Commission, Education and Training Monitor 2016, September 2016.
https://ec.europa.eu/education/sites/education/files/monitor2016-it_en.pdf

company vocational training facilities as well as reimbursements of the cost incurred by companies in providing in-house training to apprentices¹⁰⁵.

Other schemes are mandated by the government and include the compulsory employment of apprentices. An instance of this is the Flemish region in Belgium, where work placements were made compulsory for more than 140 VET courses as of 2014. Similarly, the UK introduced the compulsory **Apprenticeship Levy** to collect money from employers to fund the apprenticeship scheme. The levy will be collected as of 1 April 2017, is set at 0.5% of an employer's wage bill and applies to companies with an annual pay bill of over GBP 3 million (EUR 3.47 million). The overarching aim of the measure is to create 3 million apprenticeships by 2020¹⁰⁶. It is estimated that the levy will affect 750 construction companies among those registered with the Construction Industry Training Board (CITB)¹⁰⁷.



**VET courses had
work placements
made compulsory as
of 2014 in Flanders**

Finally, some of the schemes have a specific focus in addition to fostering the uptake of apprenticeships. For instance, the programme 'Ready for Apprenticeship' (*Startklar für Ausbildung*) introduced in the German federal state Berlin-Brandenburg aims at reducing the skills mismatch by helping unemployed youngster enter the construction workforce through 6-month training schemes that facilitate access into a construction profession.

Key takeaways

- ✓ Two important reform areas of the VET systems across the EU consist in addressing the need to **forecast skill needs** as well as the **update and definition of vocational qualifications**;
- ✓ **Close collaboration with industry** is considered a key success factor for the development of quality VET systems which reflect industry needs;
- ✓ **Practical learning and apprenticeships** are considered other two key elements for the successful implementation of VET systems and preparation of VET graduates for entry into the labour force;
- ✓ There is a need to **incentivise apprenticeships** and to support them financially. Some Member States are introducing mandatory schemes for financing apprenticeships (e.g. the Apprenticeship Levy in the UK), while others are supported by industry associations (e.g. Austria).

Initiative to recognise skills and increase worker mobility

Recognising skills is an important way to strengthen the professionalisation of the workforce as well as to enhance the mobility of construction workers. A number of Member States have thus implemented policies in this area. One of the key initiatives is related to the development of a so-called **skills card**. The skills card consists in a registry of the professional qualification of each construction worker in the form of a personal identification card. Depending on the specific

¹⁰⁵ SOKA-BAU, Berufsausbildung: Betriebsübergreifende Qualifizierung von Fachkräften. http://www.soka-bau.de/soka-bau_2011/desktop/de/Arbeitgeber/Berufsausbildung/

¹⁰⁶ Government UK, PM unveils plans to boost apprenticeships and transform training. June 2015. <https://www.gov.uk/government/news/government-kick-starts-plans-to-reach-3-million-apprenticeships>

¹⁰⁷ CITB, Apprenticeship levy and construction. <http://www.citb.co.uk/levy/apprenticeship-levy-construction/#4>

measure, the skills card may have a focus on safety at work (i.e. only workers with predetermined qualifications are allowed on certain work sites), combating undeclared employment and keeping track of professional qualifications and training. Generally, the skills card requires the registration of the employee's qualification in a centralised database. The construction worker has an electronic card with his personal data stored, which gives him access to the construction site. Nevertheless, the implementation of the skills card varies considerably across MS, as it can be either mandatory or voluntary, government-sponsored or led by industry or social partners, applicable to posted workers and include a data chip¹⁰⁸. To date, Denmark, Finland, France, Germany, Italy, Lithuania, Luxembourg, Belgium, Malta, the Netherlands, Romania, Sweden, Spain as well as the UK have implemented such programmes.

Another important initiative in this respect is related to the **certification of the quality of construction services** provided by construction companies. In addition to contributing to the recognition of skills and the promotion of professional development, such initiative allows to increase consumer confidence about construction services by making sure that minimum quality standards are upheld by contractors, thus minimising the risk of 'cowboy builders' and contributing to improving the image of the sector. A notable initiative in this respect is Ireland's official online register of contractors, the Construction Industry Register Ireland (CIRI). All companies that want to be included in the Register are vetted to a pre-defined standard that includes making use of competent and certified professionals, implementing good governance of energy efficiency and health and safety regulations, amongst others. The scheme was launched by the government in 2014 as a way to safeguard consumers, strengthen professionalism and compliance with building regulations and standards. While registration in CIRI is not mandatory, builders registered in CIRI are considered compliant with Building Control (Amendment) Regulations 2014, which mandate that a competent builder is assigned to construct in accordance with the plans, specifications and Building Regulations, and will sign the Certificate of Compliance on Completion. Not least, registration to CIRI requires mandatory Continuing Professional Development (CPD)¹⁰⁹.

Finally, some Member States have implemented specific policies dedicated to the **mobility of workers**. Depending on the Member States, policies related to mobility may be intended to attract foreign labour from other EU countries or retain the domestic workforce. With respect to attracting workers back into the economy, Ireland is making use of its *cifjobs.ie* website, through which potential candidates are able to see vacancies of the Construction Industry Federation (CIF) member companies and engage directly with Irish construction companies¹¹⁰. On the other hand, a number of Member States see the influx of workers from other EU countries as a measure to overcome labour shortages and have therefore developed specific instruments to attract foreign labour. In Slovenia, the Strategy of Economic Migration for the period 2010-2020 outlines the influx of foreign workforce as a potential instrument to tackle labour shortages and provides guidelines for the management of such mobility. Furthermore, Germany developed a specialised approach to address skills shortages with immigration policy. Indeed, non-EU workers with professional qualifications in construction are actively recruited by the German Federal Employment Agency (*Bundesagentur für Arbeit*). The Federal Employment Agency holds a so-called White List of all professions for which the country lacks skills and aims to recruit foreign workers¹¹¹. Action to foster intra-EU mobility is also being taken at the EU level, through initiatives such as the European Professional Card, which constitutes an additional measure to facilitate the recognition of professional qualifications (see

¹⁰⁸ FIEC, EFBWW, Social Identity Cards in the European Construction Industry, January 2015. <http://www.efbww.org/pdfs/EFBWWFIEC%20report%20on%20social%20ID%20cards%20in%20the%20construction%20industry.pdf>

¹⁰⁹ Construction Industry Register Ireland (CIRI). <https://www.ciri.ie/about-ciri/>

¹¹⁰ CIF Jobs, <http://cifjobs.ie/>

¹¹¹ Federal Employment Agency (Bundesagentur für Arbeit, BA), Whitelist. <https://www3.arbeitsagentur.de/web/wcm/idc/groups/public/documents/webdatei/mdaw/mta4/~edisp/L6019022DSTBAI777367.pdf>

Legal framework). Professionals working as real estate agents can already benefit from it. In the future, the EPC may be extended to other regulated professions that meet the relevant criteria.

Key takeaways

- ✓ The **skills card** is a measure to address safety at work, undeclared employment and to keep track of professional qualifications and training. It contains information on the professional qualifications of each construction worker in the form of a personal identification card (often electronic) giving access to the construction site;
- ✓ The **certification of the quality of construction services** allows to increase consumer confidence by making sure that minimum quality standards are upheld. It also contributes to the recognition of skills and the promotion of professional development;
- ✓ A number of MS have developed **specific instruments to attract foreign labour**, such as guidelines for the management of economic migration or a targeted list of all professions for which the country lacks skills and aims to recruit foreign workers.

6. Conclusion

As discussed throughout the report, the coming years represent a critical turnaround phase for the European construction sector, which is now more than ever being faced with major challenges but also opportunities to transform, adapt and consequently reach enhanced levels of growth and profitability. The various obstacles that are currently undermining the sector from the perspective of employment and skills originate from a multitude of factors, including demographic pressures (the ageing population and ensuing decline of the working-age group), the poor image of the sector, which results in a reduced appeal particularly to the younger generation, as well as intrinsic factors that characterise the industry, specifically its cyclical nature, low predictability and structural fragmentation. Combined, these have resulted in a chronic underinvestment in the training of the human capital basis of the sector, therefore leading to a recognised shortage of skills.

On the other hand, the rise of sustainable construction and energy efficiency, as well as the progressive integration of digital technologies in the building process, are offering the sector a wealth of opportunities to train and increase the level of skills of the workforce, so as to reap the benefits associated with them. In this respect, a balanced combination of technical and soft skills will be crucial, including management, planning, numeracy and communication skills, as well as ICT, digital, renewable energy and energy efficiency skills.

In order to overcome the obstacles and take full advantage of the opportunities opened up by the discussed drivers, the following remarks should be considered looking ahead.

- ✓ More **cross-industry cooperation**. This concept is acquiring increasing importance in light of the rise of sustainable and energy efficient construction and digitalisation. Indeed, cross-industry cooperation is the key to developing *cross-trade knowledge*, which is an underlying requirement for professionals involved in such innovative building practices. In fact, it is necessary to ensure that each worker has a level of knowledge that goes beyond his own area of expertise, since the innovative techniques involved in the process require a holistic view of the entire project. The same holds true in view of the increasing uptake of digital technologies. Cross-trade knowledge can be developed by strengthening the training offer through cooperation between different industries, but also between industry players,

national associations, training providers and the public sector. This would allow the creation of trainings where trainers and participants from different trades share their experiences, enabling a positive exchange of knowledge and resulting in a synergy effect.

- ✓ **Focus on training the trainers.** As previously discussed, one of the underlying factors affecting the quality of the training programmes and the ensuing level of skills in the workforce is the availability of suitable trainers. This is often not the case across some Member States, where the low quality of the teaching staff is one of the main issues. Despite its importance, the policy response of such countries has been lagging behind, with 'Train the trainers' schemes not being as widespread among national initiatives as the ones targeting construction workers. For this reason, increased attention should be devoted to the development of this type of programmes at Member State level, since the BUILD UP Skills project is currently the main framework for their creation. This holds true particularly for energy efficiency skills, although it is becoming increasingly important also for digital competences (see below).
- ✓ **Set-up of an EU-wide digital skill project.** This experiment has already been carried out in relation to strengthening the skill-base in terms of energy efficiency in the building workforce. Indeed, the BUILD UP Skills project has proved to be a successful best practice, relying on all Member States joining forces to find a common solution and approach to impart a new set of skills in response to the increasingly stringent energy efficiency requirements. A similar initiative could therefore be envisaged also in the area of digital technologies. As explored above, some projects involving consortia of Member States have already been launched, particularly with respect to the assessment of BIM skill needs and the creation of streamlined training programmes. The next step could thus entail the expansion of the scope of similar projects to include all Member States and explore such topics at the broader EU level, so as to develop harmonised vocational and education training programmes across Europe.
- ✓ **Increase the availability of apprenticeships.** As seen above, apprenticeships are deemed to be crucial to develop key skills and improve the employability of young construction professionals. However, the response of Member States has not yet reached its full potential, and more should be done to encourage employers to set up apprenticeships on private projects. Only a few countries have implemented dedicated initiatives to support apprenticeships specifically in construction. In this respect, some good practices include the introduction of *tax incentives* to stimulate companies to train their employees, as seen in countries such as Belgium. Moreover, action should also be envisaged from the public sector side. Potential measures in this context could include mandating apprenticeships on public sector projects, thus ensuring that the number of apprenticeships available meets current but especially future demand.
- ✓ **Strengthen mutual recognition of qualifications.** One of the key prerequisites for the mutual recognition of qualifications is the establishment of 'zones of mutual trust', i.e. a mutual understanding of qualifications in terms of their nature, content, regulation and importance on the labour market. Nevertheless, despite the extensive legal framework in place at the EU level that seeks to facilitate the recognition of qualifications and enhance the mobility of the workforce, these aspects are still an important obstacle for the construction sector. Indeed, qualifications and competences across countries are intertwined with their respective cultures, laws and institutions, thus encompassing different ranges of activities and knowledge requirements. Education and training systems also vary greatly across the EU, creating further incompatibilities between countries and restricting mobility. In this context, a more harmonised implementation of construction skill cards, currently introduced only in some Member States either on a mandatory or voluntary basis, could contribute to improving the situation. The support of national associations is crucial to steer action in this

direction. Moreover, further steps can be taken also at the EU level, with the expansion of the scope of initiatives such as the European Professional Card, which is presently available for the recognition of professional qualifications only for some health professions and real estate agents, potentially contributing to facilitating the mobility of the workforce from areas of low to those of high demand. As part of this effort, Horizon 2020 is supporting exchanges between projects on mutual recognition in the field of energy efficiency¹¹².

Ultimately, these efforts will lead to an improved and less fragmented training offer across the EU, which will in turn strengthen the link between education and skills and the image of the sector, with the resulting construction industry being greener, smarter, more digital and, consequently, more attractive.

¹¹² BUILD UP Skills, TWG 2 Mutual recognition of skills and qualifications.
<http://www.buildup.eu/en/skills/twg-2-mutual-recognition-skills-and-qualifications>

Annex 1 – Legend

- **Narrow definition** of the construction sector: this refers to sector F - Construction, as defined by the NACE rev.2 classification:

NACE F - Construction

- F.41 - Construction of buildings
- F.41.1 - Development of building projects
- F.41.10 - Development of building projects
- F.41.2 - Construction of residential and non-residential buildings
- F.41.20 - Construction of residential and non-residential buildings
- F.42 - Civil engineering
- F.42.1 - Construction of roads and railways
- F.42.11 - Construction of roads and motorways
- F.42.12 - Construction of railways and underground railways
- F.42.13 - Construction of bridges and tunnels
- F.42.2 - Construction of utility projects
- F.42.21 - Construction of utility projects for fluids
- F.42.22 - Construction of utility projects for electricity and telecommunications
- F.42.9 - Construction of other civil engineering projects
- F.42.91 - Construction of water projects
- F.42.99 - Construction of other civil engineering projects n.e.c.
- F.43 - Specialised construction activities
- F.43.1 - Demolition and site preparation
- F.43.11 - Demolition
- F.43.12 - Site preparation
- F.43.13 - Test drilling and boring
- F.43.2 - Electrical, plumbing and other construction installation activities
- F.43.21 - Electrical installation
- F.43.22 - Plumbing, heat and air-conditioning installation
- F.43.29 - Other construction installation
- F.43.3 - Building completion and finishing
- F.43.31 - Plastering
- F.43.32 - Joinery installation
- F.43.33 - Floor and wall covering
- F.43.34 - Painting and glazing
- F.43.39 - Other building completion and finishing
- F.43.9 - Other specialised construction activities
- F.43.91 - Roofing activities
- F.43.99 - Other specialised construction activities n.e.c.

- **Broader definition** of construction: this includes sector F, as well as other sectoral activities, namely real estate activities (NACE L), architectural and engineering activities and related technical consultancy (NACE M) and certain manufacturing sub-sectors (NACE C), related to the construction sector:

NACE L – Real estate activities

- L.68.1 - Buying and selling of own real estate
- L.68.2 - Renting and operating of own or leased real estate
- L.68.3 - Real estate activities on a fee or contract basis

NACE M - Professional, scientific and technical activities

- M.71.1 - Architectural and engineering activities and related technical consultancy

NACE C – Manufacturing

- C.16.2 - Manufacture of products of wood, cork, straw and plaiting materials
- C.23.3 - Manufacture of clay building materials
- C.23.5 - Manufacture of cement, lime and plaster
- C.23.6 - Manufacture of articles of concrete, cement and plaster
- C.23.7 - Cutting, shaping and finishing of stone
- C.25.1 - Manufacture of structural metal products

Glossary

Craft and related trades workers apply specific technical and practical knowledge and skills to construct and maintain buildings; form metal; erect metal structures; set machine tools or make, fit, maintain and repair machinery, equipment or tools; carry out printing work; and produce or process foodstuffs, textiles, wooden, metal and other articles, including handicraft goods, etc.

Elementary occupations involve the performance of simple and routine tasks which may require the use of hand-held tools and considerable physical effort. Tasks performed by workers in elementary occupations usually include performing simple tasks connected with mining, construction and manufacturing including product-sorting; packing and unpacking produce by hand, and filling shelves; providing various street services, etc.

Full Time Equivalent (FTE) is a unit to measure employed persons in a way that makes them comparable, although they may work a different number of hours per week. The unit is obtained by comparing an employee's average number of hours worked to the average number of hours of a full-time worker. A full-time person is therefore counted as one FTE, while a part-time worker gets a score in proportion to the hours worked.

Post-secondary tertiary education according to the OECD's definition "straddles the boundary between upper secondary and post-secondary education from an international point of view, even though it might clearly be considered upper secondary or post-secondary programmes in a national context. Although their content may not be significantly more advanced than upper secondary programmes, they serve to broaden the knowledge of participants who have already gained an upper secondary qualification. The students tend to be older than those enrolled at the upper secondary level".

Upper secondary education (ISCED 3) according to the OECD's definition "corresponds to the final stage of secondary education in most OECD countries. Instruction is often more organised along subject-matter lines than at ISCED level 2 and teachers typically need to have a higher level, or more subject-specific, qualifications than at ISCED 2. The entrance age to this level is typically 15 or 16 years".

Short cycle tertiary education corresponds to ISCED Level 5B, namely first stage of tertiary education: typically shorter, more practical/technical/occupationally specific programmes leading to professional qualifications.

Tertiary education in engineering, manufacturing and construction gives the number of graduations in the first and second stages of tertiary education, according to the ISCED 1997 for higher education (levels 5 and 6). The indicator refers to graduates in 'Architecture and building', specifically architecture and town planning (structural architecture, landscape architecture, community planning, cartography); building, construction; civil engineering.

