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Title: Draft Status Quo Analysis - Slovakia

Analýza národného status quo -Slovensko

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Build up Skills (BUS) initiative in CZ and SK –

Rebooting the National qualification platforms and Roadmaps towards implementation of nearly Zero Energy Buildings and support for Renovation Wave

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Further information

More details on BUILD UP Skills can be found at www.build-up.ec.europa.eu

More details on the LIFE CET programme can be found at https://cinea.ec.europa.eu/programmes/life_en

Obsah

EXECUTIVE SUMMARY

The status quo analysis and the work on it is the result of the complex work of the partners and a large number of stakeholders who actively participated in the discussions on the analysis of the data and insights gathered. Contributions to the empirical research were fundamental to the success of the analysis and in many cases the only source of the data needed.

The status quo analysis also carried out an assessment of the achievements to date in the field of improving the energy performance of buildings. It pointed out many shortcomings in the assessment of the results achieved so far in improving the energy performance of buildings, which was finally confirmed by the results of the audit by the Supreme Audit Office, although so far only the audit in the field of public buildings has been carried out. However, the aim of the status quo analysis was not to assess the renovation of the building stock as such, but to assess the contribution of building renovation to the growth in the construction sector, as the sector recorded a negative growth in spite of the renovation efforts in Slovakia. On the basis of the very favourable assessment of the performance of building renovation by the responsible authorities for the said period, also taking into account the results of the Supreme Audit Office audit, it can only be concluded that building renovation will not contribute significantly to the growth in the construction sector in the future as well, as was the case in the years assessed and considered as very building-renovation-intensive (as illustrated in Chart 2: Construction output index - international comparison). Thus, according to official data, flats and apartment buildings should be renewed by 2029 and single-family houses by 2040.

This also follows from the National Energy and Climate Goals of the Slovak Republic until 2030, based on the European-wide energy and climate goals, which are set out in the Integrated National Energy and Climate Plan until 2030, and which is an update of the Energy Policy of the Slovak Republic approved by Government Resolution No. 548/2014 of 05.11.2014. Compared to the EU, the Slovak Republic has not defined its own targets for key indicators (although targets have not been set for individual Member States) for the reduction of greenhouse gas emissions and emissions in the sector covered by the Emissions Trading Scheme (ETS). For non-included sectors and for the use of renewable energy, Slovakia has set softer targets than the EU.

However, it is necessary to anticipate the critical situation in the building sector in the 2035 horizon and therefore the building sector must undergo the necessary transformation to cope with end-of-life demolition and recycling of a significant part of the current building stock and to provide for new construction based on demographic developments. This transformation will also secure the interest of investors in the building sector and avoid a crisis in the financing of its own business activities, given the shift in investor interest towards financing sustainable business activities, which will also mean that unsustainable business activities will not have access to financing. For this reason, it is important to pay attention to developments in the EU taxonomy and the adaptation of entrepreneurial activities and its technical indicators.

To do this, it will be necessary to transform vocational education, to promote new approaches, methods and technologies in education and the assessment of learning outcomes, thus anticipating not only the needs of the labour market but also the new social needs that will increasingly be at the centre of attention.

As of 31 December 2021, according to the Construction Yearbook 2022 published by the Statistical Office of the Slovak Republic, out of a total of 160 910 employees employed in the construction sector in the Slovak Republic, about 88 % worked as self-employed craftsmen or employees of micro enterprises. From this point of view, small and medium-sized enterprises in the construction sector occupy a significant position and it is assumed that such an organisational structure will be supported in the future as well.

Small businesses accounted for the largest share of construction output at around 50% in 2021 (a 36% increase in output from 2017), with this share rising steadily over the period 2017 to 2021.

The latest data available to the partners shows that there are 969,360 single-family houses (totalling 1,008,795 dwelling units, 45% of which are renovated) and 64,846 apartment buildings (totalling 931,605 dwellings, 68% of which are renovated) in Slovakia. There are 15 435 public buildings.

There were 6 846 pupils in vocational education in secondary schools (in the fields of construction, building production, bricklayer, plumber) in the school year 2021/22, of which 1 925 were graduates. Although these figures are quite high, a study carried out by Trexima showed that only 9% of the graduates will find employment and remain as craftsmen in the construction sector. Therefore, the main objective of the construction sector is the retention of craftsmen in the sector rather than increasing the number of apprentices, whatever the reasons for this low percentage.

However, a targeted and significant increase in the number of apprentices is needed in skills related to the implementation of renewable energy (especially solar and wind energy) and the replacement of gas boilers with heat pumps. Slovakia is at the tail end of the EU in this area despite having to import 95% of its gas from Russia, 75% of which is burned in buildings, mainly for heating and hot water. This situation is worrying.

In terms of the objectives of the BUS DoubleDecker project, the roadmap will address the following areas:

- To offer a proposal for a strategy for the further development of vocational education in secondary schools to provide for future skills and knowledge needs based on the outlined vision for the construction sector for 2035 and 2050. Here, developments in other industries need to be extrapolated to anticipate developments in the construction sector;

- Make recommendations for content, material, and financial conditions so that educational institutions can manage this effectively;
- Propose a focus for further and continuing education programmes towards micro-qualifications that will significantly complement formal vocational education in secondary schools, especially in the field of fast-moving innovations to which vocational training institutions cannot respond quickly, due to the lengthy planning and approval process, which is often longer than the full exchange of information in the field (i.e. by the time a new vocational field and related vocational training programme is prepared, approved and included in the curriculum, it is already outdated and unnecessary);
- Prepare a proposal for projects and joint stakeholder activities that will be directed towards the fulfilment of the proposed objectives in the field of continuing and further education.

These proposals will be prepared in close cooperation with the stakeholders who have participated in the status quo analysis, in order to take into account their specific suggestions and comments.

The development of these proposals will be influenced by the situation following the crisis caused by the consequences of the spread of the Covid-19 virus. What we saw in 2019 as the long-term future is gradually becoming a reality. Digital technologies, which have been the basis of our contact with the world and critical to the continuity of most activities, are more accepted than ever. Under normal circumstances, we would hardly have made such progress in Europe in 3 years. This has reduced the 'transition period' to digital technologies from 10 years to a third. The reopening of communities has created a new focus and motivation for technological advances and modern construction methods. We are also seeing a greater awareness and interest in correcting the unsustainable impacts of the built environment, the carbon footprint impacts of the construction process itself, and the carbon emissions from buildings.

These changes in awareness have provided the impetus for innovation in the delivery of the built environment, which is set to be transformed by the construction industry (PV). PV is a system that uses and combines attributes of nD BIM and CDE and digital twins. It encompasses five key megatrends:

1. Big Data, AI (artificial intelligence) and predictive analytics;
2. Robotics and automation;
3. Prefabrication and off-site construction;
4. Internet of Things;
5. Technological development of manufacturing (3D).

PV is the construction sector's response to the growing lag in labour productivity behind other industries and the shortage of skilled craftsmen before multiple occupations and is seen as a long-term solution to these problems. Covid-19 has caused its uptake around the world to

accelerate significantly and is transforming the character of the entire industry. Lagging in this area will have serious consequences for Slovakia, namely for social stability and economic growth.

This means that many of the future requirements for skills, knowledge and competences will be more adaptable and digitally focused. As a result of the transformation of ESG's business operations and business strategy, the company has become a key player in the development of the local and regional economy. The construction industry will need to adapt and attract people from different backgrounds, such as **strategists, cognitive and systems thinkers, data analysts and data scientists, digital workers,** and **robotic programmers**.

The construction industry will also have to deal quickly with the concept of Industry 4.0 and focus on Industry 5.0, which is already making significant progress in other sectors. This will require socially oriented skills, and the pushing social taxonomy, which will also need to be reflected in ESG programmes, will lead to a focus on sustainability in building design and construction production techniques, as well as the acquisition of more people-oriented skills and competences and the symbiosis of people and robotic machines and tools. This will mean new team types, new qualifications and new skills, knowledge and competencies for existing ones to be sought in the best available talent.

Of the new professions and roles in the construction process, status quo analyses have been identified in the development process (the list is not exhaustive and will be added to in the process of developing the roadmap):

- Information Manager;
- Robot operator;
- Digital collaboration;
- Cyber security;
- Value engineering;
- AI architect;
- Building assembly technician;
- Construction drone operator.

In terms of skills, knowledge and competencies, the following have been identified in the process of preparing the status quo analysis (the list is not exhaustive and will be completed in the process of developing the roadmap):

- Cognitive and systems thinking;
- Programming;
- Active access to further education;
- Data-driven decision-making;
- Complex problem solving with excellent communication skills;
- Data analytics, artificial intelligence (AI) and BIM;

- Production management in industrial construction;
- Modelling and simulation;
- Robotic resource management and drones;
- Internet of Things (IoT);
- Computer visualisation;
- 3D printing;
- Augmented reality (XR), including augmented reality (AR), virtual reality (VR) and mixed reality (MR);
- Integration skills.

In terms of the current processes, including planning deadlines and accreditation deadlines in secondary vocational education, we will be able to welcome the first graduates for the above roles/professions equipped with the necessary skills, knowledge, and competencies into our workplaces in 2030 at the earliest if we start working hard on this right away, which will impact the timeframe for the transformation of the construction industry. The development of further education and work on a system of continuous learning must be adapted to this.

1 Introduction

Due to structural changes in energy efficiency (doubling of renovation rates, increasing share of deep renovations), renewables, technical advances in industry, new methods of education, new even more ambitious climate and energy targets, and the introduction of digitalisation in all sectors, there is a critical need to update the core Europe-wide documents under the Build Up Skills (BUS) initiative. This is a national analysis of the status quo and a national roadmap. In addition, national platforms need to be strengthened to accelerate the transformation of the construction industry and related sectors. The purpose of the status quo analysis and roadmap is to strategically guide developments in education for the construction sector and thus support it in its efforts to meet the objectives of the European Green Deal and the related Renewal Wave, Smart Finance for Smart Buildings, and other initiatives.

The main objective of the DoubleDecker project is to identify measures to build the necessary pool of skills, knowledge, and competences in the sector in Slovakia. The purpose of the measures is also to support the transformation of the construction sector in the horizon 2035 and 2050, considering technical progress in the industry, new methods of education and use of information, new even greater ambitions in the field of climate and energy, and the introduction of digitalization in all sectors. A secondary objective is to strengthen EU policies under the Build Up Skills initiatives.

Given the proximity of the Czech Republic and Slovakia through shared historical experience, similar building stock, construction market, including the same construction companies and language proximity, the joint project is implemented by merging activities to benefit from synergies of shared management activities, results and approaches.

The project is divided into four objectives:

1. Strengthening the National Skills Platform, which was established by the Build Up Skills initiative in Slovakia and the Czech Republic in 2012, and engaging the widest possible range of stakeholders.
2. To produce a status quo analysis (analysis of the current state of play) on improving the energy performance of buildings and the use of renewable energy sources, and on the current state of play in education and training for the professions.
3. Develop a Roadmap that will focus on the development of a pool of skills, knowledge, and competences with a horizon for 2035 and a view to 2050 necessary to transform the building sector so that it can effectively contribute to achieving the climate goals and climate neutrality of the buildings and construction sector by 2050.
4. Exchange experiences in this field with EU Member States.

Slovak partners successfully implemented a similar project in 2012 and 2013. The developed roadmap and subsequent activities led to effective changes in the integration of energy efficiency in buildings and the use of renewable energy sources into qualification frameworks,

vocational training in secondary and higher education and the establishment of further education schemes. Subsequent measures have also led to several improvements in relevant policies, regulations and the implementation of other support measures. The Roadmap remained an active tool for stakeholders during the period 2013-2022 and led to the implementation of several concrete projects. The Roadmap was reviewed mid-term (2017) as reported during the StavEdu and ingREeS projects, and a final evaluation of the implementation plans was completed during the preparation of the ongoing project aimed at improving the preparation of the new Roadmap with a horizon of 2035 and a view to 2050.

The pre-project research conducted by the partners helped to develop a first draft list of topics to be addressed, leaving room for stakeholders to assess any suggestions relevant to the skills, knowledge and competences needs they consider to be key and relevant.

The list of topics compiled by partners includes, for example:

- Adopting an effective cross-sectoral approach, transfer as much as possible know-how from other sectors, thus avoiding the "reinvention of the wheel" (e.g., in digitalisation, robotics, autonomous vehicles, virtual and mixed reality, the use of Web 3.0 and e-learning 3.0 in education and training, etc.).
- Consider digitalisation (including BIM, digital twins, etc.) as a powerful and heavily used tool to achieve objectives rather than as an end goal.
- Better balance the focus on energy solutions in buildings (coordination of energy efficiency measures with demand response, energy storage/hybrid systems, EV-mobility, distributed energy generation, etc.) with structural solutions (materials and related technologies, airtightness, etc.), which have been the main focus of the BUS so far.
- Identification of the sector's motivations for change and innovation that are necessary to meet the ambitious EU 2030 and EU 2050 targets.
- Focus more on increasing productivity in the construction sector (e.g. through innovation, use of high technologies, modular construction, etc.), which is essential for the implementation of the 'renewal wave', as the sector's capacity cannot be easily doubled.

Based on previous experience, the partners have also considered some improvements to the structure of the plans:

- Focusing the Status Quo Analysis section more on the analysis of the areas that have a direct impact on skills needs and influence the education and training process, and on the trends that will affect the training sector in 2035 and with a view to 2050.
- Focus more on innovations that would make working in the construction sector more attractive to young people and make the professions more attractive to women.

- Include measures to facilitate follow-up efforts, such as increasing the flexibility of qualification frameworks (updating qualification standards) and the effective implementation of micro-qualifications, considering the recently adopted recommendations of the Council of the European Union.

This list has already received preliminary basic support from several stakeholders at technical level. The National Qualifications Platform (NQP) will elaborate them in detail. Without being overly optimistic that the government will change its approach and support the work of stakeholders effectively, close cooperation of stakeholders is expected in the implementation of the agreed measures in the field of further education in terms of methodological and programme development. Vocational training at secondary and tertiary levels remains the full responsibility of the Government.

The status quo analysis also assessed the achievements to date in improving the energy performance of buildings. However, the aim of the status quo analysis was not to assess the building stock renewal per se, but to assess the contribution of building renewal to the growth in the building sector. Based on the very favourable assessment of the progress in renovation of buildings so far by the responsible authorities, also taking into account the results of the audit of the Supreme Audit Office, it can only be concluded that building renovation will not contribute significantly to growth in the construction sector in the future, as it actually declined in the assessed years in spite of very intensive efforts (according to the competent authorities) in this area.

2 Goals and methodology

The goal of the Analysis of the National Status Quo is to analyse the current state of the construction industry and the situation in lifelong learning in the construction industry regarding energy climate goals, energy efficiency of buildings, including trends in digitization, the introduction of smart technologies and renewable energy sources.

The analysis focuses on an overview of national policies (legislative and non-legislative) aimed at the construction sector in the fields of energy, construction, and education. The goal was to provide an overview of the most important measures leading to the achievement of energy and climate goals and measures to increase energy efficiency according to the Low Carbon Development Strategy of the Slovak Republic until 2030 and with a view to 2050.

The analysis focuses on information from the construction sector and the energy sector regarding the development of human resources and employment in the construction industry and the development of the building stock and the state of renovation of buildings in Slovakia.

One of the main goals is the analysis of the current state of vocational education and training within the system of lifelong learning and the identification of current and future needs and new requirements for education and qualification of relevant professions. The increasing rate of digitization and automation of individual processes, the use of smart technologies, new materials, as well as the transition to a green

economy clearly leads to an increased need for qualified and requalified experts in the construction industry. Furthermore, we focused on identifying obstacles and barriers that could prevent the country from achieving its energy goals by 2030 in the construction sector.

The methodology is based on individual tasks and goals set within the DoubleDecker project. It mainly consists of an analytical part and data collection and research of all relevant information published in printed form and published on the Internet. Analytical data processing of strategic materials, documents and data processed mainly by the Ministry of Transport and Construction of the Slovak Republic (MDaV SR), the Ministry of Education, Science, Research and Sports of the Slovak Republic (MŠVaV SR) and data processed by the Statistical Office of the Slovak Republic and the Center for Scientific and Technical Information of the Slovak Republic. Personal cooperation and interviews with identified stakeholders of the national qualification platform (NKP), involved mainly in professional associations, chambers, guilds and with representatives of central state administration bodies and representatives of vocational schools, universities and other educational institutions, at joint meetings (First NKP meeting on December 8, 2022 in Bratislava), workshops (Workshop-meeting of school principals with leading employers in the construction industry on March 2, 2023 in Bratislava) and other bilateral meetings.

The analysis started with an evaluation of the effectiveness of the implementation of the first national BUS road map of 2013. This evaluation and the results related to the evaluation of the fulfilment of the individual measures and goals established in the national road map and subsequently realized and implemented within the Build Up Skills Pillar II projects, were processed into the project deliverable and subsequently incorporated into the Status Quo Analysis - Slovakia.

The collection of necessary data and information was supplemented by a survey, which was carried out in the form of online questionnaires. Tree types of questionnaires designed for two target groups were created.

Questionnaire for high schools and universities, with the aim of identifying to what extent the current system includes the necessary skills and knowledge regarding new trends and needs in the construction industry. To what extent and whether the current system of formal education includes knowledge and skills related to the energy efficiency of buildings and the use of renewable energy sources in buildings, green economy, digitalization, automation, robotization and the use of new methods and technologies, smart technologies, 3D technologies and materials and using artificial intelligence and virtual reality in construction. Furthermore, we focused on the identification of barriers to the introduction of the necessary innovations and new vocational programmes at secondary schools, study programs at universities, and the need for continuous education of teachers.

The questionnaire for companies operating in the construction sector focused on the identification of needs and barriers in terms of economic and technological development and the needs of qualified workers in the construction sector. We focused mainly on the identification of shortage professions, finding out the current situation and examples of solutions with a shortage of qualified labour. For employers in the construction industry, it will

be key to set up the system and support for further education of adults, but also to improve the quality of teaching of graduates, which could help to meet the needs of the labor market. This survey has been complemented by a third survey to receive additional information needed for SQA.

The result of the work so far is this Draft Analysis of the National Status Quo - Slovakia. It will be further developed in Sections 7 to 10 based on the results of the surveys, follow-up interviews and targeted discussions at the meeting and workshop of NKP. After presenting SQA to stakeholders, consultation with experts within the framework of NKP, and stakeholder workshops, the final document of the Analysis of the National Status Quo - Slovakia will be prepared, as a starting point for preparing draft Roadmap.

3 Characteristics of the construction sector

The construction sector affects all vital parts of social life, culture and economy and is considered one of the most important sectors of the Slovak economy. It is an indicator of the development of the economy to which it is directly linked and immediately reacts to all its changes.

However, the main importance of the construction sector lies in its end products, which ensure the operation or development of other sectors and disciplines. Without the end results of the construction sector, it would not be possible to provide a social life in which housing, health care, culture, roads, or education could be integrated.

3.1 Development of the construction sector

After the fall of the totalitarian regime in 1989, the construction industry in Slovakia underwent extensive restructuring, which involved mainly changes in the number and size of construction companies and also changes in the ownership structures. After this period, the volume of construction output declined until the establishment of the independent Slovak Republic in 1993, where periods of stagnation, decline and growth alternated.

The growth in the volume of construction output started in 2000 and the most significant growth in the construction industry in Slovakia was recorded in the years 2005 - 2006. The year 2008 can be called the peak of the Slovak construction industry in comparison to the volume of construction output. At the same time, this year was also a turning point and due to the global financial and economic crisis, construction output started to decline in 2009 and continued its downward trend until 2014. During 2015, the value of construction work carried out by construction companies in the country increased by 15.2%, with the largest increase recorded in new construction, including modernisation and reconstruction. From 2015 to 2019, only slight year-on-year increases and decreases in construction output followed. A more significant decline only came in 2020 with the arrival of the COVID-19 pandemic, which after a brief growth

hit again in 2022 with the war in Ukraine. The Slovak construction industry has not yet returned to 2008 levels of construction output.

Chart 1 – Development of construction output between 2000 and 2021 (Source: Construction Yearbook 2022)

The comparison of the development indexes of the Slovak construction industry with the average of the EU 27 and the Central European countries is significantly negative for the Slovak Republic. While the development of production in 2016, 2017 and part of 2018 roughly followed the development in the neighbouring countries, after this period the Slovak construction industry started to decline significantly, even before the effects of the coronavirus pandemic became apparent.

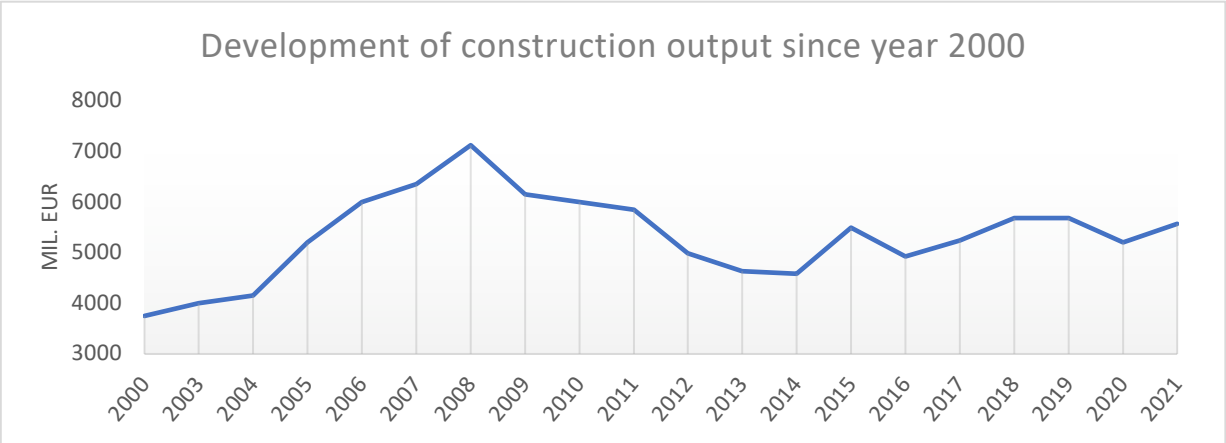


Chart 1 – Development of construction output between 2000 and 2021 (Source: Construction Yearbook 2022)

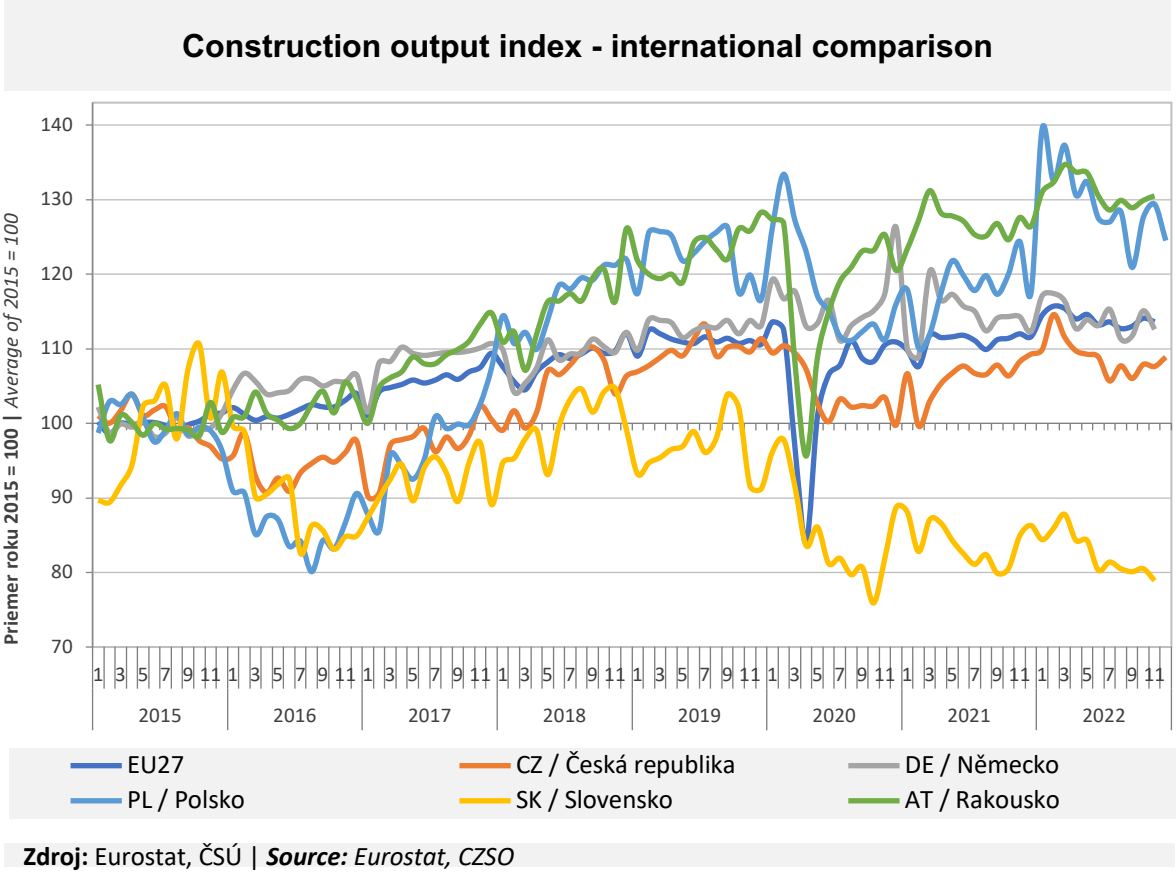


Chart 2 - International comparison of the construction output index

While other neighbouring countries as well as the EU 27 average managed to stop the decline and start growing again in mid-2020, the production in Slovakia continued to decline and oscillated in the range of 80 to 90% of the construction output of 2015. All the monitored countries were already above 100% of 2015 production in 2020. It is currently at around 80%. Investment in the construction sector in Slovakia is currently underperforming Western Europe and, once price levels are factored in, the Slovak construction sector lags behind even when compared to some Eastern European countries.

3.2 Contribution of the construction sector from the perspective of the national economy

The share of the construction sector in the gross domestic product can be the most concise assessment of the position of the construction sector in the national economy. Since 2005, the share of the construction sector in GDP has been increasing and reached its peak in 2009, when its value reached 8.6%. Subsequently, due to the financial and economic crisis, there was a decrease in private and public investment, which had a significant impact on the share of the

construction sector in GDP. In 2021, the construction sector accounted for only 5.4% of GDP of all sectors. Despite the long-term decline, the construction sector is still considered one of the crucial sectors of the Slovak economy.

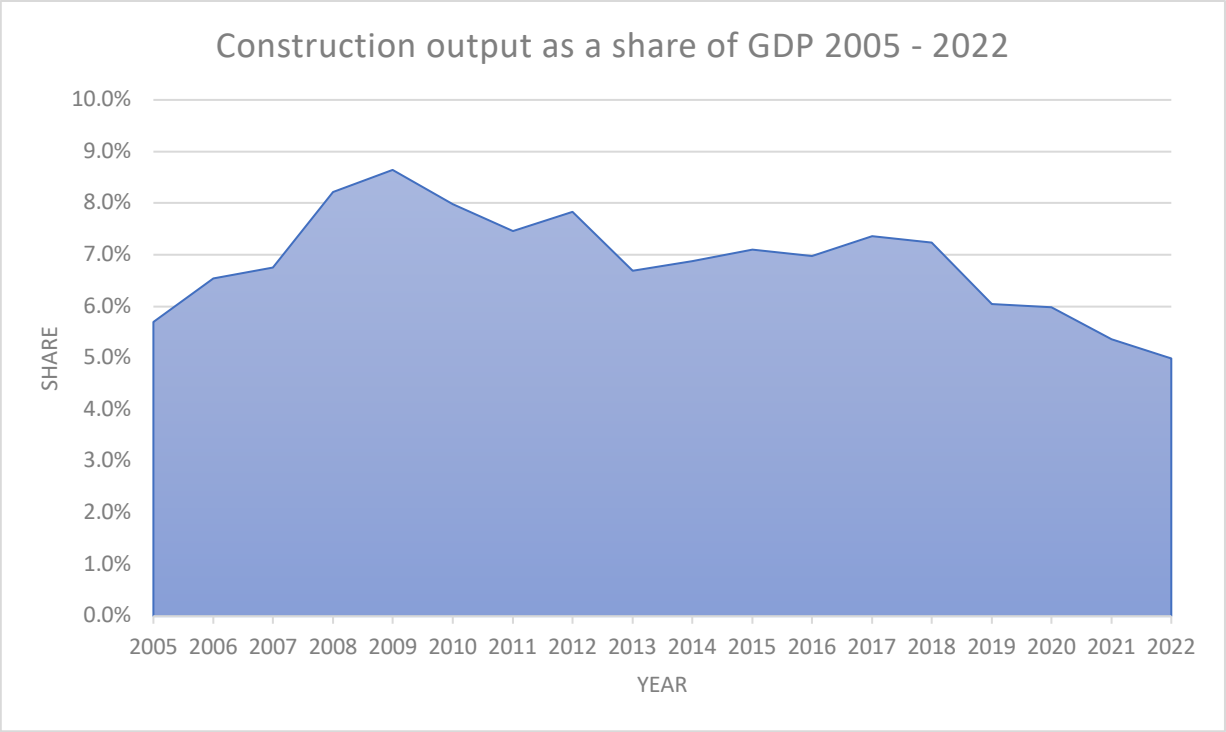


Chart 3 - Construction output as a share of GDP 2005 - 2022

Another important indicator is the share of the construction sector in total employment in the national economy. While the highest employment in the construction sector of 8.5% was in 2009, and subsequently had a declining character, the share of workers has been increasing again year-on-year in the last two years. In 2022, the share of workers in construction was 9.9% with a growth of 0.5% from the previous year. The potential is of course much higher. Construction is also important for the national economy in terms of its multiplier effect, high share of human labour, wide supply chain as well as low import intensity. In construction activities, the multiplier effect coefficient in downstream industries abroad ranges from 1.8 to 3.5. For example, a public investment of 500 million € in the construction and renovation of buildings can generate an additional 650 million € in GDP and create 17 500 jobs. At the same time, every 10 million € invested in construction will raise the national budget by 6 to 8 million € through taxes and other revenues. It is precisely through public investment in construction contracts that states stimulate the economy more effectively, even more so in times of crisis.

3.3 Subjects active on the construction market

Subjects active on the construction market have a very important social position.

Since the construction industry's tasks also include the production of building materials and the organisation and preparation of construction activities, we divide the subjects into several groups:

- Manufacturers of building materials
- Building contractors - construction companies
- Planners carrying out project management activities
- Architects providing all architectural activities from conception to design and construction of a building, i.e., building implementation plans
- Educational organisations
- Transport companies

The largest part of the construction sector's workforce is made up of freelance workers, who accounted for 51.3% of the workforce in 2021. Over the last 5 years there has been a trend indicating an increase in employment, particularly in small businesses in the category of up to 19 employees, by 46% at the expense of freelancers, where there has been a decline of 14.5% in each category over the last 5 years. This is mainly due to the way of doing business and thus the transition from freelance workers as natural persons to legal entities. In this set-up, the owner of the company and the managing director are the same person. The advantage is the limited liability and the possibility of adjusting the tax and levy burden.

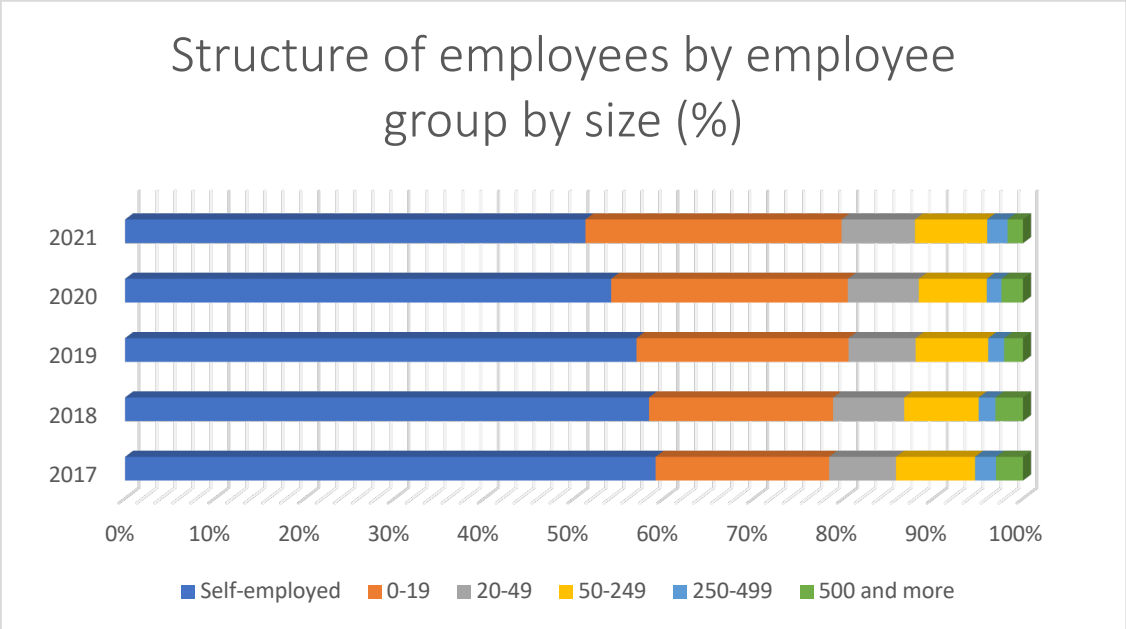


Chart 4 - Structure of employees by size groups of subjects operating on the Slovak market (Source: Construction Industry Yearbook 2022)

3.4 New technologies

The construction industry's significant impact on the economy is also influenced by innovative changes and stakeholders in the construction market. Labour shortages are causing companies to work with fewer and fewer workers and to find solutions to maintain the required

performance and increase labour productivity, which are particularly assisted by new methods. In terms of innovation, these are mainly in the areas of automation, drones, 3D technologies, BIG DATA, building information modelling - BIM, digitisation, the Internet of Things, robotics, smart technologies, artificial intelligence, virtual and augmented reality or even waste-free and carbon-free construction. New ways, methods and working practices are expected, which will require an educated workforce with new professional knowledge that will need to be complemented by new professional skills.

3.5 Development of the construction industry and forecasts of further development

It is very difficult to predict the development of the construction sector today. The war in Ukraine, the unforeseen enormous increase in the prices of construction materials and labour and especially the current unstable political situation is creating deteriorating conditions for the construction industry in Slovakia. One of the possible ways to support the construction industry and boost the national economy is the proper implementation of the Recovery and Resilience Plan in the coming period. This plan sets out a comprehensive package of reforms and investments to be implemented by 2026 in the form of calls in the context of the European Commission's recommendation to Slovakia on green and digital transformation. It is a temporary and emergency instrument designed by the European Commission to help repair the economic and social damage caused by the coronavirus and thus support economic recovery.

Another instrument is the drawdown of Structural and Investment Funds from the 2014-2020 operational programming period, which are intended to support economic growth and employment and to properly set the drawdown for the new programming period 2021-2027. These funds should be primarily allocated to pre-consumption investments.

The new Building Act with its subsequent laws and implementing decrees, which aims to streamline the planning and approval process for construction, is currently going through the legislative process. The new version of the legislation should reflect the requirements of today's modern construction industry with effect from 2024. The most important change from this year will be the transfer of competences exercised in construction procedures, which includes the establishment of the Office for Planning and Construction, the acceleration of the granting of building permits from 300 days to 40 days, and the introduction of the Urbion information system, which will automatically assess the construction plan.

3.6 Worker migration/shadow economy

The construction industry in all its sectors also faces another persistent problem, namely labour shortages. Even before the coronavirus pandemic, construction companies were already

expressing in surveys the impossibility of further developing their companies and taking on new contracts because of the lack of labour. This problem is also linked to education in the construction sector itself, which is not perceived as promising for young people, despite the low competition on the labour market. It is expected that in 2025, there will be a shortage of 20,500 workers in the areas of civil engineering, construction, bricklaying, carpentry, painting, roofing, etc. According to projections, there are expected to be approximately 11,000 more workers in the construction industry in 2025 than in 2019.

The labour shortage situation in the construction sector has led to the migration of workers, mainly from Eastern European countries. This migration affects the whole of Europe. While Slovak workers go to Western Europe to work for higher earnings, workers from Ukraine, Romania or Moldova come to Poland, Slovakia or the Czech Republic for better earnings.

In 2022, after the start of war in Ukraine, the migration of workers to all sectors of the economy was triggered. The construction sector expected that managed migration would help solve the ongoing labour shortage problem. However, the current situation is that current legislation and policy decisions do not allow for the recruitment of sufficient numbers of construction workers from outside the EU. At the same time, migration has also opened the door for the grey economy. It does not matter to migrant workers whether they work legally or illegally, what is important to them is a stable employment base, which they were forced to leave because of the war. What remains unknown for the Slovak construction industry is the situation on the labour market when work on the reconstruction of Ukraine begins, not only in terms of labour, but also in terms of construction materials and the volume of construction production abroad. At the moment, investment in the construction industry for the reconstruction of war-torn Ukraine is expected to reach 780 million €, which may also cause an outflow of domestic labour for a longer period of time.

4 National policies and strategies leading to the implementation of the EU's energy and climate targets for 2030 with a projection to 2050 in the building sector

Slovak Republic places great emphasis on air quality, reduction of greenhouse gas emissions, climate change mitigation, security of supply of all types of energy and their affordability. In this context, the Slovak Republic has signed up to a 2019 commitment to achieve carbon neutrality by 2050. In the context of this commitment, the Integrated National Energy and Climate Plan, which is an update of the Energy Policy of the Slovak Republic from 2014, has been expanded from the original four pillars of (i) energy security; (ii) energy efficiency; (iii) competitiveness; and (iv) sustainable energy to include a fifth dimension - decarbonisation.

In Europe, the building sector is the largest energy consumer. Almost 50% of final energy consumption in the EU is used for heating and cooling, while the estimated share of the building sector in final energy consumption in the Slovak Republic is around 40%. In terms of meeting the national energy and climate targets by 2030 (Table 1), the building sector is considered to be one of the key ones.

Given the long renovation cycle of existing buildings, buildings undergoing major renovation should meet minimum energy performance requirements dependent on local climatic conditions and the guarantee of indoor thermal comfort requirements. In order to be able to implement the necessary measures on the required scale in a long-term and consistent manner - whether in the construction of new buildings or in the major renovation of existing buildings - it is essential to have the right national policies and strategies in place leading to the achievement of energy and climate targets in the building sector as well as in the promotion of energy efficiency and the development of the use of energy from renewable sources.

4.1 National policies on energy efficiency (linked to climate protection) in the building sector

4.1.1 Legislative policies

Act No. 321/2014 Coll. on Energy Efficiency and on Amendments and Additions to Certain Acts, which transposed Directive 2012/27/EU on Energy Efficiency and included, among other things, an amendment to Act No. 71/2013 Coll. on the Provision of Subsidies under the Competence of the Ministry of the Economy of the Slovak Republic, or provisions that allow for the preparation of Voluntary Agreements with the participating entities.

Amendment to the Energy Efficiency Act No. 4/2019 Coll. in relation to the Eurostat methodology on guaranteed energy services, which was approved in December 2018. The amendment enabled the implementation of guaranteed energy services in the public sector without any impact on the public debt of the state. Following this amendment, the Ministry of Finance of the Slovak Republic, in cooperation with the Ministry of Economy of the Slovak Republic, developed a concept for the development of guaranteed energy services in the public sector of the Slovak Republic.

4.1.2 Non-legislative policies

The Slovak Recovery and Resilience Plan *(March 2021)* is part of the EU's joint response to the severe economic recession caused by the new coronavirus pandemic. The Slovak economy shrank by 5.2% in 2020. The Recovery Plan is a comprehensive document focusing on five key public policy areas: Green Economy, Education, Science, Research, Innovation, Health and Efficient Public Administration and Digitalisation.

The Integrated National Energy and Climate Plan for 2030 *(December 2019)*, prepared in accordance with Article 9 of Regulation (EU) No 2018/1999 on the Governance of the Energy

Union and Climate Action, is an update of the energy policy approved by Government Resolution No 548/2014 of 05.11.2014.

Report on energy efficiency and RES targets by 2020 ***(2022)***, which aims to evaluate the implementation of energy efficiency targets set by the Slovak Republic for the period 2014 - 2020. The report contains basic information on energy efficiency and consumption of individual sectors of the national economy of the Slovak Republic and information on the amount and method of meeting the energy efficiency targets.

The Low Carbon Development Strategy of the Slovak Republic for 2030 with a projection to 2050 (March 2020) is a cross-cutting document across all sectors of the economy, which individual policies must address so that they can complement each other towards the common goal of fully decarbonising the whole of Slovakia by the middle of this century. The strategy analyses three emission reduction scenarios, of which two less ambitious ones - namely the scenario with existing measures (WEM) and the scenario with additional measures (WAM), will not lead Slovakia to fully meet the goal of achieving climate neutrality by 2050. The most ambitious third scenario - the so-called NEUTRAL scenario - also includes a list of so-called "additional" measures for energy efficiency, but without further specification of their implementation.

The Long-Term Building Stock Renovation Strategy ***(December 2020)*** is the implementation of Article 2a of Directive (EU) 2018/844 of the European Parliament and of the Council from 30 May 2018 amending Directive 2010/31/EU on the energy performance of buildings and Directive 2012/27/EU on energy efficiency. The Strategy is based on the adopted document Update of the Strategy for the stock of residential and non-residential buildings in the Slovak Republic and has been updated with information for the period from 2017 to 2019 and refined according to the new requirements of the Directive, with an emphasis on the implementation of in-depth renovation of buildings and the intensification of the renovation rate. It identifies those areas of renovation where increased efforts and human and financial resources need to be devoted in the next period. Targeted implementation of cost-effective in-depth renovation of a building on a one-off or phased basis will significantly reduce heating and cooling demand and ensure significant energy savings for the future. **This strategy also implements the energy and climate priorities of the Integrated National Energy and Climate Plan for Buildings for 2030 at the national level.** The document contains a summary of current and planned measures to promote the energy efficiency of residential and non-residential buildings.

4.1.3 Current state of implementation of the European Union strategic and legislative framework in the field of energy efficiency into the national strategic and legislative framework

Slovak Republic has transposed the entire strategic and legislative framework of the European Union in the field of energy efficiency into the national strategic and legislative framework. The main implementation tools for energy efficiency up to 2020 were the Energy Efficiency Action

Plans, which evaluate energy efficiency measures as well as set new measures to meet energy savings targets. This task is shifting to biennial progress reports on the energy sector after 2020.

The national energy and climate goals of the Slovak Republic for 2030, based on the EU-wide energy and climate goals, are set out in the **Integrated National Energy and Climate Plan for 2030**, which is an update of the Energy Policy of the Slovak Republic approved by Government Resolution No. 548/2014 of 05.11.2014, as follows:

Table 1 - National energy and climate goals of the Slovak Republic for 2030

EU and SR goals	***EU 2030***	***SR 2030***
Greenhouse gas emissions (as of 1990)	**- 40 %**	No targets set for individual Member States
Emissions in the ETS sector (as of 2005)	**- 43 %**	
Greenhouse gas emissions in non-ETS (as of 2005)	**- 30 %**	**- 20 %**
Total share of renewable energy sources (RES)	**- 32 %**	**19,2 %**
Share of RES in transport	**14 %**	**14 %**
Energy efficiency	**32,5 %**	**30,3 %**
Interconnection of electrical systems	**15 %**	**52 %**

According to the Integrated National Energy and Climate Plan for 2030, one of the main priorities with the greatest potential in relation to meeting the national energy efficiency target by 2030 is the renovation and improvement of the thermal-technical efficiency of buildings.

Directive (EU) 2018/844 of the European Parliament and of the Council on the energy efficiency of buildings, amending Directive 2010/31/EU on the energy efficiency of buildings and Directive 2012/27/EU on energy efficiency, introduces an obligation for each Member State to set indicative milestones for 2030, 2040 and 2050 with a specific long-term target of 80% to 95% reduction of greenhouse gas emissions in the Union by 2050 compared to 1990 levels.

In terms of the Recovery Plan, the main objective in the building sector is to reduce CO2 emissions. To establish a baseline of emissions in the building sector in 1990, the same methodology was used as for the 2016 level. The total CO2 emissions in the building sector

were set at approximately 14.2 MtCO2 for 1990, which represents a 40% reduction compared to the 2016 baseline of 8.54 MtCO2[1].

The share of individual fuels in the energy consumption of buildings as well as the amount of CO2 emissions are shown in the following tables:

Table 2 - Building sector - estimated energy consumption (TWh) - indicative milestones

Energy consumption (TWh)	2030	2040	2050
waste/diesel/LPG	0,0		
solid fossil fuels	0,0		
supplied heat	5,7	5,1	4,6
electricity	10,9	9,8	8,9
renewable sources	8,7	10,5	12,7
natural gas	14,7	8,2	2,1
TOTAL	**39,9**	**33,6**	**28,3**
% compared to 1990	57 %	47 %	40 %

Table 3 - Building sector - estimated CO2 emissions (MtCO2) - indicative milestones

CO2 emissions	2030	2040	2050
waste/diesel/LPG	0,0		
solid fossil fuels	0,0	0,0	0,0
supplied heat	1,0	0,7	0,5
electricity	1,4	1,0	0,7
renewable sources	0,1	0,1	0,2
natural gas	2,9	1,5	0,3
TOTAL	**5,5**	**3,4**	**1,8**
% compared to 1990	39 %	24 %	13 %

Energy consumption in buildings is expected to be reduced by 40% by 2050 compared to 2020, while at the same time emissions are expected to fall by 79% compared to 2020 and 87% compared to 1990.

The model for determining the trajectory is based on several assumptions, the most important of which are the following:

- Electricity and heat supply will be decarbonised by 50% by 2050;

[1] Long-term strategy for the renewal of the building stock

- Direct consumption of solid fossil fuels, waste, LPG and gas oil and diesel will be phased out by 2030;
- The level of carbon emissions from gas will be reduced by 25% by 2050;
- The use of RES in buildings will grow +10% every 5 years;
- The net impact of new buildings on emission levels by 2050 will be zero.

Table 4 - Types of renovation based on the amount of primary energy savings achieved.

	Renovation type		
	light, shallow	**medium**	**deep**
Primary energy savings (%)	3 - 30	30- 60	over 60

In line with the set milestones, the renovation scenario requires a significant shift from partial renovation of buildings to in-depth renovation (also in incremental steps), so that the share of in-depth renovation in completed building renovations reaches 40% in 2050.

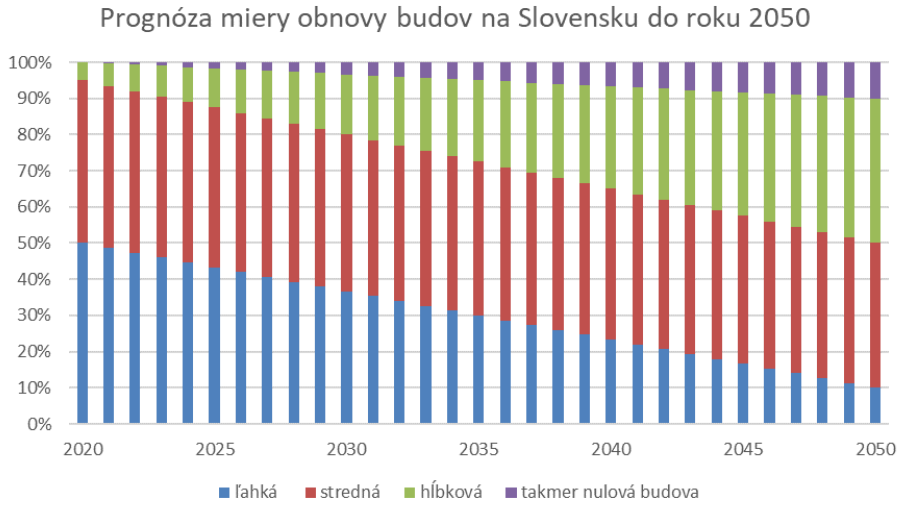


Chart 5 - Forecast of the renovation rate of buildings in Slovakia by 2050[2] (blue colour-shallow renovation, red colour-medium renovation, green colour – deep renovation, purple colour-nZEB)

[2]Long-term strategy for the renovation of the building stock

4.1.4 Estimation of the investment demand for the renovation of buildings after 2020

The current total annual rate of investment in the renovation of buildings in Slovakia is 900 million €. The model of the investment need for the renovation of the building stock in Slovakia in accordance with the established milestones points to an annual absorption capacity of 1.1 - 1.2 billion €, with a peak of 1.3 billion € per year in the period 2026 - 2031. In line with the assumption that the rate of renovation and the period of achievement of the renovation of the building stock will be maintained, the cumulative investment needs in the years concerned are shown in the table below:

Estimated cumulative investments in the building sector by 2050[3]

Building sector (billion €)	2030	2040	2050
Residential buildings (billion €)	8,2	16,7	17,3
Non-residential buildings (billion €)	4,9	5,5	5,5
Cumulative investments	13,2	22,2	22,8

Table 5 - Estimated cumulative investments in the building sector by 2050

Existing forms of support for recovery form a solid basis for the development of other financing platforms. Loans at a preferential interest rate for a long term (approx. 20 years) will continue to be the mainstay of financing for building renovation projects. These loans, combined with state subsidies and private capital, constitute a proven and effective instrument for renovation in the residential building segment.

Scope of renovation of residential buildings in 2020[4]

Description	Flats in apartment buildings	Detached houses
SODB 2011	931 605	856 147
Scope of renovation as on 31.12.2020	661 801	450 665
Renovation rate as on 31.12.2020 in %	71,04	52,64
Balance for the years 2021 to 2030	269 804	405 482
Number of years of renovation after 2020	9,1	20,3

Table 6 – Scope of renovation of residential buildings in 2020

In the segment of non-residential public buildings, the main source of financing will continue to be the ESIF funds (both repayable and non-repayable) in combination with the state budget and private capital from guaranteed energy services. The renovation of private non-residential buildings will mainly be carried out with the help of financial institutions and own capital. The

[3] BPIE model
[4] Assumption according to the Long-term Building Stock Renovation Strategy

most appropriate way to use them is a combination of the ESIF acting as a guarantee and private providers' resources to enable in-depth renovation of the building. In mobilising efforts to achieve the ambitions, additional 750 million € from the Multiannual Financial Framework 2021-2027 is expected to be used for residential buildings, and 367.5 million € for public buildings. Further additional financial resources should be used from the Mechanism for Supporting Recovery and Resilience (NextGenerationEU instrument) under the policies set out in the Modern and Successful Slovakia vision in the Green Economy section related to energy efficiency, where resources of 300 million € are proposed for improving the energy efficiency of family houses, 130 million € for the renovation of historic and listed public buildings and 200 million € for improving the EHB of public buildings.

4.2 Key actions leading to energy and climate targets in the building sector

4.2.1 Measure from the Recovery Plan in the context of Component 2: Renovation of buildings

The goal of the measure is to contribute to the reduction of CO2 emissions by implementing measures to improve energy efficiency of:

- Single-family houses
- Public historical and listed buildings.

Renovation of single-family houses

The grant for the renovation of a single-family house can be obtained for one or more measures, provided that a 30% (or more) saving in primary energy is achieved compared to the pre-renovation situation. The following groups of measures are supported by the renovation plan: i. improvement of thermal performance, ii. installation of an energy source, iii. green roof, iv. rainwater storage tank, v. shading technology, vi. asbestos removal. Eligible costs include project documentation.

Estimated cost: 500 million €

Exemplary restoration of public historical and listed buildings

In terms of social resilience, the exemplary renovation of public buildings, frequently visited by the public, carried out to a high standard, is an important element promoting a participatory approach to the renovation of buildings by other subjects in society.

Estimated cost: 200 million €

4.2.2 Financing of building renovation from the state budget in the form of subsidies and loans

Chapters 4.2.2 to 4.2.4 summarise the most relevant measures in the building sector according to the Long-Term Strategy of the Building Renovation Fund, which contains a summary of

current and planned measures to promote the energy efficiency of residential and non-residential buildings.

According to the above strategy, the state budget has provided support for the insulation of residential buildings in the form of subsidies and loans since 1996. The number of renovated residential buildings (flats) supported through the housing development programme (subsidy provided by the Ministry of the Interior of the Slovak Republic) and the State Fund for Housing (loan) as well as the amount of support provided are shown in the table below by intended use for the given period. Since 2000, 451 100 flats have been supported through the programme and the total amount of support has reached 1,43 billion €.

Number of renovated residential buildings (flats) supported through the Housing Development Programme (subsidy from the Ministry of the Interior of the Slovak Republic) and ŠFRB (loan)

Intended purpose	Form	Time period	Support provided (€)	Average yearly support (€)	Number of renovated:	
					Apartment buildings	Single-family houses
Correction of a system failure in a residential building	subsidy	2000 - 2009	112 342 700,08	5 617 135,00	151 949,00	0
	loan	2014 - 2019	24 076 470,00	4 012 745,00	15 484,00	0
Renovation of residential building	loan	2014 - 2019	1 155 280 201,00	82 520 014,36	253 350,00	28
including: - insulation of residential building		2014 - 2019	349 356 107,29	58 226 017,88		
Government programme for the insulation of residential buildings	loan	2009 - 2014	133 779 242,54	22 296 540,42	30 317,00	51
Subsidy for the insulation of single-family house	subsidy	2016 - 2019[5]	1 144 185,58	286 046,40	0	173
Total			**1 429 150 799,20**		**451 100,00**	**568**

Table 7 – Number of residential buildings (flats) renovated with Housing Development Programme

Currently the projects IROP I, IROP II and REACT EU are providing support for the renovation of residential buildings from the Integrated Regional Operational Programme (IROP), whose managing authority is the Ministry of Investment, Regional Development and Informatization of the Slovak Republic and the administrator is ŠFRB. Eligible applicants for soft loans from these credit lines are (i) owners of flats and non-residential areas represented by the administrator and (ii) associations of owners of flats and non-residential areas in a residential building. Basic information on the projects is given in the table below:

ŠFRB projects for the renovation of residential buildings

[5] State as of 31. 12. 2019

	Currency	Project name		
		IROP I	IROP II	REACT EU
Operational programme		**Integrated regional operational programme**		
Managing authority		**Ministry of Investment, Regional Development and Informatisation of the Slovak Republic**		
Date of the contract for financing		12.10.2017	28.11.2018	12.11.2021
Amount of EU funding received	EUR	109 738 446,50	27 797 307,70	47 800 000,00
Total amount of funding from the SR and EU budget	EUR	135 949 179,12	34 750 000,00	
Total amount of funds allocated to the financial instrument	EUR	159 940 210,71	43 437 500,00	56 235 294,12
Information on the purposes of the support, the objectives of the project and the measurable indicators		www.sfrb.sk/iropi/	www.sfrb.sk/iropii/	https://www.sfrb.sk/eu-fondy/react-eu/

Table 8 - ŠFRB projects for the renovation of residential buildings

4.2.3 Support for use of RES in buildings

Currently, the use of RES in buildings is promoted through the National Green Households Project, which supports the installation of five types of equipment, including small-scale electricity generation equipment with an output of up to 10 kW (photovoltaic panels, wind turbines) and heat generation equipment that covers the household's energy needs (solar collectors, biomass boilers, heat pumps)[6].

A single household can only receive support for one device of each type. Single-family houses are eligible applicants for all five types of devices, so they can apply for support for more than one type. Apartment buildings can only receive support for solar collectors and biomass boilers.

[6] Long term strategy for building stock renovation

Support for the use of RES in buildings from the National Green Households Project

	Project name		
	Green Households	**Green Households 2**	**Green Households 3**
Source of financing	**Operational Programme Quality of the Environment + SR**		
Managing authority	**Ministry of the Environment of the Slovak Republic**		
Period of implementation	2015 - 2018	2019 - 2023	2022 - 2023
Number of supported households	18 501	21 077	6 112
Total amount of funding from the SR and EU budget (EUR)	41 007 323	43 034 672	12 254 460

Table 9 - Support for the use of RES in buildings from the National Green Households Project

4.2.4 Policies and actions focused on public buildings

For the purposes of this analysis, public buildings are all buildings that are used by local or regional authorities, as well as buildings that are owned by central government or local authorities but not necessarily used by them. The renovation of public buildings in the Slovak Republic lags significantly behind the rate of renovation of residential buildings, especially apartment buildings. Slovak Republic does not have comprehensive programmes in place to support the renovation of these buildings as it does for residential projects. Public buildings have so far been renovated from the ESIF, the state budget, private funds (EcoFund), and International Fund for the support of the removal of the Bohunice VI power plant.

From 2015 to the end of 2019, 3423 buildings have been covered by the EnviroFund in terms of increasing the energy efficiency of existing public buildings, including insulation, with a subsidy of 433,83 million €.

Undertaking energy audits in public buildings helps to identify renovation measures with the greatest savings potential and partly fulfils the function of a building passport.

Since February 2019, public administration subjects in Slovak Republic can sign energy efficiency contracts for the public sector according to Act No. 321/2014 Coll. on Energy Efficiency, the subject of which is to improve the energy efficiency of a building or facility without these contracts having consequences on the amount of debt of the public

administration in the unified methodology applicable to the European Union.[7] This allows the public authority to develop and finance projects by mobilising private capital. Energy services allow the mobilisation of private finance, not only for investment but especially for the subsequent debt buyout, which can increase the pace of renewal (maximum leverage, minimum market distortion). Technical assistance in project preparation is provided by the Slovak Innovation and Energy Agency (hereinafter referred to as 'SIEA'). This measure is expected to significantly boost the renovation of public buildings but carries the risk of performing mostly partial renovations with a short payback period and thus mostly focusing only on the renovation of the technical equipment of the building, which is however not in line with the objectives of the Energy Performance of Buildings Directive with its emphasis on implementing in-depth renovation of buildings and avoiding the lock-in effect of energy savings. In order to avoid the lock-in effect and to carry out in-depth renovation of buildings using guaranteed energy services, the use of financial instruments or a combination of grant financing and repayable financing will be essential.

4.3 Measures to increase energy efficiency in accordance with the Low Carbon Development Strategy of the Slovak Republic for 2030, with projection to 2050

- Consistently apply green procurement principles to all energy efficiency measures, with an emphasis on energy consumption and emissions throughout the life cycle of the measure.
- Increase the achieved energy savings for building renovations from 30% to 60%, as building renovation is the most cost-effective and efficient measure, also according to the Low Carbon Study for Slovakia prepared in cooperation with the World Bank. In the short term until 2030, the Strategy considers building renovation policy to be the most important source of potential energy savings.
- Increase the pace of renovation of public buildings and single-family houses.
- When renovating public buildings, promote mainly in-depth renovation of the building, in line with the principles of green public procurement.
- Setting up financial support mechanisms from the EU and SR so that they can finance in-depth renovation of public buildings and create the necessary opportunities for financing the renovation of buildings in the Bratislava region in accordance with the principles of green public procurement.
- Establish multi-source financing for regional development, so-called regional development funds, which would enable the financing of decarbonisation measures in the relevant regions (forms of financing ranging from grant to revolving financing, not only from EU resources and the relevant co-financing, but from all sources, both public and non-public).

[7] www.mfsr.sk/sk/financie/ppp-projekty/garantovane-energeticke-sluzby/metodika-vzorova-zmluva.html

- Promote the establishment of regional sustainable energy centres and regional energy centres, which would provide support and advisory services at the regional and county level with the aim of increasing energy efficiency and the use of RES.
- Support the improvement of the expertise of planners and construction companies with a focus on in-depth renovation of buildings.
- Promote the improvement of the energy efficiency of buildings through measures implemented in the heating and cooling sector aimed at decarbonising the supply of heat to buildings from district heating and cooling systems. Promote only efficient district heating systems with heat supply from RES, waste heat from industrial and energy processes on economically cost-effective use of RES, e.g., also locally available biomass/biomethane and waste.
- Upgrade existing district heating systems in the field of thermal energy.
- Introduce new district heating systems in a cost-effective way in valleys and basins with increasing deployment of RES in the systems.
- Expansion of the energy efficiency monitoring system operated by the Slovak Innovative Energy Agency with the aim of creating a single database centre covering both the private and public sectors of building renovation, including an overall overview of public buildings in the Slovak Republic.
- Use of innovative financing mechanisms (green bonds and green vouchers, energy saving audits, guaranteed energy services, auction system for energy purchases, soft loans through revolving funds, bonus-malus financial mechanism, mortgages with preferential rates for energy efficient buildings).
- Installation and deployment of smart meters in energy systems and facilities, including gas distribution and supply (where the benefit to the consumer demonstrably outweighs the cost of deploying the systems).
- Consistently apply the "polluter pays" principle.
- End environmentally damaging subsidies, such as support for coal or for biomass from unsustainable sources.
- Set the rules for the use of financial support mechanisms from the EU and SR in the field of energy efficiency so that the energy sector is also eligible to receive subsidies for investments that demonstrably reduce greenhouse gas emissions.
- Support of ESCO (energy service company) companies as providers of energy services with guaranteed savings for the public sector, so-called EPC (Energy Performance Contracting) and support in the form of Guaranteed Energy Services according to Act No. 321/2014 Coll. on Energy Efficiency.
- Through the creation of financing instruments, support the deployment of heat pumps to produce heat and cold in order to increase the accessibility of heat pumps also for low-income groups of the population.
- In order to increase the energy efficiency of buildings, ensure the active application of passive elements and passive technologies in buildings, i.e. focus on reducing heat transfer through the envelope and roof cladding (by applying elements of climatic, energy-active

applications) as well as nature-based solutions, such as well-planned greenery in the streets, car parks (to serve as climatic and energy-active areas), green roofs and walls providing thermal protection and shade to the buildings.

- As part of the update of the Low Carbon Development Strategy 2030 with a projection to 2050, consider introducing a target for the whole building sector (whether for 2030, 2040 or 2050) that would be consistent with achieving climate neutrality in 2050.
- The need for education, raising awareness and understanding of the general public on the need for additional measures in this sector.

4.4 Construction sector

4.4.1 Relevant national laws and regulations in the field of construction

Act No. 555/2005 Coll. on the Energy Performance of Buildings and on Amendments and Additions to Certain Acts

Act No. 200/2022 Coll. on Spatial Planning

Act No. 201/2022 Coll. on Construction

Act No. 314/2012 Coll. on Periodic Inspection of Heating Systems and Air Conditioning Systems and on Amendments to Act No. 455/1991 Coll. on Trade Business (Trade Licensing Act), as amended

Decree No. 364/2012 from 12.11.2012, implementing Act No. 555/2005 Coll. on the energy performance of buildings and on amendment and supplementation of certain acts, as amended (energy class for the global indicator - primary energy - A0 is the minimum requirement for energy performance of buildings with almost zero energy demand for all new buildings after 2020).

Act No. 309/2009 Coll. on the Promotion of Renewable Energy Sources and on Amendments and Additions to Certain Acts.

Concept of municipal development in the thermal energy sector (Act No. 657/2004 Coll. on thermal energy).

Act No. 314/2012 Coll. on periodic inspection of heating systems and air-conditioning systems and on amendments to Act No. 455/1991 Coll. on trade business (Trade Licensing Act), as amended.

Decree No. 364/2012 from 12.11.2012, implementing Act No. 555/2005 Coll. on the energy performance of buildings and on amendment and supplementation of certain acts, as amended (energy class for the global indicator - primary energy - A0 is the minimum requirement for

energy performance of buildings with almost zero energy demand for all new buildings after 2020)[8].

Current laws and regulations can be found on websites:

www.slov-lex.sk

www.economy.gov.sk

www.mindop.sk

4.4.2 Summary of requirements related to the implementation of the revised EPBD and RES directive

Directive (EU) 2018/844 of the European Parliament and of the Council on the energy performance of buildings, amending Directive 2010/31/EU on the energy performance of buildings and Directive 2012/27/EU on energy efficiency, introduces an obligation for each Member State to set indicative milestones for 2030, 2040 and 2050 with a perspective on the long-term 2050 target of an 80-95% reduction in EU greenhouse gas emissions compared to 1990 levels. The indicative milestones for estimated energy consumption, CO2 emissions and primary energy savings for 2030, 2040 and 2050 for the Slovak Republic set out in the Long-term Strategy for the Renewal of the Building Stock are presented in Tables 2 to 4[9].

In order to meet the basic requirements for buildings and in particular to meet the minimum requirements for the energy performance of buildings, it is already necessary to ensure the implementation of in-depth renovation of buildings, i.e. the renovation of building envelope structures and the implementation of the necessary interventions in the technical systems of heating, hot water preparation, including the replacement of wiring in the installation cores of apartment buildings. In-depth renovation measures can be carried out as partial, step-by-step measures, or separately, as a major renovation of the building (building structures) and a major renovation of the technical systems. In-depth renovation can also be carried out simultaneously with the application of all measures at the same time.

The draft measures are classified according to:

a) the targets set to ensure the EHB set by the Act and Decree No. 364/2012 Coll;

b) building categories (residential and non-residential buildings);

c) periods of construction (up to 1983, up to 2002, after 2002);

[8] Long-term strategy for the renovation of the building stock
[9] Page 29 Long-term strategy for the renovation of the building stock

d) the original condition of the building structures (openings including shading, envelope, roof cladding and internal dividing structures between heated and unheated rooms);

e) the original condition of the technical systems in the building (heating, hot water, ventilation (including heat recovery), cooling, lighting);[10]

f) the age and technical condition of heating and hot water systems, cooling and distribution systems inside and outside the building;

g) the extent to which automation and automated controls can be installed;

h) the extent of the deployment of renewable sources of heat, hot water and electricity.

Procedures for cost-effectiveness assessment are specified in STN EN 15459-1 Energy performance of buildings. Procedures for the economic evaluation of energy systems in buildings. Part 1: Calculation procedures, module M1-14. These procedures have also been used to establish cost-optimal levels of minimum EHB requirements under EU Commission Regulation 244/2012, supplemented by national parameters. Intermediate targets for the achievement of individual energy levels of construction were set in Decree No 364/2012 Coll, implementing the Act in three time phases as follows: (a) a low-energy building level for both new and renovated buildings starting in 2013, given by the upper limit of energy class B for each building category; (b) an ultra-low-energy building level for all new buildings starting in 2016, given by the upper limit of energy class A1, for renovated buildings, provided that cost-effectiveness conditions are met; (c) a near-zero energy building level for new buildings owned and managed by public bodies starting in 2019 and all new buildings starting in 2021, given by the upper limit of energy class A0 for the global indicator (primary energy).

The values set for the scale of individual energy classes for different categories of buildings take into account the results of the calculations from the second phase of the deduction of cost-optimal levels of minimum energy performance requirements for buildings with near-zero energy demand published in 2018.

New buildings must meet the standardised requirements for the thermal-technical properties of building structures and elements given by the Slovak technical standard STN 73 0540-2+Z1+Z2. Significantly renovated buildings must also meet the standardised requirements. If it is not functionally, technically and economically feasible, all building structures and elements undergoing major renovation shall meet at least the thermal properties according to the technical standard (e.g. STN 73 0540-2+Z1+Z2). Achieving near-zero energy demand for all new and substantially renovated buildings requires the efficient use of renewable energy sources.

[10] Page 34 Long-term strategy for the renewal of the building stock

Under the implementation of the revised version of the EPBD through Act No.555/2005 Coll. on the Energy Performance of Buildings and on Amendments and Additions to Certain Acts, according to Section 4, the technical, environmental and economic feasibility of high-efficiency alternative energy systems at the construction site must be assessed in preparation for the construction of a new building. The technical, environmental and energy feasibility of high-efficiency alternative systems, as well as the conditions of a healthy climate in the indoor environment of the building, the level of fire safety and the risks arising from intense seismic activity, shall be taken into account in the preparation of a major renovation of an existing building, if technically, functionally and economically feasible.

4.5 National policies on continuing and further vocational education and training (VET/vocational training)

4.5.1 Estimated development of human resources for the labour market in the construction sector

The labour market in all EU countries is currently undergoing dynamic development. The ongoing transformation of several sectors of the economy in line with the Industry 4.0 concept is bringing about a number of related trends, such as the increasing digitisation and automation of individual processes, the use of smart technologies, new materials, as well as the application of the green economy and low- or zero-emission technologies.

These trends also apply to the construction sector, among other sectors. According to the document 'Strategy for the development of human resources in the construction, surveying and cartography sector by 2030', it is expected that in the near future the construction sector will focus primarily on the construction of buildings with almost zero energy consumption, in-depth renovation of the existing housing and non-housing stock, increased automation of construction, especially in the use of earthmoving machinery, and safety in the construction and operation of complex civil engineering works, where automated measuring systems will be used to a much greater extent.

The construction, geodesy and cartography sector in Slovakia currently accounts for 9.2% of GDP and this share is growing slightly in the long term. The sector is thus among the 4 sectors with the most significant contribution to GDP and is considered one of the most decisive sectors of the Slovak economy. Enterprises without employees (i.e. natural persons - entrepreneurs, self-employed persons) have a significant representation in the sector, contributing 45% to the sector's GDP and accounting for 39% of total employment in the sector. Although the sector is characterised by a high share of GDP, its labour productivity is below the national average.

The following figure shows the estimated evolution of human resources in the sector in the near term up to 2025.

In the period of 2021-2025, a total of 21 thousand secondary school and university graduates are expected to enter the labour market, having completed their studies in one of the corresponding disciplines suitable for employment in the sector and not continuing their studies. Of this number, approximately 58% will be secondary school graduates and approximately 42% will be university graduates. The number of secondary school graduates is expected to increase by 2030 at the expense of the number of university graduates. **Of the total number of graduates entering the labour market for the construction, surveying, and cartography sector, 9% are employed in this sector** and the remaining 91% find employment in other sectors. **Thus, the shortage of graduates in the sector is expected to reach around 19 thousand by 2025.** It is anticipated that this shortfall will need to be made up by human resources from other sectors once the qualifications have been supplemented accordingly.

The construction, surveying and cartography sector is one of the sectors with lower automation potential**. In the timeframe up to 2040, it is expected that around 53% of the work processes currently performed by employees can be replaced by technology.** This amounts to approximately 46 500 employees, mainly in the jobs of Bricklayer, Support worker in building construction and Construction machine operator. These changes will lead to the employees concerned seeking other jobs, which will also require additional qualifications.

4.5.2 New education and qualification requirements for all relevant professions and green professions

In Slovakia, there is a legislative obligation for building owners and designers to use new or refurbished technical systems in the construction of new buildings or significant renovation of existing buildings, to introduce smart metering systems and to install automated systems aimed at energy saving, where feasible. **This also entails the requirement for adequate training and qualifications of all relevant professions involved in the construction and renovation of buildings.** Green professions include professional staff such as: bricklayers, plasterers, roofers, carpenters and building structure installers providing construction work related to the insulation of building envelopes and roofs, the installation and replacement of opening structures, insulators and waterproofers, electricians installing solar panels, installers installing solar hot water collectors, construction workers who build energy efficient buildings and wind power plants or other workers involved in the sustainable development of a clean and renewable energy future, as well as specialists in verifying the functionality of energy efficient building systems and so-called facility managers of energy efficient buildings. These are professions associated with the sector of reducing energy consumption in buildings and the use of renewable energy sources and energy efficiency.

Following these trends and expectations, the issue of lifelong learning is coming to the fore, as it is an essential part of the process of transition to a knowledge-based economy and society. **Lifelong learning has been defined** by the EU as any purposeful educational activity aimed at the continuous improvement of knowledge, skills and general competences with a goal of increasing the participation of adults in learning.

Within the construction sector and in the sense of lifelong learning and continuing education, we focus on the acquisition of knowledge and skills of **selected professions** necessary to ensure the construction and renovation of buildings in the required quality, with the application of new construction techniques and innovative technologies and elements in order to achieve the minimum requirements applicable to the level of construction of buildings with almost zero energy demand, if technically, economically and functionally feasible.

The competence and quality of the subject to carry out specialised work in the field of the heat-exchange envelope of a building is demonstrated, for example, by **licences issued for special construction work** such as the licence for thermal insulation work (ETICS), the licence for the construction of thermal insulation and waterproofing systems for flat roofs, the licence for the incorporation of external opening structures into the building, the condition of which is the performance of these activities by qualified labour. It is therefore necessary to continuously develop the system of vocational education and further vocational education and training for the professions concerned.

In Slovakia, we are involved in activities related to the international project **BUILD UP SKILLS**. The main needs in the development of skills and knowledge of craftsmen and construction workers were identified and the BUS National Roadmap was agreed and approved. Its implementation was launched in 2014. It directly led to four projects: StavEdu, ingREeS, NEWCOM and Net-Ubiep. In the framework of the **StavEdu** project, a national system for up-skilling and further training of craftsmen and construction workers in the building sector for energy efficiency and the use of renewable energy sources in buildings was established. It offers 9 cross-cutting programmes for 30 trades and professions. It was followed up by the **CraftEdu** and **Net-Ubiep** projects, which aimed to develop further certificate programmes for the continuing education of craftspeople and construction workers in the field of energy efficiency and the use of renewable energies in buildings, which was also expanded to include online programmes and e-learning on its platform. We responded to the changing environment and new emerging needs and covered additional professions such as Electrician for Smart electrical installations (CraftEdu project); Building Information Management (BIM) - BIM for Public Administration, BIM for Building Owners, BIM for Facility Managers, BIM for Technicians, BIM for Professionals (Net-Ubiep project). The **ingREeS** project targeted middle and senior management level building professionals in five professions, key to achieving the 2020 energy targets according to the roadmap, such as building managers, building supervisors, structural engineers and architects, building sustainability consultant; qualified persons for energy

certification of buildings. The **NEWCOM** project has developed further training programmes. It focused on defining new skills and knowledge and a system of certification and mutual recognition of formal and informal learning achievements for the building sector (flat and green roofs and ventilation with heat recovery).

The 2019 OECD analysis "A National Skills Strategy for Slovakia" concluded that Slovakia faces a number of challenges in the area of skills. The skills of the younger generation in reading and science lag behind the OECD average, with a negative long-term trend. There is a significant skills mismatch between demand and supply in the labour market and a shortage of skilled labour, which is particularly evident in sectors with strong demand for skills in science and technology. The adult learning culture is underdeveloped and underfunded, adult participation in learning is low, and participation is lowest among those who would need it most.

The analysis of the green economy and related labour market needs was also addressed by the Republican Union of Employers in the document **"Identification of new trends in education and training for the labour market in relation to priorities and trends in the green economy and environmental protection"**. The document identifies 325 occupations with a significant impact of the green economy and environmental protection (of which 95 with a secondary education qualification and 230 with a university qualification), 123 apprenticeship and degree courses for secondary schools and 120 training programmes for universities with a high impact of green economy mechanisms, as well as 67 occupations that currently have no training equivalent (of which 15 with the required secondary education qualification and 52 with the required university qualification). The document proposes to address the issue of vocational education and training in the green economy by introducing a new group of disciplines called "Green economy, environmental protection and creation".

In the following part of the text, individual national policies and strategies in the field of education and skills with an overlap into the green economy are analysed separately

4.5.3 National policies related to green skills and professions

The European Qualifications Framework (EQF) was created and endorsed by the EU to facilitate comparisons between national education and qualifications systems in EU Member States and other countries that have joined its implementation. The EQF was adopted at EU level in 2008 and revised in 2017. The EQF distinguishes eight levels of competence, with level 1 being the lowest and level 8 being the highest.

For each level, the EQF defines what a person meeting that level must know, understand and be able to do. The EQFs are matched to the individual national qualification frameworks of the implementing countries, allowing easy comparison of national qualifications against a single scale of levels and their transferability between countries.

Slovak Qualifications Framework (SQF) and National Qualifications Framework (NQF)

In December 2017, Slovakia became the 33rd country to implement the EQF. This happened with the adoption of the Slovak Qualifications Framework (SQF) and the National Qualifications Framework (NQF) at the level of the Ministry of Education, Science, Research and Sport of the Slovak Republic. The so-called SQF to EQF mapping report defined the SQF as the national qualification framework in Slovakia and determined the way of mapping the SQF qualification levels to the EQF qualification levels. Like the EQF, the SQF defines eight qualification levels, describing the required knowledge, skills and competences of an employee at each level. As with the EQF levels, level 1 is the lowest and level 8 the highest. The different levels of the SQF then correspond equivalently to the corresponding levels of the EQF.

The eight levels of the SQF are linked to the individual NQF qualifications. The NQF is a publicly accessible register that contains descriptions of qualifications distinguished and verified in Slovakia with the aim of creating a unified and transparent system based on the assumption that the skills, knowledge and competences needed to obtain a qualification can be acquired through different routes of education and learning:

- **through formal education** - it takes place at school and leads to a diploma or certificate of education;
- **through non-formal education** - which takes place in a variety of educational institutions outside school education;
- **through informal learning** - takes place as a natural part of life anywhere, anytime and does not have to be intentional (e.g. learning in the family, in the workplace, in leisure time, etc.).

The NQF is expanding opportunities to gain qualifications through non-formal and informal learning. Anyone can have their skills tested by an expert committee and obtain a qualification certificate.

The backbone of the NQF are qualification cards in which qualification and assessment standards are defined. The qualification standards represent the totality of knowledge, skills and competences that are required for the acquisition of a given qualification. The assessment standards are a set of criteria, organisational and methodological procedures, material, technical and spatial prerequisites for verifying the achievement of the qualification standards. On the basis of the assessment standards, examinations are conducted to verify the qualifications.

The SQF is thus a tool for creating a typology of qualifications in the national context of Slovakia. Four subframes are defined within the SQF according to the form of education. The first three subframes (general education, vocational and higher education qualifications) are linked to formal education, while the fourth subframe (vocational qualifications) is made up of

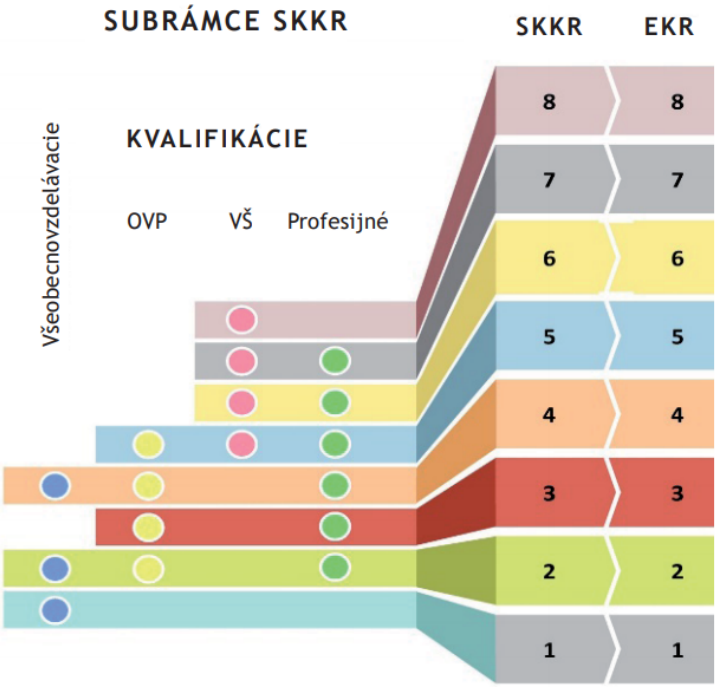
qualifications that are acquired outside the formal system, i.e. through non-formal education or informal learning. Vocational qualifications are generally tailored to the needs of the labour market and can therefore also be achieved outside formal education, e.g. in adult education, further education or through the attainment of learning outcomes in other ways. The individual sub-frames are governed by the relevant legislation:

- the sub-framework of general education qualifications - is governed by Act No. 245/2008 Coll. on Education and Training (Education Act) and on Amendments and Additions to Certain Acts, as amended;
- the sub-framework of professional qualifications - is governed by Act No. 61/2015 Coll. on Vocational Education and Training and on Amendments and Supplements to Certain Acts, as amended;
- the sub-framework of higher education qualifications - is governed by Act No. 131/2002 Coll. on Higher Education and on Amendments and Additions to Certain Acts, as amended;
- the sub-framework of professional qualifications - is governed by Act No. 568/2009 Coll. on Lifelong Learning and on Amendments and Additions to Certain Acts, as amended.

The relationships between the subframes and the levels of the SQF and EQF respectively are illustrated in the following diagram.

Picture 1 - Relationship between the levels of the EQF, the SQF and its subframes[11]

[11] Source: MŠVVaŠ SR



Všeobecnovzdelávacie-means basic qualifications, OVP-means VET qualifications, VŠ-means teriary education qualifications, SKKR-means Slovak qualification framework, EKR-means EQF

The current practice related to the creation of qualifications is governed by Act No. 568/2009 Coll. on Lifelong Learning and on Amendments and Additions to Certain Acts, as amended. The concept is based on partial qualifications and full qualifications and is currently proving to be inadequate for the needs of adult education in Slovakia. At the same time, the current legislation lacks the possibility to recognise the results of non-formal and informal learning.

In this context, the Ministry of Education, Science, Research and Sport of the Slovak Republic has published preliminary information on the forthcoming draft of a new law on lifelong learning and on amendments and supplements to certain laws. The aim of this legislative change is to introduce a system of recognition and validation of non-formal and informal learning outcomes in line with the Council Recommendation of 20 December 2012 on validation of non-formal and informal learning (2012/C 398/01) and to create space for a more intensive involvement of vocational secondary schools, universities and non-profit organisations in the lifelong learning system. At the same time, the new draft law is to introduce a new system of accreditation of educational programmes in the field of adult education, which will reflect the real needs of the labour market. It is also intended to create a sustainable system of management and activities of sectoral councils in Slovakia in order to support the alignment of the lifelong learning system with the needs of the labour market. It will also introduce basic principles for funding in the field of adult education. The pre-preparatory phase of the legislative process is now complete.

The material entitled "**Strategy for Lifelong Learning and Counselling for 2021-2030**" (hereinafter referred to as the "Lifelong Learning Strategy"), which was approved by the

Government of the Slovak Republic in November 2021, also fully corresponds to the forthcoming intention of the new Act on Lifelong Learning. This is a cross-sectoral strategy in the field of lifelong learning, which aims to ensure lifelong access to learning opportunities for every citizen, to develop their skills and competences throughout their lives and with regard to individual needs and circumstances. The Lifelong Learning Strategy builds on forms of education that have a tradition in Slovakia (formal education - schooling) and at the same time introduces innovative pilot activities, building on new challenges and good practice from other EU countries (in particular the promotion of non-formal education and an individualised approach).

The LLL strategy builds on and complements existing strategies and conceptual documents adopted in Slovakia in recent years, in particular:

- Vision and strategy for the development of Slovakia up to 2030;
- National Programme for the Development of Education and Training;
- National programme for the development of education and training "Learning Slovakia";
- National Skills Strategy for Slovakia;
- Lifelong Learning Strategy 2007;
- Lifelong Learning Strategy 2011;
- National Programme for Active Ageing for 2014-2020;
- Migration policy of the Slovak Republic with a perspective for 2030;
- Zero Action Plan of the Strategy for Inclusion in Education for 2021;
- Roma Equality, Inclusion and Participation Strategy for 2030;
- New Strategy of the Slovak Republic for Youth (2021-2030) (in preparation);
- National Programme for the Development of the Living Conditions of People with Disabilities for 2021-2030.

The LLL Strategy identifies key tools for future development in the area of skills enhancement beyond the initial education and VET system. The objectives of the LLL strategy are:

- Objective 1: Strengthen the inclusiveness of adult learning and improve learning pathways for all, including adults with low levels of basic skills;
- Objective 2: Increase participation and equity of adults in learning, i.e., opportunities also for adults with low levels of skills and/or educational attainment;
- Objective 3: Support the development of further vocational training;
- Objective 4: To link education and the labour market more effectively, with an emphasis on the expected changes in the structure of jobs, to strengthen the motivation of both employees and employers to engage in the training of their employees, without creating additional administrative burdens and increasing costs;

- Objective 5: Increase the efficiency and flexibility of the qualification system of the Slovak Republic.

Relevant actions for green skills and professions

The LLL strategy will be implemented through a number of proposed actions. Selected areas and actions relevant to the field of green skills and professions are described in more detail below.

Increasing the attractiveness and quality of VET - VET Centres of Excellence

The LLL strategy anticipates the transformation of the existing Centres of Vocational Education and Training (CVET) into Centres of Excellence in VET (CEVET). Vocational Education and Training Centres are vocational secondary schools that differentiate themselves from other vocational secondary schools in terms of material, technical and personnel facilities, the offer of adult education programmes, retraining courses, training for the low-income, the long-term unemployed or the training of teaching staff.

Some training programmes cannot currently be implemented through the existing dual education system (work experience with the employer and theory at school) because some sectors are mainly made up of small and medium-sized enterprises (e.g. construction, among others). A secondary effect of the introduction of CEVET is to increase the share of SMEs and self-employed persons in VET and the dual education system, where the Slovak Republic shows low figures compared to countries with traditional dual education.

Slovak Qualification Framework and National Qualifications Framework

The Lifelong Learning Strategy foresees a redefinition of the role and status of the National Qualification Framework through a new Lifelong Learning Act and the implementation of the linking of education and skills data with EU skills platforms. A more detailed description of the Slovak Qualification Framework and the National Qualification Framework and their position in relation to the European Qualifications Framework is given in the previous sections of the text.

Recognition system for non-formal education and informal learning

The current system of qualification verification in Slovakia focuses exclusively on obtaining a certificate of qualification - a document on the basis of which a person can apply for a trade licence in a given field. A national validation system that would include all four parts, i.e. identification, documentation, assessment and certification, needs further development of tools and their verification, as the only possible way to obtain a certificate confirming professional competence at present is to pass an examination. In this respect, the LLL strategy aims to introduce new systemic elements for the recognition of qualifications based on knowledge, skills and competences acquired through practice. This is a new way of looking at the qualifications provided and recognised in Slovakia, as until now the emphasis has been on

the education system in terms of the degree attained rather than the level of qualification achieved. Looking at the achievement of learning outcomes through qualifications represents a new systemic element - what is most important are the learning outcomes (knowledge, skills and competences) achieved by a given candidate for a qualification and not the form of study, the length of study or the credits achieved. This opens up new possibilities for more flexible forms of qualification acquisition in different life situations of citizens (e.g., change of job, career progression, the need to acquire new qualifications with an employer, etc.).

Measures in this area are also supported by the **national project "Qualifications Verification System in the Slovak Republic"**, implemented by the State Institute for Vocational Education between March 2019 and February 2023, which aims to set up a comprehensive system for the verification of qualifications and the results of non-formal and informal learning in Slovakia, by establishing structures and binding procedures for Lifelong Learning (LLL) processes, with an emphasis on the verification of qualifications valid at the national level, and by pilot testing the system of verification of qualifications and their parts (units of learning outcomes) through the promotion of LLL in Slovakia.

Increasing the flexibility of the qualifications system with smaller qualifications and micro-qualifications (micro-certificates)

The intention is to segment the existing formal qualifications acquired in secondary vocational schools into smaller sub-qualifications so that it is also possible to acquire sub-qualifications with a narrower focus in less time than a standard course of study or apprenticeship would require. Such smaller qualifications also take into account small changes in work ability, the acquisition of a small number or only one specific new market-relevant skill, may be targeted at a smaller number or only one job and may not fulfil the requirements for the attainment of a degree. Foreign experience shows that documenting such micro-qualifications is useful from the perspective of both employees and employers.

Supporting the sustainability of the management system of sector councils with a focus on the transfer of innovative processes and labour market requirements to LLL

In Slovakia, the National System of Occupations (NSO) has been created as a comprehensive information system describing the standard labour market requirements for individual jobs. The NSO specifies the requirements for professional knowledge, professional skills and competences necessary for the performance of work activities in jobs on the labour market. The NSO is continuously updated with definitions and the new vocational knowledge and skills that are related to new needs of different sectors of the economy influenced by innovation, digitalisation, new technologies as well as global challenges in the political and economic European and global context.

Alliance of Sectoral Councils, Sectoral Councils

The creation and updating of the NSO, in accordance with developments on the labour market, is ensured and coordinated by the Ministry of Labour, Social Affairs and Family of the Slovak Republic. For this purpose, the Ministry has established, with the participation of relevant ministries, professional unions and associations and other entities, the competence of which includes, in particular, the establishment of sectoral councils according to the relevant sectors of the economy and the evaluation of their functionality and effectiveness. A sectoral council is a voluntary independent professional and expert association of representatives of employers, representatives of trade unions, educational institutions and other organisations, state and local government bodies. Currently, the Alliance of Sectoral Councils and the Sectoral Councils are coordinated, methodologically guided and evaluated within the framework of the national project "**Sector-led innovations towards an efficient labour market in the Slovak Republic**", coordinated by the Ministry of Labour, Social Affairs and Family of the Slovak Republic. The activity of sectoral experts is also allocated within the national project "**System of Qualification Verification in the Slovak Republic**", coordinated by the ŠIOV, which ensures the transfer of labour market needs for a skilled workforce to the LLL system.

The NSO occupational register contains 79 different occupations in the construction sector, and the register also includes information on the recommended level of education or the relevant SQF/EQF level.

Among the 24 existing sectoral councils, there are three sectoral councils substantively related to the issue of low-emission buildings, namely:

- Sectoral Council for Construction, Geodesy and Cartography;
- Sectoral Council for Electrical Engineering;
- Sectoral Council for Energy, Gas and Electricity.

The LLL strategy focuses on the proposal of measures in the field of creating a sustainable system of management and activities of sectoral councils in the conditions of the Slovak Republic, while priority should be given to deepening coordination in the development and updating of the NSO and the National Qualifications Framework (NQF) in order to coordinate the functioning of both systems. At the same time, it is essential to align the LLL system with the needs of the labour market through the NSO and the NQF.

A more detailed description of the NQF and its relationship to the Slovak Qualifications Framework and the European Qualifications Framework is described in the previous sections of the text.

Individual Learning Accounts (ILAs) as a tool for individualised support in further education

The LLL strategy notes that the participation rate in adult learning for 25-64 year olds is slightly above the EU average (SK 46.1%, EU 44.6%), with non-formal learning taking place predominantly through employers (to a large extent mainly in the context of compulsory training resulting from legislation - e.g. OSH, various compulsory certifications, etc.), and thus

capturing mainly the employed. Schemes for the unemployed are characterised by a high degree of control at entry, which reduces opportunities and incentives for participation. The aim is to eliminate barriers to participation and to increase interest in learning among all groups. In the context of limited resources and efficient use of funds, the national skills policy will be implemented in the form of calls for tenders for different types and forms of training, which will be launched in response to current societal needs and periodically reviewed labour market needs. Support will be provided primarily to jobseekers working in sectors that are already facing, or are likely to face in the near future, an economic downturn or a change in the nature and forms of work, and only training that will lead to new qualifications or an increase in qualifications in a sector (occupational group) that has future development potential will be eligible.

5 Key figures from the construction and energy sectors

5.1 Current development of construction output

The official statistics of the Statistical Office of the Slovak Republic, which contain data up to and including 2021, do not yet reflect the turbulent development of the last two years, 2022 and 2023, caused first by the economic constraints associated with the coronavirus pandemic, then by the rising prices of building materials, and then by rising energy prices and the impact of the war in Ukraine.

According to the latest estimates, based on market developments, construction company directors expect the construction market to decline by 1.3% in 2023, followed by a recovery and growth of 2.3% in 2024[12].

In 2022, 1 720 construction contract notices were issued in Slovakia, down by 5.8% compared to the previous year, but the total (expected) value of construction contract notices in Slovakia in 2022 was 3 719 million € and even recorded a year-on-year growth of 51.3%. An important factor for the development of the Slovak construction industry this year is how the investments of the state and other contracting authorities form the stock of work.

In Q1 2023, 375 construction contract notices were issued, a decrease of 41.3% compared to the previous year. If we compare only the over-limit contracts, we get a year-on-year decrease of 32.9% in the number of contract notices. The total estimated value of construction contract notifications in Q1 2023 was 740 million €, a year-on-year decrease of 40.2%. The value for

[12] Semi-annual study of the Slovak construction industry, CEEC Research, s.r.o., 2023

over-limit contracts fell by 46.9%. The year-on-year changes are largely due to the high comparison base.

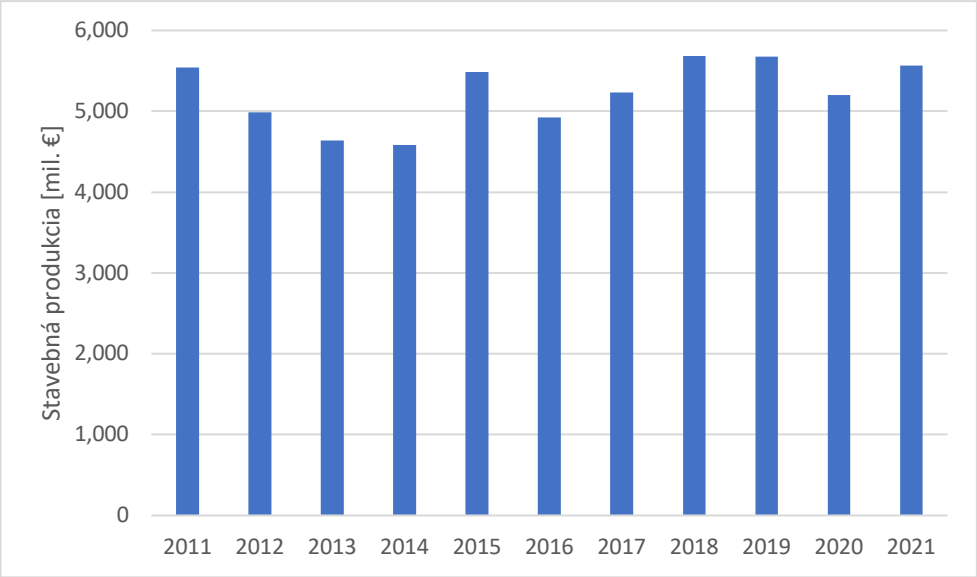
In Q1 2023, 236 construction contracts were procured, a decrease of 37.6% compared to the previous year. If we compare only the above-limit contracts, we get a growth of 22.6%. Some tendering procedures are still ongoing and also not all contract notices have been delivered, so it is to be expected that the data will be further updated in the coming months. The value of contracts procured in Q1 2023 amounted to 302 million € and decreased by 47.8% year-on-year. If we consider the value of contracts procured only for above-the-limit contracts, we get a year-on-year decrease of 50.1%.

5.2 Development of construction output since 2021

Construction output in Slovakia in the period between 2011 and 2021, without major year-on-year fluctuations, averaged at around 5200 million € in current prices (b.c.), or 5000 million € in constant 2015 prices (s.c.), per year. The most significant year-on-year declines of 10% occurred in 2011 and 2012, when output fell below 5000 million € in b.c. and 5200 million € in s.c. respectively, where it remained until it picked up again in 2015. From a slight correction in 2016, between 2017 and 2019, annual output in the construction sector in Slovakia averaged at 5500 million €, below 5100 million € in b.c. and s.c., respectively.

The impact of the COVID-19 pandemic resulted in a year-on-year decline of over 8% in b.c. and nearly 11% in s.c. in 2020 compared to 2019, followed by a slight recovery in 2021 of nearly 7% in b.c. and less than 3% in s.c. The level of output in the construction sector in 2021 reached 4654,98 million € in s.c., which represents a decline of nearly 20% in constant prices compared to 2011.

Construction output at current prices (in millions of Euro) [13]



Graph 6 - Construction output at current prices

In 2021, business entities operating in the construction production sector realised a volume of construction production worth 5562,7 million € (b.c.) and 4654,98 million € (s.c.), which means an increase of 7% in b.c. and 3% in s.c. compared to 2020.

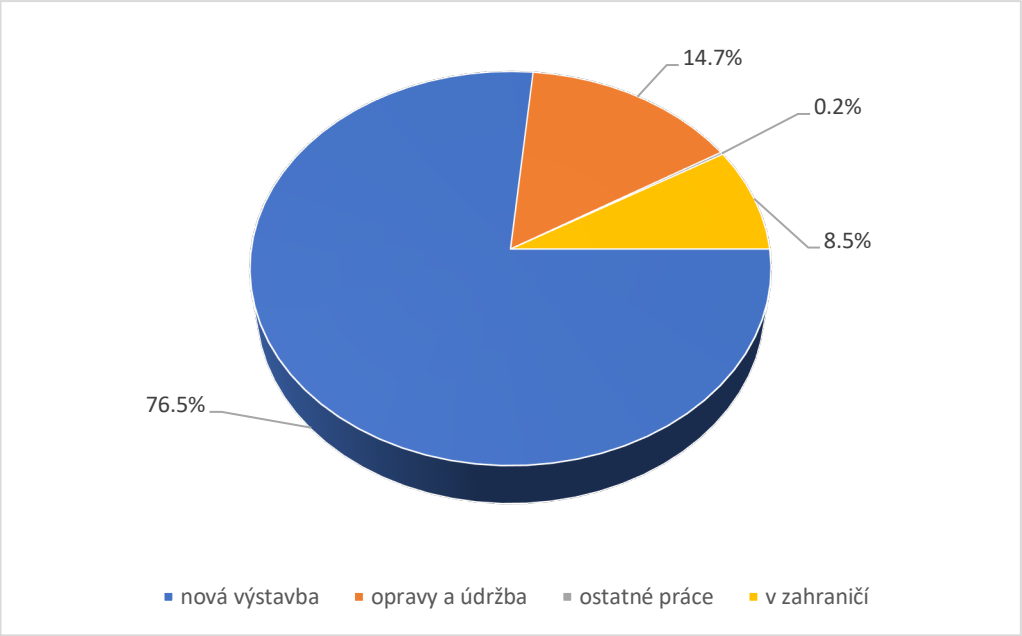
In terms of the structure of construction output by investment focus (in current prices), construction work in 2021 was carried out as follows:

- new construction, renovation and modernisation 76,5 %[14]
- for repairs and maintenance 16,3 %
- on other construction work 0,2 %
- abroad 8,5 %.

[13] Construction Yearbook 2022 and 2020, Tab. T I.1-2

[14] Construction Yearbook 2022 and 2020

Structure of construction output by type of construction in 2021 in % (Source: SO SR)



Graph 7 – Structure of construction output by type of construction in 2021 in %

Translation notes to Graph 7 – Blue colour-means new construction, Orange colour-means repairs and maintenance, Green colour-means other construction works, Yellow colour-means construction works abroad

The bulk of the construction output of 5197 million € (Graph 10) in 2021 was domestically produced (91,5%), increasing by 0,3% compared to 2020. Construction output abroad, amounting to 399,74 million €, accounted for 7,1% of total construction output and increased by 27% compared to 2020. Of the total domestic construction output, new construction, modernisation and reconstruction accounted for 76,5% (3585,02 million € s.c.), repair and maintenance for 14,7% (687,59 million € s.c.), other works for 0,2% (11,06 million € s.c.).

Development of the structure of construction output by type of construction in %

Indicator	M. j.	2017	2018	2019	2020	2021
Domestic construction production, of which	%	94,00	93,12	91,21	93,31	91,50
- Construction of residential buildings	%	7,21	6,72	8,54	7,62	7,54
- Construction of non-residential buildings	%	22,82	20,64	20,87	17,65	18,12

- Construction of residential and non-residential buildings n.e.c.	%	6,37	3,48	4,59	6,16	7,20
- Engineering constructions	%	37,21	41,15	34,76	38,01	35,02
- Specialised construction work	%	20,39	21,14	22,45	23,88	23,62
Construction production abroad	%	6,00	6,88	8,79	6,69	8,50
Total	**%**	**100,00**	**100,00**	**100,00**	**100,00**	**100,00**

Table 10 – Development of the structure of construction output by type of construction in %

According to the types of construction, the largest share of the total construction output in 2021 was accounted for by engineering constructions - 35,02% (1712,18 million €), smaller shares were accounted for by specialised construction works – 23,62% (1155 million €), or construction of non-residential buildings – 18,12% (91,5 million €).

5.2.1 Employment in construction sector

The organisational structure of the Slovak construction industry is similar to that of developed European countries. Of the total number of enterprises in the EU, up to 97% have less than 20 employees and 93% have less than 10 employees. In general, the EU pays particular attention to small and medium-sized enterprises and a significant part of EU financial resources is directed towards their development.

Number of employees in the construction industry by employer size group

Size group by number of employees	2017	2018	2019	2020	2021
Small enterprises (0-49 employees)	43 540	47 437	55 001	56 981	59 054
Medium-sized enterprises (50-249 employees)	14 310	13 818	14 301	12 599	12 933
Large enterprises (250 or more employees)	8 685	8 241	6 846	6 708	6 424
Self-employed	96 096	97 368	100 766	90 048	82 499
Total	**162 131**	**166 864**	**176 914**	**166 336**	**160 910**

Table 11 – Number of employees in the construction industry by employer size group

As of 31 December 2021, according to the Construction Yearbook 2022 issued by the Statistical Office of the Slovak Republic, out of the total number of 160 910 employees employed in the construction sector in the Slovak Republic (Table 11), about 88% worked as self-employed or employees of small enterprises. From this perspective, it is clear that small and medium-sized enterprises in the construction sector occupy a significant position and it is assumed that such an organisational structure will be supported in the future.

Development of construction output by business entities from 2017 to 2021
(EUR million - current prices)

Size group by number of employees	2017	2018	2019	2020	2021
Small enterprises (0-49 employees)	1 748,96	2 091,55	2 425,91	2 447,33	2 749,17
Medium-sized enterprises (50-249 employees)	827,96	1 010,84	1 090,08	1 033,11	1 032,03
Large enterprises (250 or more employees)	1 139,01	1 025,41	626,07	616,64	673,76
Self-employed	1 476,25	1 510,39	1 483,41	1 061,20	1 058,46
Total	**5 192,18**	**5 638,19**	**5 625,47**	**5 158,28**	**5 513,41**

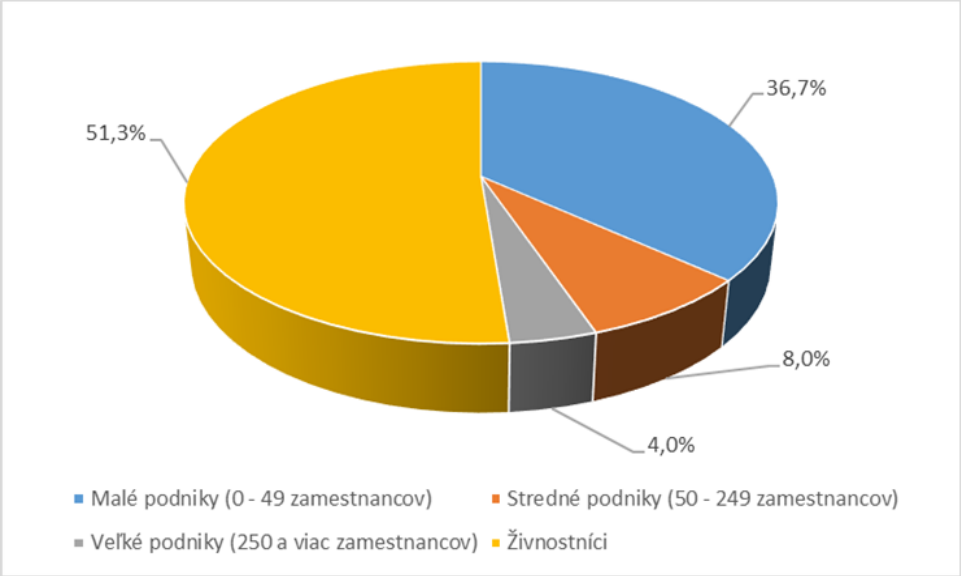
Table 12 - Development of construction output by business entities from 2017 to 2021 (EUR million - current prices)

Small businesses accounted for the largest share of construction output (Table 12) at around 50% in 2021 (a 36% increase in output from 2017), with this share rising steadily over the period 2017 to 2021.

In terms of size structure, large enterprises with 250 or more employees accounted for the smallest share (12,3%) of construction output in 2021, with a decreasing trend over the period 2017 to 2021. The output of these enterprises decreased by -40% compared to 2017.

In the case of self-employed contractors, a downward trend in output of -28,4% is visible between years 2017 and 2021, with their share of construction output in 2021 accounting for 19,2%. The construction output of medium-sized enterprises jumped by roughly 1/5 between 2017 and 2018, and in the following years it kept above the level of 1000 million € per year, with their share in the total construction output amounting to 18,7% in 2021.

The structure of employment in the construction sector in Slovakia in 2021 according to the size groups of business entities is shown in graph 8.



Graph 8 - Structure of employment in construction sector by size groups of business entities in 2021 in % (Source: SO SR)

Translation notes to graph 8 – Blue colour-means small enterprises (0-49 employees, Orange colour-means medium sized enterprises (50-250 employees), Green colour-means large enterprises (over 250 employees), Yellow colour-means self-employed craftsmen

5.3 Residential and non-residential building stock

Buildings (heated and cooled) have an impact on final energy consumption. The estimated share of the buildings sector in the final energy consumption in the Slovak Republic is around 40%, with a large part of the energy in buildings consumed mainly for heating, hot water and, in recent years, cooling and ventilation. Due to the long renovation cycle of existing buildings, existing buildings undergoing major renovation should meet minimum energy performance requirements depending on local climatic conditions and the provision of indoor thermal comfort requirements. The source of the statistical data on the stock of residential and non-residential buildings presented in this analysis is the Long Term Building Renewal Fund Strategy.

5.3.1 Residential buildings

Residential buildings are divided into apartment buildings and single-family houses. Their structural and technical design is different, they differ fundamentally in size, number of floors and number of flats. The characteristics of the building structures and their share of the total area of the building envelope and the total floor area of the building are different, and therefore the heat and energy demand for heating in those buildings is different per unit of total floor area.

Summary data on houses and apartments from the SODB 2011

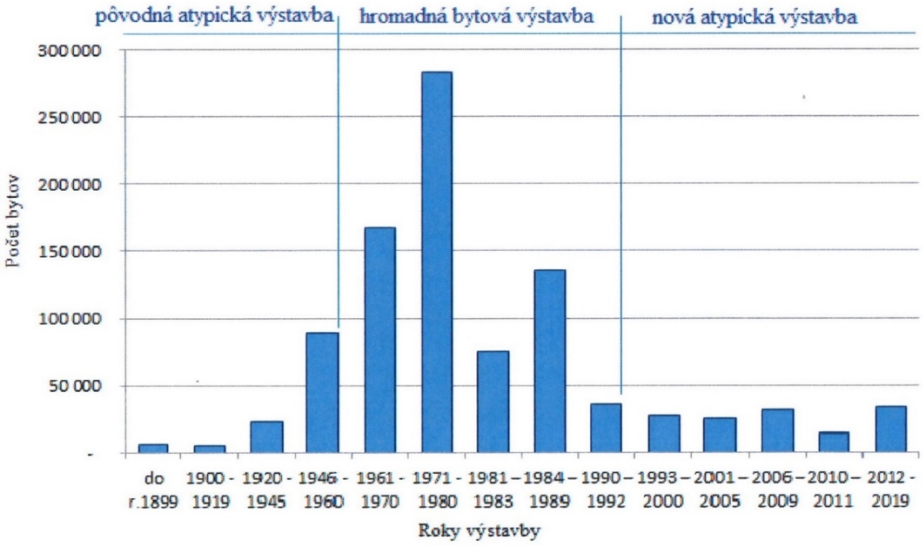
Description	Single-family houses	Apartment buildings	Total
Number of buildings	969 360	64 846	1 034 206
Number of apartments	1 008 795	931 605	1 940 400
Of which Number of occupied apartments	856 147	877 993	1 734 140

Table 13 - Summary data on houses and apartments from the SODB 2011

In addition to apartments in apartment buildings and single-family houses, there are also apartments in other buildings (religious institutions, social service homes, retirement homes, etc.), of which there are 13 020, which is a 3,41% share. The number of apartments in these buildings is 54 497.

Residential buildings can be characterised according to the period of construction. From 1947 to 1992, mass residential construction of apartment buildings was carried out in different types, construction systems and building systems (existing buildings), especially in panel technologies after 1955. After 1992, the individual solutions were atypical buildings (new buildings). More precise data on the construction of apartments in apartment buildings up to 1992 could be used from the SODB 2001 and SODB 2011 and the database of the SO SR.

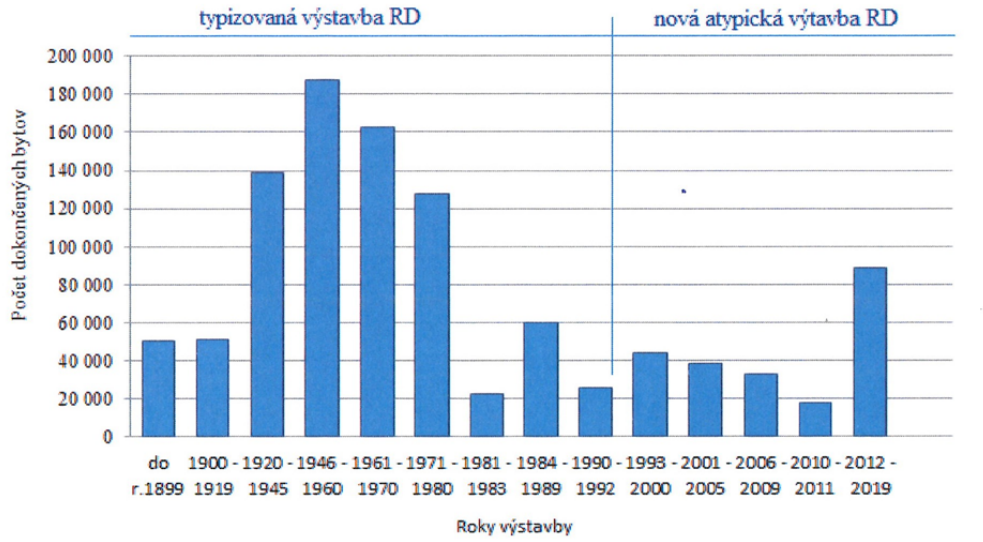
Graph 9 - Number of apartments in apartment buildings by period of construction



Single-family houses are variable in their shape, the achieved form factor values and the share of individual building structures in the building's thermal envelope. There are no detailed

statistics or databases available on detached houses. The number of apartments in detached houses built in each period is available according to SODB 2001 and SODB 2011, and statistical reports published by the Statistical Office of the Slovak Republic.

Graph 10 - Number of apartments in single-family houses according to period of construction



From the database of the SO SR it is possible to obtain data on the number of completed apartments in apartment buildings and single-family houses for the period 2012 - 2019 presented in Table 15.

Table 14 - Number of completed apartments in residential buildings for the period 2012 - 2019

New apartments	2012	2013	2014	2015	2016	2017	2018	2019	Total 2012-2019
in apartment buildings	4 155	2 603	2 995	3 751	4 176	3 516	6 037	6 369	**33 602**
in single-family houses	9 479	10 208	10 041	9 860	11 195	11 547	12 687	13 338	**88 355**
Total apartments in residential buildings	13 634	12 811	13 036	13 611	15 371	15 063	18 724	19 707	**121 957**

5.3.2 Non-residential buildings

5.3.2.1 Buildings of central government authorities

Article 5 of Directive 2012/27/EU requires each Member State to ensure that, from 1 January 2014, buildings owned and used by central government authorities (hereinafter 'CGAs') are renovated at a rate of 3% of the total floor area of heated or cooled buildings per year, so as to achieve at least the minimum requirements for the EHB set by the Member State concerned under Article 4 of Directive 2010/31/EU. Directive 2012/27/EU (Article 5(6)) also allows for an alternative way to meet the obligation under Article 5(1). This means that a Member State may take cost-effective measures, including deep renovation and behavioural change measures, to achieve energy savings in the relevant 11 buildings by 2020 that are at least equivalent to the amount of savings required by Article 5(1) of Directive 2012/27/EU, which Member States will report annually to the European Commission.

CGAs buildings - number, total floor area and built volume

Data	Number of buildings	Total floor area (m^2)	Built volume (m^3)
The sum of all buildings	3 806	4 773 344	21 678 102
The sum of all buildings by owner - area not specified	189	0	9 408
Buildings above 500 m^2 - total	**1 893**	**4 370 709**	**19 571 523**
Buildings above 500 m^2	1 364	3 175 872	14 026 720
Buildings above 500 m^2	62	112 392	536 336
Buildings above 500 m^2	135	365 202	1 860 893
Buildings above 250 m^2 - total	**2 631**	**4 641 021**	**21 070 474**
Buildings above 250 m^2 – from 1947 to 1993 (including)	1 938	3 386 048	15 178 299
Buildings above 250 m^2 – year not specified	1 938	3 386 048	15 178 299
Buildings above 250 m^2 – up to 1947	192	385 754	1 000 936

Table 15 - CGAs buildings - number, total floor area and built volume

The list of relevant (eligible) buildings of the CGAs according to Article 5 of Directive 2012/27/EU is published on the website of the Ministry of the Interior of the Slovak Republic:

https://www.mindop.sk/ministerstvo-1/vystavba-5/stavebnictvo/zoznam-budov-uoss-podla-cl-5-smernice-2012-27-eu-660

The notification report informs the European Commission of the planned alternative measures that will achieve the 2020 energy savings target according to Article 5(6) of Directive 2012/27/EU. The report includes a proposal for an interim target according to Article 5(1) of

Directive 2012/27/EU, a target expressed in terms of energy savings for the application of the alternative pathway, as well as a list of alternative measures. In order to determine the list of buildings for the implementation of the mandatory in-depth renovation of the buildings of the CGAs, the total floor area of the building of more than 250 m2 is decisive. The annual target under Article 5 of Directive 2012/27/EU is 3% of the total floor area of the listed buildings. Based on the total floor area of 445 791 m2 of the buildings of the CGAs, it means that 13 374 m2 (3%) should be renovated each year or an annual saving of 52,17 GWh should be achieved.

5.3.2.2 Public buildings

Under the Act, for the purposes of determining policies and actions under the Renovation Strategy, a public building is a building owned by the State, a higher territorial unit, a municipality or a public institution. The SR does not have a single manager for state-owned buildings or for the buildings of the CGAs. There are also no statistical surveys by ownership of non-residential buildings (of any kind). In the future, there is a need to ensure the collection and improvement of the availability of data needed for targeted planning of the renovation of public buildings, in particular data on the structural and technical condition of the building, its energy performance or data related to energy consumption.

Non-residential non-production buildings owned by the state classified according to the purpose of use

Purpose	Number of buildings	Percentage of total (%)	Built volume (m^3)	Percentage of total built volume (m^3)
Schools	6 943	45,0	58 382 303	50,9
Shops and services	156	1,0	680 090	0,6
Medical facilities	1 293	8,4	15 197 903	13,2
Culture facilities	525	3,4	3 071 713	2,7
Administrative buildings	2 556	16,6	14 365 217	12,5
Accommodation	1 317	8,5	11 814 638	10,3
Sport	126	0,8	810 218	0,7
Other	2 519	16,3	10 381 270	9,0
Total	**15 435**	**100,0**	**114 703 652**	**100,00**
of which primary schools	2 513	16,3	26 549 348	23,1

Table 16 - Non-residential non-production buildings owned by the state classified according to the purpose of use

This would provide an information source for better planning of investments in renovation in the public buildings sector. The data will have the highest added value if it is also added to

existing building information systems such as the Central Asset Register (CEM). The CEM is established as a publicly accessible register of immovable property owned by the Slovak Republic[15]. At the same time, when planning the use of existing information systems, it will be necessary to assess the costs of system modifications and to secure funding for them, in cooperation with their operators. Of the total number of non-residential buildings, 15 435 buildings owned by the State and local authorities were identified between 1994 and 2003. In terms of building volume, schools accounted for 50,9 % of these non-residential buildings, health facilities for 13,2 %, administrative buildings for 12,5 % and accommodation for 10,3 %.

CGAs buildings by ministries

Ministry	Počet budov	Výmera budov (m^2)	Výmera (%)
Ministry of Interior	3 826	1 808 682	30,1
Ministry of Health	931	1 206 568	20,1
Ministry of Justice	693	557 281	9,3
Ministry of Culture	362	372 075	6,2
Ministry of Labor, Social Affairs and Family	830	344 988	5,7
Ministry of Defense	557	318 417	5,3
Ministry of Finance	485	279 506	4,7
Ministry of Agriculture and Rural Development	769	257 525	4,3
Other	1 179	858 587	14,3
Total	**9 632**	**6 003 629**	**100,0**

Table 17 - CGAs buildings by ministries

Roughly two-thirds of public buildings are owned by the CGAs. According to the CEM records, the Ministry of the Interior and the Ministry of Health are the largest owners based on the floor area of the buildings (Table 17).

The Value for Money Unit of the Ministry of Finance of the Slovak Republic[16] and the Supreme Audit Office of the Slovak Republic (SAO SR)[17] point to the following identified serious shortcomings in the issue of renovation of public buildings in Slovakia:

[15] Act of the National Council of the Slovak Republic No. 278/1993 Coll. on State Property Management as amended by Act No. 324/2014 Coll.
[16] Prioritisation of the renovation of state buildings, October 2022
[17] Audit Report 2022: Renovation of public buildings

- The Ministry of Transport and Construction of the Slovak Republic has so far developed three strategies for the renewal of the Slovak building stock. Specifically, the Strategy for the Renewal of the Fund of Residential and Non-residential Buildings in the Slovak Republic, approved by Government Resolution No. 347/2014 of 9 July 2014, the Update of the Strategy for the Renewal of the Fund of Residential and Non-residential Buildings in the Slovak Republic, approved by Government Resolution No. 230/2017 of 10 July 2017, and the Strategy for the Renewal of the Fund of Residential and Non-residential Buildings in the Slovak Republic, approved by Government Resolution No. 36 of 20 January 2021. Although the above strategies formally meet all the requirements of the relevant European and national legislation, they do not address many of the obstacles to the renovation of buildings. These persist without major change in each of the three strategies adopted so far.
- The Ministry of Transport and Construction of the Slovak Republic, as the responsible body for energy performance of buildings, does not have the required data for the preparation of the renovation plans for the relevant buildings, therefore it is requested annually from the CGAs that manage the buildings. Only the building managers have relevant information on the condition of the buildings under their responsibility, whether and how they plan to use the building in the future. Only building managers can take into account the technical condition, energy performance, energy consumption and operating costs of buildings when selecting them for renovation. They also have to ensure that the planned renovation of the buildings is financed.
- According to the SAO SR, the biggest obstacle to the effective registration of the renovation of public buildings is the lack of a supra-ministerial view on this issue, which prevents the application of a systematic approach to the management of public buildings, including their renovation. For this reason, the SAO SR recommends that the public administration, when renovating its buildings, should accept the document of the Value for Money Unit of the Ministry of Finance of the SR "Prioritisation of the renovation of public buildings", which provides guidance for prioritising the selection of projects for the preparation and subsequent implementation of the renovation. The aim of this document was to establish a framework for the systematic renovation of buildings with the highest value for money. The SAO SR sees potential in the use of the document of the MoF's Value for Money Unit also for the renovation of public buildings that are not owned by the government.
- Due to the persistent lack of data coherence, it is not possible to calculate the renovation rate of public buildings from the available building information databases. According to the SAO SR, under these circumstances there is a risk that the data on the renovation of buildings in Slovakia will not be sufficiently reliable for the European Commission or for the implementation of the national policy in the field of energy performance of buildings.

5.3.2.3 Other non-residential buildings

Non-residential buildings in the Slovak Republic were owned by the state until 1989. In the following period, new construction of non-residential buildings started slowly. Existing non-residential buildings were gradually transferred to private ownership. Since 2016, the Slovak Statistical Office has carried out a statistical survey on the number of completed non-residential buildings from the issued approval decisions annually according to the Statistical Classification of Buildings, broken down into new non-residential buildings and renovated non-residential buildings. This survey for the period 2016-2019 shows that 1 986 new non-residential buildings were constructed, and 662 non-residential buildings were renovated.

Statistical survey for new and renovated non-residential buildings from building approvals in 2016-2019

Purpose	2016	2017	2018	2019	Celkom
Hotels	33	59	62	51	205
Administrative buildings	80	86	89	120	375
Shops and services	258	271	241	279	1 049
Schools, universities and educational buildings	42	24	34	45	145
Hospitals and healthcare facilities	35	18	23	20	96
Sport buildings	24	24	45	23	116
New total	**472**	**482**	**494**	**538**	**1 986**
Hotels	16	14	14	18	62
Administrative buildings	26	29	35	57	147
Shops and services	65	101	66	68	300
Schools, universities and educational buildings	22	11	23	27	83
Hospitals and healthcare facilities	15	11	10	6	42
Sport buildings	10	6	8	4	28
Renovated total	**154**	**172**	**156**	**180**	**662**

Table 17 - Statistical survey for new and renovated non-residential buildings from building approvals in 2016-2019

5.3.3 Current state of building renovation in Slovakia

5.3.3.1 Renovation of residential buildings

The systemic approach to the solution of the renovation of buildings in Slovakia was already taken at the beginning of the nineties of the last century, when it was stated that a common feature of buildings older than 30 years built in the Slovak Republic, especially in the years 1960 to 1992 by mass forms of construction, is the inadequate thermal protection of building structures and the high wear and tear of the technical equipment of the buildings, which should be urgently replaced by elements whose quality and characteristics will create the required safety, internal comfort and elimination of hygiene deficiencies for the purpose of further use of these buildings.

The SO SR, as well as other institutions, do not yet statistically evaluate individual construction works (e.g., insulation of external walls). For the first time, the SO SR paid more detailed attention to the renovation (insulation) of buildings in the 2011 SODB, where the tracking of house data was extended to include the items "Thermal insulation of the building" (insulation of external walls and replacement of windows) and "Extent of reconstruction". From the data obtained in this way, after their professional correction and on the basis of the professional estimation of the Association for Building Insulation, it was possible to calculate the extent of renovation (insulation) for the years 2011 until the end of 2019 and to conclude that, from a national point of view, more than 67,87 % of apartments in apartment buildings and 44,97 % of apartments in single-family houses have been renovated.

Apartments in apartment buildings and single-family houses renovated by 31 December 2019

Description	Apartments in apartment buildings	Apartments in single-family houses	Total
SODB 2011	931 605	1 008 795	1 940 400
Renovation by SODB 2011	382 319	272 415	654 734
Renovation by 31. 12. 2019	632 301	431 864	1 064 165
Share of renovation by 31. 12. 2019 in %	**67,87**	**44,97**	**54,84**

Table 18 - Apartments in apartment buildings and single-family houses renovated by 31 December 2019

5.3.3.2 Renovation of non-residential buildings

The pace of renovation of non-residential buildings lags significantly behind that of residential buildings, mainly due to the lack of systemic support in the past. The positive effect of the introduction of the energy support service has not yet helped to kick-start the renovation of the non-residential building stock. Energy efficiency contracts for the public sector provide a

suitable basis for initiating renovations, but only future developments will show the effectiveness of this measure. The Energy Certificates (ECs) processed since 2008 provide some indication of the extent of renovation of non-residential buildings.

Since 2010, the central registry records ECs separately for each building category and the energy class achieved. Between 2010 and 2019, a total of 5 814 buildings were renovated by EC, including 1 784 office buildings (31%), 1 599 schools and educational buildings (28%), 867 commercial services buildings (15%), 525 hotel and accommodation buildings (9%), 150 hospital buildings (3%), 128 sports halls and other buildings used for sports (2%) and 761 other mixed-use buildings (13%).

5.3.3.3 Renovation of residential and non-residential buildings according to data from energy certificates

Energy Certificates (hereafter "ECs"), processed since 2008, have some indicative power on the extent of renovation of buildings. Since 2010, ECs have been recorded in a central register separately for each building category and the energy class achieved. For the years 2010 to 2019 included a total of 27 661 buildings have been renovated according to the number of ECs, of which 21 847 (79 %) are residential buildings and 5 814 (21 %) are non-residential buildings.

Of the ECs issued for non-residential buildings for the period 2010 to 2019 included, 31% are ECs for office buildings, 28% ECs for schools and educational buildings, 15% ECs for commercial services buildings, 9% ECs for hotel and accommodation buildings, 3% ECs for hospital buildings, 2% ECs for sports halls and other buildings used for sports and 13% ECs for other mixed-use buildings.

Detailed data on the numbers of renovated buildings from the energy certificate database for the period 2010 to 2019 included, are presented in Tables 19 and 20.

Renovation of buildings according to data from the energy certificate database for the period 2010 to 2013 including

ENERGY CERTIFICATES 2010 - 2013								
Building category	**ENERGY CLASS**							**Total**
	A	**B**	**C**	**D**	**E**	**F**	**G**	
Single-family houses	65	2 085	1 255	341	96	36	46	3 924
Apartment buildings	3	2 446	1 613	99	13	2	0	4 176
RESIDENTIAL BUILDINGS – TOTAL	***68***	***4 531***	***2 868***	***440***	***109***	***38***	***46***	***8 100***

Administrative buildings	5	301	255	76	20	15	8	680
Schools and educational facilities	2	161	384	140	38	18	12	755
Hospital buildings	1	45	22	5	1	0	0	74
Hotel and restaurant buildings	5	138	38	11	4	1	0	197
Sport halls and other sport buildings	2	18	22	16	5	1	1	65
Buildings for wholesale and retail services	7	135	82	28	10	8	3	273
Other mixed-purpose buildings	6	145	109	26	5	0	2	293
NON-RESIDENTIAL BUILDINGS - TOTAL	***28***	***943***	***912***	***302***	***83***	***43***	***26***	***2 337***
ENERGY CERTIFICATES 2010 - 2013 - TOTAL	**96**	**5 474**	**3 780**	**742**	**192**	**81**	**72**	**10 437**

Table 19 - Renovation of buildings according to data from the energy certificate database for the period 2010 to 2013 including

Renovation of buildings according to data from the energy certificate database for the period 2014 to 2019 including

ENERGY CERTIFICATES 2014 - 2019									
Building category	**ENERGY CLASS**								**Total**
	A0	**A1**	**B**	**C**	**D**	**E**	**F**	**G**	
Single-family houses	1 124	2 944	3 177	554	141	43	18	10	8 011
Apartment buildings	631	1 102	3 427	480	64	20	6	6	5 736
RESIDENTIAL BUILDINGS – TOTAL	***1 755***	***4 046***	***6 604***	***1 034***	***205***	***63***	***24***	***16***	***13 747***
Administrative buildings	96	378	429	148	28	12	3	8	1 102
Schools and educational facilities	33	228	321	176	54	17	9	7	845
Hospital buildings	2	19	48	12	2	0	0	0	83
Hotel and restaurant buildings	17	68	166	47	12	9	1	2	322
Sport halls and other sport buildings	1	20	26	16	6	2	0	1	72
Buildings for wholesale and retail services	33	161	241	107	31	8	5	5	591
Other mixed-purpose buildings	18	128	238	63	8	6	1	0	462

NON-RESIDENTIAL BUILDINGS - TOTAL	*200*	*1 002*	*1 469*	*569*	*141*	*54*	*19*	*23*	*3 477*
ENERGY CERTIFICATES 2014 - 2019 - TOTAL	1 955	5 048	8 073	1 603	346	117	43	39	17 224

Table 20 - Renovation of buildings according to data from the energy certificate database for the period 2014 to 2019 including

6 Current state of vocational education and training

6.1 National system of vocational education and training for the construction sector in the lifelong learning system

The right to education for all citizens is guaranteed by the Constitution of the Slovak Republic, Art. 46. Lifelong education includes both educational and educational activities carried out in the school subsystem of education as formal education - kindergarten, primary, secondary, and higher schools and in the subsystem of further extracurricular education as informal education - corporate, departmental, interest, civic and other education.

Further professional education is directly linked to formal school education and is implemented in institutions of further education. Such training allows obtaining a partial or full qualification. A graduate of such education can also supplement, expand, or deepen already acquired qualifications. According to the Law on Lifelong Education, it is not possible to obtain a degree by successfully completing further education.

6.1.1 Responsible authorities

Coordination of vocational education and training for the labor market according to § 28 of Act 61/2015 Coll. on vocational education and training (VET) and on the amendment of certain laws is carried out at the national level and at the level of the self-governing region.

The following participate in the coordination of vocational education and training for the labor market at the national level:

Central bodies of state administration

- The field of lifelong education as well as vocational education is under the competence of the Ministry of Education, Science, Research and Sport of the Slovak Republic (MŠVVaŠ SR, hereinafter referred to as the "Ministry of Education")
- The Ministry of Education is the central body of the state administration of the Slovak Republic for kindergartens, primary schools, secondary schools and universities, school facilities, lifelong learning, science, and technology, for state welfare of youth and sports. The Ministry of Education is responsible for lifelong learning. In cooperation with interested ministries, state administration, self-government, social partners, it coordinates and implements measures and prepares a sequence of steps in accordance with the approved lifelong learning strategy.

As part of its competence at the level of professional education, it ensures and creates:

- strategic, conceptual and methodological documents for the field of professional education and training;
- issues and publishes state educational programs, framework curricula and educational standards;
- approves textbooks, professional teaching texts and didactic materials;
- manages a network of schools, school facilities, practical teaching centers and practical teaching workplaces;
- determines the system of study fields and teaching fields of vocational education and training;
- determines the content of vocational education and training in cooperation with state organizations, professional organizations and self-governing regions;
- processes standards for spatial, material and equipment of schools, school facilities, practical teaching centers and practical teaching workplaces;
- ensures financing of schools;
- in cooperation with state organizations and professional organizations determines the list of study fields and learning fields that are beyond the scope of the labor market needs plan.

Within the framework of its competence in the field of lifelong education, it ensures and carries out:

- implements the strategy of lifelong learning and lifelong counseling;
- carries out accreditation of educational programs of further education;
- establishes rules and procedures for verification and recognition of the results of further education aimed at acquiring partial qualifications and full qualifications;
- creates a national system of qualifications;
- creates, uses and makes available to the public an information system of further education;
- creates a system for monitoring and forecasting the educational needs of further education.

At the national level, vocational training is also coordinated by other central state administration bodies. Pursuant to §28 of the Act on Vocational Education, ministries are coordinators of vocational education and training for the labor market at the national level in their sectoral scope:

The Ministry of Transport of the Slovak Republic actively cooperates in the creation of systemic changes in vocational education, the creation of a system of study and learning fields and in the preparation for professional and craft activities within the department and in the updating of the National System of Qualifications NSK and the preparation of the system of verification of SOK qualifications.

The Ministry of Labour, Social Affairs and Family of the Slovak Republic fulfills tasks related to employment support, coordinates the preparation of Sector Strategies for the development of

human resources until 2030, coordinates the updating of National Employment Standards and fulfills tasks according to a special regulation.

The Ministry of the Interior of the Slovak Republic adequately fulfills study fields in the field of security services and fire protection. It directs the implementation of professional training in the field of fire protection.

Self-governing regions

Within its jurisdiction, the self-governing region creates a regional VET strategy, determines for each secondary school within its territorial jurisdiction the highest number of first-year students in the full-time form of study, establishes and cancels schools and educational facilities (secondary schools, professional practice centers, interest-based educational facilities, practical teaching facilities, we manage schools and school facilities within their scope of establishment and ensure the conditions for carrying out the educational process.

Within the self-governing regions - the Regional Council for Vocational Education and Training (KROVaP) is the chairman's advisory body in the field of vocational education and training. It arose as a result of the need to involve social and economic partners in cooperation on the economic and social development of the region, as well as the constantly growing importance of the coordination of secondary education and preparation for the labor market. KROVaP comments on the proposals for the inclusion or exclusion of secondary vocational schools, centers of practical education and other workplaces of practical education in the network of schools and educational facilities of the Slovak Republic. Discusses and recommends to the self-governing region the inclusion or exclusion of study fields within the system of education fields.

Guilds and professional organizations

The guilds and the professional organization provide cooperation to the Central Office of Labour, Social Affairs and Family in the creation of analyses and forecasts of developments in the labour market. They consulted on educational program, participate in development of standards for material-technical provision, participates in development of profiles of graduates of individual study fields and teaching fields, ensure the training of instructors, participate in assessing the content of textbooks and teaching texts.

The Council of Employers for Vocational Education and Training is an organization that coordinates the procedure for exercising the powers of state organizations and professional organizations in the system of dual education and vocational training.

The Council of Employers for the dual education system was created under the management of employers based on the vocational education reform and Act no. 61/2015 Coll. on Vocational Education and Training (OVP), is a union of representative state and professional organizations for the purpose of joint actions and representation of employers' interests in the field of vocational education and vocational training at the national and regional level. With the aim of

ensuring a functional system of professional education aimed at preparing for a profession according to the needs of the labour market.

According to decree no. 251/2018 Coll. on the system of fields of education in secondary schools and on the substantive scope of the fields of education, for the group of study and teaching fields in Section 36 – Construction, geodesy and cartography, the relevant professional organization is the National Employers' Union. The cooperating professional organization is the Slovak Chamber of Commerce and Industry, the Slovak Chamber of Commerce, the Association of Employers' Unions and Associations of the Slovak Republic and the Slovak Mining Chamber.

The Council of the Government of the Slovak Republic for Vocational Education and Training is an advisory body of the Government of the Slovak Republic in the field of vocational education and training. Assesses and discusses:

- strategic and conceptual documents in the field of vocational education and training;
- analyses and forecasts of developments in the labour market, sectoral concepts of vocational education and training, regional strategies of education and training in secondary schools;
- a list of study and teaching fields with an insufficient number of graduates for the needs of the labour market;
- a list of study and learning fields above the scope of market needs;
- state educational programs for professional education and training and comments on spatial, material and equipment provision standards;
- comments on the financing of vocational education and training and recommends measures in the field of vocational education and training.

The State Institute of Vocational Education (ŠIOV) is a directly managed organization of the Ministry of Education (MŠVVaŠ SR). It is responsible for the management and coordination of vocational education and training, and adult education in Slovakia. In the field of education, it helps introduce new trends and innovations, supports the development of national policies in vocational education and training and adult education. It focuses on activities for pupils, teaching, and professional staff, considering the needs of employers.
ŠIOV manages EU initiatives in the field of vocational education and training and adult education in Slovakia, namely:

- National contact point for the European Qualifications Framework
- EUROPASS National Center
- EQAVET national reference point
- EPALE national support service
- National coordinator of the European Adult Education Program
- National system of qualifications
- Slovak center of training companies
- EuroSkills national contact point
- UNESCO-UNEVOC Centre.

Alliance of Sector Councils and Sector Councils

As of February 1, 2023, the alliance of sector councils was established as an interest association of legal entities. Its activity without legal subjectivity lasted for ten years under the management of the Ministry of Internal Affairs and Communications of the Slovak Republic and was defined by the Employment Services Act 5/2004 Coll.

Sector Skills Council for Construction, Geodesy and Cartography and Sector Council for Energy, Gas and Electricity.

One of the main objectives of the sector skills council is to connect the education system with the labour market, to monitor the development of the market in terms of requirements for skills and professional training, and thus to harmonize the system of lifelong education with the needs of the labour market. It is mainly focused on supporting the sustainability of Sector-Driven Innovations (hereinafter referred to as "SRI"), in direct connection with the National System of Occupations (hereinafter referred to as "NSP") and the National System of Qualifications (hereinafter referred to as "NSK"). It started its activities in 2012. It is a voluntary, independent professional association. It is made up of representatives of employers, professional associations, schools and the Ministry of Transport and Construction of the Slovak Republic. Since June 2019, the Sector Council has been operating within the national SRI project. Its main tasks include the creation and revision of guaranteed national employment standards, the creation of a sectoral strategy for the development of human resources, and the updating of the SK ISCO-08 national employment classification. The Sectoral Council for Construction, Geodesy and Cartography guaranteed, processed, and updated a total of 70 national employment standards and the Sectoral Council for Energy, Gas and Electricity 79 jobs within the NSP.

6.1.2 Relevant regulations and accreditation bodies

The basic legal regulation governing the issue of vocational education and training at secondary vocational schools is Act 61/2015 Coll. on vocational education and training (VET) and on amendments to certain laws. The Act entered into force on 1 April 2015 and replaced Act No. 184/2009 Coll. on vocational education and training.

This law regulates the vocational education and training of secondary vocational school students, defines the types of secondary vocational schools, forms, and methods of practical teaching. It introduces the possibility of training students in the dual education system and characterizes and defines this dual education system. It allows employers to provide practical training in the dual education system and thus enter the VET process with the aim of better applying secondary vocational school pupils to the labor market. It thus enables preparation according to the specific requirements and needs of employers. It allows the employer to enter the vocational training process, but at the same time takes responsibility for the organization, content and quality of practical training. The uniform scope and content of the practical

teaching of individual branches is ensured according to model curricula and curricula developed in cooperation with relevant professional associations and organizations and are binding.

However, the construction sector is specific and this system of dual education, which on the one hand is an opportunity, on the other hand is difficult to apply and use in some areas and fields with a construction focus. Employers are not able to ensure uniform conditions of professional practice due to different places of performance and realization of work. They are not able to secure a permanent place and conditions for practical teaching in advance, which we see as one of the main obstacles to the use of dual education in the construction sector.

Within the group of 36 disciplines Construction, geodesy, and cartography, in the 2017/2018 school year, 4 secondary schools and 28 employers participated in dual education, and in the 2021/2022 school year, 20 secondary schools and 70 employers, which offer practical training in 11 disciplines.

Formal education is governed by so-called school laws:

Law no. 245/2008 Coll. on education and training (school law) and on amendments to certain laws, which establishes the principles, goals, conditions, scope, content, forms and organization of education and training in schools and in school facilities, levels of education, educational programs that define mainly the goals of education and educational standards and educational objectives, framework curricula and educational standards for basic education, secondary education and higher vocational education. State educational programs are issued and published by the Ministry of Education. Vocational education is implemented mainly within secondary vocational schools and related forms of vocational education and training, such as additional studies and in vocational schools that provide vocational training for the performance of undemanding work activities.

Law no. 596/2003 Coll. on State Administration in Education and School Self-Government and on Amendments and Supplements to Certain Acts defines the founders of primary schools, which are cities and municipalities, the founders of special schools are regional authorities, and the founders of secondary schools are higher territorial units. The founders are responsible for their functioning and financing, the task of the schools is to ensure the proper operation of the education and training process.

Act 138/2019 Coll. on pedagogical employees and professional employees and on amendments and additions to certain laws regulates the rights and obligations of pedagogical employees and professional employees, their work activities and professional development. Rights, obligations and prerequisites of a pedagogical employee and professional employee.

Act 597/2003 Coll. on the financing of primary schools, secondary schools and school facilities, regulates the financing of schools in which education is considered continuous preparation for a profession, and defines the sources of financing. Vocational education and training is financed primarily from the state budget and from the funds of the VÚC.

Law no. 293/2007 Coll. on the recognition of professional qualifications regulates the conditions for the recognition of documents on professional qualifications issued by schools or other authorized bodies according to the legislation of the member states of the European Union or states that are parties to the Agreement on the European Economic Area and the Swiss Confederation (hereinafter referred to as the "member state") for the purposes of exercising regulated professions and regulated professional activities (hereinafter referred to as "regulated profession") and for the purpose of freely providing services in the Slovak Republic.

Law no. 131/2002 Coll. on higher education institutions and on amendments to certain laws, as amended, regulates the status and tasks of public, state and private higher education institutions and their components, establishes rules for studying at a higher education institution, the status of students and employees of higher education institutions, the composition, activities and powers of the accreditation commission , establishes the rules for the financing of higher education institutions and the system of social support for students, responsibilities of public authorities and representative bodies of tertiary educational institutions.

Non-formal education and the field of continuous and further professional education

Act 568/2009 Coll. on lifelong learning and on the amendment of certain laws regulates and defines lifelong education, in which further education follows the level of education achieved in school education, regulates the accreditation of educational programs of further education, rules and procedures for the verification and recognition of the results of further education aimed at the acquisition of partial qualifications and of full qualifications, national system of qualifications, further education information system, system for monitoring and forecasting educational needs of further education. It defines the types, forms and scope of further education, educational institutions of further education and their obligations.

Informal education is regulated by Act no. 386/1997 Coll. on further education and on the addition of certain laws and its amendment no. 567/2001. This law regulates and defines further education as a part of lifelong learning (LLE), characterizes its types, establishes institutions for further education, conditions for accreditation of further education and the status and activities of the Accreditation Commission of the Ministry of Education of the Slovak Republic for further education. It regulates the issuing of educational certificates and defines the sources of funding for further education.

Further education also means preparation for obtaining a degree in addition to a higher education degree, professional education and training that enables the participant to expand, deepen or renew knowledge and skills, to gain the ability to perform an activity. Retraining is also considered vocational training. The certificate of the education obtained by its graduates is issued by institutions of further education accredited according to this law. The law here also regulates interest education, civic education, and other education.

Non-formal education is also regulated by other laws such as the Trades Act, the Employment Act and the Labor Code.

Law no. 126/1998 Coll. The Act on the Slovak Chamber of Commerce and on Amendments and Supplements to Certain Acts regulates the establishment, status, scope and organizational structure of the Slovak Chamber of Commerce.

Law no. 311/2001 Coll. Labor Code as amended. In addition to the basic and general provisions, this law also regulates the rights and obligations of the employer and the employee in connection with deepening the qualification of employees or increasing it. For employees without qualifications, the employer ensures the acquisition of qualifications through training or apprenticeship. The employer is obliged to retrain an employee who moves to a new workplace or to a new type of work. It enables employees to deepen their qualifications, maintain and renew them. Regulates the employer's opportunities to participate in further education, in which the employee must acquire the prerequisites or fulfill the requirements necessary for the proper performance of the work agreed in the employment contract.

Law no. 595/2003 Coll. The Income Tax Act, as amended, defines as tax expenditure expenditure on working and social conditions and health care of employees, such as expenditure on education and retraining of employees and own educational facilities and on the material security of pupils (according to § 26 of Act No. 61 /2015 Coll. on Vocational Education and Training as amended) and for the provision of practical teaching and from September 1, 2018 also expenses for remuneration for productive work (according to § 27 paragraph 1 of Act No. 61/2015 Coll. on Vocational Education and Training, as amended) up to 100% of the hourly minimum wage, costs (expenses) for a company scholarship (according to § 27, paragraph 6 of the Act on Vocational Education and Training) and for the operation of a secondary vocational school beyond the scope provided normative funds (§ 4, § 6 and § 6a of Act No. 597/2003 Coll. on the financing of primary schools, secondary schools and school facilities, as amended).

Law no. 124/2006 Coll. on safety and health protection at work and on amendments and additions to certain laws establishes general principles of prevention and basic conditions for ensuring safety and health protection at work and for the exclusion of risks and factors that condition the occurrence of occupational accidents, occupational diseases and other occupational health damage. This law applies to employers and employees in all sectors of the manufacturing and non-manufacturing sectors. For the purposes of this Act, an employer is also a natural person or a legal entity that conducts practical teaching of secondary school pupils, vocational secondary school pupils, secondary school pupils and university students, and an employee is also a secondary school pupil, vocational secondary school pupil, secondary school pupil during practical teaching and college student during practical teaching.

Other generally binding legal regulations that regulate the issue of vocational education and training:

Decree no. 147/2013 Coll. Decree of the Ministry of Labour, Social Affairs and Family establishing details for ensuring safety and health protection in construction works and works related to them and details about professional competence to perform certain work activities.

Decree no. 251/2018 Coll. Ministry of Education, Science, Research and Sports of the Slovak Republic on the system of education departments for secondary schools and on the substantive scope of education departments

Decree no. 287/2022 Coll. Decree of the Ministry of Education, Science, Research and Sport of the Slovak Republic on the system of education departments for secondary schools and on the substantive scope of education departments.

Act 422/2015 Coll. on the recognition of educational documents and on the recognition of professional qualifications and on the amendment of certain laws.

6.1.3 Overview of relevant secondary schools, study and teaching departments and VET centres

Vocational education in the construction sector is provided by the following types of secondary vocational schools:

- SOŠ – secondary vocational school (focusing on specific qualifications in one sector)

- STS – Secondary technical School

- Joint school (SOŠ as an organizational component of the joint school focused on several sectors)

They focus on acquiring theoretical knowledge and practical skills in various areas of construction, including civil engineering, construction materials, design, construction technology and occupational safety. It is mainly carried out through SOŠ. The following table shows the types of schools and their share in providing professional education in the resort.

Table 21 - Schools providing vocational education in the sector, breakdown by region and type of vocational school [18]

Type of school	BA	TT	TN	NR	ZA	BB	PO	KE	SR
Secondary vocational school	10	16	11	22	17	19	23	24	**143**
Secondary industrial school	2	2	2	2	1	3	5	3	**20**
Hotel academy	1	2	1	0	2	2	3	3	**14**

[18] Odvetvová koncepcia odborného vzdelávania a prípravy žiakov na výkon povolania, skupiny povolaní a odborných činností v rezorte dopravy a výstavby Slovenskej republiky 2022, 2018

Business academy	1	1	0	0	1	0	1	1	**5**
United school	1	0	1	2	2	3	7	3	**19**
Total schools in the sector in 2021	15	21	15	26	23	27	39	35	**201**
Of which total schools providing education for a group of fields of education 36 Construction, geodesy and cartography in 2021									**82**
Total schools in the sector in 2020	16	23	15	26	26	27	38	35	**206**
Total schools in the sector in 2019	16	23	15	27	25	29	40	35	**210**
Total schools in the sector in 2018	17	23	16	28	27	29	42	35	**217**
Total schools in the sector in 2017	18	23	16	28	26	29	44	31	**215**
Of which total schools providing education for a group of fields of education 36 Construction, geodesy and cartography in 2021									**84**
Total schools in the sector in 2016	18	25	17	28	28	29	44	38	**227**
Total schools in the sector in 2015	19	25	18	27	27	30	44	38	**228**
Total schools in the sector in 2014	20	26	20	27	29	30	46	35	**233**

Despite the persistent shortage of labour and the low number of qualified employees in the construction sector, we see an annual decrease in the number of vocational schools. Vocational education should respond to the needs of the labour market. Continuity can also be ensured through centres of vocational education and training (VET), which are under the competence of vocational schools and with the cooperation of the school with the relevant professional organization. They provide practical vocational education and training as well as re-skilling courses for interested parties and companies in the system of lifelong learning for the needs of the labour market. It also includes conceptual and professional activities in the field of qualification of teachers of vocational subjects and instructors of vocational education. In accordance with the Strategy of lifelong education and counselling for the years 2021-2030 and the Action Plan of the strategy, the so-called centres of excellence in vocational education and training (hereinafter referred to as "CEOVP") will be created by transformation of selected COVPs. In the following table, we offer a list of relevant COVPs.

Table 22 - Overview of vocational education and training centres for the construction sector [19]

Group of fields	COVP name	Name and address of the school authorised to use the COVP label
36	COVP for construction	SVS, Ivanská cesta 21, Bratislava
	COVP for construction	SVS for construction Emila Belluša, Staničná 4, Trenčín
	COVP for construction	SVS, Nábrežie mládeže 1, Nitra
	COVP for construction	SVS of construction, Tulipánová 2, Žilina
	COVP for construction	SS, Kremnička 10, Banská Bystrica
	COVP for construction	SVS technical, Volgogradská 1, Prešov
	COVP for construction	SVS technical, Kukučínová 23, Košice

Overview of study and learning fields within the groups of fields of education 36 Construction, geodesy and cartography and other related fields such as 26 - Electrical engineering and 24 - Mechanical engineering and other metalworking production, which are approved in the school year 2022/2023, by completing which the student will obtain the appropriate level of professional education and qualifications according to the Slovak Qualification Framework (SKR) and the European Qualification Framework (EKR) are shown in the following table.[20]

Table 23 - Overview of relevant fields of study and training for 2022/2023

Code of department	Name of department
36 - Construction, geodesy and cartography	
3650M00	Construction
3692M00	Geodesy, cartography and cadastre
3686F00	Construction production
3661H00	Bricklayer
3663H00	Carpenter
3668H00	Dry construction fitter
3672H00	Stonemason
3673H00	Tile maker
3675H00	Painter
3678H00	Installer
3679H00	Glazier

[19] Odvetvová koncepcia odborného vzdelávania a prípravy žiakov na výkon povolania, skupiny povolaní a odborných činností v rezorte dopravy a výstavby Slovenskej republiky, Jun2022
[20] Vyhláška č. 287/2022 Z.z. MŠVVaŠ SR o sústave odborov vzdelávania a o vecnej pôsobnosti k odborom vzdelávania s účinnosťou od 1.9.2022

3680H00	Flooring engineer
3684H00	Roofer
3688H00	Chimney sweeper
3656K00	Construction production operator
3658K00	Mechanic of construction and installation equipment
3667K00	Water technician, water engineer
3693K00	Building energy equipment technician
3659L00	Construction
24 – Mechanical engineering and other metalworking	
2435H00	Plumber
2435H01	Plumber - construction production
2435H02	Plumber - construction production
2419K00	Operator of ecological equipment
26 - Electrical engineering	
2675 M00	Electrical engineering
2675 L00 2675Q00	Electrical engineering
2683 H00	Electrical engineer
2675 L01	Electrical engineering - energetics
2683 H11	Electrical engineer - high current technology
2683 H12	Electrical engineer – automation technology
2683 H15	Electrical engineer – utility technology
2683 H17	Electrical engineer – refrigeration equipment and heat pumps
33 - Wood processing	
3349 K00	Wood construction technician

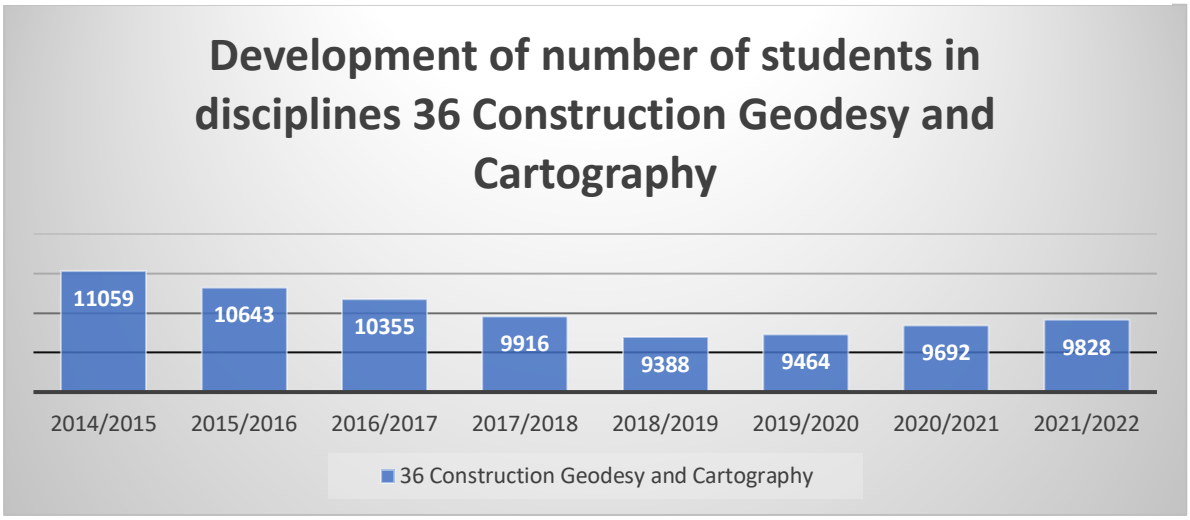
MŠVVaŠ SR, based on the obligation arising from the Act on Vocational Education, prepares and publishes on its website a list of study and teaching fields with an insufficient number of graduates for the needs of the labour market once every 3 years. In the list with an insufficient number of graduates for the labour market with effect from September 1, 2020, 5 departments from the field of construction are listed: 3675 H painter, 3658 K construction and installation equipment mechanic, 3661 Bricklayer, 3678 H plumber, 3692 M geodesy, cartography and cadastre. Therefore, support for increasing the number of students in these deficient fields is needed. In the following table, we show the list of the most numerous study fields and teaching fields with the largest number of students preparing for selected professions in the 2021/2022 school year and the number of graduates.

Table 24 - list of the most numerous fields of study and apprenticeship preparing for selected professions in the school year 2021/2022 and the number of graduates.[21]

Group of education fields	Code of department	Name of department	Number of students	Number of graduates
36 Construction, geodesy and cartography	**3650 M**	**Construction**	**3115**	**744**
	3686 F	Construction production	1352	504
	3661 H	Bricklayer	1030	288
	3678 H	Installer	790	266
	3686 G	Construction production - bricklaying	559	123

In the following graph, we see the development in terms of the number of students studying at SOŠ and other secondary schools preparing for the field 36 Civil engineering, geodesy, and cartography. There was a significant drop in the number of students in the 2018/2019 school year. The number then increases slightly from the 2019/2020 school year (2019/2020 + 76 students, 2020/2021 + 228 students, and 2021/2022 + 136 students). Despite the gradual, moderate increase in the number of students, it is still necessary to pay increased attention to the solution to the overall decrease in the number of students in departmental professions. Of course, it also affects the demographic development, which in recent years was characterized by a decrease in the number of children in the Slovak Republic. According to forecasts, the decline in the number of secondary school pupils should be completed in 2019, and an increase

Graph 15 - Development of the number of students in the study and teaching disciplines 36 Construction Geodesy and Cartography (Source: Sectoral Concept of Vocational Education and Training of Students for Occupations, Groups of Occupations and Vocational Activities in the Department of Transport and Construction of the Slovak Republic 2018, 2022)



[21] Sectoral Concept of Vocational Education and Training of Students for Occupations, Groups of Occupations and Vocational Activities in the Department of Transport and Construction of the Slovak Republic 2022

in secondary school pupils, including pupils of departmental schools, is expected in the following years. The Ukrainian migration crisis can also affect the temporary or long-term increase.

Continuing education is possible at higher vocational education levels, colleges and universities, where it is possible to study civil engineering, architecture and other construction disciplines. These programmes are aimed at gaining a deeper theoretical and technical knowledge of the construction industry and preparing students for more demanding and managerial roles in the sector. A list of accredited study programmes is maintained in the Register of Study Programmes. Entries in the register of study programmes are made by universities, the Slovak Accreditation Agency for Higher Education and the Ministry of Education, Science, Research and Sport of the Slovak Republic.

Currently, the following study programmes of state, public and private universities in the study field of civil engineering, various forms of full-time and part-time study, 1st, 2nd and 3rd level of higher education studies are listed in the register. Their current overview and the overview of universities providing these programmes are presented in the table below.

Name of the programme	Tertiary educational institution
Architectural structures and design	Slovenská technická univerzita v Bratislave
Civil engineering	Slovenská technická univerzita v Bratislave
Engineering structures and transport structures	Žilinská univerzita v Žiline
Engineering structures and transport structures	Slovenská technická univerzita v Bratislave
Engineering structures and transport structures	Technická univerzita v Košiciach
Load-bearing structures and transport structures	Technická univerzita v Košiciach
Load-bearing structures	Slovenská technická univerzita v Bratislave
Civil engineering	Technická univerzita v Košiciach
Civil engineering and architecture	Technická univerzita v Košiciach
Civil engineering and architecture	Slovenská technická univerzita v Bratislave
Civil engineering	Žilinská univerzita v Žiline
Civil engineering	Žilinská univerzita v Žiline
Technical equipment of buildings	Slovenská technická univerzita v Bratislave
Construction technology and management	Žilinská univerzita v Žiline
Construction technology and management	Technická univerzita v Košiciach
Construction technology	Slovenská technická univerzita v Bratislave
Construction technology and management	Slovenská technická univerzita v Bratislave
Theory and construction of civil engineering structures	Slovenská technická univerzita v Bratislave
Theory and construction of civil engineering structures	Žilinská univerzita v Žiline
Theory and construction of civil engineering structures	Technická univerzita v Košiciach
Theory and technology of the built environment	Slovenská technická univerzita v Bratislave
Theory of technology in civil engineering	Technická univerzita v Košiciach
Theory and technology of the built environment	Technická univerzita v Košiciach
Water structures and water management	Slovenská technická univerzita v Bratislave
water management engineering	Slovenská technická univerzita v Bratislave

Table25 - accredited study programmes of universities in the study field of civil engineering[22]

6.2 Representation of innovative trends and skills implementing energy efficiency measures in buildings and renewable energy in the current VET system

As part of vocational education and training in the context of the green and digital transformation, secondary schools and higher education institutions are working to update and innovate study fields in secondary schools and study programmes in higher education institutions. However, the communication within the NQP so far as well as the questionnaire survey we have conducted clearly show the need for closer cooperation and linking of primarily

[22] Register of study programmes: https://www.portalvs.sk/sk/morho

vocational secondary schools as well as industrial schools with construction companies in the development and updating of teaching and study fields. Secondary schools should be able to reflect more flexibly the needs of the labour market and of the construction companies themselves.

The purpose of the survey was to get answers on whether secondary schools and universities are prepared for current and future challenges related to climate change, industrial revolution 4.0, digitalization, automation in relation to the expected rapid changes in the construction industry. How are they prepared in the context of the current shortage of skilled workforce and its provision to meet the needs for achieving the climate goals by 2030. To this end, a questionnaire survey was carried out targeting vocational and industrial secondary schools focusing on the group of disciplines 36 Civil Engineering, Surveying and Cartography and 26 Electrical Engineering. Data collection was also carried out in the construction faculties of the universities by means of a questionnaire. The methodology of the questionnaire survey is described in more detail in Chapter 8.

In order to assess the readiness of vocational education for the current changes and to identify to what extent and whether the current system of formal education includes areas of education with regard to new trends and needs in the construction industry, we had to define the innovative changes and trends and the resulting competences in terms of professional knowledge and skills that should be included in the study and teaching disciplines, the teaching of which will be necessary in the future to achieve the climate goals to which Slovakia has committed itself. Their definition was based on a study prepared by experts within the Sectoral Council, mainly from the employers' environment and in accordance with the strategic document, Strategy for the Development of Human Resources in the Construction, Surveying and Cartography Sector until 2030.

The starting point for the survey of schools was the following question: To what extent, if any, do the apprenticeships and courses of study in the construction and energy sectors that you offer include competences in terms of professional knowledge and skills in the areas of:

- Energy efficiency in buildings and renewable energy in buildings/in general
- Energy renovation of historic buildings
- Electrification of heating and hot water preparation
- Renewable energy and fuel technologies
- Installation of renewable energy and fuel technologies
- Maintenance of renewable energy and fuel technologies
- Green economy/in general
- Efficient use of energy sources and the use of appropriate system solutions for energy efficient buildings
- New technologies and materials for building products with high recycling rates
- Vegetation (green roofs), mobile roofs and waterproof roofs

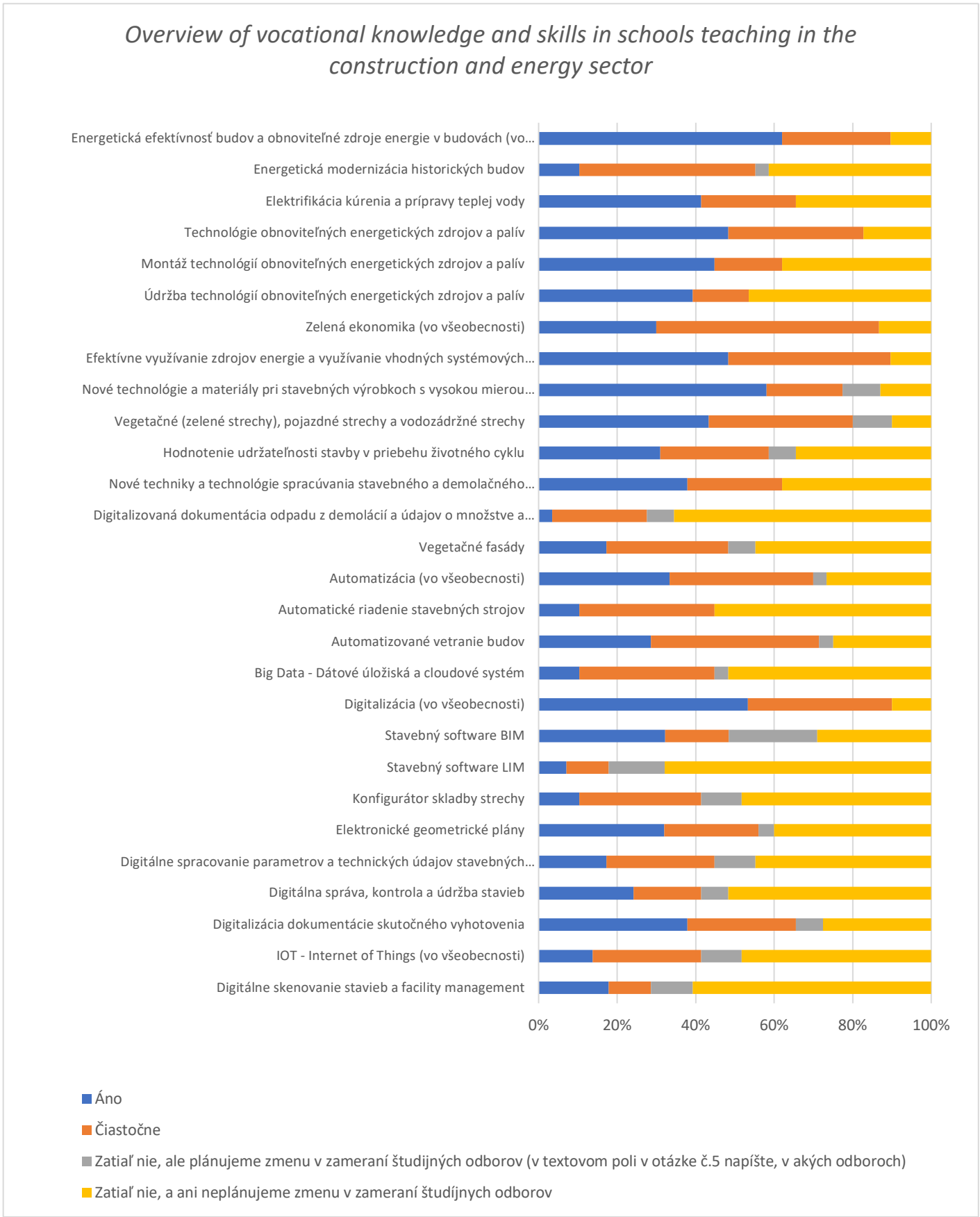
- Life cycle assessment of the building's sustainability
- New techniques and technologies for processing construction and demolition waste into recycled materials
- Digitised documentation of demolition waste and data on the quantity and type of recyclates produced
- Vegetation facades
- Automation/in general
- Automatic control of construction machinery
- Automated building ventilation
- BIG DATA Data storage and cloud systems
- Digitisation/in general
- BIM construction software
- LIM construction software
- Roof composition configurator
- Electronic geometric plans
- Digital processing of parameters and technical data of building materials
- Digital management, inspection and maintenance of buildings
- Digitisation of the documentation of the actual design
- IOT (Internet of Things)/in general
- Digital building scanning and facility management
- Measurements and non-destructive roof leakage detection
- Drones/in general
- Photogrammetry, drones and 3D building scanning
- Use of drones for areal data collection of terrain and building objects in the form of scanning and photogrammetry
- New methods/in general
- Functional units - bathrooms or rooms
- Prefabricated houses and commercial modular buildings
- Above-grade insulation
- Insulation with TPO and EPDM foils
- Cassette facade tiles
- Ventilation of roof structures and attic airtightness classes
- Robotization/in general
- Autonomous robots in the construction industry (remote-controlled machines, cranes, dumpers, robots for 3D printing...)
- Automatic assembly by robots
- Smart technologies/in general
- Smart buildings

- System components of technical building equipment
- Smart meters
- Smart energy systems in buildings
- BEMS (Building Energy Management Systems)
- Energy storage, installation, maintenance
- E-mobility (charging stations for e-mobiles in buildings and adjacent areas - maintenance, installation)
- Decarbonisation of energy system flexibility - contribution of buildings to flexibility, design and installation of building systems
- Artificial intelligence in construction
- Virtual reality in construction
- 3D technologies and materials/in general
- Production of prefabricated concrete parts through 3D printing

The recording sheet was prepared so that the survey could identify the current state of readiness of schools to educate students in construction and energy sector apprenticeships and courses, using four pre-defined responses from which respondents had a choice:

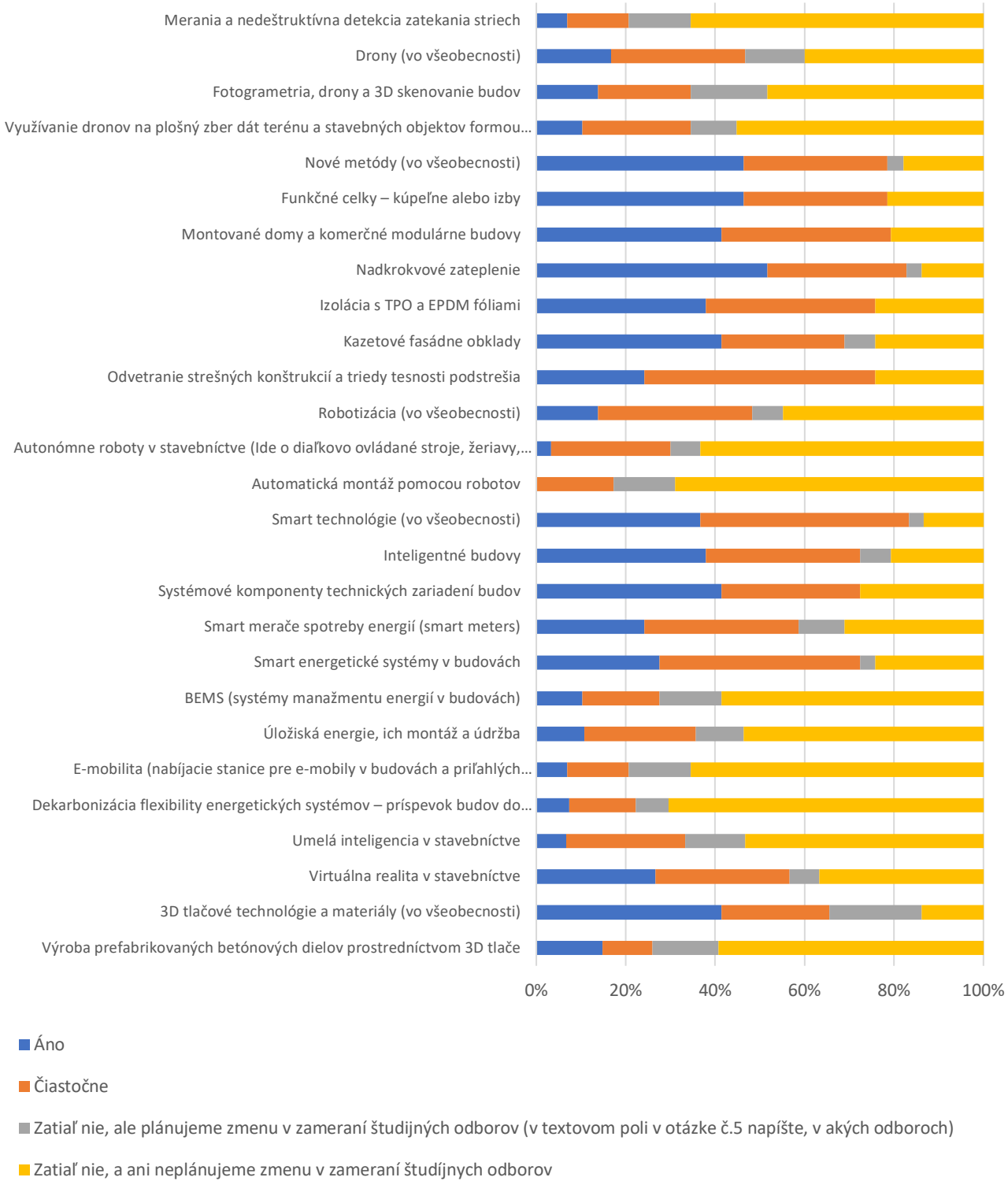
- Yes
- Partially
- Not yet, but we are planning a change in the focus of fields of study
- Not yet, nor do we plan a change in focus in the fields of study

The percentage of responses is shown in the following graph (in Slovak).



Graph 16 - Range of vocational skills and competences in schools teaching in the construction and energy sector

Overview of vocational knowledge and skills in schools teaching in the construction and energy sector

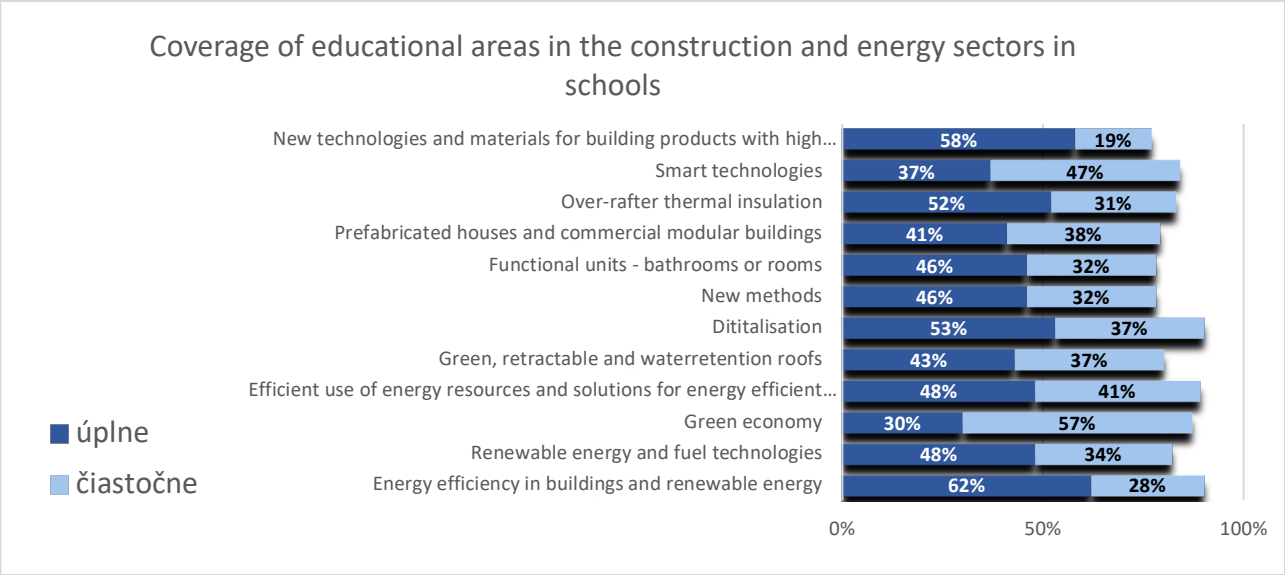


For a better understanding of the survey results, the evaluation focused only on the responses with a higher response rate, which were subsequently divided into three separate parts in order to demonstrate which professional skills and competences in the defined areas are or are not covered by secondary schools and colleges within their teaching and study fields/programmes, and which they plan or do not plan to change their focus, as follows:

a) Which educational areas are fully and partially covered by schools
b) Which educational areas are not covered by schools but are planning a change in their focus
c) Which educational areas are not covered by the schools and do not plan to change their focus

Educational areas fully or partially covered by schools

The results of the survey show that selected areas that are currently necessary for the requirements of the labour market are included in the curriculum to the full extent only in a minority of the schools surveyed. In this particular case, these are educational areas such as New technologies and materials for building products with high recycling rates: 58% of respondents, Digitalization: 53% of respondents, Efficient use of energy resources and solutions for energy efficient buildings: 48% of respondents, Energy efficiency of buildings and renewable energy sources: 62% of respondents or Green Economy, which is taught in full at only 30% of respondents but partially represented at another 57% of respondents, which means that if the remaining schools whose teaching content is only partially covered by these educational areas would focus on supplementing their courses in the near future, then the education system would include the above mentioned areas in their teaching courses and programs at 80-90 percent of respondents in accordance with the needs.



Graph 17 - Coverage of educational areas in schools teaching in the construction and energy sectors

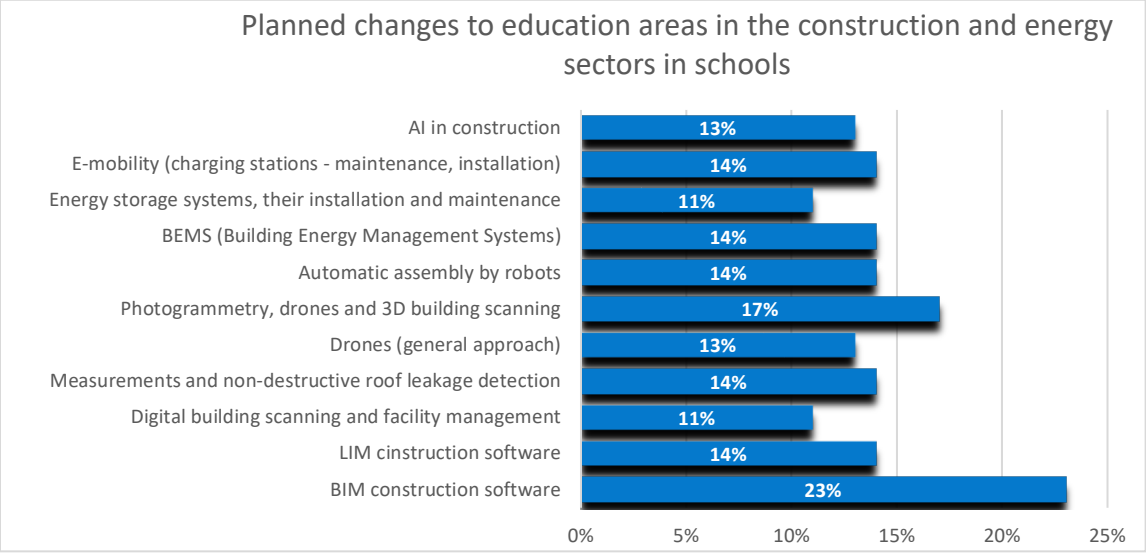
Educational areas that are not covered but schools are planning a change in their focus

Secondary schools and colleges also identified educational areas in the survey that they do not currently have implemented in their curricula, but based on perceived interest from students or construction companies, they are fully aware of the need to introduce them into the curriculum. In terms of educating future school graduates, it is important to realise that any change in an apprenticeship or field of study will not be reflected in the labour market until 3-4 years later. That is how long it will take to put an apprentice graduate into practice as part of his or her training and qualification.

In the survey results, the educational areas that are not covered by the schools but are planning changes were analysed. Of these, by a significant margin, up to 23% of respondents plan to change and include the area of BIM construction software, which is one of the most discussed tools to increase efficiency and safety in the construction industry. 17% of respondents plan to change their field of study and include areas such as Photogrammetry, drones, 3D scanning of buildings. Only 14% of respondents have the potential to change fields of study and add education in areas such as E-mobility, BEMS (Building Energy Management System), automated assembly using robots, measurements and non-destructive roof leakage detection.

From the results it can be seen that only a small percentage of respondents have the desire to address the problems and challenges facing the Slovak construction industry in the near future and to increase the qualification of graduates who would be able to use elements of artificial intelligence or automation. Rather, they are focusing on areas that are easier for schools to reach with all the areas and skills needed in the future. This may also be due to the fact that there is no system of continuous and continuing professional education in Slovakia that focuses on educating educators and enabling them to gain new information and knowledge about new

Graph 18 - Planned changes to educational areas in schools teaching in the construction and energy sectors



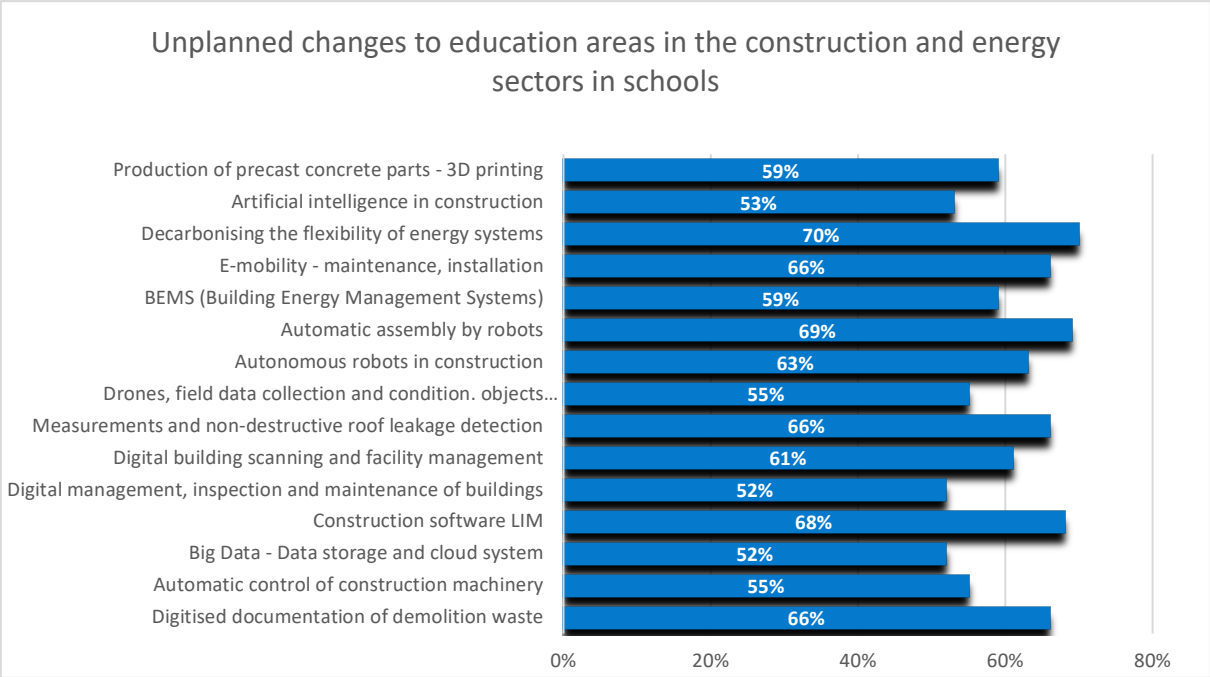
materials and technologies, and they use the most accessible and publicly known innovations to update their curricula.

Educational areas that are not covered and the schools do not plan to change their focus

Despite the positive results of the survey, where up to 62% of the respondents are willing to adapt education to the changing needs of the market, up to 54% of the respondents are currently preparing a new concept of education, but they encounter obstacles or consider this change impossible. More than 38% of respondents do not want to make any changes. They do not plan to make any changes, for whatever reason, and to adapt the teaching or study fields of education in areas such as in particular decarbonisation of the flexibility of energy systems, automated assembly using robots, LIM construction software, digitised documentation of demolition waste, autonomous robots. These are all areas that are not even used in large construction companies. This situation is very unfavourable in terms of the future within 10 years, and the impact on the labour market in the construction sector could be catastrophic, as there will be a significant shortage of skilled workers with the aforementioned skills and competences in these areas.

Of course, this state of affairs may be caused by several factors such as the high number of teaching and professional staff aged 50+ who are not motivated to train in new procedures and technologies, poor material and technical provision which schools are unable to update from their budgets in the light of rapid changes, but also the lack of interest on the part of the state to increase the attractiveness of teaching jobs and to support schools by investing in innovation and modernisation as well as in streamlining the school network so that they play a key role in the preparation of future qualified professionals. All these factors will be discussed in more detail in Chapter 9.

Graph 19 - Unplanned changes to teaching areas in schools teaching in the construction and energy sectors



6.3 Accreditation bodies and education providers in the system of informal education - further professional education

In informal education, educational activities are carried out by various educational institutions. They can also be schools, educational institutions, educational institutions of companies, employers, estate organizations, private educational institutions, and other entities such as professional unions, guilds, associations and chambers. The main group consists of further commercial education providers that provide educational activities on a commercial basis depending on demand. The non-formal education system is able to respond more flexibly to changes and market needs and to adapt supply almost instantly, also in relation to the need to implement training and skills acquisition in energy efficiency, building renovation, renewable energy and digital skills related to modernisation.

The exact number of institutions that operate and implement training within the continuing education system is not known. From the data collected as part of the annual statistical survey on further education (DALV), which is carried out by the Centre for Scientific and Technical Information of the Slovak Republic (CVT SR), we can obtain some data. However, it should be considered that, despite the legal obligation, in the case of entities that do not accredit their programs, the actual data provided by these entities is considerably limited, almost non-existent. We processed the situation in this area mainly based on the last accessible data processed for the years 2019-2021.

The years 2020 and 2021, like all areas, were significantly affected by the COVID-19 pandemic. Therefore, the implementation of educational activities within further education was affected

by anti-pandemic measures, which significantly affected the course, forms, and possibilities of implementing education at all levels. These were mainly restrictions related to the provision of face-to-face educational activities. In some cases, activity, and business itself were made impossible and limited. The activities that required professional practice in face-to-face form turned out to be the riskiest. Educational entities reacted by changing the form of education to distance education, especially by using e-learning. The content focus of the courses was also affected. In many cases, they had to react by cancelling or interrupting educational activities. The restrictions clearly had a negative impact, which is also shown by the data in the table.

Table 25 - Impact of COVID-19 containment measures on entrepreneurial activities in further education

Impact of COVID-19 containment measures on entrepreneurial activities in further education	Number	Share
The number of participants in the educational activities offered has significantly decreased	68	40,0%
We have toned down business in this area	49	28,8%
The number of participants in the educational activities offered has slightly decreased	29	17,1%
No impact on our business	13	7,6%
It had devastating consequences for us	7	4,1%
We have seen a positive increase in the number of training activities/participants	3	1,8%
No answer	1	0,6%
Total	170	100.0%

*Source of data: CVTI SR, survey on the impact of the COVID-19 pandemic on the field of further education in Slovakia [23]

According to the data processed by the Centre for Scientific and Technical Information for 2019, we know that in 2019 a total of 540 entities operating in the field of further education provided data on their activities, while 73 (13,5%) entities submitted a so-called negative report, which in practice means that in 2019 they did not carry out any educational activities and therefore did not provide any additional data. Compared to 2018, almost eleven percent more entities provided data on their activities[24].

[23] The impact of the COVID-19 pandemic on further education in Slovakia. Interim survey report.
[24] Further education in numbers 2019

Table 26 - Number of educational entities by regions of the Slovak Republic in 2019

Region	Number	Share
Bratislava region	117	25,1%
Trnava region	38	8,1%
Trenčín region	28	6,0%
Nitra region	46	9,9%
Žilina region	59	12,6%
Banská Bystrica region	53	11,3%
Prešov region	48	10,3%
Košice region	78	16,7%
SR Total	**467**	**100,0**

Educational entities reported a total of **2345 educational activities implemented in 2019**. The highest number of educational activities was implemented in the Bratislava region (877), the lowest number (104) in the Trenčín region.

Table 27 - Basic data on educational activities (VA) of educational institutions (VI) by regions of the Slovak Republic

Region	Number of realized VA	Number of reported but not realized VA	VI with at least one reported VA	VI with at least one realized VA
Bratislava region	877	171	113	78
Trnava region	238	36	37	34
Trenčín region	104	23	28	19
Nitra region	180	106	43	32
Žilina region	215	65	57	35
Banská Bystrica region	234	54	52	44
Prešov region	177	46	46	35
Košice region	320	97	77	55
SR Total	**2 345**	**598**	**453**	**332**

*The VIs with at least one implemented educational activity included those entities that reported non-zero numbers of participants and/or graduates.[25]

In 2019, according to data provided by educational entities through the DALV report, a total of 709 educational activities were implemented, which were accredited according to Act 568/2009 Coll. about lifelong learning. In addition, 35 entities reported a total of 277 implemented activities that were accredited under other legal regulations than the Lifelong Learning Act. According to the reported data, in 2019 a total of 130,866 participants took part

[25] Further education in numbers 2019

in educational activities implemented as part of further education, of which 56.0% were women.[26]

For the year 2019, educational entities reported the total sources of financing their educational activity in the field of further education at the level of €45,860,704.90. At the same time, more than a third of all funds (35.9%, €16,191,413.97) came from the public sector, in which funds from employment offices clearly dominated.

Table 28 - Sources of funding of further education

Region	Training participants	Private enterprises	Public sector	From the state budget for organisations connected to to the SR	From foundations and non-profit organisations	From EU funds	Other sources of funding	Total
BA	3 763 150,80	603 079,93	11 984 362,17	7 046 294,52	10 200,00	7 601 463,82	470 365,05	31 478 916,29
TT	635 801,48	404 571,91	353 243,65	8 131,80	3 340,00	27 548,00	105 334,06	1 537 970,90
TN	167 474,75	312 787,40	69 180,60	3 250,00	0,00	194 970,50	0,00	747 663,25
NR	385 111,50	376 826,17	462 567,80	61 743,78	60,00	182 901,00	2 000,00	1 471 210,25
ZA	1 217 483,55	159 837,43	1 293 298,20	18 420,00	470,00	227 408,60	6 855,00	2 923 772,78
BB	896 042,60	110 746,10	130 644,09	258 527,60	0,00	601 159,02	24 359,55	2 021 478,96
PO	698 051,00	82 336,50	544 965,52	744 781,22	550,00	3 077,00	880,00	2 074 641,24
KE	635 795,13	633 264,90	1 353 151,94	631 658,41	7 702,00	283 284,28	60 194,57	3 605 051,23
SR	8 398 910,81	2 683 450,34	16 191 413,97	8 772 807,33	22 322,00	9 121 812,22	669 988,23	45 860 704,90

From the point of view of the focus of educational activities, out of the total number of 2,345 implemented educational activities, educational activities focused on teacher training and pedagogy (broader programs) had the largest representation, the share of which in the total number of implemented courses was at the level of 11.0%. Programs focused on construction and energy accounted for a total of only 2.47%.

Table 29 - Basic data on educational activities by content of education

Content of education	Number of educational activities implemented	Number of reported non-implemented educational activities	Educational institutions with at least one reported educational activity	Educational institutions with at least one educational activity implemented
Electrical engineering and energetics	23	1	8	8
Construction	35	0	7	7
Other focuses total	2287	597	438	317
Total	2 345	598	453	332

[26] Further education in numbers 2019

*Overview of statistical indicators for 2019 collected in the framework of the annual DALV survey.[27]

Accreditation of an educational activity can be a quality assessment criterion to a certain extent, but it is not mandatory for every activity. The legal obligation concerns retraining for labour, social affairs and family offices, further education of employees and elected representatives in public administration, as well as other educational activities for which financial resources are provided from the state budget.

Accredited programs go through a system of approval and quality control according to Act 568/2009 on lifelong learning Coll. Such programs may lead to the acquisition of full or partial qualifications necessary to perform certain activities or professions. Within the further education system, however, an important area is precisely the area of programs without formal accreditation. When education providers can flexibly respond to needs. In the subsystem of non-formal education, a more liberal approach applies and the functioning is left to supply and demand relations.

The importance of education in the European context and adult education continues to grow. New challenges related to industrial revolution 4.0, digitization and automation, climate change, place ever higher demands on individuals. It requires an increase in adaptability and flexibility to new conditions on the labour market. However, the current legislative environment does not create sufficient conditions for development and changes, for example in the area of financing, quality assessment and recognition of education. At the same time, it must be noted that sufficient conditions are not created for a clearer connection between formal and informal education.

The national project System of verification of qualifications in the Slovak Republic is the first step for transparency and easier access to the CŽV system, and it is also proving to be essential for the area in the construction sector. It sets up a system of verification of qualifications and results of informal education and informal learning in the Slovak Republic. The effort should also be to increase the motivation of people to enter the educational process, by accepting various and partial educational outputs obtained through informal education and their recognition in the system of verification of qualifications, supported by a network of authorized institutions and persons leading to the recognition of education and obtaining documents about education comparable to a document from a formal education. This would ensure horizontal permeability between systems and the openness of both educational subsystems.

[27] Further education in numbers 2019

6.3.1 Education providers and other entities providing a system of informal education in the construction and energy sector

New technologies, materials, construction procedures and the overall development of the construction industry also bring new, higher requirements for education and practice. Even the simplest construction activities are digitized, automated and robotized. The long-term shortage of craftsmen on the labour market can be solved by increasing the level of education of craftsmen and other qualified workers.

In the construction sector, guilds and other professional unions, associations and chambers actively participate in the system of further professional training and education, focusing mainly on expanding and supplementing the knowledge and skills of already acquired qualifications.

a) Guilds

Guild of Roofers of Slovakia (CSS)

Education, as one of the main activities of the guild, concerns those who participate in the design and construction of roofs in order to familiarize themselves with new trends, technologies in the construction of roofs and on the market, they also pay attention to the new generation of craftsmen. Guild education is provided in cooperation with partner members. Among the guild's main educational activities are professional seminars such as Guild Days. Each year, through expert lectures and various processed materials, CSS members and the entire construction public will receive up-to-date information on new modern technologies, new products in the product range, and problems during design and implementation. Professional seminars are usually held in 4 cities in Slovakia.

Professional International Bratislava Symposium ROOFS is a professional symposium on roofs that has a long-standing tradition in Slovakia. It is intended for the professional public and representatives of science and research from universities meet here, representatives of roof implementers and production resp. trading companies with materials and accessories for roofs. (participation has been increasing and is around 145 participants)

Support for the vocational education of primary school students, their teachers and vocational training masters

CSS participates in improving the quality of practical teaching with the aim of introducing the most modern technologies that are commonly used on construction sites into the school curriculum, and thus the materials and products of the partner members are brought to the attention of young future craftsmen, in the form of professional lectures to students at all schools associated in CSS.

Slovakian championship of primary school pupils in roofing professions - CONECO with international participation. CSS annually organizes the Slovak Primary School Championship as

part of the CONECO Bratislava international construction fair. The competition is attended by two-member teams of pupils together with their masters in the newly conceived profession of roofer. Here, the profession of ROOFING becomes known to the public, so the competition can also help to recruit students to schools, which still lack a sufficient number of students interested in the professions covered by the guild.

CSS continuously provides and publishes various professional publications and magazines, such as the guild newsletter STRECHÁR, members of the guild receive a monthly - professional magazine ROOFS - FACADE - INSULATION and participate in the creation of other professional publications.

CSS other activities such as participation in national international fairs and exhibitions, organizes, for example, the annual Roof of the Year competition, summer seminars and other activities within the framework of national and international cooperation.

Flooring Guild (CPS)

The guild cooperates with the SOŠ in the form of professional lectures, in the preparation of curricula, in the involvement of young apprentices in international competitions organized by similar cooperating guilds abroad. For direct financial support, SOŠ Cech does not have enough funds, as it manages itself only from membership contributions and from occasional contributions from partners for their promotion. The cooperation with the university was limited to help in issuing CPS Expert Opinions, respectively. when they are increased to Forensic expert opinions.

CPS helps the lay public by providing free advice at construction exhibitions or via blogs on the CPS website. Since the education of the Podlahár trade has been absent from the SOŠ for several years, CPS obtained the Accreditation of the Kindergarten for Education as well as for the subsequent Verification of Professional Competence (OOS). However, there is little interest in this accredited education, as there is still a parallel free trade for the execution of the profession of Flooring (Laying tiled floor coverings). CPS has been fighting against this fact for many years, also on the basis of numerous construction errors caused by unprofessional laying by just such "self-proclaimed "experts". From In 2018, at least the restriction of free trade to free laying without full-surface gluing of floor coverings was achieved.

The importance of the Flooring trade and our efforts to preserve it is also supported by the involvement of CPS in the Qualification Verification System (SOK) as an Authorized Institution (AI) or some members of CPS as Authorized Persons (AO). In this direction, the cooperation with the Secondary School of Education, which joined this project as an AI for our craft, will continue.

Tilers' guild

The tiler's guild focuses, among other things, on the educational activities of its members, but also on the care of other young professionals. It also provides professional training and consultancy in areas related to the business activities of its members. It also provides an educational program in the field of tiling for obtaining a certificate for opening a business.

b) Chambers and associations

The Slovak Chamber of Civil Engineers (SKSI) is a professional organization that organizes and conducts authorization tests and tests of professional competence for construction managers, construction supervision and energy certification, issues authorizations for authorization and professional competence, maintains a list of authorized engineers, a register of visiting persons and records of professionally qualified persons for the performance of the activities of construction manager, construction supervision and energy certification, recognizes the professional qualification for construction engineers, submits statements on the recognition of professional qualification for the activity of construction manager, construction supervision and energy certification of buildings. It organizes professional educational events and preparatory seminars for authorized civil engineers and thus supports the lifelong education of experts in the construction sector, also supports the publication of professional publications and magazines and provides useful and important information for civil engineers.

The Slovak Chamber of Commerce represents and represents the interests of entrepreneurs, small and medium-sized entrepreneurs and participates in improving the overall conditions for doing business. It enters the educational process mainly by representing experts in the commissions of final and matriculation exams, and within the framework of the dual education system, it coordinates this process as a state-level professional organization.

As part of its activities, it also offers several accredited courses, but it does not currently offer any courses or training in the field of construction. However, within its scope, it provides examinations to verify professional competence for crafts and personal services. Such as for qualifications such as bricklayer, plumber, carpenter, roofer, joiner, insulator and tinker.

Slovak Trade Union

The SŽZ provides advisory services to its members and the public, organizes professional seminars, and prepares professional publications.

The construction sector has long been trying to improve the quality of the work carried out. The professional public agrees that the current situation with the setting of requirements for education and experience in construction activities within the framework of the regulation of trades is set very low. There are a large number of so-called free trades, where it is not necessary to prove the relevant education or course, which does not guarantee the quality of the work carried out. That is why the effort to change is also in cooperation with the Slovak Trade Union.

c) **Professional bodies**

Other professional bodies also intervene in the education process.

The Association of Construction Entrepreneurs of Slovakia (ZSPS) is an independent, voluntary, non-political, open economic and interest-based legal entity operating as an employers' organisation. It brings together economic business entities active in construction-related activities and acts as a representative representative representative of employers in the construction industry. It represents businesses in construction production, the production of building materials, research and development, design and other related activities. It is the publisher of the online daily Stavebné noviny.

The basic aim of the ZSPS is to conduct dialogue with the national council, ministries, other state administration, local government, trade unions and others, thus defending the collective interests of its members. ZSPS assists members in promoting their business plans, creates favourable conditions for the development of the business environment in the construction industry, provides information on legislative intentions, innovations in building systems, processes, technologies and in building materials. The Association also ensures social dialogue and creates conditions for better employment. It is permanently invited as an expert partner to various professional events, trainings, and conferences, is asked to comment on current topics and issues in the construction sector, whether for the state administration or the media, and is also a member of various working groups, commissions, monitoring committees, committees, etc.

Since 1994, ZSPS has been a member of the European Federation of the Construction Industry FIEC, thanks to which it has been involved in solving pan-European problems in the construction industry, while at the same time gaining valuable information and taking advantage of the opportunity to influence European construction legislation. At the same time, it is a member of the Republican Union of Employers and the Association of Industrial Unions and Transport, through which it applies its demands to the state sphere up to the level of the Economic and Social Council of the Slovak Republic.

The Slovak Council for Green Buildings has been active since 2010 (also known by the abbreviation SKGBC from the English Slovak Green Building Council). He is the main ambassador of sustainable construction in Slovakia. With the aim that both newly built and renovated buildings are implemented according to sustainable standards, which reduces energy consumption, eliminates the impact of buildings on the environment and minimizes the carbon footprint. He also directs his professional activities and events in this field. It implements professional seminars and webinars focused on the topic of energy class A0, water recycling and green roofs and facades. In 2022, they started a series of webinars focused on sustainable construction called Green Building Academy 2022, where they deal in individual modules with

the basic definitions and principles of sustainability in the construction industry, but also with good examples from practice and individual areas and phases of construction in relation to sustainability. In the framework of the project "Preparation of students for practice in the field of sustainable buildings", educational activities focused on sustainable construction were carried out by Slovak secondary schools. For secondary schools. In Slovakia, they mediated and organized 117 online lectures focusing on the topic of basic principles of sustainable construction. Members and partners of the council actively participated in further education. They organized 130 lectures and 8 interactive excursions with workshops. In total, they recorded approximately 3,100 participations in 2021-2022 in these professional activities. The goal was to increase the professional readiness and motivation of students, while also spreading awareness about sustainable and high-quality construction. The project was launched in November 2019. Other professional activities include the annual organization of the Sustainability in Architecture and Construction conference. The 11th Green Building Week included, for example, the Sustainable Buildings and Sustainable Materials event focused on sustainable construction and increasing the efficiency of off-site construction with an emphasis on the pre-project and project phases. Here, experts also focused on optimizing processes, reducing the carbon footprint and reducing waste. In addition to circular waste management, the topic was also modular construction. The week also included an event focused on a healthy indoor environment and an event focused on the topics of green financing and investing in sustainable projects and the EU taxonomy.

Buildings for the Future is the largest professional interest association for the building sector in Slovakia. Through our 9 member organizations, we represent almost 900 entities active in the field of quality construction, renovation and operation of buildings. Since the establishment of the association in 2013, the main mission has been to actively participate in the creation of public policies that affect the construction and renovation of buildings, with an emphasis on energy efficiency, a healthy indoor environment and sustainability.

The Association for the Support of the Renewal of Apartment Buildings focuses on supporting activities aimed at helping cities and municipalities in the Slovak Republic to restore their housing stock and its immediate surroundings so that it meets current requirements and modern trends. It supports professional growth and personal development through professional conferences and educational activities and other social events.

The Association for the Insulation of Buildings (OZ ZPZ) is a civil, professional association of legal and natural persons working in the field of insulation of building envelopes. It focuses on raising the awareness of the professional and non-specialist public about the benefits and conditions of applying thermal insulation systems for the benefit of the final consumer and on supporting the use of thermal insulation systems leading to long-term ecologically, economically, and energetically positive effects. The goal is to support a high standard of compliance with the quality conditions for the production and implementation of thermal

insulation systems and to support the harmonization of standards and regulations on thermal insulation systems and standards with the standards and regulations of the European Union.

The Slovak Society for Environmental Technology (SSTP) is a voluntary association that brings together scientific and technical workers, educators, students, and practitioners from the field of environmental technology and technical building equipment. It mainly focuses its activities on educational, publishing, and international activities. Every year we organize around 30 professional events, some of which already have a long-standing tradition, such as conferences Heating, Ventilation, and air conditioning, Sanhyga, Indoor climate of buildings, Measurement and calculation of heat. SSTP is a member of the Association of Slovak Scientific and Technical Societies (ZSVTS) and a member of the European Federation of Heating, Ventilation and Air Conditioning Companies REHVA SSTP is also a guarantor of professional activities in the field of TZB and environmental technology in Slovakia.

SLOVENERGOokno, an association of manufacturers and sellers of windows, doors, glazed walls, light exterior cladding and suppliers of related components, technologies and materials for installing windows. It prepares conferences, seminars and workshops for members and supporters, they are also a contractual organization of the accredited inspection body TSÚS, n.o. for the training of window and door installers to obtain a license for the installation of external opening structures, which is necessary for proving applicants for subsidies for insulation and replacement of window structures.

The Association for Better Administration of Apartment Buildings is an association in the field of administration in Slovakia. It organizes seminars and workshops and the BETTER FACILITY MANAGEMENT congress, aimed at increasing awareness and supporting the quality of administration in apartment buildings.

Other associations and interest associations operating in the field of energy and electromobility:

- Slovak Association of Photovoltaic Industry and RES (SAPI),
- Association of energy suppliers
- Slovak Battery Association (SBaA),
- Slovak Association for Electromobility (SEVA),
- Cluster of Energy Communities of Slovakia (KEKS)
- Consumer protection society

In the field of training of installers of equipment for renewable energy sources in accordance with Directive 2009/28/EC is currently in force Decree of the Ministry of Economy of the Slovak Republic No.133/2012 Coll., which establishes the scope of training, the scope of the

examination, details on the establishment and operation of examination commissions and the content of the certificate for installers, and according to the **Act No. 309/2009 Coll. on the promotion of renewable energy sources and high-efficiency combined production** in § 13a provided for the possibility of obtaining a certificate for installers since 2011. The training of installers is aimed at acquiring theoretical knowledge and practical skills for installation:

- **biomass boilers and stoves**
- **photovoltaic systems and solar thermal systems,**
- **shallow geothermal systems and**
- **heat pumps.**

The training of installers in these areas can be considered as examples of existing best practices in the field of education on the use of RES in buildings.

The following companies are active and provide training in this field:

Slovak Association of Photovoltaic and RES Industry (SAPI) is a non-governmental professional interest association whose main mission is to support the development of sustainable renewable energy in Slovakia. Since its establishment in 2010, SAPI has actively participated in the development, commenting and approval of legislation in the field of energy with an emphasis on the development of RES. At the domestic level, we represent the renewable energy sector in negotiations with institutions such as the Ministry of Health, ÚRSO, OKTE, SEPS and the National Assembly of the Slovak Republic. We also regularly communicate with distribution companies and the media. In addition to monitoring legislative processes, SAPI is also involved in training its members and interested entrepreneurs, installers and those interested in photovoltaics. The Association is the only one in Slovakia to organize specialized events focused exclusively on photovoltaics and RES.

In the field of training of installers for renewable energy sources in accordance with Article 14 of Directive 2009/28/EC of the European Parliament and of the Council, the training is carried out by the educational programme "**Training for renewable energy sources**". The purpose of this training is to obtain a certificate authorising the installation of photothermal and photovoltaic systems within the framework of the **Green Households project**.

- Professional training for installers of photovoltaic systems
- Training for installers of solar thermal systems
- Combined module PV+FT (photovoltaic and photothermal systems)

The training is accredited, combined with an examination and issuance of a certificate for installers of small energy sources according to the Act on the Promotion of Renewable Energy Sources No. 309/2009 Coll.

Persons who have already successfully completed this training in the past have been issued a Certificate for Installer in the relevant field by the Ministry of Economy of the Slovak Republic.

This certificate is valid for 5 years. It can be extended once for a further 5 years on condition that the holder must undergo refresher training. These programmes are a joint project of **SAPI and THERMO|SOLAR Žiar s.r.o.** and fully comply with the requirements of the Decree of the Ministry of Economy of the Slovak Republic 133/2012 Coll. The training is combined with an examination and issuance of a certificate for installers of small energy sources according to the Act on the Promotion of Renewable Energy Sources No. 309/2009 Coll.

The Slovak Association for Refrigeration and Air Conditioning Technology (SZ CHKT) is an independent, selective, self-governing organization, professional and trade association with legal personality, non-business nature. It is active in the field of refrigeration and air-conditioning technology as well as heat pumps. Its main activities and tasks include the organisation and promotion of the exchange of experience, the development of professional knowledge and the publication of professional, informative periodicals, catalogues, professional publications and the organisation of seminars, conferences, symposia, etc., It also participates in the creation of laws, standards, regulations, directives, research, development, testing in the field of refrigeration and air-conditioning technology. **It provides basic training for mechanics and technicians of refrigeration and air-conditioning equipment, training and testing of heat pump installers, basic and update accredited training** according to the methodology of SZ CHKT and EHPA (European Heat Pump Association) in accordance with Directive 2009/28/EC and Decree of the Ministry of Health of the Slovak Republic No. 133/2012Z.z. **309/2009 Coll. on the Promotion of Renewable Energy Sources and High Efficiency Combined Production and on Amendments and Additions to Certain Acts, as amended**.

The basic training on heat pumps focuses on the following areas:

- cooling circuits and energy efficiency;
- heat sources;
- buildings and hydronic systems;
- buildings self-generating electricity;
- installation and commissioning;
- measurements on cooling and heating circuits;
- energy, economic and ecological calculations;
- assessment of correct installation and operation;
- risk assessment, quality systems, guarantees.

Update of the training on heat pumps focuses on the areas of:

- changes in legislation, data reporting;
- transfer of heat pump map to company website;
- presentations by applicants on the selected CHP installed or designed by them.

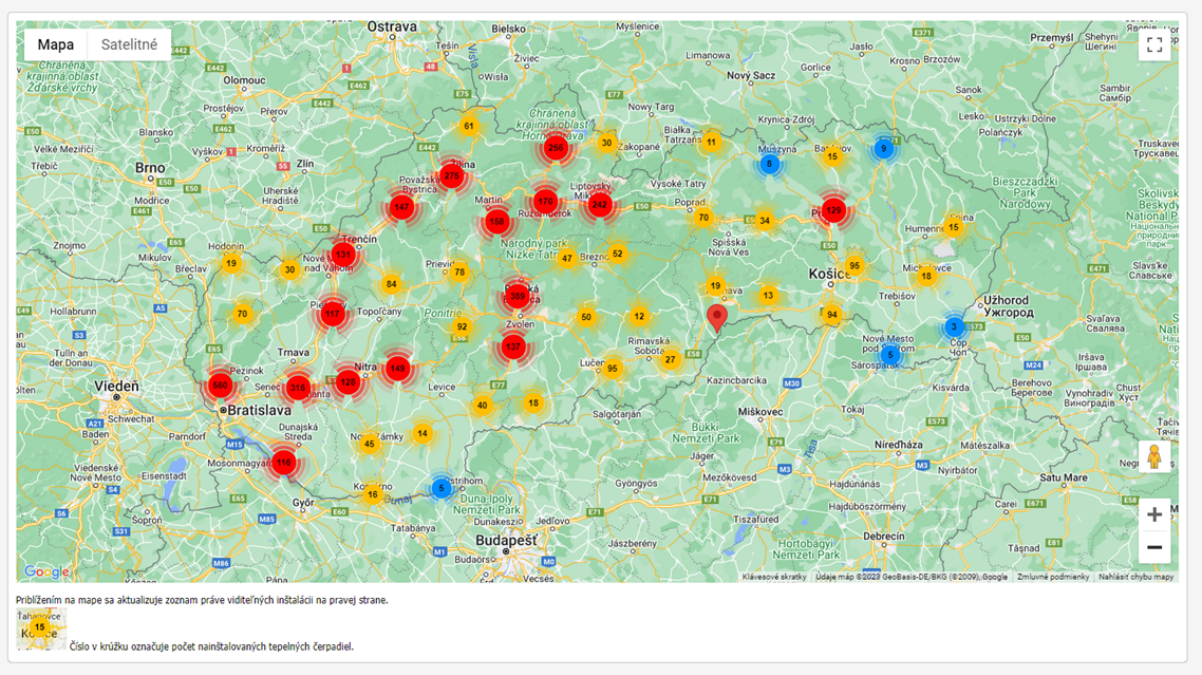
Within its remit, it maintains **data on heat produced by heat pumps in accordance with the EC Decision of March 2013 for the years 2007-2018**, and on its website - https://mapatepelnychcerpadiel.sk/ it records a map of installed heat pumps and a map of renewable energy systems in the EU and Slovakia by type of heat pump (air-to-air, air-to-water, water-to-water, waste air-to-water), location and the company that installed it. It keeps a **register of professionals certified to install heat pumps, certified according to EHPA**[28] and certified organisations to install heat pumps. As of 30 June 2023, **740 installers** have been certified under the Act and have also complied with EHPA requirements.

Table 33-Numbers of certificates issued for heat pump installers[29]

Number of issued certificates for heat pump installers according to § 13a of Act No. 309/2009 Coll. on the promotion of RES and high-efficiency combined production												
Year	2012	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	**Spolu**
Number of issued certifica-tes	8	72	141	57	24	33	46	65	85	125	84	**740**

Obrázok 2-Mapa inštalovaných tepelných čerpadiel

[28] https://www.szchkt.org/a/databaza/odbornici/tepelne_cerpadla
[29] Source: https://www.economy.gov.sk/energetika/obnovitelne-zdroje-energie/osvedcenia-pre-instalaterov?csrt=5079519865190487230



The certificate is required for installations financed/co-financed by public sources (including EU sources). Their number is not yet sufficient for a wider campaign to make substantial progress in replacing carbon-based sources for heating and hot water with heat pumps (thus replacing gas imported from Russia) or RES to reverse their under-utilisation in the building energy mix. Heat pump and RES installers are also trained for the profession in 3 apprenticeship courses in secondary schools:

- Building Energy Equipment Technician;
- Electrical mechanic - refrigeration and heat pumps;
- Plumber.

However, the number of students in these courses is limited by the secondary school founders (they decide on new and existing apprenticeship courses and the number of students who can be admitted to the first year for specific courses), despite the high need for apprenticeship and interest in recent years, in some cases the numbers have even been reduced.

d) Companies

Companies in the construction and energy sectors themselves are also involved in education. They are mainly manufacturers and suppliers of various building materials, technologies, and systems of technical building equipment. However, their activity is coordinated to a large extent through the various associations already mentioned above operating in the subject area.

7 RELEVANT PROJECTS

7.1 Introduction

For over decade, buildings have been identified as key sector for clean energy transition, key for twin climate-digital transition and for achieving the climate neutrality by 2050. Consequently, the needed skills, knowledge, and competences for facilitating this transition have been in the focus of the stakeholders participating in the Build Up Skills Initiative since its start. In 2013, the stakeholders in Slovakia agreed on a roadmap aimed at making a step change in education and training of craftsmen, on-site workers, middle and senior level specialists in the buildings sector.

The present report aims at evaluating effectiveness of this roadmap in the meaning of the level of results from the actions of stakeholders it triggered in years 2013-2020. The following rating of the effectiveness were adopted for the assessment:

Level 1: The action was completed, and the expected impact and outcomes were delivered;

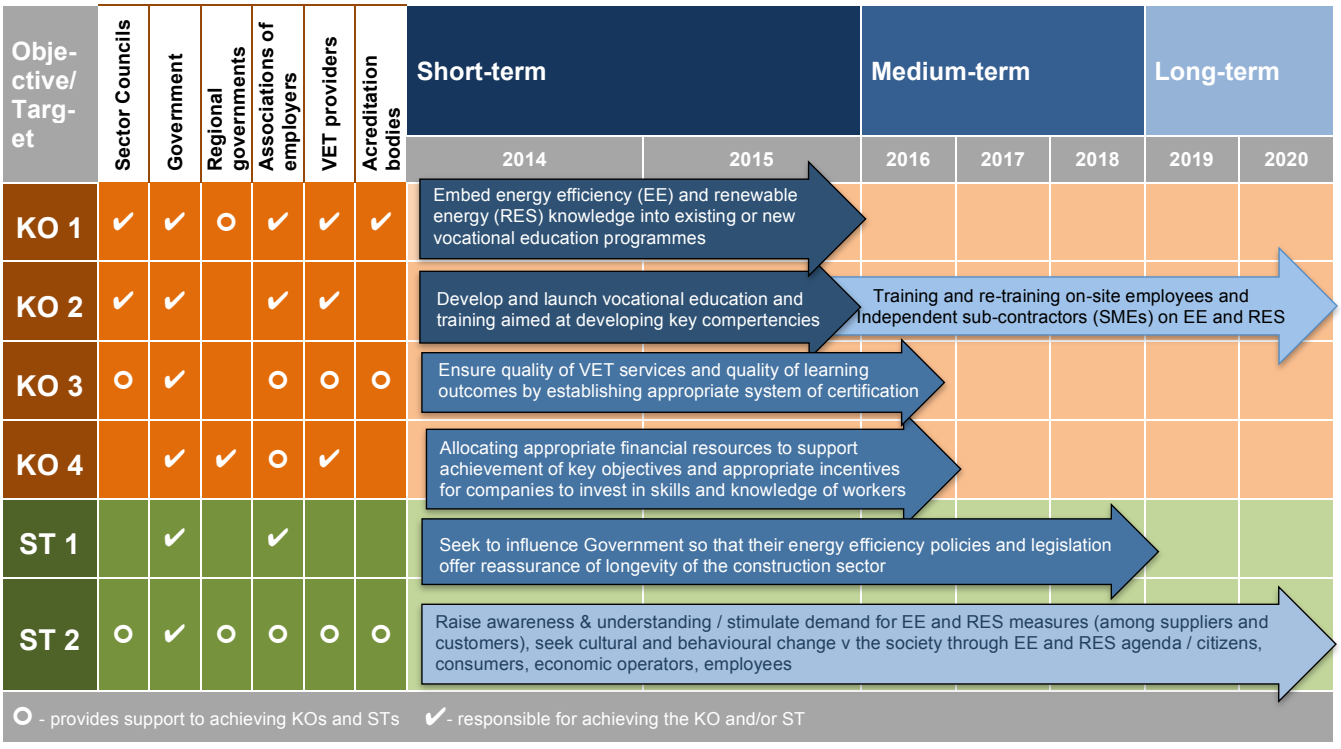
Level 2: The action was completed partially but the expected impact and outcomes were delivered;

Level 3: The action was completed partially, and the expected impact and outcomes were partially delivered;

Level 4: The action was completed partially, and the expected impact and outcomes were not delivered;

Level 5: The action is still in implementation and the impacts and outcomes cannot be assessed yet;

Level 6: The action was not taken because circumstances changed, and the action was not needed;



Level 7: Action not taken because support from key stakeholders has waned.

The stakeholders agreed in the roadmap on **4 key structural and operational objectives (KO)**.

These objectives, including the identification of the stakeholders responsible for achieving them and/or providing support, and respective deadlines are:

The structural objectives were to be delivered through implementing measures focusing on systematic changes (new programmes, changes in the content of the existing programmes) and qualification and certification schemes. Operational objectives were focused on activities concerning vocational education and re-training of workers in the building sector.

The stakeholders also identified **2 supporting objectives (SO)**. Supporting objectives were focused on supporting the need of new intelligent solutions and use of renewable energy sources (focusing on customers served by the construction and energy sectors). These objectives were also focused on the total change in the population behaviour, without which it would be not realistic to achieve the 2020 energy objectives.

For achieving these objectives, the stakeholders agreed on 21 measures to be implemented.

The outcome of the assessment is:

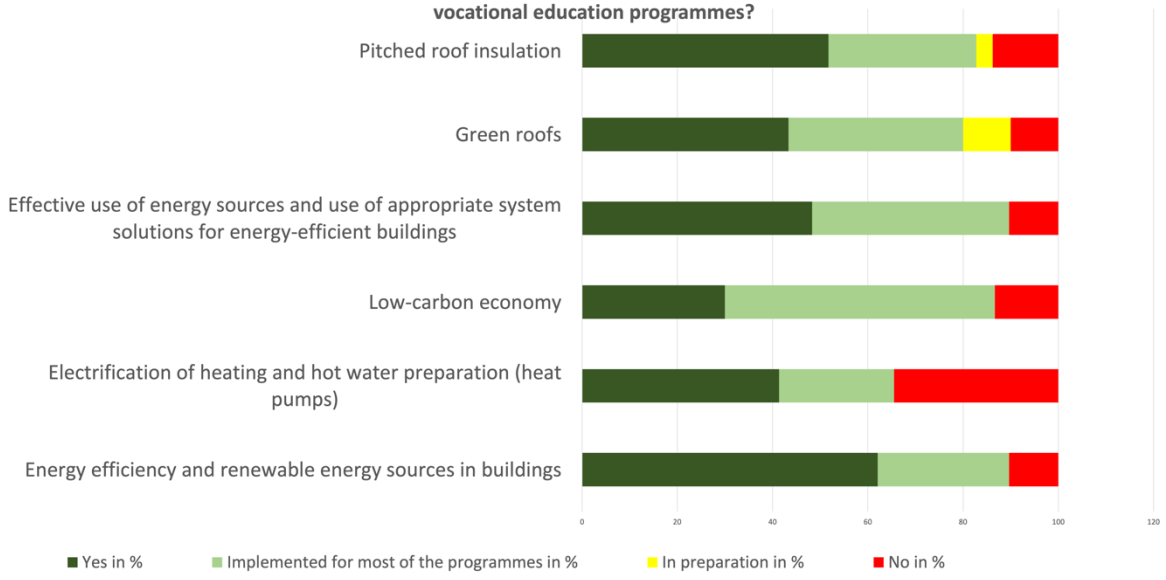
Objectives	Level of Effectiveness	Description of the objective	Employers	Sector Skills Councils	Training providers	Government	Regional	Accreditation bodies
KO1	**1**	Embed energy efficiency (EE) and renewable energy sources (RES) in existing or new further vocational training	✓	✓	✓		O	✓
KO2	**1**	Develop and launch further education and training aimed at developing key competences	✓	✓	✓	O		✓
KO3	**1**	Ensure quality of further vocational training and effectiveness of acquiring the targeted learning outcomes by establishing appropriate system of certification	✓	✓	O			✓
KO4	**3**	Allocating appropriate financial resources to support achievement of key objectives appropriate incentives for companies to invest in skills and knowledge of on-site workers	✓		O	✓	O	
KO5	**5**	Embedding the energy efficiency and use of RES in buildings in vocational programmes for apprentices.	✓	✓	✓	✓	✓	✓

Objectives	Level of Effectiveness	Description of the objective	Employers	Sector Skills Councils	Training providers	Government	Regional	Accreditation bodies
SO1	1	Seek to influence the government so that their energy efficiency policies and legislation offers reassurance of longevity of the construction sector	✓	✓				
SO2	2	Raise awareness and understanding / stimulate demand for EE and RES measures (among suppliers and customers), seek cultural and behavioural change in the society through EE and RES agenda (among citizens, consumers, economic operators, employees)	✓			✓	O	

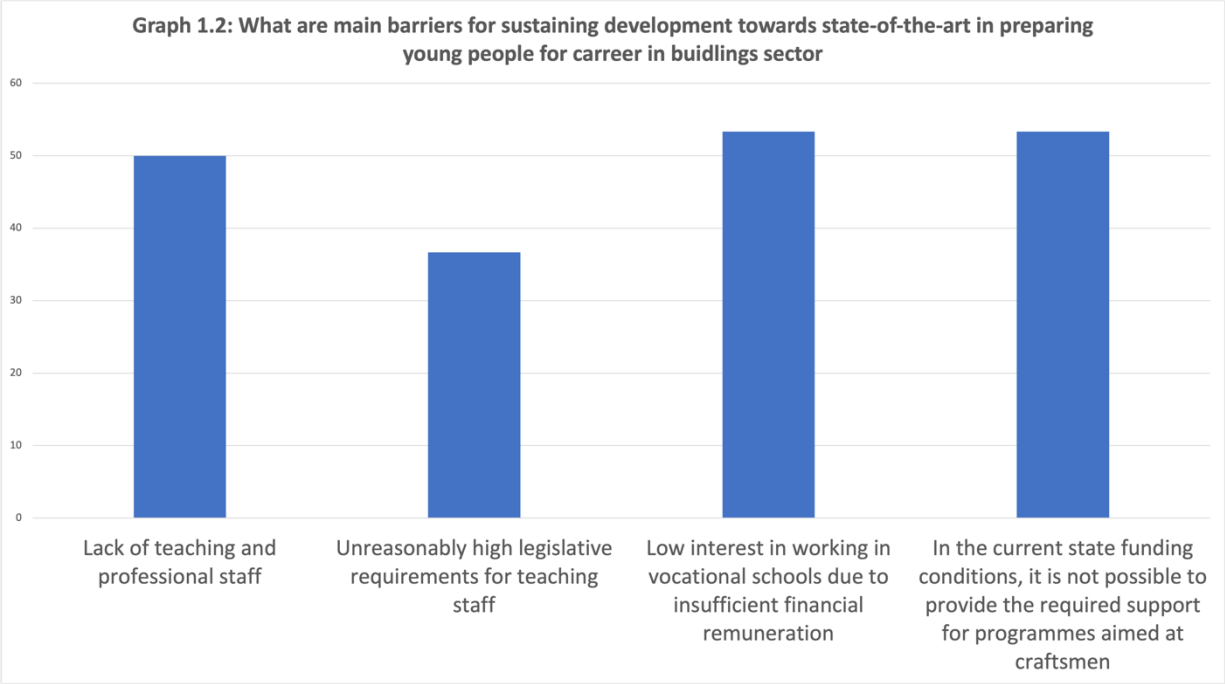
The details and justification of the assessment are provided in Sections 3 to 5 of this report. They include details on the assessment of effectiveness of all 21 measures agreed in the roadmap.

The outcomes of the assessment carried out were independently confirmed in the survey among educational institutions involved in vocational training. As is shown in Graph 1.1, the energy efficiency and use of renewable energy sources is well embedded in the education and training programmes.

Graph 1.1: Is energy efficiency and use of renewable energy sources in buildings embedded in your vocational education programmes?



The main barrier remains financing of the vocational schools at secondary level. The 4 top barriers are shown in Graph 1.2.



7.2 Build Up Skills in Slovakia

The overall national strategies in the building sector to contribute to the EU 2020 energy targets were underpinned by two pillars of the national energy policy – energy efficiency and sustainable development. Two key priorities followed by these strategies are:

- Increasing energy efficiency of buildings in life-cycle perspective and decrease energy needs:
  a) in primary energy consumption, and
  b) in final energy consumption considering the overall CO2 footprint of buildings;
- Increasing the share of renewable sources of energy in saturating the energy needs of buildings in life-cycle perspective.

In 2012 and 2013, Slovakia participated in the Build Up Skills Pillar I project managed by EACI (later EASME, now CINEA) to analyse a status quo in the level of competencies available in the Slovak buildings sector, future needs and obstacles for improvement and investments needed in skills and knowledge of human resource in the buildings sector. Although the Pillar I project was aimed at craftsmen and on-site workers in the sector of buildings, the Slovak team used this opportunity to address also several middle and senior level professionals, as the needs in this area were of the same urgency and needed to be addressed should the objectives in energy efficiency of buildings and use of renewable energy sources be delivered. Moreover, considering the specific situation in Slovakia, not addressing these needs in middle and senior level professions in the sector of buildings would undermine the effectiveness of achieving the expected impact of the action focused on craftsmen and on-site workers.

The agreed and endorsed roadmap anticipated leadership of employers in the process, with support of universities, accreditation bodies (ministries in charge of education), file managers of relevant governmental policies (ministries in charge of energy policies, including

achievement of EU 2020 targets, ministries in charge of the construction sector etc.), social partners and suppliers of services related to preparing and delivering construction works, construction materials, machinery, technology and equipment that is essential for achieving the set objectives.

The roadmap considered the major obstacles identified in status quo analysis and triggered major follow-up activities, including but limited to numerous projects and:

- Facilitated dialogue and cooperation between world of continuing education and training, world of work and policy makers in the area of continuing education and training, essential for triggering a qualitative and quantitative step-change in delivering continuing education and training on energy efficiency and use of renewables in buildings for craftsmen, on-site workers, middle and senior level professionals;
- Increased transparency of companies' needs in developing skills, knowledge and competencies in the energy efficiency and use of renewables in buildings, so educational institutions could effectively build programmes targeting specific needs and demand of companies;
- Triggered the flow of information on new technologies, materials, machinery and equipment, as well as on qualitative requirements, technology, work safety and protection of human health from construction companies, suppliers of materials, machinery, technology and equipment to education institutions to ensure continuous improvement of their training programmes;
- Increased accessibility of continuing education and training for learners and educational institutions, and access to study materials on the subject and facilitated efficient investments of companies in improving competencies of their craftsmen and other on-site workers, middle and senior level professionals.

This report is providing assessment of effectiveness of the roadmap in the meaning of the level of results from the actions of stakeholders it triggered. After consulting the stakeholders from the NQP, the following rating of the effectiveness were adopted for the assessment:

Level 1: The action was completed, and the expected impact and outcomes were delivered;

Level 2: The action was completed partially but the expected impact and outcomes were delivered;

Level 3: The action was completed partially, and the expected impact and outcomes were partially delivered;

Level 4: The action was completed partially, and the expected impact and outcomes were not delivered;

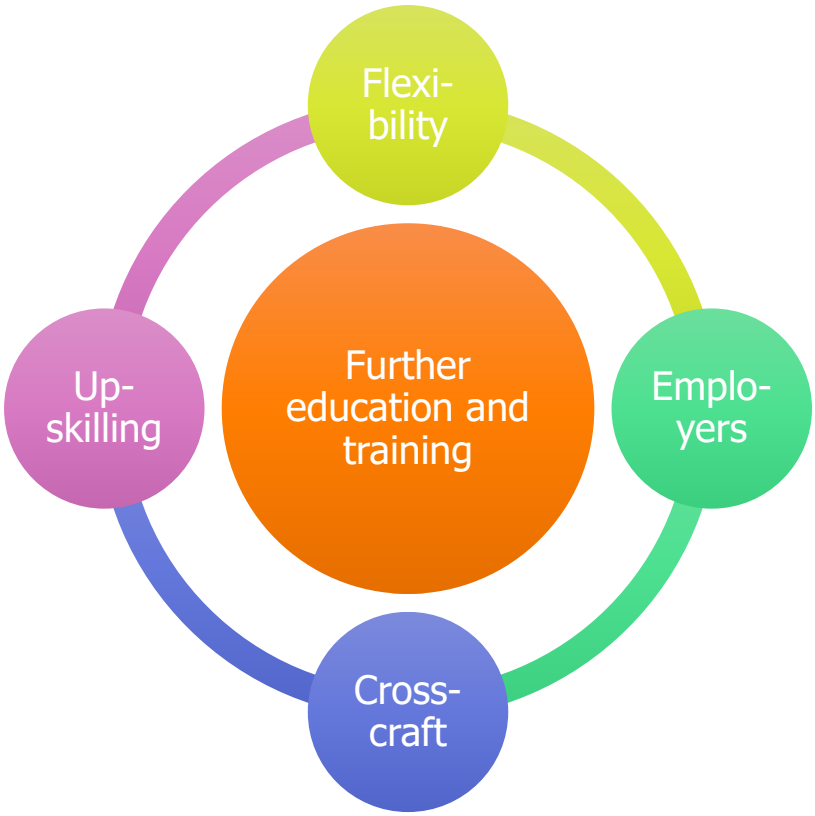
Level 5: The action is still in implementation and the impacts and outcomes cannot be assessed yet;

Level 6: The action was not taken because circumstances changed, and the action was not needed;

Level 7: Action not taken because support from key stakeholders has waned.

7.3 Implementing the set strategy

The strategy to overcome the barriers identified in Build Up Skills Status Quo Analysis (SQA) has been providing support to continuing education and training to the targeted learners on energy efficiency and use of renewable energy sources in buildings that will bring an added value to the learners and the companies in the Slovak building sector. It has been underpinned by four pillars:



Involving employers in continuing education and training to tailor-made education and training for the needs of enterprises and adapted to practical conditions of companies to increase the practical aspects of training and efficiency of invested costs on employee education and training. This has been effectively achieved by involving employers as coordinators and/or partners and/or collaborators on the projects developing and testing continuing education and training programmes, for example involving:

- Employers such as Association of Construction Entrepreneurs of Slovakia (ZSPS) – StavEdu, ingREeS, CraftEdu, NewCom, Net-Ubiep;
- Sector Skills Council for the Construction Sector chaired by ZSPS and affiliating not only employers but also social partners and other key stakeholders;
- Professionals' organisations such as Slovak Chamber of Civil Engineers (SKSI) – ingREeS, SeeTheSkills;
- Guilds such as Guild of Roofers, guild of window installers SLOVENERGOOKNO – StavEdu, CraftEdu.

Moreover, these employers' associations, professional organisations and guilds were drivers of the actions triggered by the project and key contributors on the skills, knowledge and competences needs.

Education flexibility: modular training courses with the possibility of cumulating credits, and education making use of the latest information and communication technologies, e.g., e-learning. Such approach was the basis for ingREeS, Net-Ubiep and CraftEdu projects allowing to tailor the courses to the specific audience by creating training modules/clusters that can be combined to create these tailor-made courses. This modular structure also provides easy possibility to add new modules or update modules integrating new knowledge and technical progress or remove obsolete modules from the courses.

Cross-sectoral approach to education and training focused on energy efficiency and use of renewable energy sources in buildings to motivate innovations in the target area was achieved by:

- Building a cross-sectoral training courses for groups of craftsmen, where close collaboration is needed due to sequence of works in the workflow – e.g., StavEdu, Net-Ubiep;
- Embedding cross-sectoral aspects in the training courses for specific craft to ensure good cooperation with other crafts on-site critical to the quality of the work and ensuring technological compliance with the relevant standards (CraftEdu, ingREeS, Net-Ubiep).

Retraining, upskilling: specific programs were be implemented considering the economic and social situation in Slovakia. Retraining included existing employees and tradesmen providing work and services in the building sector with the established trades (by completing the relevant 3- or 4-year long vocational education and training or with recognised prior learning) and aimed at developing new skills, knowledge and competences specifically linked to increasing energy performance of buildings and use of renewable energy sources in the energy mix of buildings. This was the case in all projects implemented in Slovakia under Build Up Skills initiative.

Retraining of unemployed persons has been the competence of the state and the employers did not have access to these activities. There is no knowledge such retraining led to fil the gaps on the labour market in respect of targeted qualifications/professions.

The activities under Build Up Skills initiative were underpinned by key actors that was organised into two groups:

- **Network of stakeholders** underpinning the dissemination of the training – this network was formed by active members of the National Qualification Platform (NQP), adding new stakeholders, for example, companies from the building sector and vocational schools (providers of the vocational education and training). This network was reinforced by the projects StavEdu and CraftEdu. This network was aided by two key state agencies: National Institute of Lifelong Education (NUCZV) and Slovak Innovation and Energy Agency (SIEA). These agencies participated to the project StavEdu, ingREeS and CraftEdu as partners;
- **Competence Centre** consisting of experts from ZSPS, UVS (Institute of Education and Services) and ViaEuropa Competence Centre that collaborated on developing and

implementing new initiatives and projects. The impact of the activity of this competence centre was enhanced through cooperation with the above-mentioned state agencies and Sector Skills Council in the Construction Sector.

As of today, the network of stakeholders includes companies, universities, vocational schools, and operators in building value chain summarised in Table 34.

Table 34

No.	Name of the organisation	City
1	Stredná odborná škola stavebná, Nitra	Nitra
2	Innovia, s.r.o.	Trnava
3	Stavoinvesta Dunajská Streda, s.r.o.	Dunajská Streda
4	Ipeľské tehelne, a.s.	Lučenec
5	STU BA, Stavebná fakulta	Bratislava
6	Slovenergookno, n.o.	Bratislava
7	SCHIEDEL Slovensko, s.r.o	Zamarovce
8	STRABAG Pozemné a inžinierske staviteľstvo, s.r.o.	Bratislava
9	Chemostav, a.s.	Poprad
10	Stredná odborná škola stavebná - ÉSzKI	Nové Zámky
11	Cech strechárov Slovenska	Bratislava
12	Kerkotherm, a.s.	Košice
13	STU BA, Stavebná fakulta	Bratislava
14	IMOS – Systemair, a.s.	Kalinkovo
15	HERZ, spol. s.r.o.	Bernolákovo
16	Ústav vzdelávania a služieb, s.r.o.	Bratislava
17	VIEGA, s.r.o.	Praha
18	ZEUS PB, s.r.o.	Dunajská Streda
19	Beztech, s.r.o.	Miloslavov
20	TERRASTROJ spol. s.r.o.	Bratislava
21	KUHN – SLOVAKIA, s.r.o.	Senec
22	MTS – com, s.r.o.	Stupava
23	Stredná odborná škola stavebná,	Nové Zámky
24	Stredná odborná škola technická, Prešov	Prešov
25	Technická univerzita v Košiciach – Stavebná fakulta	Košice
26	Stredná odborná škola technológií a remesiel	Bratislava
27	Stredná priemyselná škola elektrotechnická	Bratislava
28	Stredná odborná škola elektrotechnická	Liptovský Hrádok
29	Stredná odborná škole elektrotechnická Trnava	Trnava
30	Spojená škola Kremnička 10	Banská Bystrica
31	Stredná priemyselná škola, Mnoheľova 828	Poprad
32	Stredná odborná škola technická, Nitrianska 1731/81	Šurany

No.	Name of the organisation	City
33	Stredná odborná škola polytechnická, SNP 2049/2	Zlaté Moravce
34	Stredná priemyselná škola, Komenského 5	Bardejov
35	SOŠ elektrotechnická, Zvolenská cesta 18	Banská Bystrica
36	Stredná priemyselná škola J. Murgaša	Banská Bystrica
37	Spojená škola, Medvedzie 1	Tvrdošín
38	Stredná odborná škola technická, Komenského 37	Námestovo
39	SPŠ stavebná v Žiline	Žilina
40	Stredná odborná škola elektrotechnická Žilina	Žilina
41	SOŠ polytechnická	Humenné
42	Stredná priemyselná škola elektrotechnická, Komenského 44	Košice
43	SOŠ techniky a služieb, Pod amfiteátrom 7	Levice
44	SOŠ Tisovec, Jesenského 903	Tisovec
45	SOŠ Handlová, Lipová 8	Handlová
46	SOŠ techniky a služieb, Cintorínska 4	Nitra
47	SPŠ Stavebná, Konkolyho 8	Hurbanovo
48	SOŠ technická, Hviezdoslavova 5	Rožňava
49	SOŠ technická, Dukelských hrdinov 2	Lučenec
50	Stredná odborná škola technická	Stará Ľubovňa
51	Stredná odborná škola technická	Nižná
52	SOŠ, Terézie Vansovej 32	Prievidza
53	SOŠ Poľná 1	Veľký Krtíš
54	SOŠ Revúca	Revúca

The activities and projects triggered by BUS initiative were closely connected mainly with the following relevant projects and initiatives in the field of VET:

- The creation of regional training centres for the construction industry on the basis of secondary vocational schools under auspices of the umbrella employers' association to which ZSPS was member;
- Completion of the register of skills, knowledge and competences, qualifications, and occupations under auspices of the Sector Skills Council in the Construction Sector, chaired by ZSPS;
- Cooperation at European level through participating in the initiatives led by FIEC, including European Sector Skills Councils.

Effectiveness level achieved: Level 1 – The action was completed, and the expected impact and outcomes were delivered.

7.4 Reaching to the target groups identified in the roadmap

The roadmap identified a long list of professions linked to increasing energy efficiency and use of renewable energy sources in buildings. The following table summarises the professions from

this list covered by projects developed and implemented under BUS initiative and activities to which BUS initiative contributed:

Table 35

No.	Profession	Covered by BUS project
1	Bricklayer (bulk production), incl. insulator and plasterer	StavEdu
2	Roofer	StavEdu, NEWCOM, CraftEdu
3	Window installer/construction opening filling installer	StavEdu, CraftEdu
4	Hydro insulator	StavEdu, CraftEdu
5	Assembler of light building envelopes	StavEdu
6	Concrete and steel worker	StavEdu
7	Construction machinery operator	StavEdu
8	Crane operator	StavEdu
9	Scaffolding assembler	StavEdu
10	Assemblers of concrete and steel structures	StavEdu
11	Wooden structure assembler	StavEdu
12	Mason	StavEdu
13	Chimney sweeper and builder (installer)	StavEdu, CraftEdu
14	Floorer	StavEdu
15	Painter, paperhanger, tile setter, paver	StavEdu
16	Dry mounting assembler, plasterer	StavEdu
17	Construction locksmith	StavEdu
18	Plumber, installer of sanitary equipment	StavEdu
19	Installer of heating, cooling and water preparation equipment	StavEdu
20	Construction carpenter, carpenter	StavEdu, CraftEdu
21	Locksmith (for heritage buildings)	PRO-Heritage
22	Electrician of power distribution systems	StavEdu, CraftEdu
23	HVAC installer	StavEdu, NEWCOM
24	Building energy equipment technician	StavEdu, CraftEdu
25	Photovoltaic system installer	StavEdu, CraftEdu
26	Building lighting system installer	StavEdu
27	Solar energy technician	StavEdu
28	Renewable energy technician	StavEdu
29	Technician of low-carbon operations	CraftEdu
30	Low-current electrician	StavEdu, CraftEdu

Besides these professions, BUS projects to which Slovakia participated responded to the changing environment and new emerging needs and covered additional professions and functions:

- Electrician for smart electro installations (CraftEdu project);

- Building Information Management (BIM) – BIM for public administration, BIM for building owners, BIM for facility managers, BIM for technicians, BIM for professionals (Net-Ubiep project).

Although the scope of the BUS Pillar 1 project was limited to on-site workers and crafts persons, the roadmap identified several middle and senior level professionals as essential for achieving the objectives in increasing energy performance of buildings. The BUS projects to which Slovakia participated, covered those which were not covered by a special procedure regulated by the state, for example:

- Architects/planners (ingREeS project);
- Site managers (ingREeS project);
- Site supervisor (ingREeS project);
- Sustainability/Energy Advisor (ingREeS project);
- Assessor of the achieved energy performance (ingREeS project).

Effectiveness level achieved: Level 1 – The action was completed, and the expected impact and outcomes were delivered.

7.5 Achieving the overall objectives of the roadmap

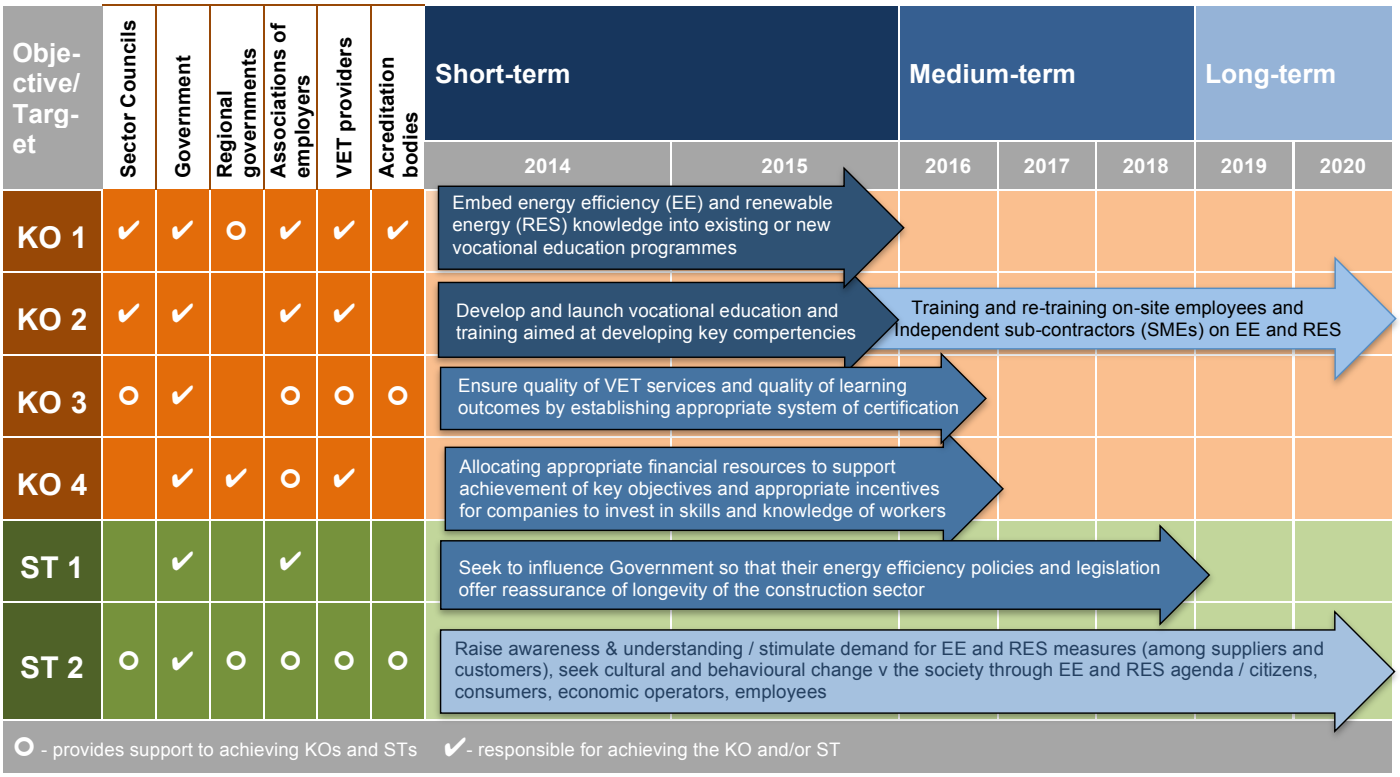
In the 2013 roadmap, the key structural and operation objectives were agreed together with supportive objectives, as shown in Picture 1. This picture illustrates:

- Four key structural and operational objectives (KO) and two supporting objectives (ST) which represented the basis of the roadmap;
- Recommended milestones, in which the defined objectives were to be achieved to meet the EU2020 energy targets (the objectives were divided into short-term ones: 2014 – 2015, medium-term objectives: 2016 – 2018 and long-term objectives: 2019-2020);
- Involvement of the main stakeholders who were responsible for achieving the objectives or who were to play an important role in the process of achieving these objectives.

Key objectives were divided into two groups:

1) Key structural and operational objectives (KO). The structural objectives were to be delivered through implementing measures focusing on systematic changes (new programmes, changes in the content of the existing programmes) and qualification and certification schemes. Operational objectives were focused on activities concerning vocational education and re-training of workers in the building sector.
2) Supporting objectives (SO). Supporting objectives were focused on supporting the need of new intelligent solutions and use of renewable energy sources (focusing on customers served by the construction and energy sectors). These objectives were also focused on the total change in the population behaviour, without which it would be not realistic to achieve the 2020 energy objectives.

Picture 1



The next two sub-sections are providing the assessment of the effectiveness of the measures that were agreed in the 2013 roadmap to deliver the set objectives illustrated in Picture 5.1.

7.6 Assessment of the effectiveness of the measures aimed at achieving the key structural and operational objectives

The assessment is summarised in Table 36.

Table 36

Objectives	Level of Effectiveness	Description of the objective	Assessment of implementation	Employers	Sector Skills Councils	Training providers	Government	Regional	Accreditation bodies
KO1	**1**	Embed energy efficiency (EE) and renewable energy sources (RES) in existing	Objective achieved, BUS StavEdu, H2020 ingREeS, CraftEdu, Net-Ubiep, NEWCOM projects developed new further vocational training for craftsmen and on-site workers on EE	✓	✓	✓		O	✓

Objectives	Level of Effectiveness	Description of the objective	Assessment of implementation	Employers	Sector Skills Councils	Training providers	Government	Regional	Accreditation bodies
		or new further vocational training	and use of RES in buildings. Moreover, H2020 ingREeS developed new further vocational training for middle and senior level construction professionals on EE and use of RES in buildings. These projects were implemented in close collaboration with the educational institutions, for example 2nd grade vocational schools (certified as training centres). This is why the projects had a spill-over effect to the vocational education. The defined ULOs, training material and the resources developed and collected (also internationally) were used for developing vocational education and training programmes. In most cases, the projects were the first and key source of up-to-date knowledge, material and practice that provided vital input to these programmes. Today, the vocational schools can ensure continuity of the work on adapting the training programmes. Nevertheless, they are lacking again the resources on the latest innovations such as digital layer, modular and off-site construction, Zero Emission Buildings etc.						
KO2	**1**	Develop and launch further education and training aimed at developing key competences	BUS StavEdu launched the National Qualification and Further Education Scheme for craftsmen and on-site workers on EE and use of RES in buildings and piloted the programmes. H2020 ingREeS project set up new National Qualification and Training Scheme for middle and senior level	✓	✓	✓	O		✓

Objectives	Level of Effectiveness	Description of the objective	Assessment of implementation	Employers	Sector Skills Councils	Training providers	Government	Regional	Accreditation bodies
			construction professionals on EE and use of RES in buildings and trained 400 professionals in Slovakia. These schemes were complemented by new modules such as Construction 4.0. H2020 projects Net-Ubiep, NEWOM and CraftEdu further developed programmes for continuing training of craftsmen, on-site workers, and technicians defined in the 2013 roadmap.						
KO3	**1**	Ensure quality of further vocational training and effectiveness of acquiring the targeted learning outcomes by establishing appropriate system of certification	The objective was achieved. Both national schemes established are qualification schemes with assessment of the acquired learning outcomes based on the agreed assessment standards. The projects facilitated developing solutions for cross-craft qualifications of craftsmen ("nano degrees"), accreditation of cross-craft training programmes according to EU and national legislation. Valorisation of the qualifications acquired will has been increased through mutual recognition of qualifications tested by H2020 NEWCOM project that will build basis for EU-wide mutual recognition of qualifications.	✓	✓	O			✓
KO4	**3**	Allocating appropriate financial resources to support achievement of	Objective still in delivery phase. The financial resources for supporting further education and training have been identified in ESF national operational programme "Human Resources", priority axes 1 and 3.	✓		O	✓	O	

Objectives	Level of Effectiveness	Description of the objective	Assessment of implementation	Employers	Sector Skills Councils	Training providers	Government	Regional	Accreditation bodies
		key objectives appropriate incentives for companies to invest in skills and knowledge of on-site workers	Ministry of Labour and Social Affairs of the Slovak Republic, however, failed to publish the relevant calls for proposals. At the time of this assessment, new promises were made in respect to the new operational programmes. Further efforts are needed to secure financial resources and in motivating operators to invest in skills. Proposals for motivation measures will be further discussed and implemented.						
KO5	**5**	Embedding the energy efficiency and use of RES in buildings in vocational programmes for apprentices.	**NEW OBJECTIVE added in 2017 review of the roadmap.** Developing cross-craft vocational training programme for operators in the construction sector as inception programme for all apprentices and developing specific vocational training programmes for apprentices in cooperation with SMEs. Although aimed at continuing training for craftsmen already having working experience, the H2020 project CraftEdu provided input to the apprentice programmes. The objective is still in implementation.	✓	✓	✓	✓	✓	✓
SO1	**1**	Seek to influence the government so that their energy efficiency policies and legislation offers reassurance of longevity of the	Objective achieved. Ministry of Transport, Construction and Regional Development adopted all necessary policies and implemented supporting policy instrument to meet the Slovakia's commitments under the EPBD.	✓	✓				

Objectives	Level of Effectiveness	Description of the objective	Assessment of implementation	Employers	Sector Skills Councils	Training providers	Government	Regional	Accreditation bodies
		construction sector	The H2020 project GreenDeal4Buildings developed wide stakeholders' dialogue on how the objectives of the European Green Deal, REPowerEU action plan and other policies can be achieved by industry.						
SO2	**2**	Raise awareness and understanding / stimulate demand for EE and RES measures (among suppliers and customers), seek cultural and behavioural change in the society through EE and RES agenda (among citizens, consumers, economic operators, employees)	Implementation of this objective started in 2018 with support of the H2020 projects CraftEdu and NEWCOM. Both projects involved operators and other stakeholders to raise their awareness of the EU requirements linked to the objectives of the European Green Deal, REPowerEU action plan and other policies. This is also promulgated by the new H2020 project GreenDeal4Buildings. This project promotes individual and collective ownership of the energy assets (e.g., by Energy Communities) and smart energy systems that involve the consumers in the energy markets, as outlined in the Commissions Communication "Clean Energy for All Europeans". The new LIFE project BungEES is also focusing on engaging consumers in the energy markets and facilitates their understanding the benefits of the clean energy transition and promotes investments in energy assets at consumer level and thus changing the role of consumers to prosumers.	✓			✓	O	

7.7 Assessment of the effectiveness of the measures aimed at achieving the key structural and operational objectives

The assessment is summarised in Table 37.

Table 37

Measure no.	Level of Effectiveness	Measure adopted in 2013 Roadmap, its scope, and targets	Progress achieved
1.1	1	**Ensure the mandate and the pilot phase of work of the Competence Centre for education in EE and use of RES in buildings (KCEB):** The Competence Centre is a team of professionals and a network of specialised subjects active in VET, which, under the mandate and coordination of employers´ associations in the sector of buildings, develops methodological and educational/training materials in a form of specific projects supported from public resources (EU funds, state budget).	Completed. The Competence Centre is defined and includes today the partners of Build Up Skills and Horizon 2020-construction skills projects. It has no legal personality. Specific objectives were set in the projects that were implemented by the organisations forming the competence centre. The work of the competence centre is underpinned by the network of supporting organisations and companies established by BUS StavEdu project and further developed under follow-up projects as reported in Section 3 of this report.
1.2	1	**Finalise /develop new qualification standards and assessment standards** for the professions included in the Roadmap on EE and RES essential for achieving EU 2020 targets. Incorporate outputs into national system of occupations.	Completed. The qualification standards were reviewed, and the measure triggered the need to develop new qualification standards (QS) and assessment standards (AS). BUS StavEdu and H2020 ingREeS, NEWCOM, Net-Ubiep and CraftEdu developed new QS to include the key skills and knowledge on EE and use of RES. These QS are part of the work of the Sector Skills Council in the Slovak construction sector that is reviewing Slovak NQF linked to EQF.

Measure no.	Level of Effectiveness	Measure adopted in 2013 Roadmap, its scope, and targets	Progress achieved
1.3	1	**Develop a programme for further professional development of employees and craftsmen in the sector of buildings.**	Completed. StavEdu National Qualification and Training Scheme for craftsmen and on-site workers laid the base for further training of craftsmen and on-site workers in the sector of buildings. This scheme was further developed by the H2020 projects CraftEdu, NEWCOM, and Net-Ubiep.
1.4	1	**Develop teaching and methodological materials for embedding intelligent energy solutions in vocational curricula.**	Completed. BUS StavEdu project developed the needed teaching and methodological materials for vocational training at secondary level and H2020 ingREeS project developed the needed materials for vocational training at tertiary level. These resources were further developed and complemented by the H2020 projects CraftEdu, NEWCOM, and Net-Ubiep.
1.5	7	**Develop cross-craft training programmes for apprentices**	Implementation not started yet, as there was not support by the relevant stakeholders.
1.6	7	**Develop programme for improving skills and re-qualification.**	Objective still in delivery phase. The financial resources for supporting further education and training have been identified in ESF national operational programme “Human Resources”, priority axes 1 and 3. Ministry of Labour and Social Affairs of the Slovak Republic, however, failed to publish the relevant calls for proposals. At the time of this assessment, new promises were made in respect to the new operational programmes.
1.7	1	**Monitor the level of professional skills and knowledge of the workforce in the building sector.**	Completed. Slovak Sector Skills Council in the construction sector renewed its work and ensures the needed monitoring. The projects implemented under BUS and H2020 provided input to the work of the Council and closely collaborated with the members of the Council on implementing the project.

Measure no.	Level of Effectiveness	Measure adopted in 2013 Roadmap, its scope, and targets	Progress achieved
1.8	1	**Increase the transparency of the labour market and skills requirements of employers.**	Completed and 2020 objectives achieved. The work on further adaptations of the NQF linked to EQF to technical progress continues. Slovak NQP increases the transparency of the requirements, and the Slovak Sector Skills Council supports cooperation among social partners in developing and upgrading the qualification standards.
1.9	1	**Ensure training and certification in accordance with the Article 14(3) of Directive 2009/28/EC.**	Completed. Established in compliance with Order 133/2012 Coll. Issued by the Slovak Ministry of Economy.
1.10	1	**Ensure training and licensing for ETICS ensuring implementation of requirements of Directive 2010/31/EU.**	Completed. For example, TSUS (partner in Build Up Skills Pilar I project) offers the training and licensing. Further efforts are needed to review the system and lowering price of the licensing to avoid market barriers and barriers to competition.
1.11	7	**Introducing ECVET system in vocational training of apprentices.**	Implementation not started yet, as there was not support by the relevant stakeholders.
1.12	7	**Allocation of necessary resources:** Allocate resources for implementing the measures in this Roadmap. Ensure transparency in the use of ESF for education in Slovakia.	Objective still in delivery phase. The financial resources for supporting further education and training have been identified in ESF national operational programme “Human Resources”, priority axes 1 and 3. Ministry of Labour and Social Affairs of the Slovak Republic, however, failed to publish the relevant calls for proposals. At the time of this assessment, new promises were made in respect to the new operational programmes.
1.13	5	**Dialogue of employers and government on financing further education and training.**	Implementation in progress. The dialogue is facilitated by the H2020 project GreenDeal4Buildings.

Measure no.	Level of Effectiveness	Measure adopted in 2013 Roadmap, its scope, and targets	Progress achieved
1.14	5	**Introduce motivational tools for investments in education:** Introducing motivational tools (tax, grants) for employers involved in cooperation with providers of vocational education and supporting forms of cooperation for vocational education and practical education.	Implementation not started yet. The dialogue on motivational tools is facilitated by the H2020 project GreenDeal4Buildings.
1.15	7	**Use of receipts from the sale of CO_2 allowances for vocational education and training:** Under the current legislation, the receipts from the sale of CO_2 Allowances could be used for supporting measures aimed EE and use of RES, including vocational education in this area.	Implementation not started yet. The responsible authorities did not accept any proposals in this respect. Further dialogue on this measure is facilitated by the H2020 project GreenDeal4Buildings.
1.16	1	**Secure financial resources, support mechanisms and other tools for energy renovation of buildings.**	Completed. As published in the Information by the Slovak Ministry of Transport and Construction, the needed resources are secured, and support mechanisms were established to deliver on the Slovak commitments on energy renovation of public buildings according to EPBD.

7.8 Assessment of the effectiveness of the measures aimed at achieving the supporting objectives

The assessment is summarised in Table 38.

Table 38

Measure no.	Level of effectiveness	Measure adopted in 2013 Roadmap, its scope, and targets	Progress achieved
2.1	5	**Creating working and advisory groups for the government on EE and use of RES in building:** Working and advisory groups for the Slovak government for increasing energy performance of buildings and use of renewable energy sources in the energy mix of buildings.	Implementation in progress. Discussions on the action plan are in progress. Measures were agreed for certification of companies for complex new buildings and renovation of existing buildings and compliance with the permit, reviewing the conditions for authorisation of regulated professions (to also include aspects of EE and use of RES in buildings) and setting up quality criteria for construction projects (related to the efforts to pursue multi-criteria public procurement, as current lowest price principle does not deliver quality). Further dialogue on this measure is facilitated by the H2020 project GreenDeal4Buildings.
2.2	1	**Developing national strategy for EE and RES education and training.**	Completed. Slovak Ministry of Transport, and Construction, Ministry of Education, Research and Development and Ministry of Economics agreed on national strategy for education and training in EE and RES in buildings.
2.3	1	**Ensure impact assessment of new legislation relevant to the sector of buildings.**	Completed. Stakeholders are consulted on legislative proposals relevant to the sector of buildings.
2.4	1	**Monitor implementation of the roadmap.**	Implementation in progress. Stakeholders' dialogue triggered with the BUS StavEdu project and H2020 ingREeS project made mid-term evaluation of implementing the roadmap. Final evaluation has been carried out for in 2022 and summarised in this report.
2.5	2	**Increase awareness of the public about EE and use of RES in buildings.**	Implementation of this measure started in 2018 with support of the H2020 projects CraftEdu and NEWCOM. Both projects involved operators and other stakeholders to raise their awareness of the EU requirements linked to the objectives of the European Green Deal, REPowerEU action plan and

Measure no.	Level of effectiveness	Measure adopted in 2013 Roadmap, its scope, and targets	Progress achieved
			other policies. This is also promulgated by the new H2020 project GreenDeal4Buildings. This project promotes individual and collective ownership of the energy assets (e.g., by Energy Communities) and smart energy systems that involve the consumers in the energy markets, as outlined in the Commissions Communication "Clean Energy for All Europeans". The new LIFE project BungEES is also focusing on engaging consumers in the energy markets and facilitates their understanding the benefits of the clean energy transition and promotes investments in energy assets at consumer level and thus changing the role of consumers to prosumers.
2.6	1	**Increase awareness about EE and use of RES in buildings among employers in the sector of buildings.**	Completed. BUS StavEdu project disseminated information via dissemination and communication activities, specialised conferences, and workshops, and H2020 ingREeS, Net-Ubiep and CraftEdu projects targeting craftsmen, on-site workers, middle and senior level construction professionals with training to increase their knowledge in this area.
2.7	1	**Amend the conditions of the public procurement in Slovakia:** Amending rules to allow multi-criteria public procurement to pursue quality and effectivity of the measures aimed at increasing EE of buildings and use of RES in the energy mix in buildings.	Completed. BUS StavEdu and H2020 ingREeS project triggered (within the stakeholders' dialogue) discussion to initiate pilot multi-criteria public procurement. A conference was organised under ZSPS leadership with stakeholders on 7 November 2017. Further dialogue on this measure is facilitated by the H2020 project GreenDeal4Buildings, including guidance and relevant implementation measures.
2.8	1	**Information portal about EE and use of RES in buildings:**	Completed. The H2020 project CraftEdu developed such portal that includes many instructional videos and e-

Measure no.	Level of effectiveness	Measure adopted in 2013 Roadmap, its scope, and targets	Progress achieved
		Setting up and operate a portal providing professional information about EE of buildings and use of RES to the public.	learning for professionals, and all interested parties.
2.9	5	**Developing strategy for vocational education of apprentices in EE and use of RES in buildings.**	Implementation in progress. A working group was created by the Ministry of Transport, Construction and Regional Development of the Slovak Republic and stakeholders were included in the discussion. Further dialogue on this measure is facilitated by the H2020 project GreenDeal4Buildings, including relevant implementation measures
2.10	5	**Prepare a new Roadmap for achieving the objectives of the EU 2050 Energy Roadmap.**	Implementation in progress. The several partners of the 2013 roadmap succeeded with new project proposal under LIFE programme and the discussion is ongoing in the framework of the BUS DoubleDecker project that triggered this report.

7.9 Main projects contributing to delivering the objectives

7.9.1 StavEdu

The overall objective of the project has been to commence implementation of the roadmap established and endorsed under Pillar I Build Up Skills project in Slovakia. The roadmap identified key measures for setting up a national scheme and other measures for ensuring development of skills essential for the field of buildings to contribute to the fulfilment of the Europe 2020 targets. The project particularly focused on measures 1.3 and 1.4, and facilitated implementation of measures 1.1, 1.2, 1.6, 1.12, 1.13, 1.14 and 1.16 of the roadmap[30].

[30] Roadmap established in Pillar I of Build Up Skills initiative, part 5, see also in Strategy on Setting up Complex System of Further Education and Training in the Sector of Buildings prepared by the Slovak Government, Annex I.

The Project set up the national qualification and training scheme for on-site workers in the field of buildings focused on energy efficiency and use of renewables in buildings. This strengthened the qualification of craftsmen, construction workers, system installers and other professions identified as priority target group in the roadmap. The project further facilitated further investments in the skills anticipated in the EU Roadmap to a Resource Efficient Europe[31].

The main activities of the project were focused on:

- Developing 9 cross-trade training programmes for further education and training and transfer of 1 training programme for on-site trainers and assessors[32] from Build Up Skills CrossCraft project implemented in Austria;
- Setting up permanent network of trainers delivering the training[33];
- Training of trainers for delivery of the programmes[34];
- Setting up the network of companies cooperating in delivering cross-trade training programmes based on agreements negotiated under the project[35];
- Developing a follow-up project to be financed under ESF operational programme "Human Resources" established by the Ministry of Labour, Social Affairs and Family of the Slovak Republic[3637];
- Review of the Roadmap to address proposals to Slovak Government for incentives boosting demand for highly qualified workers[38];
- Set up of the database of trained professionals to be accessed by construction companies for recruitment of skilled professionals[39].

The project delivered the following results:

1	The national qualification and training scheme for on-site workers in the field of buildings with national network of supporting employers in the field of buildings.
2	9 cross-trade training programmes for on-site workers and transferred 1 training programme for on-site trainers and evaluators with defined matrix of learning outcomes and testing for validation of the learning outcomes and certification.

[31] COM(2011) 571 final, p.19.
[32] Key measure 1.4 agreed in the Roadmap: Develop learning resources for further education and training of on-site workers and micro-entrepreneurs in the sector of buildings on energy efficiency and use of renewables in buildings.
[33] dtto
[34] dtto
[35] Key measure 1.3 agreed in the Roadmap: "Build up programme of further professional development on-site workers and micro-entrepreneurs" and key measure 1.6 in the Roadmap: "Rollout programmes of developing qualification and re-qualification"
[36] Key measure 1.14 agreed in the Roadmap: "Implement incentives for Investments in Skills"
[37] Key measure 1.12 agreed in the Roadmap
[38] Key measure 1.13 agreed in the Roadmap: "Dialogue of employers and competent authorities on financing of further education and training" and 1.14 agreed in the Roadmap (see foot note 7)
[39] Key measure 1.6 agreed in the Roadmap

3	Network of trained trainers for delivering cross-trade training programmes for on-site workers in the field of buildings and testing the learning outcomes.
4	Network of on-site trainers and internal evaluators of issues to be addressed in on-site inception training.
5	Proposal for a follow-up project to be financed under ESF operational programme "Human Resources" established by the Ministry of Labour, Social Affairs and Family of the Slovak Republic to facilitate the participation of craftsmen and other target groups to training programmes.
6	Review of the Roadmap to address proposals to Slovak Government for incentives boosting demand for highly qualified workers.
7	1 database of trained on-site workers to be accessed by employers for verification of their training and awarded certificates. This database also includes register of all trained trainers for delivering cross-trade training programmes on energy efficiency and use of renewables in buildings. Moreover, the database includes trained on-site trainers and assessors of critical issues to be addressed in inception on-site training.
8	10 presentation courses on energy efficiency and use of renewables in buildings delivered to provide demonstration of competencies developed through the national qualification and training scheme for on-site workers in the field of buildings with national network of supporting employers in the field of buildings.
9	9 qualification and assessment standards for identifying targeted competencies and assessing the learning outcomes of the cross-trade training programmes.
10	1 voluntary initiative of employers aimed at developing competencies of craftsmen and on-site workers in the field of buildings.

The project established the necessary resources and prepare technical, organizational and financial conditions for training and re-training on energy efficiency and use of renewables of craftsmen and on-site workers in the Slovak field of buildings in the period until 2020.

The project partners learned several lessons from implementing the project that reflect situation in developing human resources for the construction sector and obstacles that needed to be overcome and/or persists:

- There is higher interest in training among craftsmen (including self-employed) than it is generally expected and perceived by the market players;
- General practice of working with ULO was rather formal and they are developed after developing curriculum and content of the training programme to document content not as a tool that defines the content of the programme – the project used ULOs correctly for defining targeted learning outcomes;
- Companies in Slovakia start to feel grave impact of missing qualified craftsmen after the critical generation of craftsmen retired and call for more actions to be taken to fill the skills gaps;

- Promotion of the training is more effective if it targets directly trainees, for example self-employed craftsmen, and not only employers;
- Qualification requirements for craftsmen and on-site workers are not set adequately in the NQF, access to qualification is limited due to missing certification schemes, prior learning and informal learning recognition;
- New licencing/certification requirements relevant to energy efficiency and use of renewable energy sources in buildings are creating barriers through prohibitive pricing of the required training and certification/licencing. Moreover, if applied to be supplier-specific, they restrict competition and are illegal under EU competition law;
- Development of NQF without European standardisation and/or harmonisation of qualification standards for the common professions leads to lack of transparency and high complexity of the requirements and creates barriers to free movement of people in the Internal Market and mutual recognition of qualifications.

The project activities also have shown that further actions are needed, particularly to:

- Embed training on energy efficiency and use of renewable energy sources also in the vocational education and training for pupils and apprentices;
- Review of the NQF in the construction qualification and develop certification schemes for craftsmen and construction professions;
- Address new barriers raised by new licencing schemes (for example ETICS).

7.9.2 ingREeS

The ingREeS project have materialised the measures in the roadmaps established based on these analyses and endorsed under Pillar I Build Up Skills project in Slovakia and the Czech Republic relevant to middle and senior level professionals. The project particularly was focused on key measure 1.3 and facilitate implementation of key measures 1.1, 1.2, 1.5 and 2.2 of the roadmap endorsed in Slovakia, and on priority 4.3.1 and measures 1,2 and 4 of the Roadmap endorsed in the Czech Republic.

The project set up national qualification and further training schemes in Slovakia and the Czech Republic for middle and senior level construction professionals on energy efficiency and use of renewable energy sources in buildings.

Particularly the project led to:

- Development of 16 training modules that are building blocks of 5 education and training programmes;
- Setting up permanent network of trainers delivering the training programmes developed under the project;
- Training of trainers for delivery of the programmes;
- Creating a database of the offered training and awarded certificates to trainees;
- Proposal for policy and financial measures to be implemented to facilitate adequate demand response for intelligent energy solutions that would motivate middle and

senior level professionals in participating to training programmes, boosting demand for highly qualified professionals and SMEs to invest into continuing education.

The project established necessary resources and prepared technical, organizational and financial conditions for training and re-training middle and senior level construction professionals on energy efficiency and use of renewables of in buildings during the project and beyond its expiry, as all partners will continue in further delivering the training and continuously improve and develop the further training schemes that were set up (as their open and modular structure supports continuous improvement and development).

The project succeeded to deliver training to over 900 middle and senior level professionals (the project target was to train 700 professionals) during the project lifetime, while the scheme continues deliver training to further professionals since 1 March 2018 (i.e. beyond the project expiry).

The training was delivered through in-class training combined with distance learning delivered using ICT, such as e-learning, on-line conferencing, video on demand and special sessions and workshops with practical demonstrations.

The learning outcomes are assessed using on-line testing, while the participants could prepare for the assessment using the simulated tests available for each module.

The training in the Czech Republic is a credited training by the Czech Chamber of Chartered Engineers and Technicians. In Slovakia, Slovak Chamber of Civil Engineers (SKSI) works with the competent authorities to include the competences in the energy performance of buildings in the requirements for the mandatory certification of civil engineers for regulated professions. The topic of energy efficiency and use of renewable energy sources in buildings will be embedded in the university curricula and SKSI will help universities to embrace this agenda and where practicable and feasible, SKSI will provide access to the e-learning and testing system.

Although the focus was on Slovakia and the Czech Republic, the project led to developing specific programme for Austrian civil engineers and complemented the training offer in Austria.

In Slovakia, the main hurdle was missing culture of continuing education and training among civil engineers. SKSI had to promote the need in having good understanding of the energy performance subject in the sector of building for delivering quality and the targeted performance in the buildings (renovated existing buildings or new buildings that must comply with nZEB standard).

In the Czech Republic, the culture of continuing education and training was already developed, and the local Construction Academy organises weekly one or more training sessions on the topics relevant to the civil engineers. Here, however, the training on energy efficiency and use of renewable energy sources was missing and the project perfectly fit the necessary training into the training offer and success of the project was almost inevitable. The project also helped the university teachers (involved as trainers) to develop their university teaching and therefore the project has wider impact that was targeted by its activities.

To succeed in this effort, the partners had to pay extra attention to the innovativeness of the programmes, easy access to the training and quality in delivering the training to the participants. Moreover, the information included in the training had to be up-to-date and

accurate. Therefore, the system was built to be easily updated and one module was created to bring newsworthy content to the trainees.

The success of the project in overcoming these hurdles was measured by higher than expected participation in the training (over 900 instead anticipated 700) and the feed-back from the participants showing that over 60% of the information they learned during the training were completely new to them, while the rest of the information help them better understand the information they already knew, which helped them to turn it into knowledge.

The project also triggered cooperation among stakeholders to tackle the efforts needed for achieving the EU 2020 Energy Targets. For example, the Association of Construction Entrepreneurs of Slovakia (ZSPS) presented the benefits of the multi-factor public procurement to procure construction of new building and energy renovation of existing buildings not only by price, but also quality, environmental impact, including energy performance. The conference organised by ZSPS triggered wide attention from private and public sectors and ZSPS will continue in the efforts to promote "value for money" in the construction sector. (Comment: *In Slovakia, unlike in other countries and at EU level, the public procurement is solely based on lowest price. Although "green procurement" is allowed by the law, it does not provide legal certainty for organisations/institutions procuring works and services and for the result of the particular procurement process.*)

The partners in Slovakia also reviewed implementation of the roadmap established in 2013. It was concluded that implementation of the roadmap progressed substantially and all measures due to this day were implemented with exemption of one - legislative requirements on quality of the works and services and related level of qualification of the construction professionals.

7.9.3 NEWCOM

Main objective of NEWCOM was to develop needed training schemes to enable construction workers and building professionals to build the nearly zero-energy building standard. By implementing the training modules developed by the project construction workers and building professionals are getting skilled to construct the nearly zero-energy building and to renovate the existing building stock up to a very high energy standard. Furthermore, building professionals are qualified to ensure the energy standard qualities of renovated and new buildings. Respective "train the trainer" trainings were implemented in the participating countries.

The project had set itself the task of identifying existing training offers for the correct execution of the building envelope, the installation of ventilation systems as well as for the quality control accompanying the planning and construction process for the new construction of and renovation to nearly zero-energy buildings or nZEBs in Austria, Hungary, the Netherlands, and Slovakia. Based on this task content and structure of existing trainings were examined regarding their accordance to the needs. Upon the findings, the missing training contents were identified.

In the inception phase of the project, it was confirmed, that the importance of personal certifications in the construction sector is not particularly high. This is illustrated by the decline in demand for personal certification according to ISO 17024 in the field of building services engineering and the end of personal certification for passive house craftsmen within the CertCraft project in Austria. Only binding certifications for safety-relevant work can assert

themselves on the market. This applies to all four partner countries of NEWCOM. The project partners found out the certifications developed by educational institutions in general have better chances.

This allowed the following conclusions to be drawn for the further development of the project:

- Completely new development of qualifications in the form of personal certification has little chance of being accepted by the market. The development of modules and qualifications as a supplement to already established courses was considered significantly more successful.
- Moreover, the greatest similarities in needs and thus prospects of success for the development of training modules in the partner countries (Austria, Hungary, the Netherlands, and Slovakia) arise in the following areas and trades:
  - Flat roof and structural waterproofing;
  - Comfort ventilation (low energy ventilation and air conditioning);
  - Quality assurance and quality control of near zero-energy buildings (building inspection).

The identification and collection of relevant existing training material was a central issue of the project, to ensure that already available material can be optimally used. For collecting the training materials, a Moodle platform was established. This platform offers existing training material in English, German, Dutch, Hungarian and Slovak and is structured in the chapters “building envelope”, “building techniques” (TBS) and “building inspections”. The Moodle platform was used as a knowledge hub for the trainers trained in NEWCOM.

To ensure maximum flexibility, the trainings were designed in modules so that they can be used both as stand-alone units and as a complement to already established courses. The training blocks were conceived in cooperation with further education institutes as well as public and private stakeholders.

Another key objective of NEWCOM was that course participants must have clear advantages on the European market after the successful completion of the developed training modules. In this context, the project supports the increase of the labour market transparency and application of skills’ requirements of employees in new competences in increasing the energy efficiency and use of renewable energy sources in buildings. For this reason, NEWCOM created a basis for the mutual recognition of the developed training modules.

7.9.4 Net-UBIEP

The Net-UBIEP project focused on increasing the energy efficiency of buildings by expanding and strengthening the use of BIM (Building Information Modelling) throughout the life cycle of buildings. The use of the BIM system makes it possible to simulate the energy efficiency of buildings using various materials and components that will be used in the design of new buildings and/or in the reconstruction of existing buildings. The BIM system, which serves to model building information, is a process that takes place throughout the life cycle of buildings from the design phase through construction, management, maintenance, and demolition. In each of these phases, it is very important to consider all energy aspects to reduce the environmental impact of buildings during their life cycle.

As part of the project, the net-Ubiep BIM School was implemented in Slovakia from June 1, 2019, which in the first phase offered 7 modules for public administration workers, construction authorities, building owners and managers, professionals (architects, civil engineers) and craftsmen. The modules, supplemented by the buildingSMART Certification, consisted of:

- Basic module for public administration;
- Basic module for owners of public buildings;
- Basic module for managers of public buildings;
- Module for technicians and craftsmen;
- Introduction to BIM for professionals;
- Work with BIM software;
- Designing fire protection for professionals.

7.9.5 CraftEdu

The CraftEdu project successfully launched national qualification and further training scheme for craftsmen on energy efficiency and renewable energy sources in buildings in the Czech Republic and complemented the already established national schemes (established with support of previous Build Up Skills projects) with new training programmes that were requested by the construction sector due to lack of qualified craftsmen in the targeted professions.

In numbers, the project consortium developed ULOs, qualification and assessment standards, content, and methodological aspects for:

- 8 training programmes in Czech Republic,
- 5 training programmes in Slovakia,
- 2 training programmes in Austria,
- 2 training programmes in Bulgaria.

The following training resources were developed to underpin delivery of these programmes:

Resource	Student textbooks	Testing tools	Qualification standards**	Assessment standards**	e-learning programmes	Video lectures	Trainers' handbooks
Czechia	6 + 1*	6	8	8	6 + 3*	16	8
Slovakia	5 + 1*	5	5	5	5 + 3*	37	5
Austria	3	2	-	-	5	-	2
Bulgaria	2	2	-	-	3	-	2
TOTAL	**17**	**15**	**13**	**13**	**22**	**53**	**17**

* Shared by Czechia and Slovakia (calculated in total only once)

** For Austria and Bulgaria, the qualifications covered by CraftEdu were guaranteed by already existing qualification and assessment standards

The training is supported by the **CraftEdu database** developed by the project that is hosting register of trainers, trainees, e-learning server, video lectures, student textbooks and trainers' handbooks, provides for developing tailor made training courses, registration for training courses and testing to receive digital certificate.

For delivering training, **94 trainers** were trained by the project that form a further developing network of trainers registered in the CraftEdu database.

The training programmes were demonstrated and tested through pilot courses delivered mainly online due to Covid-19 restrictions (detailed explanations are later in this report). The results of these pilot online courses are:

Programme number	Qualification	Number of participants	Number of issued certificates (based on testing)
P1	HVAC Installer	44	27
P2	Carpenter	104	36
P3	Electrician for 50V-1000V	120	28
P4	Window/fillings-for-construction-openings installer	117	31
P5	Hydro-insulator	72	29
P6	Electrician for up to 50V/smart electro installations	105	24
P7/P8	Chimney sweeper/inspector	84	30
SE	Airtightness/Ventilation/HVAC introduction only	25*	23
TOTAL		**671**	**228**

The developed resources were used also in individually compiled educational programs and conferences. The use of videos prepared within the CraftEdu program and freely available on the ABF Stream Channel on YouTube has been (as of end of the project):

Number of individual educational programs	6
Number of followers online in real-time	1,381
Followers online in a shifted time	695
Total followers	2,076

The programmes were successfully exploited also by external providers, for example PC Revue that is streaming 6 video lectures from the programme for electricians for smart electro installation from the CraftEdu project having till today **7,779** views.

The project facilitated stakeholders' dialogue that led to discussion on the key topics relevant to energy renovation of buildings and qualification of craftsmen working on construction sites in 216 bilateral and multilateral meetings organised either by the partners or by other stakeholders.

SPS launched voluntary initiative "Building Future" aimed at sustainable construction reducing impact on the environment, final energy consumption in buildings, CO_2, and other greenhouse gas emissions. It is seeking to create the basis and conditions for dialogue with the government and the public tom promote education and training of relevant professionals in the sector of buildings aimed at increasing the energy efficiency of buildings and the use of renewable energy sources, as well as implementing the related concepts of smart cities and intelligent buildings.

SPS has built on the experience and practice of ZSPS that launched and developed such programme with support of earlier BUS projects.

7.9.6 SEEtheSkills

The SEEtheSkills project seamlessly follows the topics of the ingREeS project with the aim of supporting energy efficiency in buildings, especially regarding the use of information and communication technologies and raising awareness of solutions related to renewable energy sources. The project dealt with increasing skills in the field of energy-efficient construction of new and renovation of existing buildings using the innovative 3V approach - visibility, validation, and value. 10 organizations from 5 European countries participate in the solution and its duration is until the end of May 2024.

8 Skills gaps between the current situation and the needs for achieving the 2030 targets

A long-standing obstacle to development in the construction sector is the mismatch between the skills and competencies of secondary and tertiary graduates and the needs of the labour market in terms of both quality and quantity. Experience from abroad suggests that this mismatch is often due to a combination of factors, including a lack of awareness of the needs and requirements of employers, employees and graduates, weak cooperation in the government-school-employer triangle, a weak supply of training and courses for educators and adults as well as low interest in these courses, the need to modernise schools so that they can provide education that meets the current demands of employers and be able to respond flexibly to changing needs and technological advances.

Today, however, the construction sector is facing a more complex situation and the schools themselves are unable to resolve the emerging disparities either in terms of the content of education or in terms of their material and technical provision.

Labour productivity in the Slovak construction sector, as in the EU as a whole, is the second lowest after agriculture. It has even been declining slightly in recent years. This is a consequence of lagging behind other sectors in innovation and digitalisation. This situation is beginning to threaten not only the sector itself, but also the EU's long-term objectives in the fight against climate change, which is increasingly shifting towards mitigation and the related need to transform to clean energy. It also threatens important short-term objectives such as the phase-out of gas imported from Russia. In Slovakia, more than 70% of gas imported from Russia is consumed in buildings. From this perspective, the situation in the construction sector is becoming a security threat.

Profound changes are awaiting the Slovak construction industry. The sector has to deal with several challenges at once. It has to replace the missing workers in the industry and at the same time improve the attractiveness of the sector. In the area of energy savings, the construction

sector is the sector that will implement the renovation of the building stock, which is the key to reducing the energy intensity of buildings in Slovakia. The construction industry needs to prepare itself for the increasingly rapid development of technology and a stronger perception of the carbon footprint of the products it uses. It is not just about the quality and price of the product itself, but also its entire production chain. We can also expect ever higher demands on the assembly quality of construction products in view of their increasingly demanding required parameters.

The transformation will take place mainly over the next 10 years and will lead to profound structural changes in the industry, the downsizing of some trades and the creation of entirely new attractive positions, and will result in the re-industrialisation, automation of the industry and the mass-produced delivery of individuality in construction.

The most important starting point for transformation will be digitalization, industrialization of the sector and adaptation to the changing ecosystem (modularization, networked capacities for the production of construction products, AI in production planning and logistics), which has long been ahead of the changes in the construction industry, and which will change the construction industry on several levels. The need for digital literacy in the construction professions will increase significantly with regard to working inside the digital model of the building and its blending with reality. Construction workers will have extensive support in the form of augmented reality, but the aim of construction companies will be to avoid complex processes being implemented on construction sites. Another product of these changes will be significantly faster construction preparation. A complex digital twin (digital twin - a model of the existing state), a technology that has been used in other industries for more than two decades, is already becoming the basis for implementation. With regard to the Internet of Things, better time coordination of the delivery of construction products and their installation is also offered. Increasingly, worker specialisations are emerging in the creation and use of digitisation, robotics, machine-to-machine communication, remote control and other technologies. From these, professions that do not yet exist will be recruited. Very high added-value positions will start to emerge in the construction sector, linked to the digital transformation in the sector and the repeatability of the outputs produced. Talent will gradually become more important than capital. The construction industry will have to adapt to nurturing talent and value workers with skills and competencies more highly in order to retain them in the industry. But this will come back to the sector many times over in high labour productivity, quality of work, high return on investment and other benefits.

An important starting point is also the change in customer needs. The last two years have accelerated some of the changes in society, for example, in the need for the digital home and the creation of the virtual office, the reduced need for new office buildings and the growing demand for small family homes. There has been a demand for more flexibility in buildings. This will enable the further development of modular and prefabricated buildings - buildings that go

from customer order to construction in a matter of weeks rather than years. This will speed up the construction process and increase turnover in the industry. It will also change our housing environment. Although the reason we live in cities hasn't changed for thousands of years, they will no longer need to be large hubs of material flows with the aim of manufacturing things. The main focus will be on high quality of life in cities and providing a dignified old age.

This will trigger dramatic changes in the education of professionals for the construction sector at all levels. While formal education will remain the core, continuing/ further education will be an integral part of the training of professionals. Only this form will be able to respond promptly to changes, new innovations and new requirements. Micro-credentials will be essential to keep pace with the growing demands of the labour market.

The methods of education will also change. Augmented reality will enable on-the-job or on-site training. It also brings services such as testing the overall level of skills and competences across teams (it is not enough that only some team members have the required skills and competences, but their overall level in the team is essential) or the possibility to have individuals or entire teams tested by an expert or a group of experts, remotely. Both examinees and examiners may be geographically located in different places, albeit in different countries.

It should be stressed that we are talking here about approaches and technologies that are already proven in practice in other sectors and are not some kind of "music of the future".

This shows the complex task ahead of the DoubleDecker project team in preparing proposals that should guide developments in education for the next decade.

In order to analyse the situation more deeply and to propose specific measures to help vocational education and improve its quality so that it can meet the needs of the labour market and the rapid transformation of the construction industry, we chose a method of data collection in the form of closed questionnaires, where respondents could choose from the options offered in advance and could also add their own suggestions and insights. This method was chosen mainly to allow for a credible presentation of the results.

Two questionnaire surveys were carried out as part of the SQA, with each survey focusing on a specific target group, namely:

1) Questionnaire for vocational and industrial secondary schools and civil engineering faculties of universities:

The aim of the survey focused on secondary vocational and industrial schools teaching construction and electrical engineering, together with the civil engineering faculties of universities, was to analyse through a questionnaire the current state of education and to identify the barriers that prevent schools from responding promptly to the current rapidly changing needs of the labour market, together with the overlay of achieving higher quality education.

All secondary schools teaching civil and electrical engineering, together with three civil engineering faculties of universities, were involved in the collection of the required data. Through questionnaires, we documented the current status of the disciplines and programmes and their readiness for future needs based on the EU Green Deal. We then identified barriers that prevent schools from introducing new courses/programmes and flexibly adapting existing ones to changing needs. The results of the survey have been described in more detail in Chapter 6.2.

2) Questionnaire for construction companies:

The questionnaire used to survey the employer environment was focused on the analysis of the current situation in construction companies, identification of employers' needs, methods of solving the current situation with the lack of qualified workers, defining barriers and expected future trends with a link to the training of their own employees. The questionnaire consisted of 14 questions, where it was possible to answer the questions individually in the form of a direct answer, multiple choice and, for certain questions, by assigning weights of importance.

The survey included companies operating in the construction industry, representing a sample not only of large contractors, but also of designers, architects, material manufacturers as well as smaller subcontractors. On the sample surveyed, which represents the construction industry as a whole, we were able to analyse the current state of the skilled labour shortage together with plans and expectations for future developments.

In Chapter 6.2 we analysed the readiness of vocational education for current changes and identified to what extent and whether the current system of formal education includes areas of education with regard to new trends and needs in the construction industry, whether secondary schools and colleges are prepared for current and future challenges related to climate change, industrial revolution 4.0, digitalization, automation in relation to the expected rapid changes in the construction industry.

Since the link between employers and the need for closer cooperation in the development and updating of teaching/training courses and programmes in schools is clear, we focused on the current and future needs of the labour market from the perspective of employers in the construction sector using a questionnaire designed for construction companies. In addition to analysing the current state of the workforce, the survey provided us with answers to questions about what methods and trends employers will need to implement over time in order to achieve and meet the future challenges towards the EU's stated 2035 targets.

8.1 Estimated development of human resources for the labour market in the construction sector

The labour market in all EU countries is currently undergoing dynamic developments. The ongoing transformation of several sectors of the economy in line with the Industry 4.0 and 5.0 concept is bringing about a number of related trends, such as the increasing digitisation and

automation of individual processes, the use of smart technologies, new materials, the application of the green economy and low- or zero-emission technologies, as well as a change in the position of people in the new technology environment, a new management paradigm and a people-centred and inclusive approach. The promotion of these principles, together with EU consumer protection standards in new business models and service delivery practices, will have a paradigm shift in consumer engagement and acceptance. It will ensure the just energy transition that Europe is striving to achieve.

These trends also apply to the construction sector, among other sectors. According to the document 'Strategy for the development of human resources in the construction, surveying and cartography sector until 2030', in the near future the construction sector is expected to focus primarily on the construction of zero-emission buildings and buildings that generate and store energy and feed it back into the energy grid, and in-depth renovation of the existing residential and non-residential stock towards such buildings.

The construction, geodesy and cartography sector currently accounts for 9.2% of GDP in Slovakia and this share is growing slightly in the long term. The sector is thus one of the 4 sectors with the most significant contribution to GDP and is considered one of the decisive sectors of the Slovak economy. Enterprises without employees (i.e. natural persons - entrepreneurs, self-employed persons) have a significant representation in the sector, contributing 45% to the sector's GDP and accounting for 39% of total employment in the sector. Although the sector is characterised by a high share of GDP, its labour productivity is below the national average.

The development of human resources for the construction sector is determined by all of the aforementioned changes and developments, which we discuss in the SQA from different perspectives and in the context of the sector's development and position within the economy and the development of society. We perceive an increased pressure for the transformation of the construction sector and the necessary introduction of innovative changes and approaches and the need to increase labour productivity, since productivity in the construction sector is the second lowest after agriculture and has even been declining slightly in recent years, mainly as a result of the lag in the introduction of innovation and digitalisation. The evolution of the workforce is influenced by demographic developments and the evolution of labour market needs, the ageing population, the increase in the representation of older age groups in the construction sector (retirement outflows and a reduced share of young people aged under 29). The SQA findings confirm the mismatch between the current labour supply and development in terms of the number of graduates in relevant fields of study and knowledge, competences and readiness for new challenges and innovative trends and the needs of the labour market in terms of both quality and quantity. This was confirmed by the survey we carried out as part of the SQA processing.

The estimate of the development is also based on the number of pupils and graduates of study and apprenticeship courses of secondary vocational schools entering the labour market. We

focused on monitoring the development of the number of pupils, the number of new entrants and graduates for the period 2013-2022. The data was processed on the basis of the database of the Centre for Scientific and Technical Information of the Slovak Republic (CVTI SR). The data concerned the number of pupils, the number of graduates and new entrants within the groups of education fields 36-Construction, surveying and cartography and other related fields such as 26-Electrical engineering, 24- Mechanical engineering and other metalworking and 33-Woodworking, which are relevant and related to construction production and construction implementation. An overview of the relevant fields of study and training is given in Chapter 6.1.4. A complete detailed overview of these fields and the numbers of pupils in each field, the numbers of graduates and new entrants can be found in Annex 3 of this document.

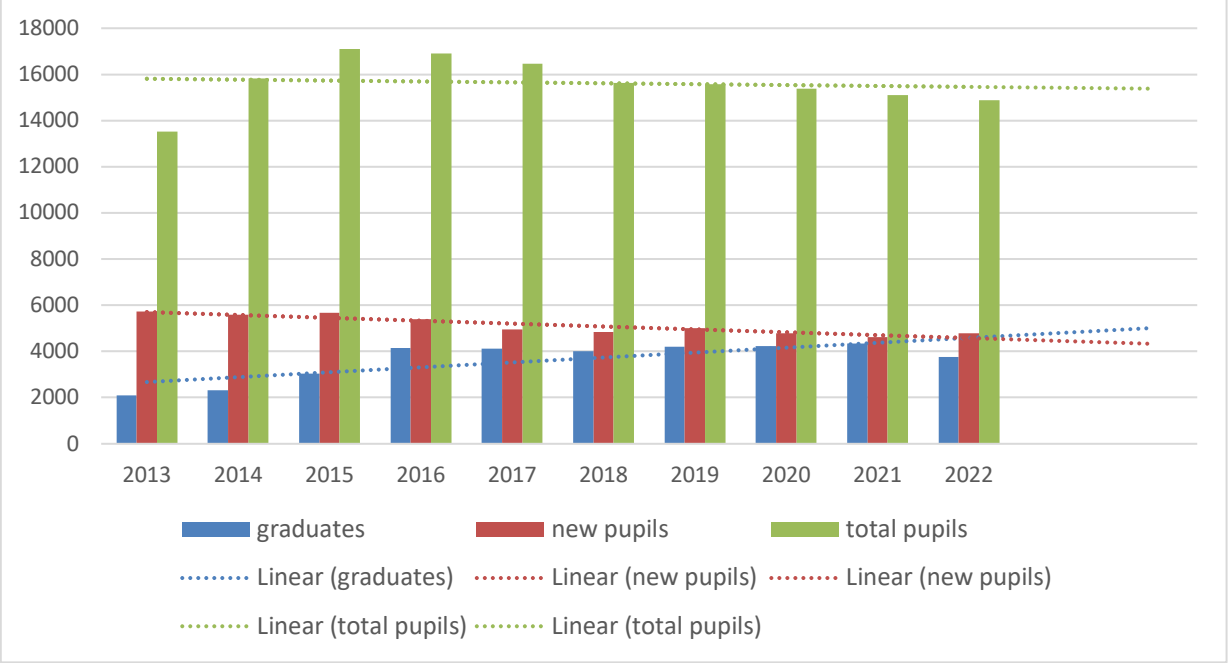
Table 39-Summary - Number of pupils, graduates, and new entrants in selected fields of study in secondary schools 2013 – 2022

	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
graduates*	2103	2315	3045	4159	4121	4015	4214	4245	4341	3753
new entrants	5719	5580	5685	5393	4956	4854	5017	4792	4631	4800
all pupils	13535	15825	17100	16901	16465	15618	15564	15372	15102	14882

**data on graduates are from year 2017/2018*

To get a better idea of the development, the following graph provides an overview of the number of pupils, graduates and new entrants in selected fields of study in secondary schools between 2013 and 2022.

Graph 20 - Overview of pupils, graduates and new entrants in selected fields of study in secondary schools



The numbers of pupils in selected disciplines increased significantly and peaked in 2015 at 17100 pupils. Then this development stopped and in the following years until 2022 we see a gradual decline in the number of pupils and in 2022 the CVTI SR registers 14 882 pupils in the selected fields. The demographic development reflects the development of the number of newly enrolled students, where a slightly decreasing tendency is evident from the beginning of the monitored period until 2018 and then the situation stabilized and the growth and decline is slightly fluctuating from this year onwards and is subsequently reflected in the number of graduates with the intervals of years. The representation of females or girls in the total number of students from 2013 (4%) slightly increased in 2020-2022 to 10% and then decreased in 2023 to 8%. A greater representation of women is certainly an asset and we see it as a potential and should be a motivation when looking for measures to increase it.

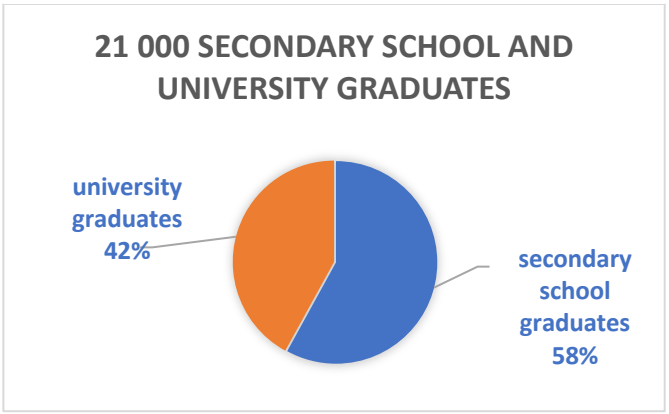
The most numerous construction trades during the monitoring period are civil engineering (2022/3103 pupils), construction manufacturing (2022/1268 pupils), bricklayer (2022/1002 pupils) and plumber (2022/847 pupils). Their development and numbers can be seen in the table below. However, it is important to draw attention to the vocations related to the implementation of renewable energies (in particular solar and wind energy and the replacement of gas boilers with heat pumps). For example, in the field of energy equipment technician for buildings (2022/466 students), which is growing in importance, despite the gradual increase in the number of graduates it appears to be insufficient in terms of the total number of graduates and the needs with a view to the future. The development of the number of pupils in the field of wood construction technician (2022/246 pupils) is also positive, although not satisfactory. The most numerous fields of study in electrical engineering include electrical engineering (2022/4225 pupils) and electromechanics - high voltage technology (2022/1128 pupils). However, the number of students in disciplines such as electrical engineering-power engineering (2022/56 pupils) or electromechanics-refrigeration and heat pumps (2022/57 pupils), despite a gradual slight increase, appears to be insufficient in view of the future needs of the labour market development. For a complete overview of the number of pupils and the individual branches, see Annex 3. The following table gives an overview of the most numerous selected branches.

Field of study	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
36 – Construction, geodesy and cartography										
3650 construction	1405	2216	2906	2844	2988	2736	2977	3094	3115	3103
3656 construction manufacturing operator	284	419	511	426	411	340	300	297	308	320
3658 mechanic of construction and installation equipment	295	442	566	559	496	438	403	388	394	415
3659 construction	763	554	432	420	382	409	369	316	326	309
3661 bricklayer	895	1365	1339	1272	1216	1009	919	967	1030	1002
3663 carpenter	83	162	180	154	127	130	128	120	142	166
3667 water technician and water engineer (exp.)				30	69	92	129	127	117	107
3668 dry construction builder	94	134	104	89	79	67	69	61	66	67

3675 painter	118	149	105	96	86	72	69	97	125	122
3678 installer	571	829	789	786	698	699	704	783	790	847
3684 roofer	14	38	34	66	79	74	70	50	49	65
3686 construction manufacturing	1373	1424	1473	1461	1326	1216	1457	1492	1352	1268
3688 chimney sweeper			10	19	27	21	23	22	18	28
3692 geodesy, cartography and cadastre	318	440	567	532	471	433	442	470	486	538
3693 building energy equipment technician	202	287	345	319	339	392	433	476	463	466
26 - Electrical engineering										
2675 electrical engineering	5573	5809	6118	6136	5918	5649	5242	4807	4499	4225
2675 electrical engineering - electronic equipment	148	87	110	107	86	77	73	94	84	63
2675 electrical engineering - energetics	49	45	30	50	39	50	26	45	42	56
2675 electrical engineering - manufacturing and operation of machinery and equipment	216	191	148	106	105	146	140	90	106	110
2683 electromechanics - refrigeration equipment and heat pumps	16	18	18	24	24	28	49	28	50	57
2683 electromechanics – automation technology	18	35	59	85	105	122	141	128	95	70
2683 electromechanics – high voltage technology	492	851	907	818	935	970	1017	1021	1110	1128
2683 electromechanics – utility technology	160	170	121	136	149	181	171	125	112	74
33 – Wood processing										
3349 wood construction technician		67	144	186	243	226	189	207	208	246

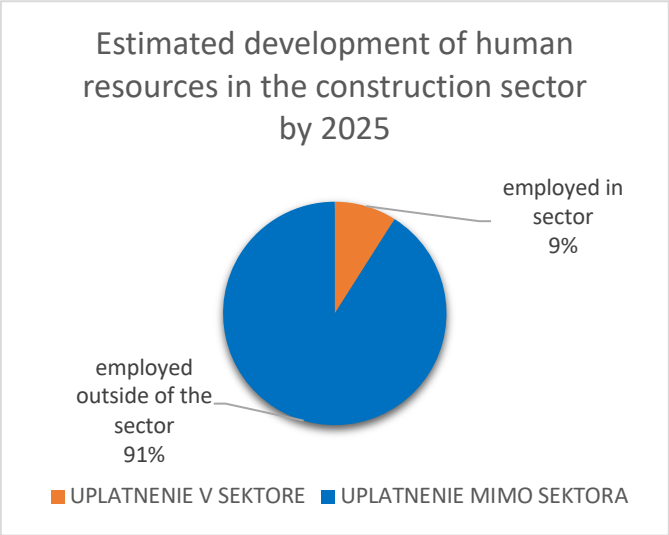
In the period of 2021-2025, a total of 21 thousand secondary school and university graduates are expected to enter the labour market, having completed their studies in one of the corresponding disciplines suitable for employment in the sector and not continuing their studies. Of this number, approximately 58 % will be secondary school graduates and approximately 42 % will be university graduates. The number of secondary school graduates is expected to increase by 2030 at the expense of the number of university graduates.

Graph 21 - Expected number of absolvents by 2025



Of the total number of graduates entering the labour market for the construction, surveying, and cartography sector, 9% are employed in this sector and the remaining 91% find employment in other sectors. For this reason, the sector's main strategy will be the retention of professionals in the sector[40]. To meet this challenge, the construction sector needs to undergo the aforementioned transformation, which will change the nature of work in the sector and thus make it more attractive to young people and, in particular, to the talent that will play a decisive role in the progress of the construction sector. All sectors of industry have had to undergo such a transformation, and the construction industry therefore has the advantage of being able to draw on the experience of these sectors and apply solutions that have already been proven and successful in practice. From this perspective, the most important thing will be to break down the 'silos' in which the construction sector operates.

Graph 22 - Employments of graduates in the sector



In the timeframe to 2040, it is expected that technology will be able to replace around 53% of the work processes currently carried out by employees. This amounts to approximately 46 500 employees, mainly in the jobs of Bricklayer, Construction Assistant and Construction Machine Operator. These changes will lead to the employees concerned seeking employment in other jobs, which will also require additional qualifications.

According to the results of our survey, up to 100% of employers in Slovakia feel a shortage of skilled labour in the sector, with 88% of employers feeling a shortage of workers in professional skills and 65% of employers feeling a shortage in the area of professional competences.

The labour shortages in the sector and the need for more graduates in relevant fields of study are confirmed in Table 31, which shows an overview of occupations with labour shortages from data identified by the Centre for Labour, Social Affairs and Family. The scarcest construction occupations were ironworker in construction, tile layer, insulator, carpenter, plasterer, building fitter and concrete worker. The intensification of the construction of motorways and expressways, the building of strategic parks and the development of residential construction production further shows an increased need for bricklayers, construction specialists and

[40] Strategy of Human Resource Development in Construction, Geodesy and Cartography Sector up to 2030

technicians, plumbers, pipefitters, building and operating electricians. The profession of Building Energy Equipment Technician, which is also in short supply in other EU countries, is gaining in importance and shortage of graduates based on the current changes with regard to the use of RES.

However, the result of the TREXIMA study on the high number of school graduates who do not see a future in the construction sector suggests that either these graduates only started their studies because they had no other option (i.e. they did not consider a career in construction), construction companies are unable to pay them due to low labour productivity, or a combination of these factors. This clearly shows the need to transform the sector also in terms of providing interesting career development. This would both avoid a disproportionate waste of human, material and financial resources on school pupils/students who do not plan to work in construction anyway and focus resources on preparing genuine candidates for jobs in the sector. If the construction sector is made attractive, the interest in working in it will increase and the resources to train them will also increase. This will increase the resources to pay teaching staff, who are also in very short supply.

From this perspective, the data in the table above are only relevant to the current unacceptable state of the construction sector, but do not provide the 2035 outlook that is needed for programming the necessary transformation of the construction sector. The Roadmap will take a closer look at this time horizon. As shown by the empirical research, the results of which are analysed in the next chapter, the requirements anticipated in this horizon are not yet felt by firms and therefore could not generate the necessary data. The roadmap will be based about countries and sectors that have already undergone the necessary transformation and will extrapolate them to the Slovak construction sector.

Table 31 - Overview of occupations in the construction sector with labour shortages for the period 2018/2019 - 2021[41]

Sector	4Q 2018 to 3Q 2019	4Q 2019 to 3Q 2020	4Q 2020 to 2Q 2021
Construction	- ironworker in the construction industry - bricklayer - concreter - concrete finisher - carpenter - roofer - tiler - plasterer - insulator	- ironworker in the construction industry - bricklayer - concreter - carpenter - scaffolder - roofer - tiler - dry construction fitter - insulator	- ironworker in the construction industry - bricklayer - concreter - carpenter - scaffolder - flooring engineer - tiler - plasterer - dry construction fitter

[41] Sectoral Concept of Vocational Education and Training of Pupils for Occupations, Groups of Occupations and Vocational Activities in the Department of Transport and Construction of the Slovak Republic 2018, 2022

	- installer - electrician - construction machinery operator		- insulator - construction machinery operator - construction assembler of simple buildings

The following table shows the expected development of human resources by field of study. It is based on the current capacity of schools and is increasingly influenced more by demographics (fewer young people enrolling in 2nd level). It also considers the priority that the construction sector has in the energy transition as long as this is respected by the national and regional governments. However, these fields of study will have to be significantly upgraded to take account of technological developments, digitisation, robotisation, the use of artificial intelligence, etc.

Table 30-Expected needs in human resources by educational programmes

Field of study	2023	2024	2025	2026	2027	2028	2029	2030
36 – Construction, geodesy and cartography								
3650 construction	3384	3705	4106	4420	4635	4875	5045	5256
3656 construction manufacturing operator	314	452	511	556	592	645	700	775
3658 mechanic of construction and installation equipment	428	464	516	564	584	625	642	685
3659 construction	425	484	544	582	625	664	715	785
3661 bricklayer	1014	1055	1104	1180	1228	1265	1305	1354
3663 carpenter	170	192	215	241	255	265	265	265
3667 water technician and water engineer (exp.)	110	118	120	138	154	175	194	212
3668 dry construction builder	68	75	85	92	101	105	105	105
3675 painter	122	126	130	130	130	130	130	130
3678 installer	852	875	894	905	905	905	905	905
3684 roofer	65	70	75	80	85	90	95	100
3686 construction manufacturing	1625	1775	1942	2090	2240	2384	2455	2552
3688 chimney sweeper	30	34	34	38	42	46	50	54
3692 geodesy, cartography and cadastre	540	570	620	645	670	695	720	745
3693 building energy equipment technician	554	654	754	810	865	915	965	1050
26 - Electrical engineering								
2675 electrical engineering	5573	5809	6118	6136	5918	5649	5242	4807

2675 electrical engineering - electronic equipment	145	195	240	295	340	365	390	445
2675 electrical engineering -energetics	65	85	95	105	115	130	145	164
2675 electrical engineering - manufacturing and operation of machinery and equipment	110	145	195	225	265	305	345	395
2683 electromechanics - refrigeration equipment and heat pumps	62	75	125	175	235	295	365	755
2683 electromechanics – automation technology	140	175	215	265	315	365	415	465
2683 electromechanics – high voltage technology	1030	1060	1080	2020	2060	2060	2060	2060
2683 electromechanics – utility technology	130	155	205	255	295	345	385	425
33 - spracúvanie dreva								
3349 wood construction technician	264	276	288	302	332	362	392	422

The roadmap will specify the areas of key innovations that will need to be incorporated into the courses of study and the phased roll-out of work on new courses of study through the creation of continuing education programmes under the Build Up Skills initiative, in which vocational training institutions would participate and thereby gain the know-how to prepare innovative 4-year courses of study, so that the new graduates can support innovation efforts in the construction sector from 2030 at the latest, even though even this date already means a considerable lag and any delay would mean a deepening of the crisis in the residential sector, which will exacerbate the already very negative demographic trend and intensify the emigration of the younger generation. It should also be considered that we will not reverse the demographic development and we will not replace the missing workforce with migrants, as Slovakia is no longer attractive even for migrants from conflict zones.

8.2 The impact of future competences on skills and qualification needs

This part of the analysis is devoted to the short-term horizon in terms of the EU and Slovak energy targets for 2030, namely the identification of the new skills needed and the need for a sufficient number of skilled workers in the construction sector according to the European Statistical Classification of Economic Activities (NACE) and the International Standard Classification of Occupations (ISCO), and analyses the needs and the number of professionals required in accordance with the different skill levels (EQF level).

We have identified innovation trends and the resulting skills needs in the defined areas. We have described their representation in the formal education system in more detail in chapter 6.2 and offer an overview in the table below.

Table 32 - Innovation trends

1	ENERGY EFFICIENCY OF BUILDINGS AND RENEWABLE ENERGY SOURCES IN BUILDINGS/in general
2	Energy renovation of historical buildings
3	Electrification of heating and hot water preparation
4	Renewable energy and fuel technologies
5	Installation of renewable energy and fuel technologies
6	Maintenance of renewable energy and fuel technologies
7	GREEN ECONOMY/in general
8	Efficient use of energy resources and the use of appropriate system solutions for energy efficient buildings
9	New technologies and materials for construction products with high recycling rates
10	Vegetation (green roofs), mobile roofs and waterproof roofs
11	Life cycle sustainability assessment
12	New techniques and technologies for the treatment of construction and demolition waste into recycled materials
13	Digitised documentation of demolition waste and data on the quantity and type of recyclates produced
14	Vegetation facades
15	AUTOMATION/in general
16	Automated control of construction machinery
17	Automated building ventilation
18	BIG DATA Data storage and cloud systems
19	DIGITALIZATION/in general
20	BIM construction software
21	LIM construction software
22	Roof track configurator
23	Electronic geometric plans
24	Digital processing of parameters and technical data of building materials
25	Digital management, inspection and maintenance of buildings
26	Digitisation of the documentation of the actual design
27	IOT (Internet of Things)/in general
28	Digital building scanning and facility management
29	Measurements and non-destructive roof leakage detection
30	Drones/in general
31	Photogrammetry, drones and 3D building scanning
32	Use of drones for area data collection of terrain and building objects in the form of scanning and photogrammetry
33	NEW METHODS/in general
34	Functional units - bathrooms or rooms
35	Prefabricated houses and commercial modular buildings
36	Above-grade insulation
37	Insulation with TPO and EPDM foils

38	Cassette facade tiles
39	Ventilation of roof structures and attic leakage classes
40	ROBOTISATION/in general
41	Autonomous robots in the construction industry (remote-controlled machines, cranes, dumpers, robots for 3D printing...)
42	Automatic assembly by robots
43	SMART TECHNOLOGIES/in general
44	Smart buildings
45	System components of technical building equipment
46	Smart meters
47	Smart energy systems in buildings
48	BEMS (Building Energy Management Systems)
49	Energy storage, installation, maintenance
50	e-mobility (charging stations for e-mobiles in buildings and adjacent areas - maintenance, installation)
51	Decarbonisation of energy system flexibility - contribution of buildings to flexibility, design and installation of building systems
52	ARTIFICIAL INTELLIGENCE in construction
53	VIRTUAL REALITY in construction
54	3D TECHNOLOGIES AND MATERIALS/in general
55	Production of prefabricated concrete parts through 3D printing

Given the rapid pace of development, almost all professions are affected by these innovations. The following table provides an overview of occupations in the construction, surveying and cartography sector according to the ISCO occupational classification - EN ISCO-08 - that are affected by these innovative trends. The updating of the individual occupations and the definition of the professional competences and skills affected by these trends within the NSP and the occupational register were also dealt with by the Sectoral Council and these were subsequently assigned to the individual occupations, occupation cards in the National Occupational Classification System as current knowledge and skills and currently needed and used in the labour market or future ones which, given the developments, will in the future with a high probability be needed for the performance of this occupation. An up-to-date overview of the individual occupation cards and the occupational knowledge, skills and competences required for performance is available at: https://www.sustavapovolani.sk/register-zamestnani/pracovna-oblast/stavebnictvo/

Overview of occupations affected by innovation trends according to SK ISCO- 08

Table 33 - Overview of occupations affected by innovation trends according to SK-ISCO - 08

	occupation SK ISCO-08
1.	1323002 Production manager in the construction industry
2.	1323003 Director of an organisational unit (plant, division) in the construction industry
3.	2142002 Construction quality management specialist
4.	2142003 Construction specialist technologist

	occupation SK ISCO-08
5.	2142004 Construction manager
6.	2142005 Construction supervisor
7.	2142014 Authorised engineer for structural engineering of buildings
8.	2142015 Construction specialist in technological research and development
9.	2142017 Authorised engineer for civil engineering structures
10.	2142018 Authorised engineer for ground structures
11.	2142019 Authorized engineer for technical, technological and energy equipment of buildings
12.	2142020 Building Information Modelling (BIM) Specialist
13.	2149007 Fire protection specialist
14.	2161000 Construction architect
15.	2162001 Landscape and garden architect (except authorized)
16.	2162002 Authorized landscape architect
17.	2165003 Geographical information system specialist
18.	2165004 Surveyor and cartographer (except authorised)
19.	2165005 Authorised surveyor and cartographer
20.	3111008 Survey technician
21.	3112001 Construction quality control technician, laboratory technician
22.	3112002 Construction budgeter, cost estimator
23.	3112003 Construction preparator
24.	3112006 Construction designer
25.	3112007 Assistant construction manager
26.	3112008 Assistant construction supervisor
27.	3113035 Building automation technician
28.	3119017 Revision technician
29.	3119040 Modular production technician
30.	3123000 Construction foreman
31.	3257006 Playground inspector
32.	7111000 Construction assembler of simple buildings
33.	7112001 Paver
34.	7112002 Bricklayer
35.	7112004 Builder of chimney systems
36.	7114001 Ironworker in the construction industry
37.	7115001 Carpenter
38.	7115003 Building opening installer
39.	7119001 Asphalter
40.	7121000 Roofer
41.	7122001 Flooring
42.	7122002 Tiler
43.	7123001 Plasterer
44.	7123002 Decorative plasterer
45.	7123003 Installer of dry structures

	occupation SK ISCO-08
46.	7124000 Insulator
47.	7124002 Thermal Insulator
48.	7125001 Glazier
49.	7126001 Plumber
50.	7133003 Asbestos disposal worker
51.	7213001 Construction plumber
52.	7222005 Construction locksmith
53.	7543016 Quality inspector, construction inspector
54.	8113001 Well driller
55.	8114003 Concrete machinery and equipment operator
56.	8189004 Coated compounding plant operator
57.	8342001 Construction machinery operator
58.	8342002 Heavy machinery operator
59.	8343001 Crane operator
60.	8343002 Lifting equipment operator (except crane operator)
61.	9313002 Construction assistant in building construction

Representation of different occupations suffering from labour shortages

Graph 22 shows the results of the survey and specifically the representation of each occupation suffering from labour shortages. Based on the survey, critical occupations have been identified that are currently suffering from a shortage of skilled workers, which will have an impact on the efficiency and quality of construction preparation and execution as well as on the further development and speed of the transformation of the construction sector.

Among the scarcest occupations is the profession of construction manager, construction foreman, which was identified by 59% of respondents from construction companies. This profession plays an important role in the coordination and supervision of construction, and therefore a shortage of these workers can have a negative impact on the efficiency and quality of construction.

44% of respondents from construction companies reported an insufficient number of workers with training in construction equipment operation, specifically construction equipment operators. This shortage can limit companies' ability to use construction machinery and equipment efficiently, which can lead to increased costs and delays in projects.

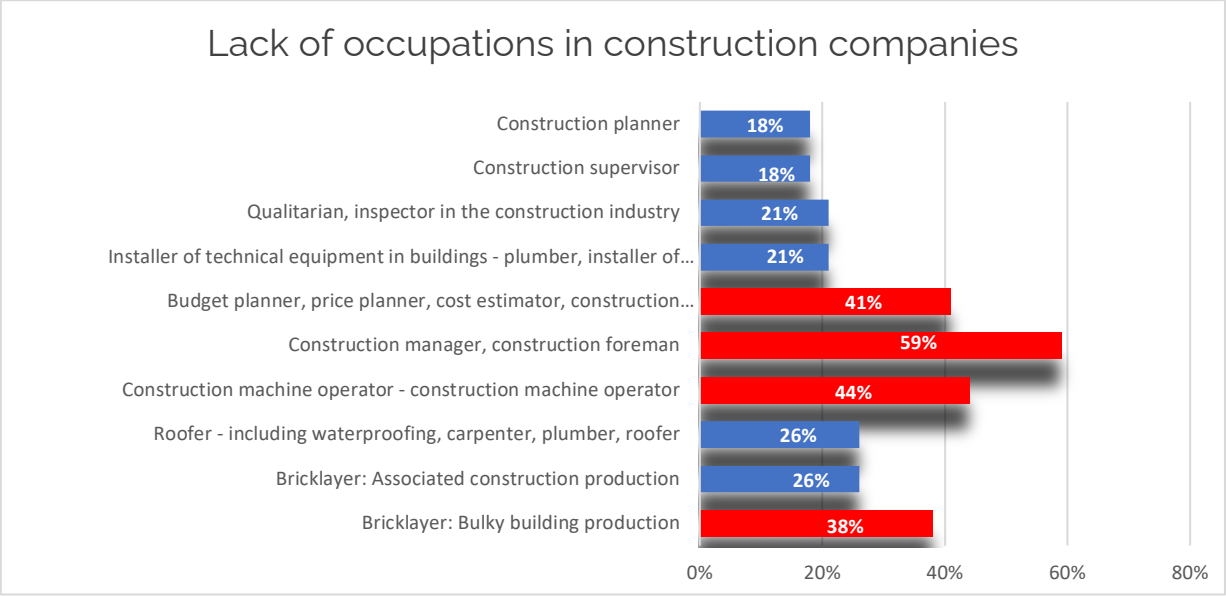
Another major shortcoming is the absence of experts in budgeting, price calculations and cost estimators. As many as 41% of respondents said they lacked staff with the ability to accurately quantify the cost of construction projects and produce cost estimates. This shortage can have a negative impact on financial management, factoring, and project preparation with the risk of overcharging for construction work.

For the HSV Bricklayer occupation, up to 38% of respondents from companies operating in the construction industry stated that they lack workers, and for the PSV Bricklayer occupation, 36% of respondents stated so. A shortage of skilled bricklayers will result in delays in projects and limited ability of companies to undertake construction work in these sectors.

A smaller number i.e. 21% of respondents reported a shortage of workers in the occupation of Installer of technical equipment of buildings, such as plumbers, installers of health equipment, heating and cooling systems. Their expertise and skills are essential for modern and efficient technical systems in buildings. With a higher share of RES use as well as a faster need for a change to RES use, the pressure will gradually increase for a sufficient number of such workers who will also be able to continuously update their knowledge and skills in the light of further changes and advances in technology.

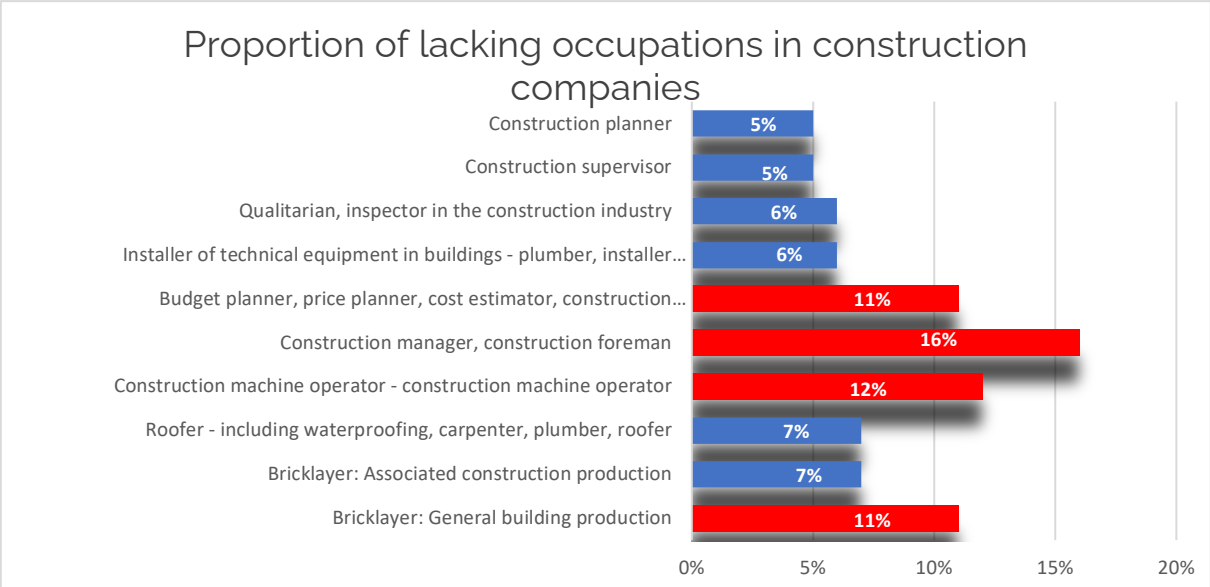
The same number i.e. 21% of the respondents reported a shortage of workers in the profession of Quality Assurance and Inspection in the construction industry. The least i.e. 18% of the respondents reported shortage of staff in the Construction Designers and Construction Supervisors who are responsible for designing, planning and supervising the proper progress of construction projects.

Graph 23 - Lack of occupations in construction companies



Graph 23 shows the weight (importance) of each missing occupation relative to the other missing occupations identified by respondents: Construction Manager, Construction Foreman 16%, Construction Equipment Operator 12%, Budgeter, Estimator, Construction Preparer, and HSV Bricklayer 11%. Other occupations from the chart were in the 5 to 7% importance range.

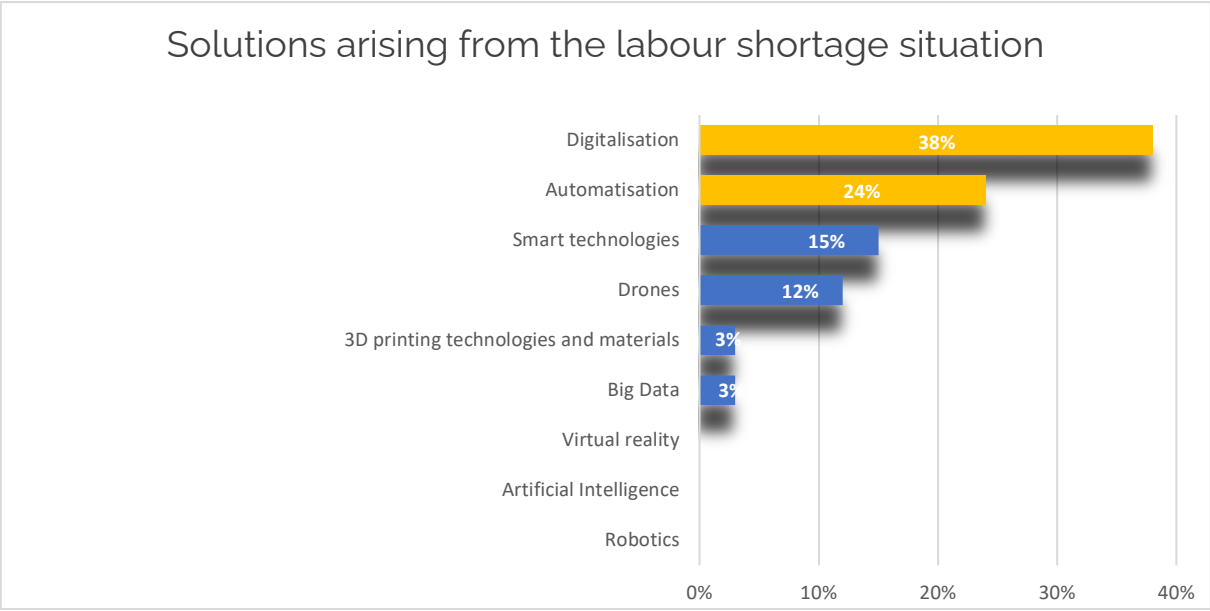
Graph 24 - Proportion of lacking occupations in construction companies



Methods for solving the current problem of labour shortages in the labour market, the impact of digitalization, automation and smart technologies

Faced with a shortage of workers in the construction industry, companies are turning to different strategies, technologies, and measures to respond to the current situation. The survey results show that companies see the solution from the technologies that use the Industry 4.0 concept mainly in digitalization, automation and partly in smart technologies. However, the results are influenced by the fact that companies do not yet fully feel the need to implement current technologies, as mentioned in the previous section of this status quo analysis. The results are presented in Graph 25.

Graph 25 - Solutions arising from the labour shortage situation



As can be seen in Graph 25, up to 38% of respondents from construction companies are currently solving the problem of the lack of skilled workers by digitalization, which brings with it a wide range of possibilities and expectations. In Slovakia, the digitalization of the construction industry is gradually developing, but it is not yet at the same level as in some other developed industries and countries, but there is an effort to introduce new digital tools and technologies. Currently, the digitalisation of the construction industry in Slovakia is particularly evident in the following areas:

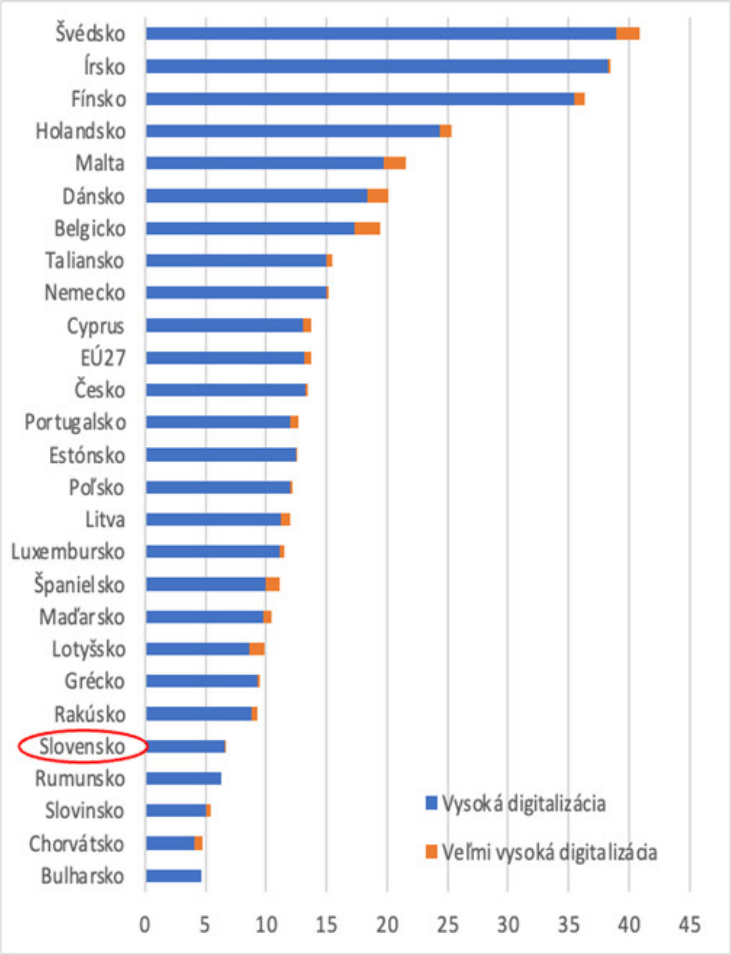
- Building Information Modelling (BIM), implemented by several construction companies, whether in preparation, construction or management. BIM enables the creation of digital models of buildings that contain information on construction, materials, costs and other relevant factors. This allows for better coordination, resolving conflicts and improving overall project planning and management.
- Online communication, in which construction companies and workers use new online tools and platforms to increase productivity on construction projects. Cloud-based platforms enable the sharing of documents, information and plans between different project participants. This improves the efficiency and speed of communication and enables better collaboration between different stakeholders.
- Digital planning tools: planning tools and software are becoming part of the construction industry in Slovakia. These tools enable better planning, tracking and management of construction projects. They help to monitor time and financial budgets, manage resources, and coordinate different activities.

However, according to data from Eurostat[42], the digitisation rate of the construction sector is less than 7%, while the EU average digitisation rate is 12.7%.

The low digitalisation of Slovak companies may be because the construction industry is known for its traditional practices and conservative approach to change. Many companies prefer tried and tested methods and are concerned about the risk associated with implementing new technologies, even if these technologies are already proven by long-standing practice in other industries. Another barrier is precisely the lack of expertise and skills, where the digitisation of the construction industry requires expertise and skills in information technology and digital tools. The lack of skilled workers with the necessary digital competences limits the implementation and use of digital technologies in the construction sector. The digitalization of the construction industry itself brings a number of benefits that are positively perceived by construction companies, with 74% of respondents from construction companies expecting

[42] Source Eurostat: https://sita.sk/vrealitach/digitalizacia-stavebnictva-to-nie-je-pdf-vykres/

Graph 26 - Digitalization in EU countries

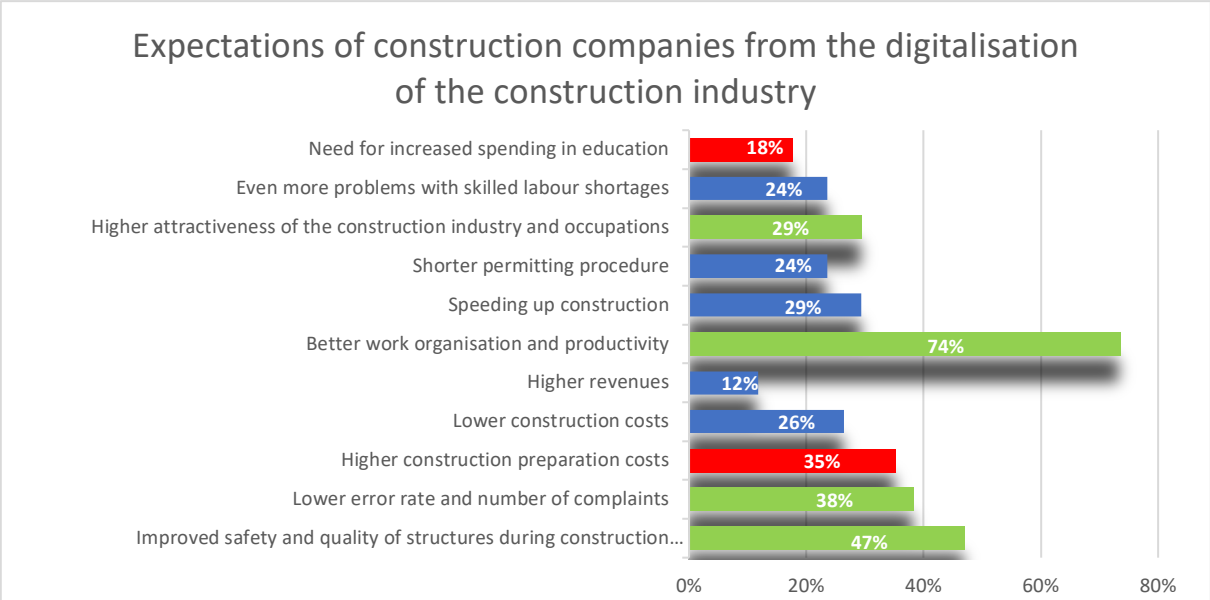


better organization and work productivity from digitalization, increased safety and quality of construction during construction and operation (47% of respondents), lower defect and claim rates (38% of respondents), and 29% of respondents from construction companies expecting higher attractiveness of construction jobs or faster construction.

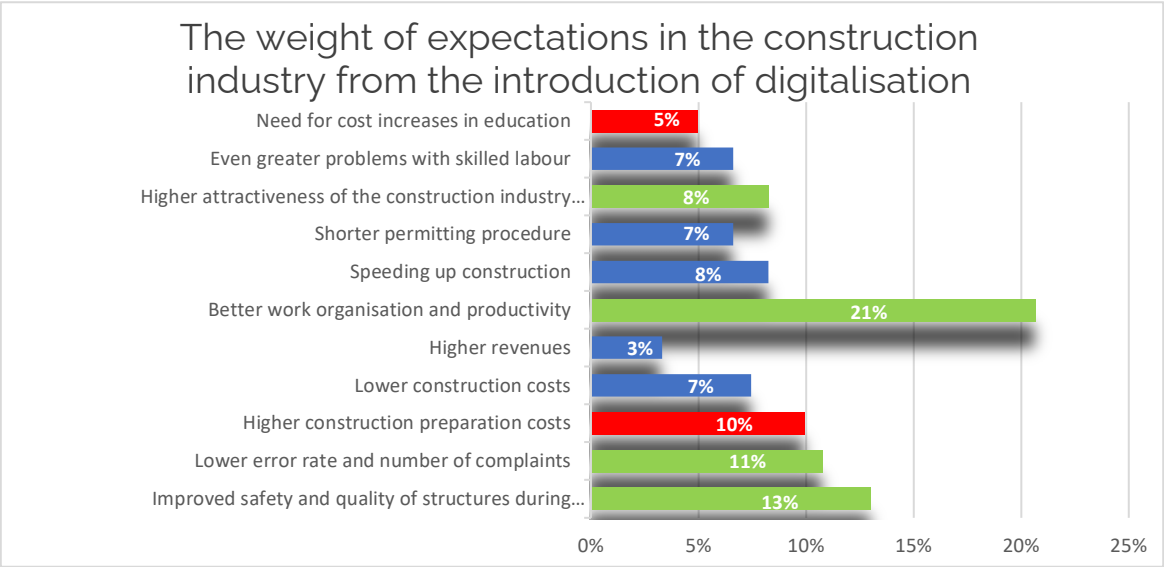
Up to 35% of respondents from construction companies expect higher construction preparation costs due to digitalisation, which stems from a lack of understanding of how digitalisation, e.g. the use of BIM, will change the cost at different stages of the building lifecycle, where the increased costs of creating a BIM for a project will be recouped in the later stages of approval, procurement and delivery of the building. In any case, digitisation allows automation and optimisation of processes thus achieving high savings overall. Using modern technology and software solutions, companies can achieve greater efficiency in all phases of construction projects - from design and planning to implementation and management. This reduces the time and cost of projects and increases overall productivity. At the same time, using digital tools and technologies, projects can be modelled and simulated in more detail, leading to better planning and minimising errors. Improved quality of work means lower repair and maintenance costs and increases safety during construction but also during the use of the building. It also increases the efficiency of subsequent building management.

When comparing the weights of individual expectations, it can be noted that 21% of the weight is given to better work organisation, 13% to increased safety and quality, 11% to lower defect rates and the number of complaints, while higher costs are weighted up to 10% for construction companies. The other expectation weights range from 5 to 8% with higher sales having the lowest weight of 3%. The need for increased costs in training also has a low importance/weight (5%) among respondents.

Graph 27 - Expectations of construction companies from the digitalisation of the construction industry



Graph 28 - The weight of construction companies' expectations from the introduction of digitalisation



The survey also focused on the trends that companies operating in the construction industry expect to see in relation to the shortage of specific skills.

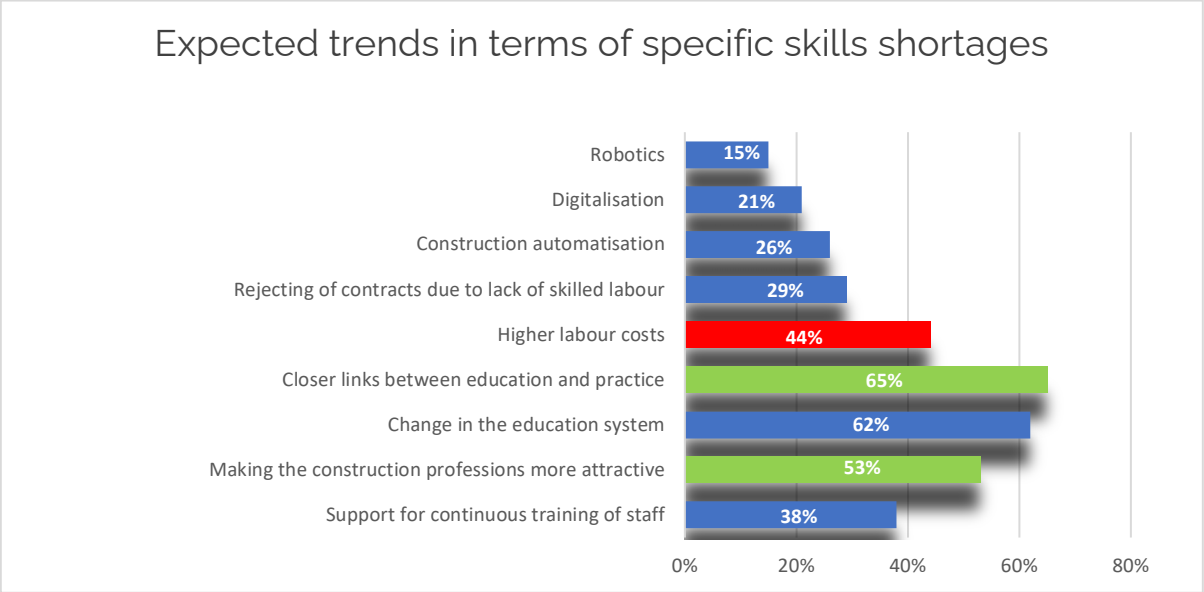
The results show that 65% of respondents from companies doing business in the construction industry expect trends closely related to the education system and 62% of respondents see room for innovation in the education system that would better prepare workers for the needs of the construction industry and ensure quality practical training in practice.

Other trends expected by respondents are related to the attractiveness of construction occupations (53% of respondents) and the promotion of continuous training of employees (38% of respondents). These trends point to the need to improve the image of the whole sector in

society and the prestige of the construction professions, but also to the need to transform the construction sector into a modern and attractive industry that offers interesting work and career progression. This change must also include investment in the training and development of employees. A slightly less expected trend is higher labour costs (expected by 44% of respondents), as the construction industry needs to adapt to the cost structure of a mature industry.

On the positive side, a less expected trend is the rejection of contracts due to a lack of skilled labour (29% of respondents). Among the least expected trends are those related to robotization, digitalization and automation of production, indicating that these changes are not yet relevant for respondents in terms of the future, which is a surprising result, as these are the ones that increase efficiency and productivity and are key tools to turn the construction industry into an attractive sector. From the above chart the most topical issue for respondents at the moment is the linking of education with practice, changing the education system to prepare graduates for the needs of the labour market and increasing the attractiveness of construction occupations, which requires less expected change in terms of digitalization, automation and robotization.

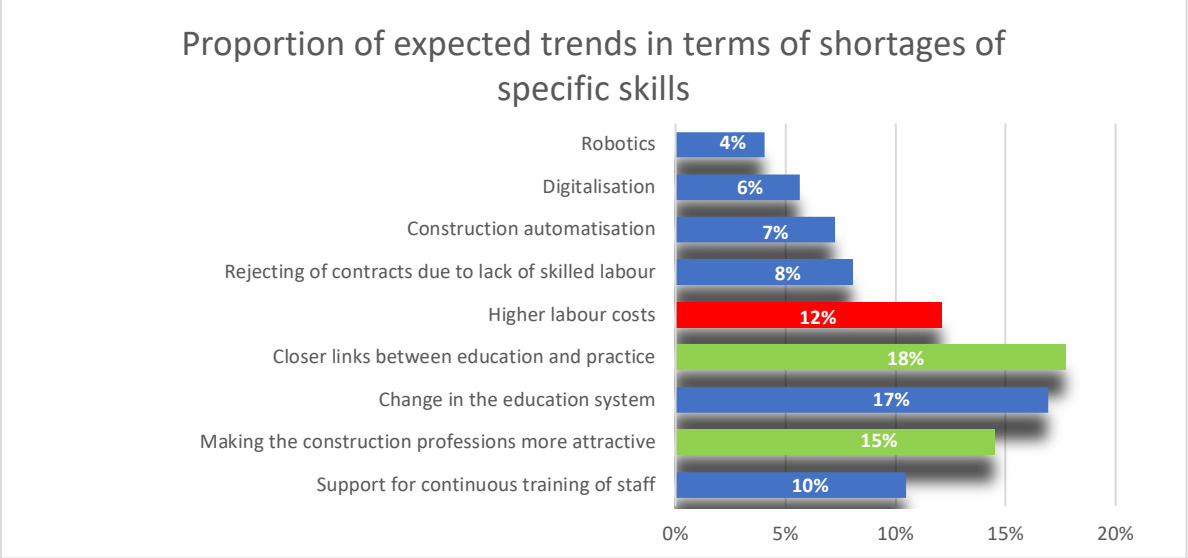
Graph 29 - Expected trends in terms of specific skill shortages



The resulting trends expected by the respondents (companies doing business in the construction industry) should show the direction in which the construction industry will be heading soon. The weight of the individual trends points to a change in the education system, whether in the form of cooperation between companies and schools, innovation in the education system or also making the construction professions more attractive, which also has a direct impact on the number of pupils studying construction and the promotion of continuous vocational training. Together, these weights account for up to 60% of the total expected trends.

In contrast, the robotization, digitalization and automation of construction has a weighting against the other trends amounting on 17%.

Graph 30 - Proportion of expected trends in terms of shortages of specific skills



However, it is important to note that with the digitalization, robotization and automation of the construction industry in Slovakia, increased training requirements for workers in this sector are expected.

Changes in technology and processes require new skills and knowledge that will be integral to the evolution of the construction industry:

1. Knowledge of new technologies - workers will need to gain knowledge of new technologies that are part of the digitisation, robotization and automation of the construction industry. These technologies may include advanced robotic systems, 3D printing, drones, augmented reality (AR) and virtual reality (VR), and more. Workers will need to understand their principles, uses and potential in the construction industry.
2. Operation of automated machinery and equipment - with the spread of automation in the construction industry, it is expected that workers will need to operate automated machinery and equipment. This may include operating robots, CNC machines, 3D printers, and other automated systems. They need to acquire skills in the use, setup, programming and maintenance of these devices.
3. Programming and software knowledge - with the automation and digitalisation of the construction industry, there is an increasing demand for workers with programming and software knowledge. Workers should have the ability to program, create, and modify software applications that are required for automated processes. Knowledge of programming languages and software tools will be essential for some positions.
4. Technical and engineering background - workers will need to have a technical and engineering background. An understanding of the technical aspects of new technologies

and automated systems as well as their integration into construction processes is required. Workers should have knowledge of engineering in mechanical, electrical, automation and other related disciplines. This will enable them to better understand the operation and maintenance of automated systems and robotic equipment in the construction environment. They will also be able to work more effectively with technical specifications and designs, implement new technologies into construction projects, and make necessary adjustments and repairs.

5. Project management skills - workers will need to have project management skills. These technologies and processes will change the way construction projects are planned, managed, and executed. Workers will need the skills to effectively manage projects, coordinate different tasks and resources, and use digital tools to track and manage projects.
6. Safety and maintenance skills - with the increasing automation and robotics in the construction industry, it is important for workers to have the workplace safety and maintenance skills for these new technologies. They must be familiar with safety procedures and regulations regarding the work with automated systems and robotic equipment. They should also have the skills to maintain and repair these technologies to minimise breakdowns and downtime.
7. Continuous learning and adaptability - given the rapid evolution of technology in the construction industry, it is important that workers can continuously learn and adapt to new trends and innovations. They must be willing to improve their skills, take training and courses, and maintain an up-to-date knowledge base. Flexibility and adaptability are key to successfully coping with changes in the digitalization, robotization and automation of the construction industry.

8.2.1 The impact of construction transformation on new skills, knowledge and competences and new skills needs

The construction sector is facing a transformation that goes beyond construction production alone. The industry is facing several mega trends that together require the construction sector to find ways to change not only how it operates, but also what and how it builds. These mega trends are:

1. Big data, artificial intelligence, and predictive analytics
2. Robotics and automation
3. Prefabrication and off-site construction
4. Internet of things
5. 3D printing

These have given a boost to innovations in building delivery, which is set to change through industrial construction (IC).

IC is the construction sector's response to the growing labour productivity gap with other sectors and the shortage of skilled tradespeople for a number of occupations, and is seen as a long-term solution to these problems. Covid-19 has caused its uptake around the world to accelerate significantly and is transforming the nature of the industry. Lagging in this area will have serious consequences for Slovakia, namely for social stability and economic growth.

This means that many of the future requirements for skills, knowledge and competences will be more adaptable and digitally focused. Considering a greater awareness of sustainability transformed into ESG in the next generation, the construction industry could become key to developing, designing and building the communities of the future. The construction industry will need to adapt and attract people from different backgrounds, such as strategists, cognitive and systems thinkers, data analysts and data scientists, digital workers and robotics programmers.

The construction industry will also have to deal quickly with the concept of Industry 4.0 and focus on Industry 5.0, which is already making significant progress in other sectors. This will require socially oriented skills, and the pushing social taxonomy, which will also need to be reflected in ESG programmes, will lead to a focus on sustainability in building design and construction production techniques, as well as the acquisition of more people-oriented skills and competences and the symbiosis of people and robotic machines and tools. This will mean new team types, new qualifications and new skills, knowledge and competencies for existing ones to be sought in the best available talent.

Identified needs for new professions:

Of the new professions and roles in the construction process, the following have been identified in the process of preparing the status quo analysis (the list is not exhaustive and will be added in the process of developing the roadmap):

- information manager
- robot operator
- digital cooperation
- cybersecurity
- value engineering
- AI architect
- building installation technician
- construction drone operator

Needs for new skills, knowledge, and competences:

In terms of skills, knowledge, and competences, they have been identified in the process of preparing the status quo analysis (the list is not exhaustive and will be completed in the process of developing the roadmap):

- cognitive and systems thinking
- programming
- active access to further education
- data-driven decision-making
- complex problem solving with excellent communication skills
- data analysis, AI, and BIM
- production management in industrial construction
- modelling and simulation
- management of robotic resources and drones
- internet of things
- computer visualization
- 3D printing
- extended reality (ER), including augmented reality (AR), virtual reality (VR) and mixed reality (MR)
- integration skills

Professionals with these and other skills, knowledge and competencies will work in the following teams, which are already taking shape and two important stages (from the perspective of countries with a mature construction sector) will be important for their evolution:

1. The first phase by 2025, when there will be two environments in which to work - on-site and off-site production;
2. Second stage 2025-2030, when an integrated industrial development will have already been formed.

This shows that we are in a significant delay and further lagging behind only worsens the starting position of the Slovak construction sector. Slovakia is perhaps the last country in the EU where the impact of these changes is still being debated as if we had a choice. But no one will wait for us (or run against us). In terms of training new professionals, we need to start quickly building future core teams that can clearly understand their roles and place in the transformation of the sector.

Key teams in this process will include:

- Integrated team for design and preparation of construction production
- Production team (industrial production part of construction production)
- Value chain team
- Construction production management team (on site)
- Data analysis and integration team

In terms of the current set-up processes in education, we will be able to welcome the first graduates for the above-mentioned roles/professions equipped with the necessary skills, knowledge and competencies to our workplaces in 2030 at the earliest, if we start working on this intensively right away, which will have an impact on the timeframe of the transformation of the construction industry. The development of further education and work on a system of continuous learning must be adapted to this.

8.2.2 Proposed solutions with regard to skills needs

Proposed solutions for companies in the construction industry regarding the shortage of skilled workers

Often the shortage of skilled workers in the construction sector is a serious challenge for companies. According to graph below, which shows the plans of companies in the construction sector to deal with the shortage of skilled workers, companies operating in the construction sector in Slovakia are trying to find different ways to cope with this situation.

The results confirm that respondents recognise the importance of collaboration between companies, educational institutions, and professional associations, which is key to successfully tackling the shortage of skilled workers in the construction industry. This is confirmed by the survey conducted, which shows that up to 62% of respondents plan to address this situation by supporting the education and training of future employees, 56% of respondents plan to develop cooperation with secondary and vocational schools. This suggests that employers in the construction industry plan to invest in supporting the education and training of young people, which could increase interest in construction occupations and secure future employees, while at the same time increasing the readiness of graduates for market demands. Such investment in education may involve working with secondary schools and universities, updating education to new trends that meet the needs of the construction sector, or with employer-based training to provide graduates with the necessary qualifications and skills. Cooperation with construction employers and schools can also take the form of scholarships, student internships, joint research projects, training for teachers, selection lectures for pupils and students, or assistance in providing up-to-date material and technical support.

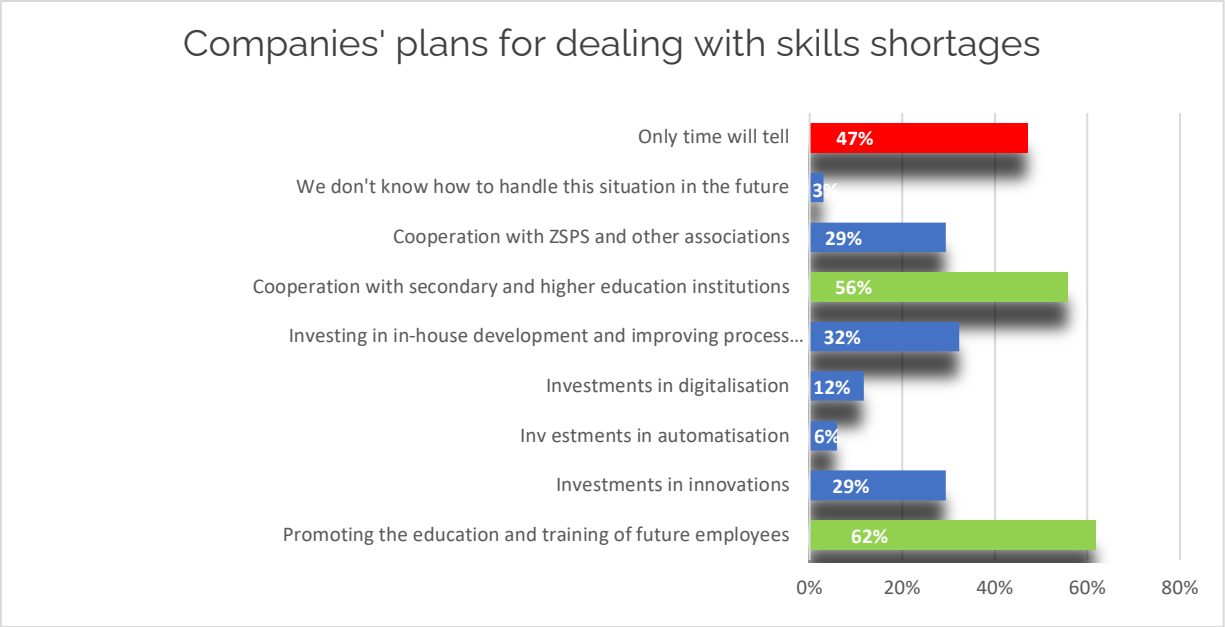
32% of respondents from construction companies plan to invest in self-development and increase efficient processes, where investment in training, specialised courses and professional development for existing staff increases the skills and efficiency of existing staff.

Cooperation with ZSPS or other associations and professional organizations in the construction sector is planned by 29% of respondents, where cooperation should lead to joint initiatives aimed at raising awareness of the construction sector, promotion of construction professions and joint projects focused on training and education.

Alarmingly, almost half of respondents (47%) said they would leave it to time to address the skills shortage, but this approach will not solve the situation, rather it will make it worse. It is

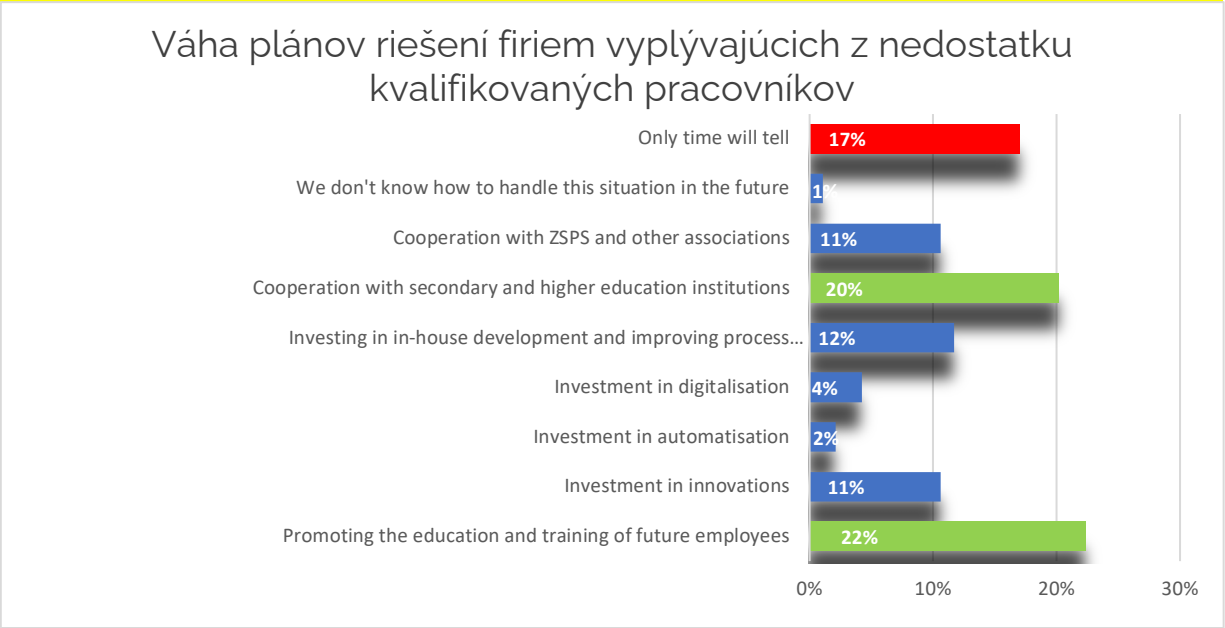
important that construction companies address this situation and use proven methods and ways to ensure enough skilled workers.

Graph 31 - Companies' plans for dealing with skills shortages



Again, we can see from Graph 31, which shows the importance of the weights, that construction companies' plans to deal with the shortage of skilled workers are mainly associated with training. Up to 44% of all responses are focused on cooperation with secondary and higher education institutions and support for training and education of future employees. It is important that construction companies actively cooperate with educational institutions and invest in training.

Graph 32 - Weight of companies' plans to address skills shortages



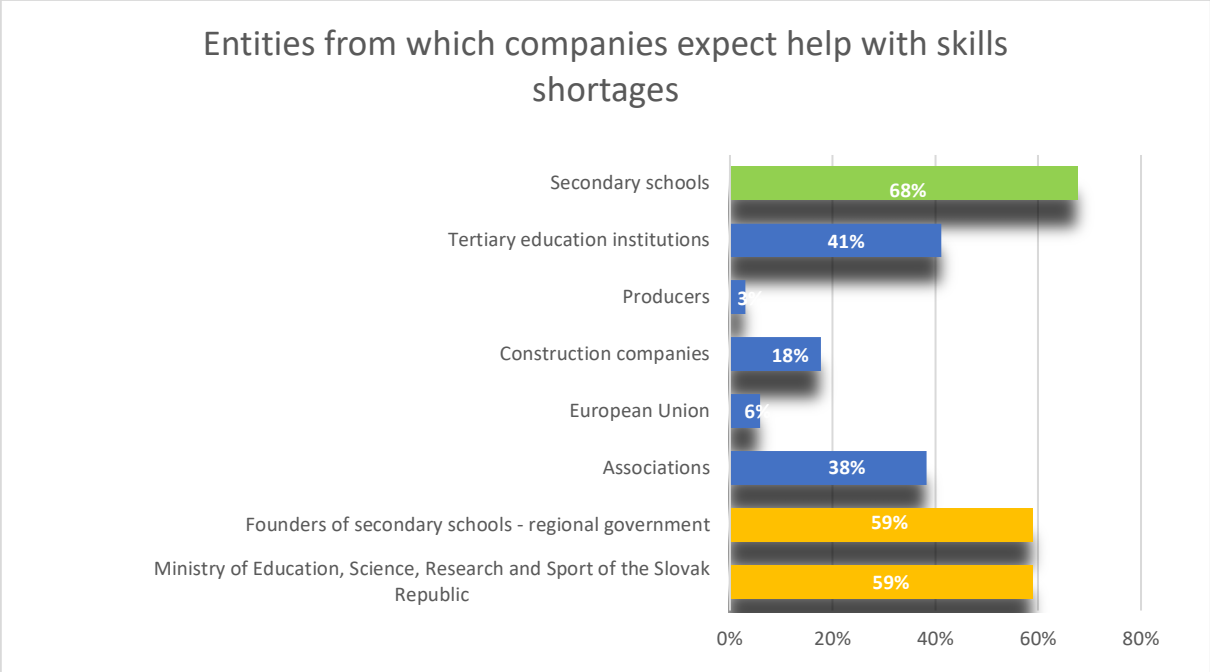
Choosing an effective approach to address the skills shortage is an inevitable challenge facing many organisations and institutions today. In the questionnaire, we also focused on identifying the assistance expected to address this situation. The primary objective was to determine which entities and organizations should be involved in working together to meet the needs of the current and future labour market.

Secondary schools have the task of providing education and training that is directly linked to specific sectors and occupations. Given the long-term nature of construction projects and the need to continually replenish human resources with skilled workers, it is important for construction companies that schools produce well-educated graduates who can become future professionals in their industry. This is confirmed by the results shown in Graph 32. As many as 68% of respondents from construction companies view high schools and 41% of respondents view colleges as an important source of addressing the shortage of skilled workers in the construction industry.

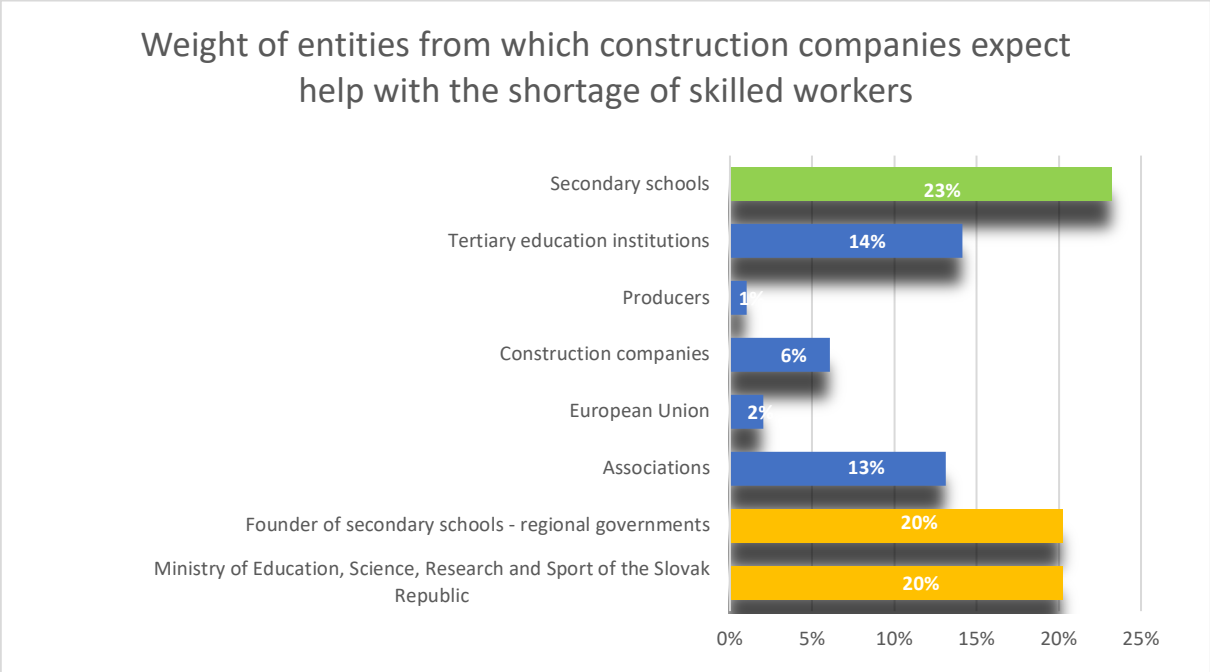
59% of the respondents expect help from entities such as the Ministry of Education, Science, Research and Sport of the Slovak Republic and also from the administrators of secondary schools (Local Authorities). These entities have a considerable influence on the education system and can influence the content, attractiveness, flexibility and direction of education and training, which are essential for the needs of the construction sector. The Ministry of Education, Science, Research and Sport is responsible for the development of education policy and the management of the education system in the country. It is its role to work with secondary schools and employers to ensure that educational programmes are relevant to the needs of the labour market. The Ministry should support initiatives, employers and professional associations involved in the modernisation of education in the introduction of new vocational fields/programmes. On the other hand, it is the administrators of secondary schools who have the responsibility for their management and administration. They have the possibility to influence the network of secondary schools as well as to support pupils in shortage courses or employers cooperating with secondary schools. However, the discussion on the status quo analysis revealed that in many cases local authorities are lowering the guideline numbers for building trades and trades that focus on the installation of renewable energy technologies and heat pumps. This trend is in full contradiction with Slovakia's tasks in the field of clean energy transition, substitution of gas by electrification of heating/cooling in buildings and with the international climate commitments to which Slovakia is bound.

In the results of the survey on expectations for assistance, unions, and associations (38% of respondents), construction companies (18% of respondents), the European Union (6% of respondents) and manufacturers (3% of respondents) have a significant position. The expectation of assistance from construction companies naturally falls on organisations that have a direct influence on setting up a quality education system and its links with practice, as well as on the promotion of the professions and their applicability in practice.

Graph 33 - Entities from which companies expect help with skills shortages



Responding construction companies see a variety of entities that they expect to address the shortage of skilled construction workers. Graph 33 shows that construction companies are willing to establish cooperation with educational institutions such as secondary and higher education institutions (overall weight 37%), as well as the need to address the current situation on the part of school administrators and the Ministry of Education, Science, Research and Sport of the Slovak Republic (overall weight 40%).



Graph 34 - Weight of entities from which construction companies expect help with the shortage of skilled workers

Proposed solutions to the shortage of skilled workers regarding education and training providers in the construction industry

The research also focused on addressing the skills shortage from the perspective of providers of retraining programmes and courses. In the construction industry, it is important that there is a sufficient supply of quality retraining and reskilling programmes and courses to up-skill workers and that they are relevant to current needs and trends in the sector.

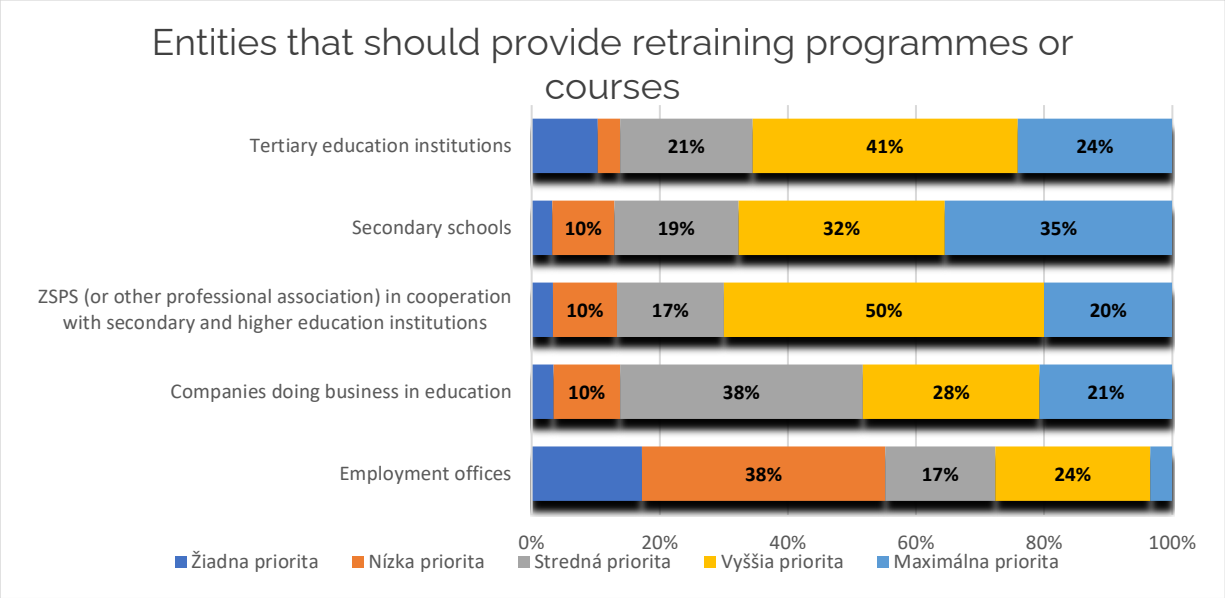
Based on the results summarized in Graph 34, construction companies give maximum priority to high schools (35% of respondents) and colleges (24% of respondents) as the entities that should provide retraining programs or courses. Therefore, it can be concluded that construction companies see colleges and high schools as the main players in the provision of training and education.

Professional associations and unions have a deeper understanding of the specifics of the construction industry and its needs and are therefore given a higher priority by construction companies (50% of respondents). They can work with secondary and higher education institutions to develop vocational retraining programmes and courses that focus on current requirements and new technologies in the sector. Professional associations and unions can also organise professional seminars, workshops and conferences that enable construction workers to continuously learn and develop their skills.

On the contrary, respondents assigned a medium priority to training companies in the provision of retraining programmes in the construction industry and a low priority to employment offices, indicating that such courses are not beneficial from the employers' side.

Construction companies may perceive job centres as a low priority because they are concerned about the quality and relevance of the training programmes offered by these centres. It can be assumed that they lack tailoring training programmes to the specific needs and trends of construction employers. A medium priority for business education may indicate concerns about the expertise and quality of the training programmes offered because of the relevance of such training to practice.

Graph 35 - Entities that should provide retraining programmes or courses



9 Barriers

Skills and enough skilled construction workers play a key role in achieving the country's 2030 energy targets. There are several barriers that may prevent the country from responding to current changes and maintaining a competitive construction sector in Slovakia.

Improving working conditions and increasing the attractiveness of construction occupations as well as ensuring job security in the construction sector, together with the promotion of vocational training, will contribute to strengthening the skilled labour potential in the sector and enable the achievement of the 2030 energy targets. It is essential to jointly identify these barriers and seek measures and strategies that will help overcome or remove them and ensure the sustainable and efficient development of the construction sector in line with the country's energy targets.

The construction sector is characterised by its diversity and fragmentation, which makes it difficult to ensure a high level of cooperation in solving problems. This fragmentation leads to a lack of coordination and cooperation between stakeholders in the construction sector. This lack of coordination and communication between stakeholders in the construction sector limits opportunities, flexibility as well as the ability to respond to current challenges and changes in the construction sector, which cannot be handled without the existence of a sufficient number of skilled workers.

It can therefore be concluded that there are several key areas that need to be explored and addressed. The fragmentation of the construction sector, job insecurity in the construction industry and the limited interest of many sole traders and one-man firms to train apprentices present challenges that require innovative solutions.

The following section discusses the barriers identified from the aforementioned survey whose respondents were construction schools and construction firms. The identified barriers provide concrete information and a deeper understanding of the current situation and challenges facing the construction industry in achieving the country's 2030 energy goals.

9.1 Barriers on the side of educational institutions

The survey conducted focused on vocational education and identifies the barriers and challenges faced by schools that affect their ability to provide adequate training and meet the needs of the labour market. We also focused on the barriers to the introduction of new innovative educational concepts and the focus of the fields of study.

44% of the schools involved in the survey see low interest in working in the education sector due to lack of financial compensation as the biggest obstacle to the introduction of innovative education concepts. At the same time, 42% of respondents mentioned the lack of teaching and professional staff as a barrier. These are the factors that hinder schools from recruiting qualified teachers, vocational masters but also school principals. Insufficient financial remuneration

discourages experienced professionals from pursuing a career in education and focusing on more financially attractive job opportunities. This situation consequently has an impact on the quality of teaching and training, in terms of reduced motivation and reduced interest to operate in an environment with insufficient financial rewards. This also has an impact on the lack of interest in updating knowledge and skills on the part of teachers and results in an unfavourable generational structure of the teaching staff.

A related problem is the unnecessary requirements for teaching practice. This hinders the employment of highly qualified practitioners due to a failure to meet these requirements. Such requirements only exist in the former socialist states of Eastern Europe. Consequently, principals, especially of secondary schools, devote an unnecessary amount of energy and time to recruiting new teachers, which, together with the high administrative demands of the position, takes away from the time needed to manage the school adequately, plan its development as well as control it.

Another identified barrier perceived by vocational schools is state funding. It is not sufficient to provide the required modern technical equipment. This lack of funding is an insurmountable obstacle to the development of education in terms of needs in 2035. For this reason, the proposals of the roadmap for vocational education in secondary schools will only be in the level of recommendations and only the issues of the development of further education can be seriously addressed, which, however, cannot compensate for the shortfall that will occur in the field of formal education and preparation for employment, which is, among other things, guaranteed by the Constitution of the Slovak Republic.

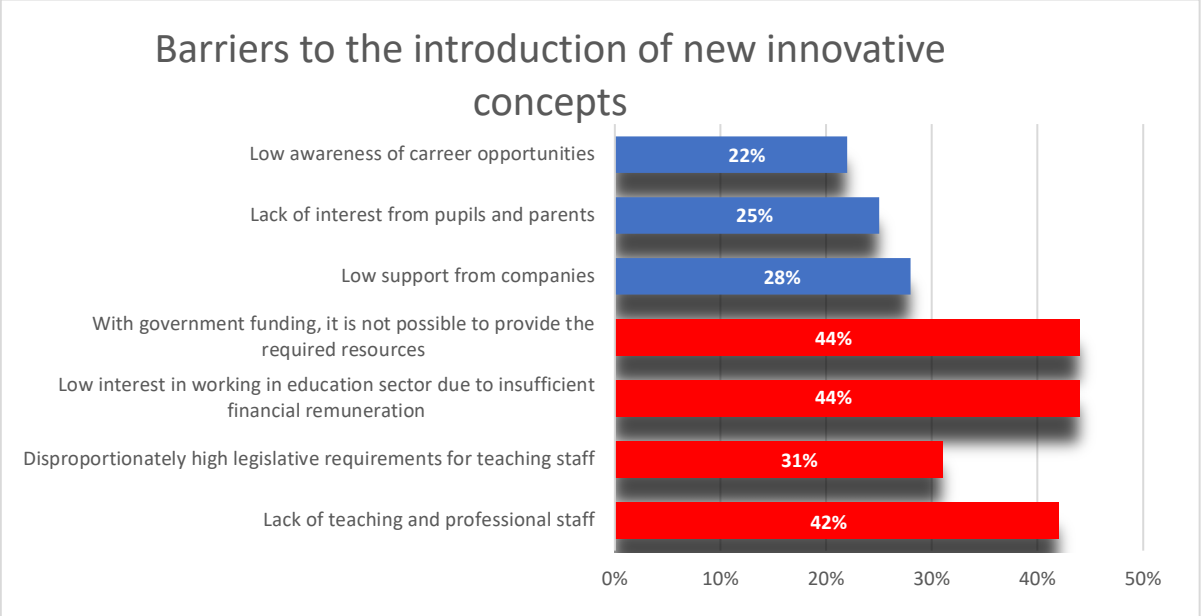
If we put this fact in the context of repeatedly unspent funds from Eurofunds, it is difficult to explain why schools do not have everything they need, even in a sector that is key to achieving climate neutrality by 2050 (although the Slovak government should be able to cover these needs from its own resources, as European taxpayers cannot be expected to contribute endlessly to ensure constitutional rights in Slovakia).

This barrier was mentioned by 44% of the schools involved in the survey. It should be stressed once again that insufficient funding limits the ability of schools to provide even the currently necessary material and technical provision and to keep up with current changes. Consequently, they are forced to use outdated procedures and technologies, which has a negative impact on the quality of vocational training and on the attractiveness of construction education in the eyes of young people. Modern technical equipment is an essential part of the education process in the construction sector, enabling pupils to gain practical experience and to become familiar with current technologies and practices. Out-of-date training of young people results in their unpreparedness for practice, which employers then must take on during the first months to years of employment, again hindering their transition to new practices and technologies.

The lack of teaching and professional staff also has a negative impact on the quality of education and training of students in the construction sector, which is confirmed by the results

of the survey, where 16% of respondents from vocational schools see it as an obstacle to the preparation of innovative educational concepts. In Slovakia, the trend of shortage of pedagogical and professional staff in education is a general problem and is not limited to the construction sector. The value status of a teacher is very low in society, and together with low financial remuneration of teachers, a situation arises where school principals cannot fill the position of a professional teacher for several years.

From the results of the survey we have identified several obstacles such as inadequately high legislative requirements (pedagogical education) for teaching staff (31% of respondents), low support from companies (28% of respondents), lack of interest on the part of pupils and parents (25% of respondents) and low awareness of the applicability of such education (22% of respondents).

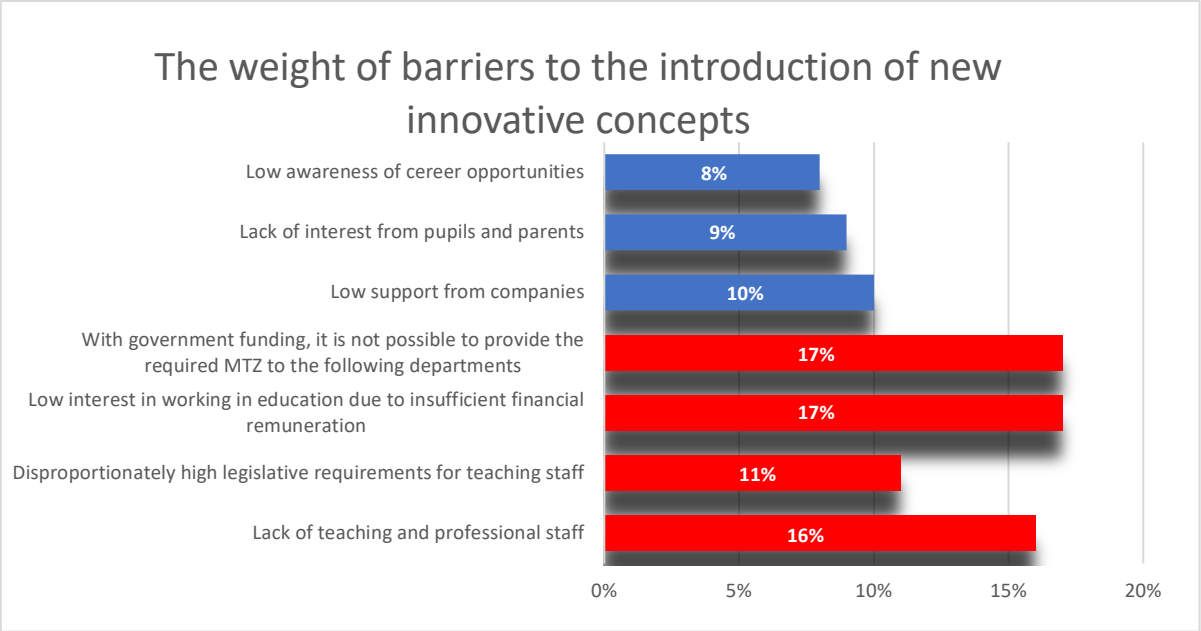


Graph 35-Barriers to the introduction of new innovative concepts

From the survey it is also possible to identify the weight of barriers to the introduction of new innovative concepts. Barriers related to the lack of teachers, their financial remuneration and the demands placed on them have an overall weight of 44%. Subsequently, the weights focusing on barriers in terms of awareness of employability, interest in studying and company support have an overall weight of 27% and the inability to provide the required resources has a weight of 17% .

Lack of teaching and professional staff is therefore the most significant barrier. This suggests that the lack of qualified teachers and professionals in the construction industry severely limits the possibilities of implementing new innovations and upgrading in schools. In addition to the aforementioned necessary transformation of the construction industry, there is also a need to focus on greater promotion of the sector, the applicability of education and the promotion of the link between education and practice. It is clear from the results that construction schools

face several significant challenges in introducing new innovative concepts. Without mastering them, it will not be possible to cope with the changes coming to the construction industry in the required time.



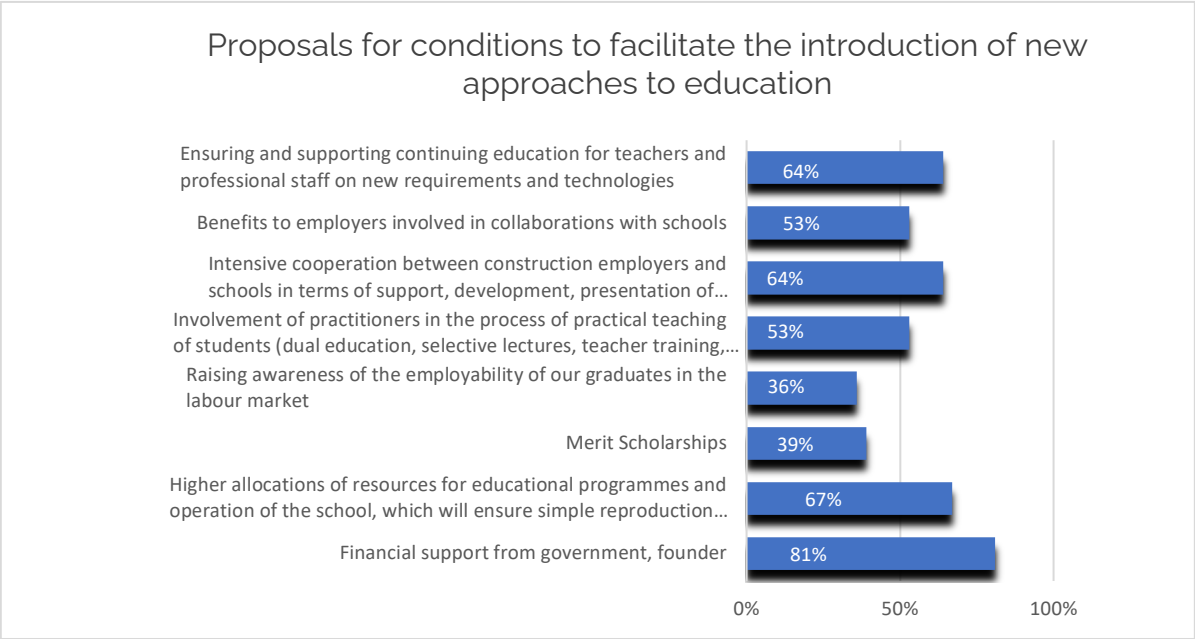
Graph 36-Weight of barriers to the introduction of new innovative concepts

Based on these findings, it is important to take measures to address these barriers and ensure quality training in the construction sector. Figure 38, shows the solutions that schools see to address the problems identified.

Schools' responses expressed the need for financial support from governments and founders (81% of respondents) to enable them to implement projects and invest in modern equipment, which in turn would help in the implementation of new education concepts and increase the attractiveness of education for young people. Closely related to financial support is the solution through a higher normative for the material and technical provision and operation of the school (67% of respondent-schools).

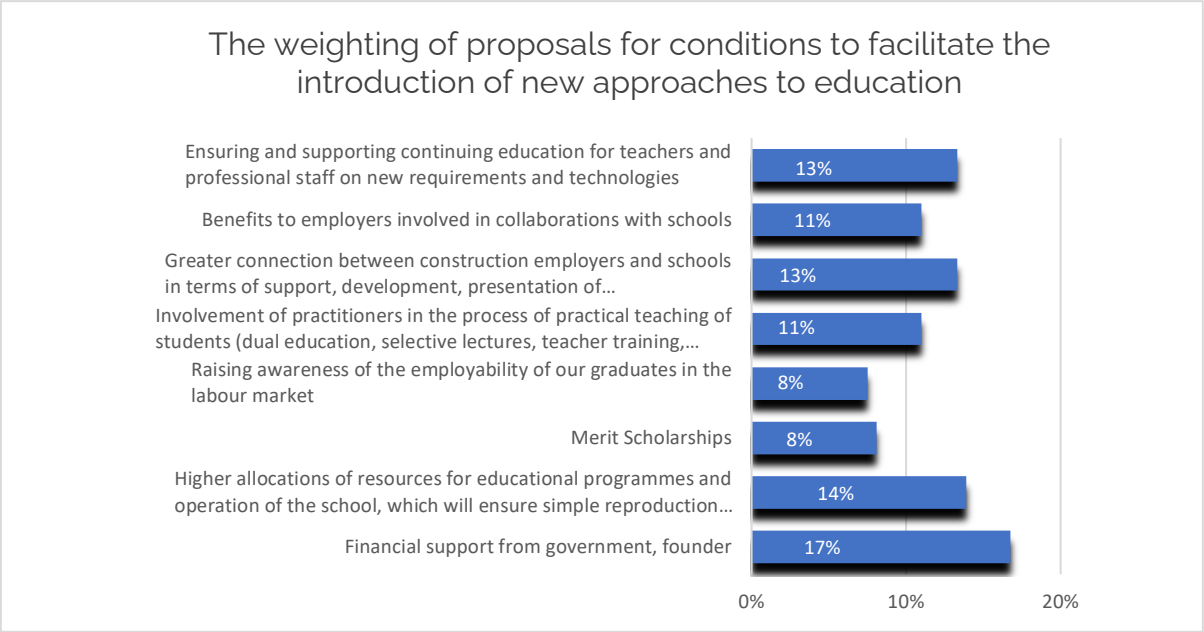
The survey results show that 64% of respondents from schools believe it is important to achieve greater links between construction employers and schools. This linkage should relate to a greater connection between education and practice as well as promoting, developing, and showcasing the applicability of education to practice. Schools could work with practitioners, whether through dual education, selection lectures, teacher training or excursions, to ensure that their education is in line with the current requirements of the construction labour market. In addition, 64% of the responses from schools highlight the need to provide and support continuing education for educators and professional staff to ensure that they can respond to new demands and technologies in the construction industry.

In conclusion, except for two solutions, all others exceeded the 50% threshold and can be considered as significantly supported solutions to the identified problems. Of these, the most significant came out to be the need for a higher financial contribution from the state and the founder, either for the educational programmes or the school operation in general.



Graph 37-Suggestions for conditions to facilitate the introduction of new learning concepts

In terms of the weights of the individual solution proposals, it is confirmed above that financial support from the government and the founder as well as a higher allocation of resources has the highest weight (31%). Involvement of practitioners in education as well as higher cooperation with employers in terms of support, development, presentation of applicability as well as support of such employers has an overall weight as well as support of schools by employers has a high overall weight of 35%.



Graph 38-Weights of suggestions for conditions to facilitate the introduction of new learning concepts

9.2 Barriers on the side of employers

The European Commission has identified the building sector as key to achieving climate neutrality by 2050. In addition, the Slovak construction sector has a very important position in the Slovak economy. Nevertheless, it is not such a priority of the government that resources adequate to the requirements of this sector and its role in the clean energy transformation are provided to this sector, either from the EU funds (not even from those designated for this purpose by the priorities set by the EU budget) or from the state budget's own resources. It therefore faces various challenges that it cannot overcome. The undercapitalisation of the sector, the underfunding of education and the lack of investment in areas where the fragmented construction sector, composed mainly of medium, small, and micro enterprises, has no chance to invest, such as the material and production base for modular construction, the industrialisation of construction production, its transfer off-site and ensuring the application of other innovations that are already shaping the construction industry in Western Europe. If Slovakia continues to see its future in the European Union, it too will need to undergo such a transformation to support the climate ambitions of the EU and Slovakia.

No solution to these barriers could be found other than a change in the situation by the competent authorities. Therefore, the Roadmap will have problems even address this issue.

In the status quo analysis, the authors addressed the process of renovation of the building stock in Slovakia. It was not the purpose of this analysis to evaluate its results; the Supreme Audit Office has taken on this task and no additional comment is needed on its findings so far. Similarly, the situation in the area of residential and non-residential buildings that are not in

public ownership should also be addressed, as the number of such buildings is far greater, and their weight is consequently higher.

The task of the status quo analysis was to assess to what extent the renovation of buildings would contribute to the growth of the sector. As the construction sector has seen a decline in the years under review, even during the intensive building renovation, as assessed by the responsible authorities, no significant growth can be expected in the coming years.

There is therefore scope for the construction sector to focus on its own transformation as described in the previous sections, but this will require a change in government and societal priorities as outlined above. In this way, it can at the same time prepare for the period after 2035, when it will be necessary to cope with demolition and recycling a large part of the building stock after their end-of-life and launch new construction tailored to the demographic development in Slovakia.

This transformation of the construction industry also includes the changes necessary to address the shortage of skilled workers. An empirical survey of employers was the basis for analysing the barriers and reasons why there is a shortage of workers who lack professional skills or knowledge. The aim was to gather information directly from the companies in the construction sector that have directly faced these challenges.

The results of the questionnaire show that the shortage of skilled workers in the Slovak construction industry is the result of a combination of various factors that we have already written about. These results help us to understand the main factors that influence the interest in studying construction disciplines and, consequently, the availability of skilled workers in the sector.

One of the main barriers identified by employers is a lack of interest in studying construction disciplines, which was reported by 79% of respondents - companies doing business in the construction industry. This lack of interest is due to the perception of the construction industry as less prestigious and less attractive compared to other industries. Many young people prefer other disciplines or degree programmes that make use of new and digital technologies. The use of already outdated practices and technologies and the associated working conditions lead to a limited number of students interested in studying construction disciplines. As data analysis from other studies has shown, even of those students who do graduate with a construction degree, few remain in the industry. One of the studies reports only a 9% retention rate, which although questioned by the schools, shows that a significant proportion of graduates leave for other sectors. There is no data on the reasons for leaving for other sectors, but it is possible to accept the conclusion that, on the one hand, many do not find a job in the construction industry in Slovakia or do not believe in an interesting long-term career in the sector. Another significant proportion of graduates leave because they have already enrolled in studies for reasons other than an interest in a job in the sector. This barrier will be removed by transforming the sector, making it more attractive and able to offer interesting work and long-term careers.

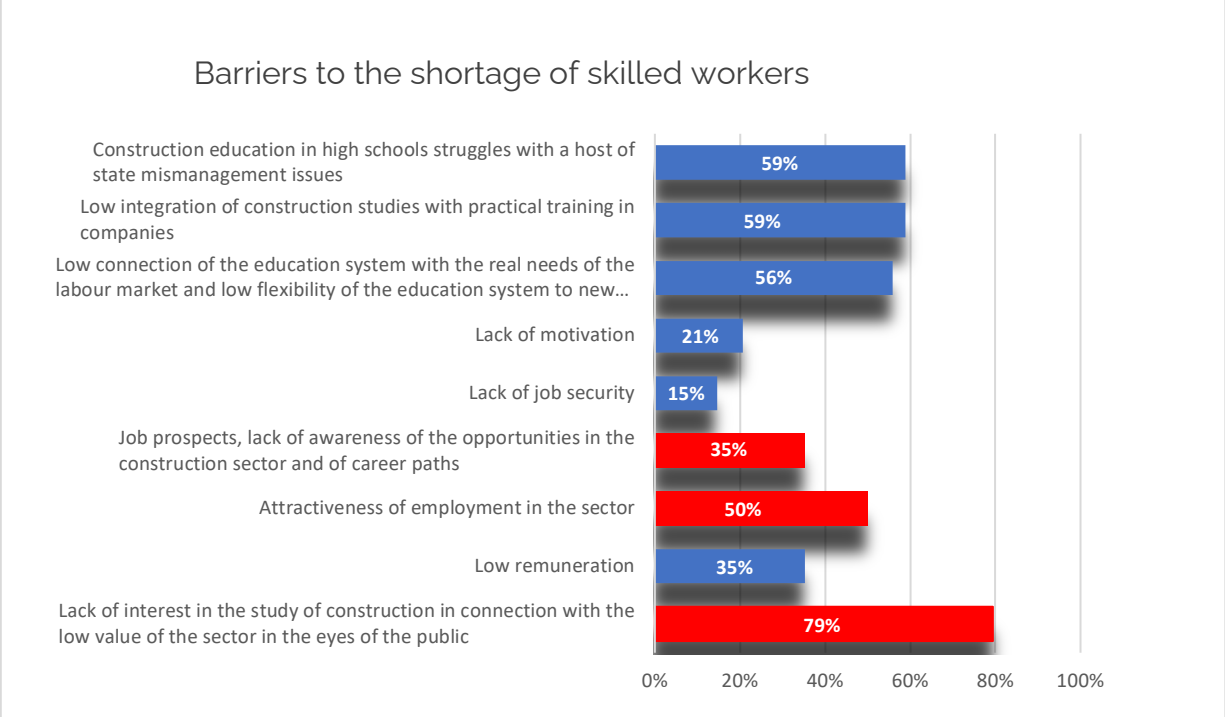
The analysis also showed that the low connection of construction studies with practical training in companies is another important barrier (59% of respondents - companies doing business in the construction sector). This barrier can be overcome, and the roadmap will address possible solutions. There is a need to ensure that construction students have access to practical learning on real construction sites and encounter real situations. In this way, they will gain better practical skills and experience, which are essential for a successful career in the construction industry, and they will also gain better information about the employability of their training, which in turn also has the effect of increasing the attractiveness of the construction industry in their eyes. The same number of respondents from construction companies think that education in the construction industry faces many unmanaged problems due to lack of the state support to schools. There is a need on the part of the state to address these problems and invest in the education system to be able to provide quality and relevant education in the construction trades.

In addition, the analysis also pointed to a lack of link between the education system and the real needs of the labour market (56% of respondents - companies operating in the construction industry). This means that educational institutions do not always sufficiently consider the current requirements and trends in the construction sector when preparing their teaching/study fields/programmes and their curricula. It is important to strengthen this cooperation and to ensure that students gain relevant knowledge and practical experience to help them better manage between education and practice.

The attractiveness of employment in the construction industry was identified as a reason for the shortage of skilled workers by 50% of respondent firms operating in the construction industry. Working conditions in the construction industry, such as working outdoors and physical exertion, may be less appealing to some people. Low job stability and working conditions in construction companies also appear to be less attractive than in other industries. It is therefore necessary, in addition to the aforementioned transformation of the sector, to set up new approaches to employees and to emphasise the advantages and prospects of employment in the construction industry, such as opportunities for rapid career development, working on permanent diverse projects, as well as the use of digitisation and other new technologies.

Another factor is the lack of awareness of employment prospects in the construction industry, which was identified by 35% of respondent construction firms. Young people have limited information about career opportunities and about current changes and developments in the construction industry and this may lead to a lack of interest in studying construction disciplines. To this must be added another factor that the survey showed, and that is wage remuneration. As many as 35% of respondent firms operating in the construction industry identified this barrier. Low wages, job stability but also the possibility to take out a mortgage loan discourages potential students and workers from getting a job in the construction industry because they

prefer fields with more attractive and stable conditions. It is essential to improve working conditions in the construction industry to increase its attractiveness and competitiveness vis-à-vis other sectors.



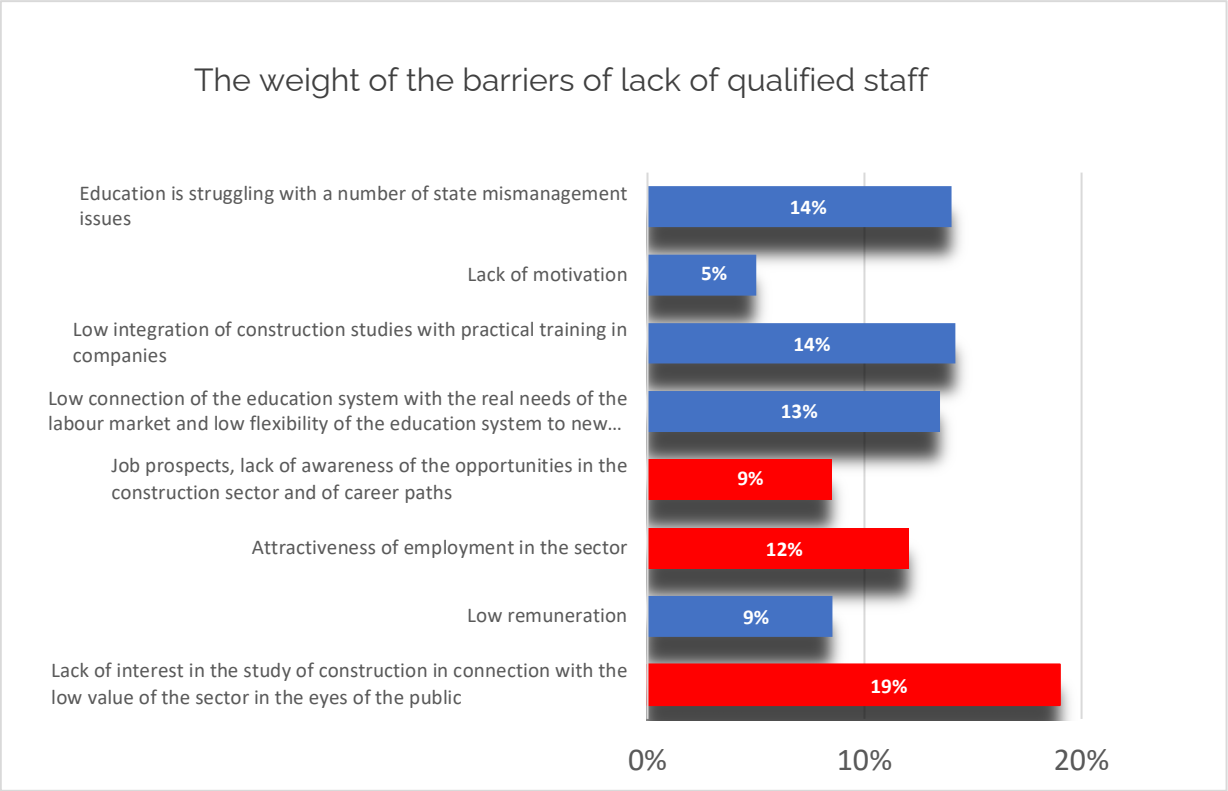
Graph 39-Barriers to shortages of skilled workers

As is evident, all secondary barriers are based on the primary barriers mentioned in the introduction of this section.

Based on the responses, it was also possible to assess the weights of each barrier as perceived by the firms. The analysis showed that the highest weight is disinterest in studying construction disciplines (19%). Together with attractiveness and job prospects, they have an overall weight of 40%. These factors point to the importance of industry transformation and strong collaboration between construction firms and the education system to ensure that students gain the necessary practical experience and knowledge in line with the real requirements of the labour market.

Other important barriers in terms of their overall weights are the low interconnection between studies and practice and the low cooperation between the education system and practice, in which we can also include the low flexibility to incoming changes with an overall weight of 27%. Wage evaluation is with a weight of 9% against this the amount of state unmanaged problems has a weight of 14%.

The results identified indicate that the shortage of skilled workers in the construction industry is a complex problem that requires an integrated approach and solutions at multiple levels along the chain.



Graph 40-Weight of barriers to lack of skilled workers

10 Conclusions

The status quo analysis and the work on it is the result of the complex work of the partners and a large number of stakeholders who actively participated in the discussions on the analysis of the data and insights gathered. Contributions to the empirical research were fundamental to the success of the analysis and in many cases the only source of the data needed.

The analysis carried out highlighted several shortcomings in the assessment of the results achieved so far in the field of improving the energy performance of buildings, which was finally confirmed by the results of the audit by the Supreme Audit Office, although so far only the audit in the field of public buildings has been carried out. However, the aim of the status quo analysis was not to assess the renovation of the building stock as such, but to assess the contribution of building renovation to growth in the construction sector. Based on the very favourable assessment of the results of building renovation so far by the responsible authorities, also taking into account the results of the Supreme Audit Office audit, it can only be concluded that building renovation will not contribute significantly to growth in the construction sector in the future, as the sector recorded negative growth in the years assessed as very intensive in this area.

However, it is necessary to anticipate the critical situation in the building sector in 2035 and therefore the building sector must undergo a necessary transformation to cope with the demolition and recycling of end-of-life buildings that form a significant part of the current building stock and to provide for new construction based on demographic developments. This transformation will also secure the interest of investors in the building sector and avoid a crisis in financing its own business activities, given the shift in investor interest towards financing sustainable business activities, which will also mean that unsustainable business activities will not have access to financing. For this reason, it is important to pay attention to developments in the EU taxonomy and the adaptation of business activities to its technical indicators.

To do this, it will also be necessary to transform vocational education, promoting new approaches, methods and technologies in education and the assessment of learning outcomes, thereby anticipating not only the needs of the labour market but also the new societal needs that will increasingly be at the centre of attention.

In terms of the objectives of the BUS DoubleDecker project, the roadmap will address the following areas:

- To offer a proposal for a strategy for the further development of vocational education in secondary schools to provide for future skills and knowledge needs based on the outlined vision for the construction sector for 2035 and 2050. Here, developments in other industries need to be extrapolated to anticipate developments in the construction sector;
- Make recommendations for content, material, and financial conditions so that educational institutions can manage this effectively;
- Propose a focus for further and continuing education programmes towards micro-qualifications that will significantly complement formal vocational education in secondary schools, especially in the field of fast-moving innovations to which vocational training institutions cannot respond quickly, due to the lengthy planning and approval process, which is often longer than the full exchange of information in the field (i.e. by the time a new vocational field and related vocational training programme is prepared, approved and included in the curriculum, it is already outdated and unnecessary);
- Prepare a proposal for projects and joint stakeholder activities that will be directed towards the fulfilment of the proposed objectives in the field of continuing and further education.

These proposals will be prepared in close cooperation with the stakeholders who have participated in the status quo analysis, in order to take into account their specific suggestions and comments.

The development of these proposals will be influenced by the situation following the crisis caused by the consequences of the spread of the Covid-19 virus. What we saw in 2019 as the

long-term future is gradually becoming a reality. Digital technologies, which have been the basis of our contact with the world and critical to the continuity of most activities, are more accepted than ever. Under normal circumstances, we would hardly have made such progress in Europe in 3 years. This has reduced the 'transition period' to digital technologies from 10 years to a third. The reopening of communities has created a new focus and motivation for technological advances and modern construction methods. We are also seeing a greater awareness and interest in correcting the unsustainable impacts of the built environment, the carbon footprint impacts of the construction process itself, and the carbon emissions from buildings.

These changes in awareness have provided the impetus for innovation in the delivery of the built environment, which is set to be transformed by the construction industry (PV). PV is a system that uses and combines attributes of nD BIM and CDE and digital twins. It encompasses five key megatrends:

6. Big Data, AI (artificial intelligence) and predictive analytics;
7. Robotics and automation;
8. Prefabrication and off-site construction;
9. Internet of Things;
10. Technological development of manufacturing (3D).

PV is the construction sector's response to the growing lag in labour productivity behind other industries and the shortage of skilled craftsmen before multiple occupations and is seen as a long-term solution to these problems. Covid-19 has caused its uptake around the world to accelerate significantly and is transforming the character of the entire industry. Lagging in this area will have serious consequences for Slovakia, namely for social stability and economic growth.

This means that many of the future requirements for skills, knowledge and competences will be more adaptable and digitally focused. As a result of the transformation of ESG's business operations and business strategy, the company has become a key player in the development of the local and regional economy. The construction industry will need to adapt and attract people from different backgrounds, such as **strategists, cognitive and systems thinkers, data analysts and data scientists, digital workers,** and **robotic programmers**.

The construction industry will also have to deal quickly with the concept of Industry 4.0 and focus on Industry 5.0, which is already making significant progress in other sectors. This will require socially oriented skills, and the pushing social taxonomy, which will also need to be reflected in ESG programmes, will lead to a focus on sustainability in building design and construction production techniques, as well as the acquisition of more people-oriented skills and competences and the symbiosis of people and robotic machines and tools. This will mean new team types, new qualifications and new skills, knowledge and competencies for existing ones to be sought in the best available talent.

Of the new professions and roles in the construction process, status quo analyses have been identified in the development process (the list is not exhaustive and will be added to in the process of developing the roadmap):

- Information Manager;
- Robot operator;
- Digital collaboration;
- Cyber security;
- Value engineering;
- AI architect;
- Building assembly technician;
- Construction drone operator.

In terms of skills, knowledge and competencies, the following have been identified in the process of preparing the status quo analysis (the list is not exhaustive and will be completed in the process of developing the roadmap):

- Cognitive and systems thinking;
- Programming;
- Active access to further education;
- Data-driven decision-making;
- Complex problem solving with excellent communication skills;
- Data analytics, artificial intelligence (AI) and BIM;
- Production management in industrial construction;
- Modelling and simulation;
- Robotic resource management and drones;
- Internet of Things (IoT);
- Computer visualisation;
- 3D printing;
- Augmented reality (XR), including augmented reality (AR), virtual reality (VR) and mixed reality (MR);
- Integration skills.

In terms of the current processes, including planning deadlines and accreditation deadlines in secondary vocational education, we will be able to welcome the first graduates for the above roles/professions equipped with the necessary skills, knowledge, and competencies into our workplaces in 2030 at the earliest if we start working hard on this right away, which will impact the timeframe for the transformation of the construction industry. The development of further education and work on a system of continuous learning must be adapted to this.

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13 Glossary

AR	Augmented reality
AT	Austria
b. c.	Current prices
BD	Residential buildings
BEMS	Building energy management system
BIM	Building Information Modeling
BUS	Build Up Skills
CNC	Computer numerical control
CO_2	Carbon oxid
COVID-19	Coronavirus Disease 2019
COVP	Centre for vocational training
CPS	Guild of floor engineers
CSS	Slovak roofers guild
CVTI SR	Centre for scientifical and technical information of Slovakia
CZ	Czechia
CZT	District heating
CŽV	Lifelong learning
DALV	Statistical form on further education and training
DE	Germany
EE	Energy efficiency
EHB	Energy performance of buildings
EHPA	European Heat Pump Association
EKR	European qualification framework
EN	European norm
EP	European Parliament
EPC	Energy Performance Contracting
EPDM	ethylene propylene diene monomer rubber
EQF	European Qualifications Framework
ESCO	Energy Services Company

EŠIF	European structural and investment funds
ETS	Emissions Trading System
EÚ	European Union
GWh	Gigawatthour
HDP	Gross domestic product
IOT	Internet of Things
IROP	Integrated regional operational programme
ISCO	International Standard Classification of Occupations
IVU	Individual study accounts
KEKS	Cluster of energy communities in Slovakia
KROVaP	Regional council for vocational training
kW	Kilowatt
LIM	Landscape information modelling
m^2	quadrat meter
m^3	cubic meter
MD SR	M inistry of Transport of the Slovak Republic
MDaV SR	Ministry of Transport and Construction of the Slovak Republic
MDV SR	Ministry of Transport and Construction of the Slovak Republic
MDVRR SR	Ministry of Transport, Construction and Regional Development of the Slovak Republic
MF SR	Ministry of Finance of the Slovak Republic
MIL.	Million
mil.	Million
mld.	Billion
MPSVR SR	Ministry of Labour, Social Affairs and Family of the Slovak Republic
MSP	Small and medium sized enterprises
MŠVVaŠ SR	Ministry of education, science, research and sport of the Slovak Republic
Mt	Million ton
MTZ	Material and technical provision
MV SR	Ministry of the Interior of the Slovak Republic
NACE	Nomenclature statistique des activités économiques

NEUTRAL	Scenario with additional measures needed to achieve climate neutrality of the Slovak Republic by 2050
NKP	National Qualification Platform
NSK	National qualification framework
NSP	National professions framework
OVP	Vocational education and training
OZ ZPZ	Association for thermal insullation
OZE	Renewable energy sources
PL	Poland
PV	Inustrial production
RD	Single-family homes
REACT EU	Recovery Assistance for Cohesion and the Territories of Europe
ROP	Regional operational programme
s. c.	Fixed prices
SAPI	Slovak Photovoltaic and RES Industry Association
SBaA	Slovak Battery Association
SEVA	Slovak Association for Electromobility
SIEA	Slovak Innovation and Energy Agency
SK	Slovakia
SKGBC	Slovak Green Building Council
SKKR	Slovak qualification framework
SKSI	Slovak chamber of civil engineers
SODB	Census of population, houses and dwellings
SOŠ	Secondary VET school
SR	Slovakia
SRI	Sector-led innovation, operational programme: Human Resources; Beneficiary: Ministry of Labour and Social Affairs of the Slovak Republic; Implementation: April 2019 - December 2022
SSTP	Slovak Society for Environmental Engineering
STN	Slovak technical norm
Stratégia CŽV	Strategy of lifelong learning and consulting
SZČO	Self-employed person

ŠIOV	State Institute for Vocational Training
ŠR	State budget
ŠÚ SR	Statistical Office of the Slovak Republic
TJ	Terrajoule
TPO	Thermoplastic olefin
ÚOŠS	Central state authority
ÚVS	Institute for Education and Services, s.r.o.
VA	Educational activity
VET	Vocational education and training
VIA	ViaEuropa Competence Centrre s.r.o.
VR	Virtual reality
VŠ	Tertiary educational institution
VÚC	Region
WAM	With additional measures
WEM	With existing measures
Z. z.	Collection of Laws of the Slovak Republic
Zb.	Collection of Laws of the Czechoslovak Republic
ZSPS	Association of Construction Entrepreneurs of Slovakia

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