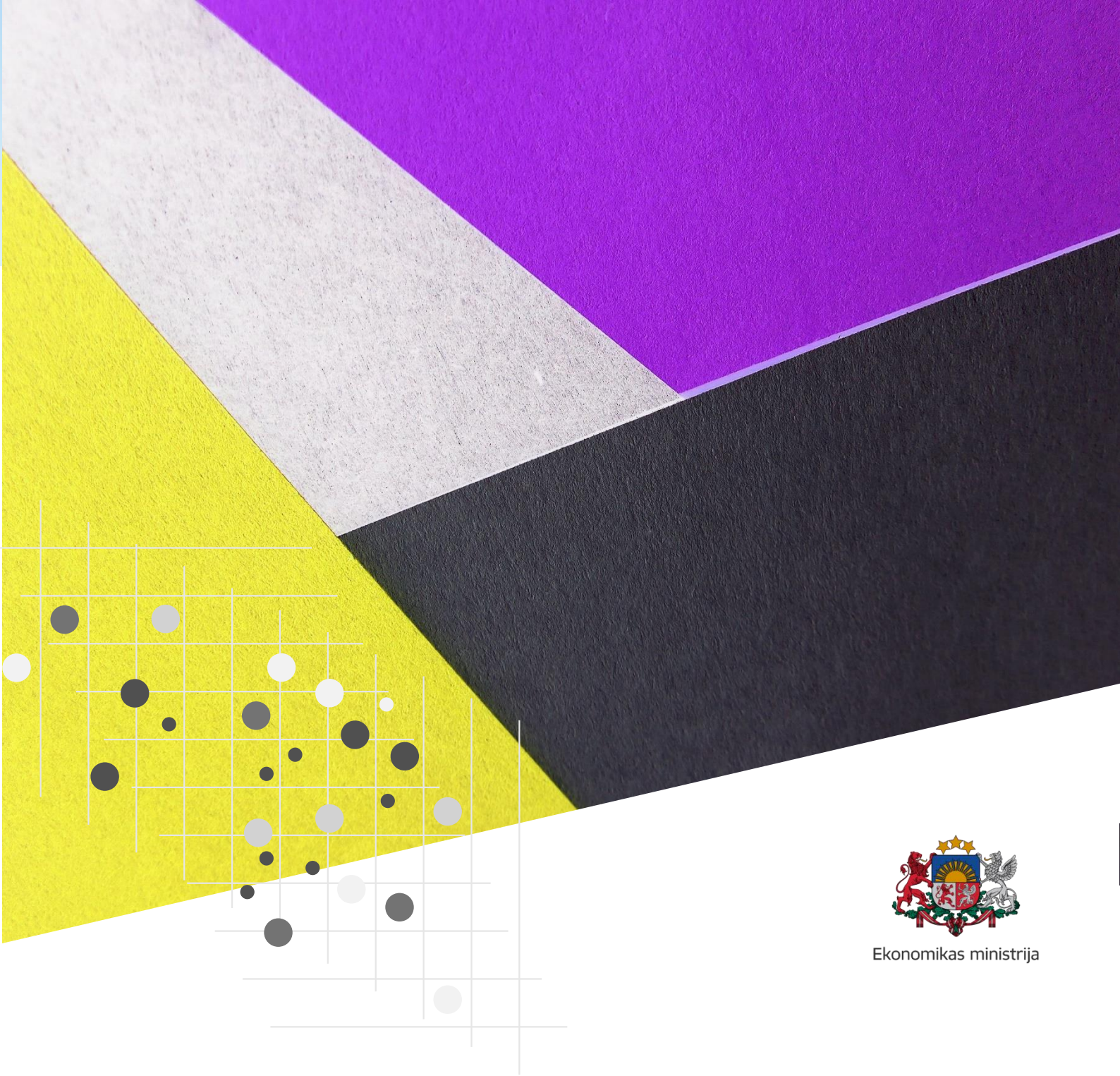

Ekonomikas ministrija

PROJECTED CHANGE IN LABOR FORCE AND BUILDING MATERIALS COSTS
in the construction sector in Latvia in 2021-2025

2021 | INNOMATRIX RESEARCH & INNOVATION

Research client: Ministry of Economics of the Republic of Latvia. Study ID. No. EM 2021/15

Researcher: InnoMatrix SIA | Reg. no. 40103264228

The study was completed in July 2021. An expert survey was conducted in May and June 2021.

The study is based on the methodology developed in 2018, which is included in the final report of the study.

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The research report includes information obtained from several primary and secondary information sources, including the Ministry of Finance of the Republic of Latvia (MoF) and the Central Statistical Bureau (CSB). The quality and adequacy of the data received from the FM and the CSB are accepted as optimal, without the authors checking the sources of data. The circle of research experts was represented by Latvian civil society organizations, public administration, academic and industrial organizations and companies in the field of construction. A detailed list of experts and the organizations and companies they represent is available in the Study Appendix. The number of experts, specializations and the sample of organizations they represent correspond to a statistically representative population.

Within the framework of the research, the authors take responsibility for the assessment of data quality and their use in the analysis, selecting the necessary data and excluding possible inappropriate observations and data from the analyzed data set as a result of insufficient data quality. During the quality control of the received data, limitations on the availability of data have been identified, which apply both to incomplete questionnaires of experts and statistically missing observations.

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Abbreviations and terms used in the report

Abbreviation	Explanation
CSP	Central Statistical Bureau
LR	Latvian republic
EM	Ministry of Economics of the Republic of Latvia
FM	Ministry of Finance of the Republic of Latvia
EU	The European Union
Eurostat	Statistical Office of the European Commission
CAGR	The compound increase over several years is calculated
GDP	Gross domestic product
pp	Percentage points (unit of arithmetic difference of two percent)
Experts	59 experts in the field of Latvian construction, who expressed their opinion within the framework of the Study and who represent public administration, civic and academic environment, and industry. A detailed list of experts can be found at the end of the report (see table of contents)
Customer	Ministry of Economics of the Republic of Latvia
Researcher	Socio-economic market process research company "InnoMatrix" Ltd.
Research	Final output of the study - final report “Study on projected changes in labor and construction materials costs in the construction sector in Latvia in 2021-2025.”

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SUMMARY

To be able to more effectively plan the potential costs of public construction procurement and assess possible price changes in the coming years, the Ministry of Economics (MoE) annually from 2018 assesses projected changes in labor and construction costs in the construction sector and their impact on the economy.

A unique multifactor methodology has been scientifically developed for forecasting, which includes complex both statistical and expert assessments. Reports from previous years show that the MoE has obtained highly reliable annual forecasts, despite drastic fluctuations in the construction sector. The forecasts obtained in 2020, despite the pronounced uncertainty in the economy and the state of emergency in the country, differed in the volume forecasts by only 0.4 pp and in the cost forecasts by only 1.4 pp.

Table 1.
Comparison of actual changes in construction output and costs against forecasts. Source: CSB data and construction change studies performed on behalf of the Ministry of Economics in 2018, 2019 and 2020.

Construction VOLUME change% compared to previous year - actual comparison with forecast

Year	*2011*	*2012*	*2013*	*2014*	*2015*	*2016*	*2017*	*2018*	*2019*	*2020*
Actual	12.2	14.8	7.3	10.6	0.6	-16.6	18.6	21.9	2.9	2.7
							Forecast	16.6	12.5	3.1
							Deviation	*-5.3 pp*	*9.6 pp*	*0.4 pp*

% Change in construction COSTS compared to the previous year - actual comparison with forecast

Year	*2011*	*2012*	*2013*	*2014*	*2015*	*2016*	*2017*	*2018*	*2019*	*2020*
Actual	2.1	6.8	2.5	0.4	0,1	-0,5	1,9	4,4	4,1	1,3
							Forecast	4.1	4.9	2.7
							Deviation	*-0.3 pp*	*0.8 pp*	*1.4 pp*

In particular, cost estimates have been accurate, varying by not more than one and a half percentage points. A comparison of forecasts and actual data indicates a high level of competence for construction experts in Latvia and a sound methodology.

Within the framework of the 2021 study, 59 experts from the Latvian construction sector expressed their views, representing 56 organizations from the public administration, civic initiative (NGO) and academia, as well as construction companies, including: the Latvian Association of Electricians and Energy Builders; Association of Transport Engineers; Ogre County Construction Board; Latvian Geotechnical Union; JSC "Latvian State Forests"; Latvian Builders Association; Latvian Traders Association; Building Materials Manufacturers Association; Latvian Partnership of Construction Contractors; Latvian Union of Civil Engineers; Real Estate Developers Alliance; Ministry of Environmental Protection and Regional Development; Latvian Association of Heat, Gas and Water Technology Engineers; Rezekne District Construction Board; Ventspils City Council; Kuldiga municipality; Valmiera City Municipality; Department of Architecture and Construction, Latvia University of Agriculture; University of Latvia; AS Sakret Holdings; AS "SEB banka"; SIA "Citrus Solutions"; SIA "Ostas celtnieks"; Latvian State Roads, SIA "Limbažu ceļi"; Association "Latvian

Road Construction", SIA "Optimera Latvia"; SIA "BIM Solutions"; SIA "Arčers". A detailed list of experts and the organizations they represent can be found at the end of the report (see table of contents).

The forecasts obtained in 2021 indicate that the volume of construction in 2021 compared to 2020 will increase by +6.6%, continuing to grow in 2022 +7.1%. Between 2023 and 2025, growth is projected to continue at a relatively steady pace between 6.5% and 4.9%. It is important to note that most of the construction experts interviewed point to high reliability of forecasts for the next 12 months, but given the current high economic uncertainty, 2-4 year forecasts may be significantly more inaccurate.

Table 2.
Forecasts of changes in the volume of construction output compared to the previous year 2021-2025. year.
Construction output VOLUME forecasts against the previous year 2021-2025. year

2019	*2020*	*Forecast 2021*	*Forecast 2022*	*Assessment 2023-2025*
+2.9%	+2.7%			
Combined forecast →		**+6.6%**	+7.1%	+6.5% to +4.9%
Expert forecast →		*+8.7%*	*+10.1%*	*+9.1% to +6.4%*

The obtained forecasts indicate that construction costs in 2021 compared to 2020 will increase by a record high of +6.6%, reaching the highest increase in the last nine years. Table 1. In case of unfavourable global situation (logistical problems, high market demand, non-increase of producer capacity, etc.) an increase of 11.4% could also be achieved. In the period from 2022 to 2025, the increase in construction costs will decrease, however, in 2022 the increase is still projected at 5.5% - significantly higher than in the pre-pandemic period. 2023-2025 Over the period 2007-2013, cost growth is expected to return to the average level of the last decade, with an average annual increase of 3.3% per year, which is lower than in 2018 and 2019.

Table 3.
Forecasts of changes in construction costs against the previous year 2021-2025 year.
Forecasts of changes in construction COSTS compared to the previous year 2021-2025.

2019	2020	Forecast 2021	Forecast 2022	Assessment 2023-2025
+4.1%	+1.3%			
Combined forecast →		**+6.6%**	+5.6%	+3.7% to +2.6%
Expert forecast →		+11.4%	+9.5%	+5.7% to +3.6%

The main drivers of growth in the construction industry in 2021-2025. The following were identified in 2006: (1) **economic recovery from the pandemic,** (2) **national and EU support for economic recovery,** and (3) **major infrastructure projects.** In turn, the costs of construction materials are most influenced by the average annual **price** of **metal products,** the **volume** of **construction in Latvia** and the **average annual price of timber**.

Based on the information collected and dynamic assessments from 2020 to 2021, the construction industry shows some overheating risks, but these risks are substantially lower than in 2006 and the 2008. If at the end of 2021 the significant short-term jumps in the costs of timber and metal products decreases, then the dynamics for 2022 is expected to reduce the risk of overheating of construction and a similar trend will continue until 2025. [3]

Based on the acquired forecasts for the period 2021 to 2025, there is a trend to move along the overheating risk limit and then move away from it. In the period from 2020 to 2021, the construction sector is showing relatively high signs of overheating, which manifests itself in an increase in costs faster than an increase in the volume of construction output. In 2021, the risk of overheating is

considered to be the highest in the last five years, and in the following years, until 2025, this risk will decrease based on current forecasts. Figure 1.

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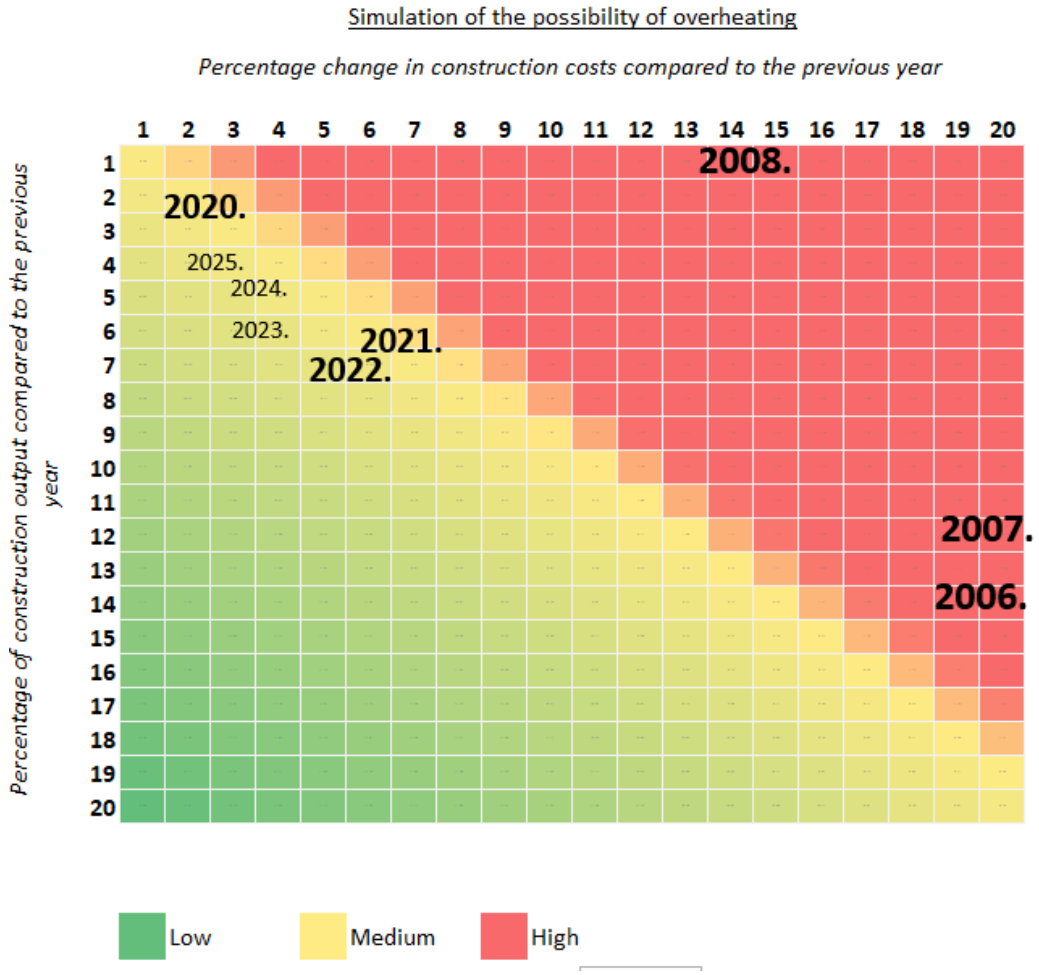

Figure 1. Simulation of overheating of the construction industry at different variants of changes in the volume and cost of construction output by extrapolating expert estimates, forecasts and the situation of the previous recession in the period from 2005 to 2025. The years are given according to the combined forecast.

One of the most significant risks that could lead the construction industry deeper into the overheating zone is if construction material costs do not stabilize or fall at the end of 2021 and the total annual increase in construction material costs significantly exceeds the 6.6% increase in construction costs and 7.1% in the combined forecast % increase in the cost of building materials, but this assumption will be verifiable in 2022, when actual data on construction spending will be available.

Factors affecting costs. Labor wages in the construction sector are most significantly affected by the volume of construction in Latvia, as well as the level of labor wages and the demand of the construction sector in other EU countries.

Significant influencing factors are also the level of labor taxes in Latvia, the demand for EU labor in the construction sector and the number of constructions plans that are being implemented with public funds.

Architectural and engineering services, technical testing and analysis sub-sector 's labor costs significantly affect the construction process of digitization intensity.

The transport construction industry is the most sensitive to the amount (availability) of educated workforce and the second most important factor influencing labor costs in the sub-sector is the number of learners in construction-related education programs.

The costs of construction materials are most significantly influenced by the average annual price of metal products, the volume of construction in Latvia and the average annual price of timber. The average fuel price in Latvia significantly affects the construction of transport facilities sub-sector. In turn, epidemiological measures have a significant impact on costs in the sub-sectors of architecture and engineering services, technical testing and analysis, and specialized construction.

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Construction of residential buildings is expected to grow faster than in the non-residential segment. Construction growth forecast for 2021 year is 5.9% and in 2022, the 6.0%. In the period 2023-2025. Growth could accelerate to 8.2% on average in 2007.

In construction of buildings in 2021, a very rapid increase in costs is forecast by 11.6% - almost twice as much as volume growth, which is forecast to increase in the following years as well, creating an average annual growth of 6.1% by 2025.

The transport construction industry will face volatile trends in the short term. Experts don't have relative clarity and consensus about the expected funding for 2022. The development of the transport sector is related to the implementation of significant municipal, state and European Union projects. In 2021, according to both expert forecasts and combined forecasts, growth is expected in all sub-sectors of construction of transport facilities. However, in 2022 a decline is forecast in some sub-sectors - construction of roads and highways and construction of bridges and tunnels. This is explained by fluctuations in the Structural Funds and, consequently, the impact of expert opinion. In the period from 2023-2025. Road and motorway construction trends are estimated as a period of moderate growth with a slight increase in market volume. At the same time, the construction of railways, bridges and tunnels is experiencing a sharp leap, which is related to the significant construction works of Rail Baltic. Given that this sub-sector is highly cyclical, these large jumps may be followed by equally significant declines in the long run. Also in the last decade, the railway sub-sector has seen alternating years of rapid increases and decreases.

Urban infrastructure sub-sector, in the experts' view of further development is relatively optimistic with rapid growth of over 10% per year from 2022 to 2024. Adjusting this view with statistical forecasts and thus obtaining complex forecasts, it is estimated that in the short term this sub-sector would have moderate growth below the 10% threshold, which will become more moderate from 2022 and will be only a few percent per year in the medium term.

Architectural and engineering services, technical inspection and analysis sub-sector in the period from 2021 to 2024, the sector is forecast to grow faster and faster from 6.4% in 2021 to 17.9% compared to the previous year in 2024.

The costs of the sub-sector of architectural and engineering services, technical testing and analysis in 2021 and 2022 could increase significantly by 13.6% and 15.7%, respectively, however, in the medium term the increase in costs is estimated to be lower on average in 2023-2025. per year than 5.2% per year.

In the field of construction resources, a significant increase in costs in 2021 is expected for construction materials, which is estimated at 7.1% annually, in 2022 an increase of 4.5%, but in the following years until 2025 on average by 3.1% per year.

The steady increase in workers' wages is forecast to be equal to the previous five-year period, increasing by 7.1% in 2021 and by 7.4% in 2022. In the coming years, growth is likely to decline and is estimated at an average of 6.5% per year.

The cost of machinery and equipment is projected to grow relatively insignificantly by 1.3% in 2021 and 1.1% in 2022. In the further period, the growth is estimated to be even lower and could reach 0.2% growth in 2025.

In the construction of residential and non-residential buildings in 2021, the most significant increase in the cost of construction materials should be taken into account in the amount of 14.7-14.8%, while the increase in wages is estimated at 6.9-7.0%.

A significant increase in the costs of construction of transport facilities in 2021 is forecasted for both construction materials (10.0%) and maintenance and operation of machinery and equipment (10.0%), while an increase in wages is estimated at 8.0%, followed closely by architectural and other services with an increase of 7.8%. This sector is characterized by specific forecasts that the costs of services alone will grow faster and faster and in 2023-2025. could increase by 9.6% on average per year.

The largest increase in the construction of urban infrastructure objects is also forecast for construction materials with a 15.3% increase in 2021, with other types of resources growing relatively less - workers' wages by 7.6%, machinery and equipment expenditure by 6.6% and service expenditure by 7%. 7%.

In the sub-sector of specialized construction works, the increase of construction material costs in 2021 is forecasted in the amount of 15.8%, while the increase of wage costs is estimated as the smallest of the types of resources - 5.1%, however, a high.

In construction products the most significant increase in costs in 2021 is forecasted for timber in the amount of 30.0%, which in the period from 2022 to 2025. could reach an average annual growth rate of 5.3%. The second most significant cost increase in 2021 is forecast for metal products at 24.3%, which is estimated at an average annual increase of 6.7% over the next four years.

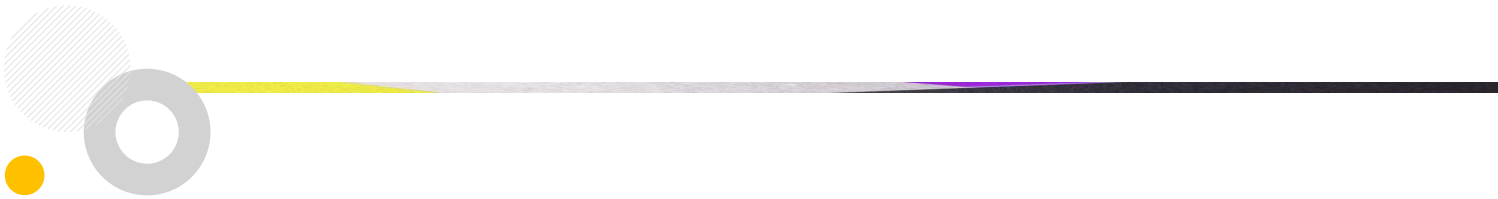
In the category of finishing materials (exterior, interior finishing and other), the most significant increase in costs in 2021 is forecasted for interior finishing materials on average 11.0%, with an annual increase of 6.3% in the next four years.

In the category of main system equipment, the most significant cost increase in 2021 is forecasted for electricity systems in the amount of 16.0%, which could significantly stabilize from 2021 and grow by 3.3% per year on average by 2025. In other items (automation, firefighting, security, plumbing, heating, cooling and lighting systems, lifts and escalators), cost increases are expected to be below 8% per year.

According to construction products trade experts, the largest volume use (share) in construction in Latvia is cement, concrete, aggregates, sand, gravel, and other materials - together the group accounts for 21.0% of consumption, followed by metal products 17.3% and finishing materials 16, 0%.

The shadow economy control measures have a moderate impact on construction labor costs. The biggest impact of the anti-shadow measures is the introduction of an electronic working time accounting system and the setting of a minimum wage in the construction sector. Measures to combat the shadow economy have a negligible effect on the cost of building materials.

COVID-19 has had a mediocre impact on the cost of building materials, but the impact on labor costs can be assessed as weak. The greatest impact of COVID-19 on the cost of building materials is seen by the building construction sub-sector, while the greatest impact on labor costs is seen by experts in the building materials trade.



PROPOSALS

Based on the results of the research, expert opinions, development dynamics of the industry and evaluation by researchers, the following proposals are put forward in three blocks:

Monitor current developments in construction in enhanced detail

1. To react promptly by temporarily and in a controlled manner reducing the amount of public procurement or EU funds support if the prices of construction products do not fall or if workers' wages continue to rise.

2. Competition supervision institutions should monitor the compliance of construction material price dynamics with world price dynamics and to investigate cases when the fall in world prices is not followed by a fall in prices in the Latvian market. Increase control in categories of construction materials, the production of which involves a low number of production facilities in Latvia, the Baltic region and neighboring countries.

3. Researchers do not see significant arguments not to continue the planned grant program for infrastructure improvement, because the private construction order component in 2021 is considered to be temporarily increasing due to free funds during the pandemic, but to continue to monitor the situation if operational differs from the forecast.

Continue to improve the speed of both statistical and qualitative data received

4. For timely monitoring of the construction industry, industry researchers should consider using the opportunities provided by the CSB to retrieve data characterizing the development of the construction industry with an application program interface or API.

5. Consider introducing regular quarterly or half-yearly forecast reports.

6. To improve cooperation between state institutions and organizations representing the construction industry for timely identification of risk situations in connection with fluctuations of certain construction expenditure items

Further develop measures that help reduce the dependence of the construction sector on 3 main influences - rapid fluctuations in volume, labor and construction products

7. Increase the productivity of the construction industry by developing the production of modular products and promoting further automation in order to reduce the share of labor costs in construction costs.

8. Continue to support the introduction of BIM in the Latvian construction market with the help of technical requirements of public procurement in order to reduce the total costs of construction works and maintenance of structures in the medium and long term.

9. Improve the regulatory framework and popularize the inclusion of construction material costs in the costs of long-term construction projects at the actual price at the time of project implementation.

10. Promptly ease the requirements for employment of foreign labor in the construction sector from countries outside the European Union, responding to regular cyclical jumps in construction growth, thus reducing the pressure on labor wages caused by labor shortages.

11. Develop qualification improvement programs for the existing participants of the construction industry in order to increase the number of highly qualified employees, as well as to promote

retraining of specialists for work in the construction industry, incl. opportunities for lifelong learning programs

Suggestions for improving the research methodology

Reports from previous years show that forecasts have been obtained with high reliability, despite drastic fluctuations in the construction sector. The forecasts obtained in 2020, despite the pronounced economic uncertainty and the state of emergency in the country, differed in the volume forecasts by only 0.4 pp and in the cost forecasts by only 1.4 pp.

It is recommended to complement the methodology with the following sub-classification of experts, supplemented by materials producers and traders' representatives:

1. Construction of residential and non-residential buildings;
2. Transport facilities construction (i.e. roads and motorways, railway and subway construction, bridges and tunnels, urban infrastructure);
3. Specialized construction sub-sector;
4. Architectural and engineering activities and technical testing and analysis;
5. Manufacturers and traders of construction materials;
6. Construction equipment rental service providers.

In conducting the study in 2021, the authors were confronted with the strong impact of Covid-19 measures and a relatively larger situation of heterogeneity, marked by sharp fluctuations in the components of construction. The development of the industry in the last 24-36 months is associated with a very unstable development, characterized by sharp changes in development vectors, which, according to international economists, may continue for the next 2-5 years, stabilizing the new post-pandemic economic rhythms. In such circumstances, statistical forecasts are too moderate, but expert forecasts are extremely rapid. In such situations, the annual cut is often outdated for planning topical political actions. Thus, for increasingly accurate forecasts, it is recommended to develop and implement a semi-automatic, operational forecasting model for monitoring the volume and costs of construction semi-annually or quarterly, which will facilitate obtaining increasingly high-quality forecasts based on the most recent quarterly and semi-annual developments.

1. Analysis of the results and data of the general and sub-sectoral expert survey

1.1. Structure and course of the general and sub-sectoral expert

The general survey of experts is one of the two stages of the examination, which was carried out in the study "Study on projected changes in labor and construction costs in the construction sector in Latvia in 2021-2025." based on the developed methodology. The first stage of the expertise allowed to achieve part of the set goals and to assess the quality of the obtained results.

The following issues were investigated in the general expert survey:

1) Factors influencing changes in labor costs;
2) Factors influencing changes in construction material costs;
3) Forecasts of changes in the volume and costs of construction output;
4) Impact of measures to combat the shadow economy;
5) The impact of COVID-19;
6) Impact of construction output on costs and industry average profit margin.

The survey of experts was carried out within the framework of the study by surveying experts representing professional associations and unions representing the construction industry, state institutions, non-governmental organizations, academic institutions, banks.

The expert survey took place in May and June 2021. Within the framework of the sub-sector expert survey, six groups of organizations were identified, in each of which a survey was conducted:

1. Construction of residential and non-residential buildings;
2. Construction of transport objects;
3. Construction of city infrastructure objects;
4. Construction of specialized construction works;
5. Architectural and engineering services, technical testing and analysis;
6. Production and sale of construction products.

Residential and non-residential construction enterprises were merged into one group of experts, taking into account that according to the NACE v.2 classification, separate codes are not distinguished for residential and non-residential construction enterprises. Tailored questions were developed for each group of experts, which were combined with common questions from the general expert survey. The general questions were focused on the assessment of the development of the construction sector, the adjusted questions were focused on the development trends of the defined sub-sector, influencing factors, etc.

A total of 228 experts were individually interviewed to participate in the Study. Positive feedback and involvement in the study was obtained from 59 experts.

Within the framework of the general expert survey, 7 questions were identified, which included a total of 86 expert evaluations from each expert. In the survey of sub-sector experts, 7 questions were singled out, which in total included over 87 expert evaluations from each expert. In both cases, in addition, the number of open-ended responses varied according to experts.

1.2. Factors influencing changes in labor and construction material costs

1.2.1. Overall expert assessment of factors influencing labor costs

The impact of various factors on labor costs in the construction sector was performed by both general experts and experts representing the sub-sector. The considered factors cover various areas both at the Latvian and EU level. Analyzing the obtained expert answers, the average expert assessment, standard deviation of expert assessments was calculated. Factors were rated on a 10-point scale, where a higher score means that the factor is a more significant factor influencing labor costs in construction.

Table 4.

Average expert assessments of the factors influencing labor costs in descending order (all experts) on a 10-point scale, where 10 points indicate that the factor is extremely significant, while an assessment of 0 indicates that the factor has no effect.

No.	FACTORS AFFECTING LABOR COSTS in order of significance of the impact	Number of evaluations	Average rating
1.	**Volume of construction in Latvia**	59	7.75
2.	**The level of wages in the construction industry in the EU countries**	57	7.05
3.	**EU labor demand in the construction sector**	58	6.90
4.	Volume of construction plans implemented with public funds	58	6.74
5.	Labor tax level in Latvia	59	6.73
6.	Number of learners in construction-related education programs in Latvia	58	5.90
7.	Wage levels in other EU sectors	58	5.86
8.	Extent of measures to combat the shadow economy in Latvia	58	5.81
9.	Labor migration balance in Latvia	58	5.71
10.	Intensity of digitization of construction processes	59	5.27
11.	Construction of the project “Rail Baltica”	58	5.16
12.	Implementation of sustainability principles in construction (energy efficiency, eco-construction, etc.)	58	5.02
13.	Planned mandatory involvement of an engineering consultant in public procurement	56	4.86
14.	Unemployment rate in Latvia	58	4.55
15.	Extent of epidemiological safety measures	58	4.28
16.	Unemployment rate in Latvia in other sectors (not construction)	58	4.17

The three most important factors influencing labor costs, based on the overall assessment, are the volume of construction in Latvia, the level of labor wages in the EU countries in the construction sector and the demand for labor in the EU construction sector. The level of labor taxes in Latvia, the demand for EU labor in the construction sector and the number of construction plans that are being implemented with public funds are also very important factors.

The above results refer to the overall assessment of the experts in all sectors, however, looking at the situation in more detail, there are differences in the sub-sectors. In general, regardless of the sub-sector represented by the expert, the overall trends are the same. However, some sub-sectors have more pronounced factors than others. For example, the construction of transport facilities is the most sensitive to the amount of educated workforce and the second most important factor was the number of learners

in construction-related education programs in Latvia, which, in turn, was less important in other sub-sectors.

In the sub-sector of construction of urban infrastructure objects, the second highest rating indicated the amount of construction plans implemented with public funds, which is understandable considering that this sub-sector is more dependent on public procurement than on orders from the private sector. On the other hand, experts in the sub-sector of architecture and engineering services, technical testing and analysis pointed out the intensity of digitization of construction processes as the second most important factor, which was generally not highly valued, but obviously has a significant impact on labor costs in this sub-sector. The second most important factor for experts in the construction materials trade sector, similarly to the urban construction sub-sector, is the level of labor wages in the construction sector in the EU countries.

1.2.2. Overall expert assessment of the factors influencing the cost of construction materials

The impact of various factors on labor costs in the construction sector was performed by both general experts and experts representing the construction sub-sector. The considered factors cover various areas, both at the Latvian and EU level. Analyzing the obtained expert answers, the average expert rating was calculated. Table 5. Factors were evaluated on a 10-point scale, where a higher score means that the factor is a more significant factor influencing labor costs in construction.

Table 5.

Average expert assessments of the factors influencing the cost of construction materials (all experts) on a 10-point scale, where 10 points indicate that the factor is extremely significant, while an assessment of 0 indicates that the factor has no effect.

No.	BUILDING MATERIALS COST factors influencing the relevance effect of the order	Number of evaluations	Average rating
1.	**Average annual price of metal products in Latvia**	57	7.91
2.	**Volume of construction in Latvia**	58	7.24
3.	**The average annual timber price in Latvia**	58	7.21
4.	Total EU construction market demand	58	7.07
5.	Volume of construction plans implemented with public funds	57	6.65
6.	Indicators of competition concentration in the building materials market in Latvia	57	6.47
7.	Number of construction plans in Latvia	58	6.29
8.	EU economic growth rates	57	6.28
9.	Volumes of real estate lending in Latvia	56	6.05
10.	Implementation of sustainability principles in construction (energy efficiency, eco-construction, etc.)	57	6.04
11.	The average fuel price in Latvia	57	6.02
12.	Technical requirements for the quality of construction of EU buildings	57	6.00
13.	Average annual energy price in Latvia	57	5.74
14.	Extent of epidemiological safety measures	58	5.64
15.	Changes in gross domestic product in Latvia	56	5.27
16.	Natural resources tax rate in Latvia	57	5.16
17.	Construction of the project “Rail Baltica”	57	4.98
18.	Intensity of digitization of construction processes	58	4.48
19.	Extent of measures to combat the shadow economy in Latvia	57	3.98

The three most important factors that affect the cost of construction materials, based on the overall assessment, are the average annual price of metal products, the volume of construction in Latvia and the average annual price of timber.

The following have also been identified as important factors: the total demand of the EU construction market, the volume of construction plans implemented with public funds and the concentration of competition in the building materials market. These results are relatively unique compared to previous years, as they shed light on the significant impact of metal and wood costs on construction sector spending in 2021. Concentration of competition is also assessed significantly higher than in previous years.

The above results refer to the overall assessment of experts from all sectors, but when looking at the situation in more detail, there are significant slight differences across sub-sectors. Significant differences can be observed in the sub-sector of construction of transport facilities, in which the second most important factor is the average fuel price in Latvia. However, metal and timber are also dominant factors in this sub-sector. Unusually, the most important factor has been identified in the sub-sector of urban infrastructure objects - the growth rates of the EU economy.

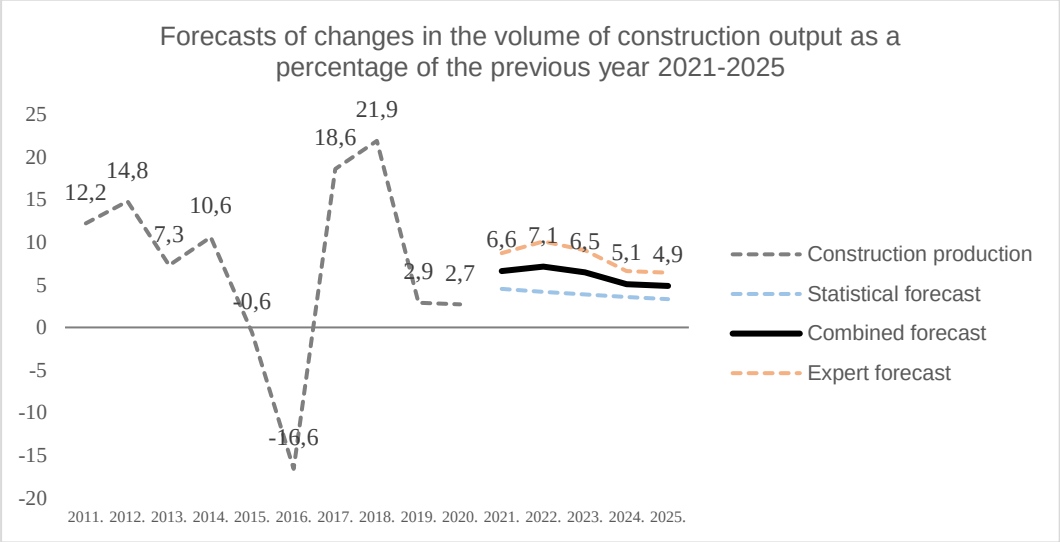
In the specialized construction, architectural and engineering services, technical testing and analysis sub-sectors, the second most important cost factor is the extent of epidemiological safety measures, which was not a significant factor in other expert groups. Thus, it can be concluded that the epidemiological measures for the architectural and engineering services, technical testing and analysis and specialized construction sub-sectors led to a more significant increase in costs than for the other sub-sectors.

1.3. Forecast of changes in the volume and cost of construction output

1.3.1. Overall industry forecast

Within the framework of the study, all involved experts provided a direct forecast, assessing the expected number of changes in the volume of construction output and, respectively, construction costs for the period from 2021 to 2025. Summarizing the forecasts provided by the experts, the average expert assessment for each forecasted year was obtained. In order to assess the variation of expert opinions in each year, the positive and negative deviation in the amount of standard deviation from the average expert forecast was calculated.

When forecasting changes in the volume of construction output, the average expert assessment indicates a moderate increase in the volume of construction output in 2021, after which only in 2022 a higher annual growth is forecast, followed by a continuous decrease until 2025.



	2021	2022	2023	2024	2025
Statistical forecast	4.5	4.2	3.9	3.6	3.3
Combined forecast	**6.6**	**7.1**	**6.5**	**5.1**	**4.9**
Expert forecast	8.7	10.1	9.1	6.6	6.4

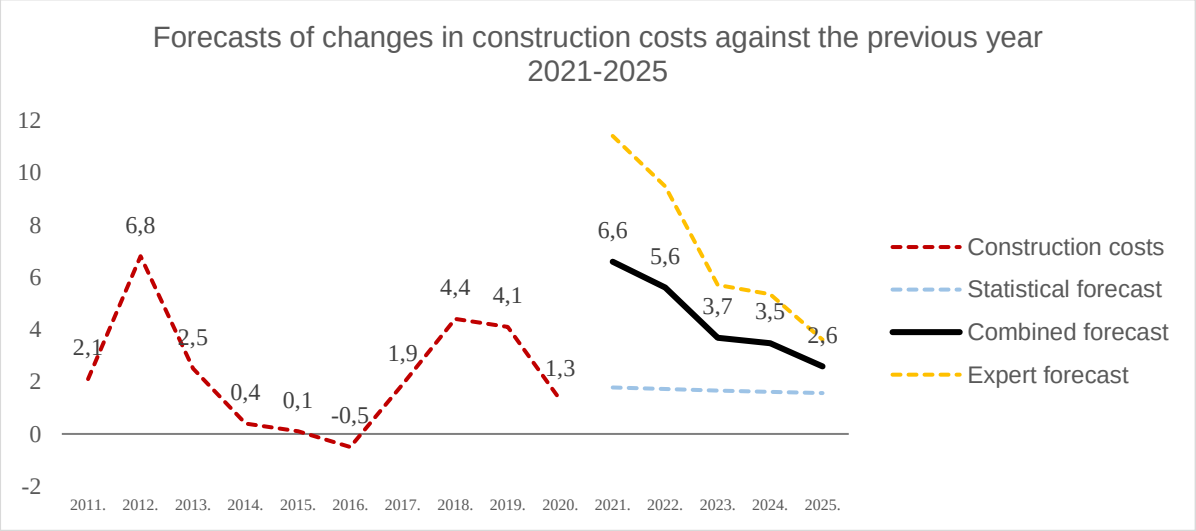
Fig 2. Forecasts of changes in the volume of construction output in 2021-2025 as a percentage of the previous year.

According to the methodology, both statistical and expert forecasts were calculated within the study. If in the results of previous years (2018, 2019, 2020) forecast research it was characteristic that statistical forecasts were more optimistic than expert forecasts, then in 2021 the opposite situation is observed in the Study. This can be partly explained by the information available to experts on the expected state and EU support for the sector, as well as the expectations of post-pandemic economic recovery. As a final forecast, the authors use a combined (expert-statistical) forecast, which is obtained as the average between the two forecasts mentioned above.

The data available in the final stage of the study on the short-term development of the construction sector show a 12% decrease in construction output in the 1st quarter of 2021 and a 1% increase in the 2nd quarter. Such a development of the situation can be perceived as contradicting the experts' view of the development of the industry. However, researchers believe that there are two arguments that the indicators for the second half of 2021 could mean a generally positive output of the construction industry:

1. In the construction sector in Latvia, the quarterly growth has historically been very inconsistent compared to the previous year, therefore it cannot be stated that a bad situation in the first half of the year would correlate with a bad situation in the second half;
2. Total GDP in the first half of 2021 shows a positive growth trend (10.3% year-on-year increase in the second quarter), which is likely to be reflected in the development of the construction sector, which delivers the final product with a longer time lag than other industries.

When forecasting changes in construction costs, there is a similar tendency that expert assessments are significantly higher than statistically obtained forecasts. There is also a very strong view that in 2021 a sharp increase in costs is expected. For all the next forecast years, cost increases are also projected to gradually decline until the 2025 forecast reaches the average of 2019 and 2020.



	2021	2022	2023	2024	2025
Statistical forecast	1.8	1.7	1.7	1.6	1.6
Combined forecast	**6.6**	**5.6**	**3.7**	**3.5**	**2.6**
Expert forecast	11.4	9.5	5.7	5.3	3.6

Fig 3. Construction cost change forecasts for 2021-2025. as a percentage of the previous period.

Some expert estimates predict a relatively rapid jump in terms of costs, but, similar to the accepted method for forecasting the volume of construction output, a combined (expert-statistical) forecast is also used here, which provides a more moderate forecast. In previous studies, the combined prognosis has proven to be more reliable.

Table 6.
Forecasts of changes in construction output and costs in 2021-2025. year.

Changes in the VOLUME of construction output compared to the previous year				
2019	2020	Forecast for 2021	Forecast 2022	Assessment 2023-2025
+ 2.9%	+ 2.7%			
Combined forecast →		+ 6.6%	+ 7.1%	+ 6.5% to + 4.9%
Experts forecast →		+ 8.7%	+ 10.1%	+ 9.1% to + 6.4%

CHANGES IN CONSTRUCTION COSTS compared to the previous year				
2019	2020	2021	2022	2023-2025
+ 4.1%	+ 1.3%			
Combined Forecast →		+ 6.6%	+ 5.6%	+ 3.7% to + 2.6%
Experts forecast →		+ 11.4%	+ 9.5%	+ 5.7% to + 3.6%

In the period from 2021 to 2025, a further increase in the volume of construction output is forecasted at a higher annual rate than in the previous five years. Initially, in 2021 and 2022, this growth can be justified by Latvia's gradual exit from the pandemic and the impact of related epidemiological measures and market recovery, as well as by state support for warming up the economy. In the following years, further market growth is associated with large construction projects, such as the Rail Baltica project, entering the active construction phase.

A significant jump in construction costs is expected as early as 2021, which will be less pronounced in the coming years, but still significantly higher than in the last decade. The significant increase in costs is primarily due to the increase in the prices of construction materials, mainly timber and metal products. Taking into account the very unusual situation in the building materials market in Latvia in 2021, the assessments of experts also differed radically. This can be explained by various experiences and specifics of work, as well as by a high level of uncertainty during the research - in May-July 2021. During this period, construction material prices had peaked, but in the reporting phase, price adjustments were already observed in some markets, such as the US timber exchanges. Consequently, there is also a significant variation between the experts' view, which on average predicted an increase in construction costs of 11.4% and the combined methodology forecast that they would increase on average by 6.6%. If the global supply of timber and metals increases in the second half of 2021 and demand stabilizes or decreases, then the 6.6% forecast is more plausible. On the other hand, double-digit cost increases will be more likely in the event of problems with logistics channels and the supply of raw materials on world markets due to speculative reasons or exceptional circumstances.

A topical issue is the possibility of overheating of the construction industry in the period under review. Within the framework of the study, performing a retrospective on changes in the volume of construction output and changes in construction costs, trends in the bubble of the construction industry and overheating of the market in 2007-2008 were considered. This was followed by the economic downturn and the crisis not only in the construction sector, but in the entire Latvian economy. Based on the relationship between changes in the volume of construction output and changes in costs, risk areas were identified that characterize the probability of conditional overheating risks. Unlike the previous

recession, this time the economy was negatively affected by the global pandemic and the consequences of measures taken to combat it. Also, towards the end of the pandemic, new risks emerge in the form of overly intensive economic recovery measures, which could lead to excessive inflation. Therefore, it is important to observe whether similar trends exist.

In the scenario, if the total demand for construction products in the market increases, an increased demand for labor, construction materials and other resources is expected. If the market is unable to provide entrepreneurs with the necessary resources, a situation arises with increasing demand and constant supply, which leads to an increase in supply prices. In such a situation, if costs increase more slowly than output, the situation is considered normal. On the other hand, if the increase in costs starts to approach or even exceeds the growth of production, then it may be an indicator of too rapid growth of demand. In this case, there is a risk of overheating, which could be followed by a market correction, which would mean a sharp drop in demand - a downturn.

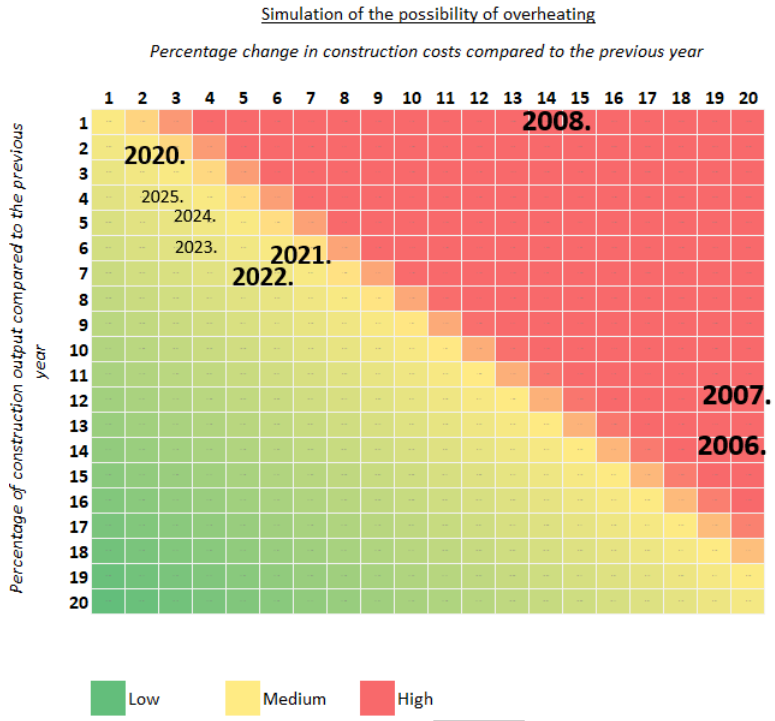


Fig 4. Simulation of overheating of the construction industry at different variants of changes in the volume and cost of construction output by extrapolating expert estimates and forecasts and the situation of the previous recession. The years are given according to the combined forecast.

Based on the obtained forecasts for the period from 2021 to 2025, there is a tendency for the construction industry to move along the risk of overheating and then move away from it. In the period from 2020 to 2021, the construction sector is showing relatively high signs of overheating, which manifests itself in an increase in costs faster than an increase in the volume of construction output. However, in 2021 the risk of overheating can be considered to be the highest and in the following years, until 2025, this risk will decrease based on current forecasts.

One of the risks that could lead the construction industry deeper into the overheating zone is if construction materials costs do not stabilize or fall by the end of 2021 and the total annual increase in construction costs significantly exceeds the 6.6% increase in construction costs and 7.1% in the combined forecast. increase in the cost of building materials. The occurrence of these facts will be identifiable in early 2022, when data on actual construction expenditure will be available.

Another indicator of the sector's overheating is its share of national GDP. Looking at the dynamics from 2014 to 2020, it has varied between 5.3% and 7.0% of the country's GDP at current prices.

Table 7.
The share of the construction sector in Latvia's GDP and GDP dynamics at current prices.

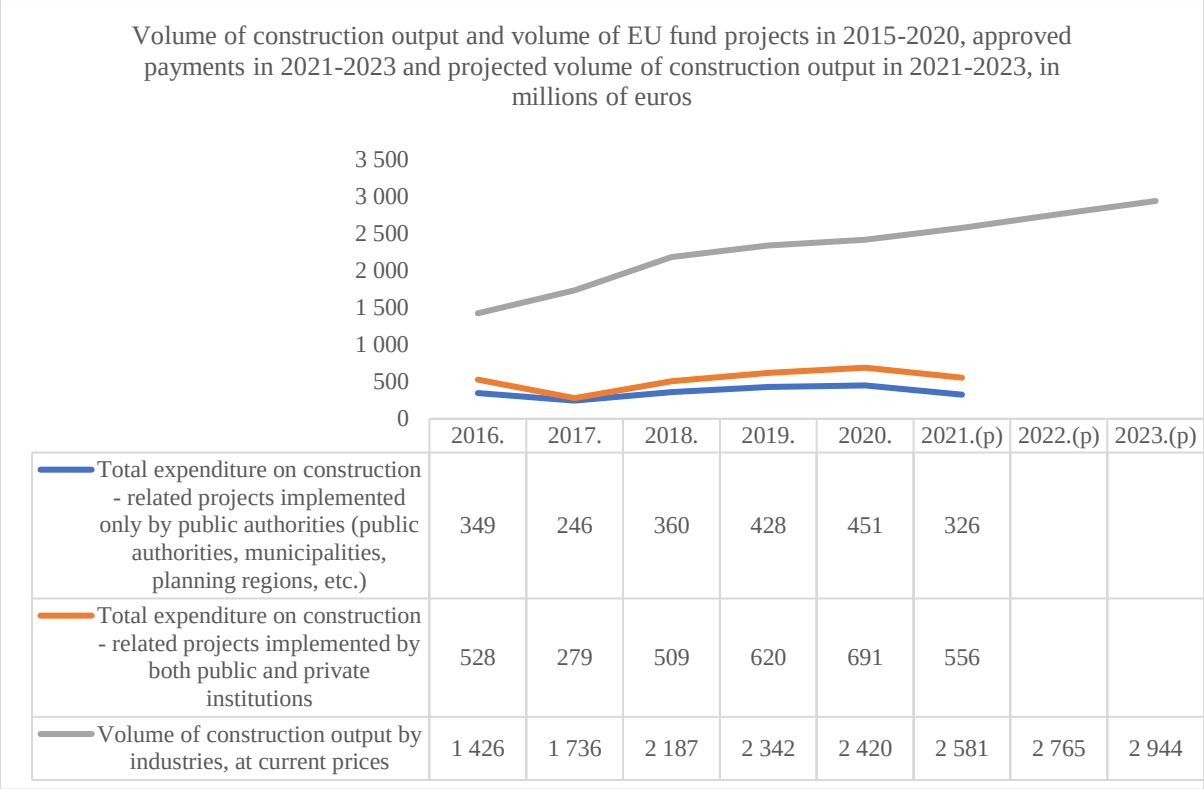
Year	2014	2015	2016	2017	2018	2019	2020
The share of the construction sector in Latvia's GDP at current prices, per cent.	6.3	6.1	5.3	5.8	6.4	6.5	7.0
GDP at current prices, billion euro	23.6	24.6	25.4	27.0	29.1	30.4	29.3

Based on the dynamics of the construction sector and GDP, in 2020, on the one hand, the share of the construction sector has increased critically, reaching 7%, which could be considered as a signal of overheating. However, the context of the situation must be taken into account. In 2020, the economic downturn in Latvia had already started due to the consequences of the pandemic, the total GDP decreased compared to 2019. It is necessary to assess at the expense of this reduction, and this is at the expense of the sectors that suffered directly from the COVID-19 pandemic that began in 2020, such as tourism, hospitality and catering. However, no decline was observed in the construction sector, so it is logical that as the total GDP falls and the GDP of a sector remains, its share in GDP will increase. Therefore, in this context of 2020, it cannot be unequivocally stated that this share of GDP is critical. At the same time, a recovery of all sectors could be expected in 2021 and 2022, which could again reduce the share of the construction sector in GDP to 6%.

Construction order structure dynamics

The volume of construction output, which is produced annually in Latvia, can be structurally divided not only by its sub-sector, but also by the source, type, division of private and public procurement. The overview of the breakdowns of different types of funds allows to assess the dynamic trends and the share of public procurement in it. In the event of uneven development of the sector, public procurement can serve as a tool to stabilize the market through corrective action.

Looking at trends in the sector, one of the data sources available to researchers is the amounts according to the Cohesion Policy Management Information System and the EU Structural Funds and Cohesion Fund Management Information System for approved interim and final project payments, which summarize all project funding sources (both EU funds and national co-financing).



	2016.	2017.	2018.	2019.	2020.	2021.(p)	2022.(p)	2023.(p)
Total expenditure on construction - related projects implemented only by public authorities (public authorities, municipalities, planning regions, etc.)	349	246	360	428	451	326		
Total expenditure on construction - related projects implemented by both public and private institutions	528	279	509	620	691	556		
Volume of construction output by industries, at current prices	1 426	1 736	2 187	2 342	2 420	2 581	2 765	2 944

Fig 5. Volume of construction output and volume of EU fund projects in 2015-2020. approved payments in 2021-2023. and the projected volume of construction output in 2021-2023. per year, in millions of euros. Source: Data compiled by the Ministry of Finance 2021.

Based on this distribution, it is possible to assess the importance of EU fund projects in the total volume of construction output, which in the period from 2016 has reached its highest level of 534 million EUR, if we look at the total expenditure on construction-related projects implemented only by public institutions, and 906 million. if the total expenditure of both public and private institutions on construction-related projects is taken into account. Current data 2019-2020. points to the contribution of European Union funds in the construction sector in the range of 600-700 million.

A topical issue in this context is the European Recovery Fund support grant to Latvia, which was submitted for 1.82 billion. in the amount of 65%, of which 65% are intended for the construction of infrastructure objects, therefore they can be attributed to support for the construction sector. This proportion is equivalent to 1.183 billion euros. This support is for the period up to 2026, so it can be assumed that this amount will be spread over about 5 years, averaging 237 million euros per year. Based on the actual volume of construction output in 2020, this amount would make up 9.8% of the total volume of construction. Applying it to the volume of construction output projected in the Study, this amount would make up about one tenth of the industry's projected turnover, which is a marginal factor influencing the growth of the total industry.

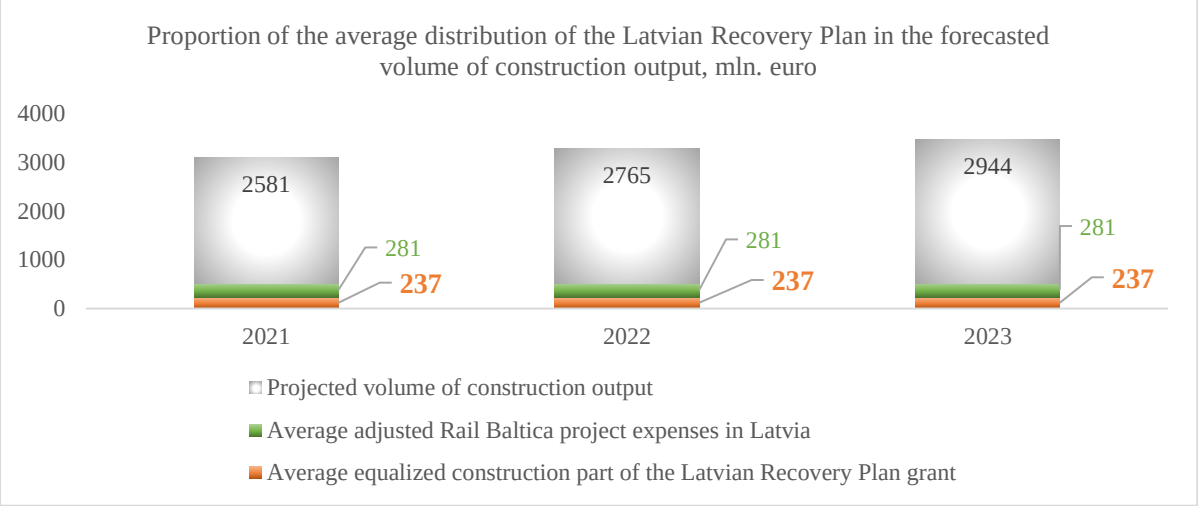


Fig 6. Proportion of the average distribution of the Latvian Recovery Plan in the forecasted volume of construction output, million euro.

A similar significant cash flow object in the industry is the Rail Baltica project. Based on the study "*Rail Baltica Global Project Cost Benefit Analysis*" conducted by the research company "Ernst & Young", the expenditures in the territory of Latvia are estimated at 1.968 billion. in euros. Based on the fact that the construction period of Rail Baltica is 2019-2026. The exact trend, which is the average expenditure over 7 years, is considered. Thus, the average adjusted amount is 281 million. euros per year, which is also about one tenth of the projected turnover of the construction industry.

1.3.2. Impact of construction output on costs and industry average profit margin

Experts in the framework of the study were presented with the current average relationship between the ratio of pre-tax profit of construction companies to turnover in order to assess the dependence of the profit margin on the volume of construction output.

Looking at the period from 2011 to 2020, there is a moderately strong correlation between the changes in the volume of construction output and construction costs in Latvia. There is a general correlation that in years with higher construction volume growth, there is also a higher cost increase and vice versa. However, the expert forecasts obtained in 2021 show that costs will increase at the same pace as construction output, which will return to the current trend in the coming years.

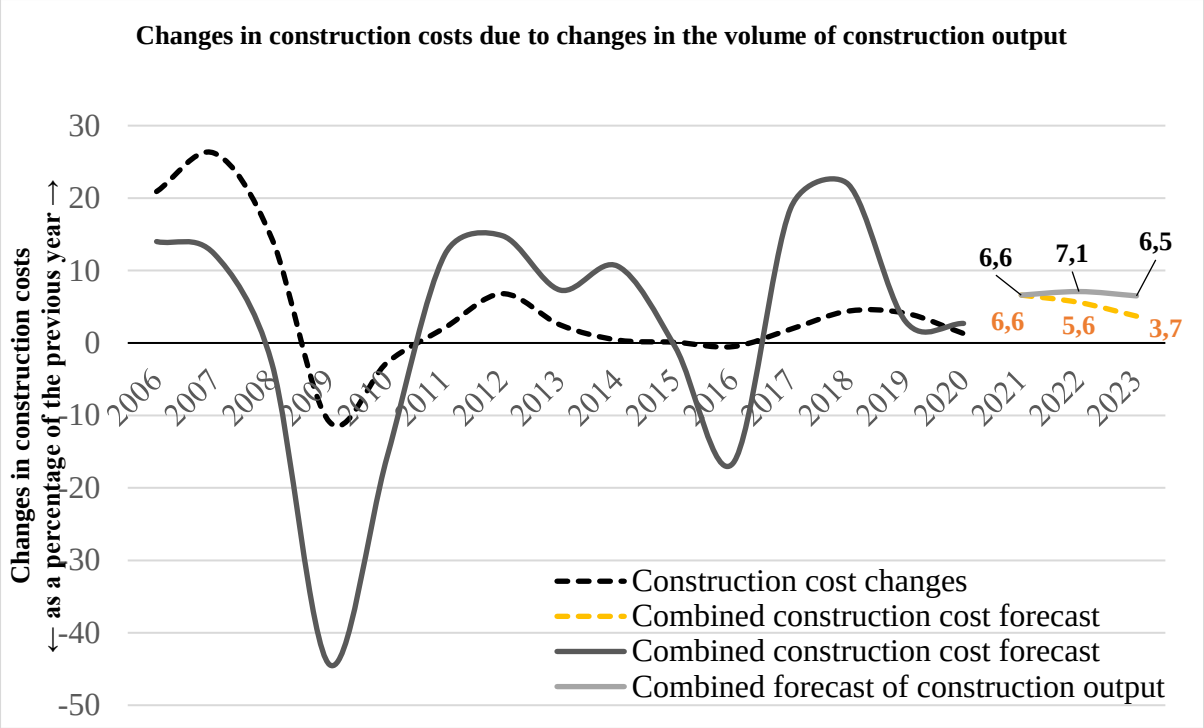


Fig 7. Changes in construction costs due to changes in the volume of construction output and the combined forecast.

Looking at the actual development of the situation over a longer period from 2006 to 2020, it can be observed that the general trend remains that in years with increasing construction output there is also an increase in construction costs. In this broad dynamic, the actual level of cost increases in 2020 is in line with normal trends and there are no abnormal developments in the sector. However, projections for 2021 point to a temporary departure from this normal trend and cost increases as large as output growth. In the period after the 2021 forecast, the situation indicates a return to a more normal proportion.

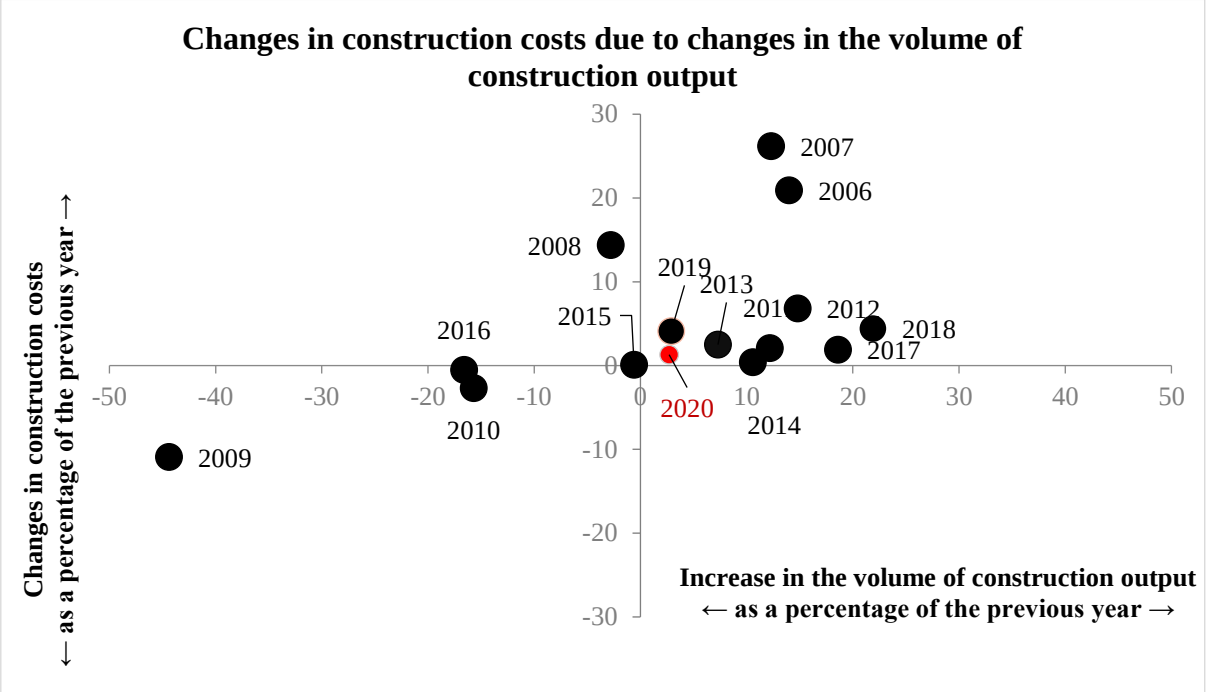


Fig 8. Changes in construction costs due to changes in the volume of construction output.

The experts also performed a conditional simulation of possible costs depending on the volume of construction output, which was used as a basis for the overheating simulation.

Table 8.
Construction cost changes and profit margins expert estimates for various construction industry growth scenarios.

Construction volume change s price lists	Changes in construction costs	Profit rate *%, which would be acceptable to Latv. construction company
-20% to -10%	3.21	5.81
-10% to -0%	4.30	6.19
0% to + 10%	6.05	8.53
+ 10% to + 20%	10.06	10.46
+ 20% to + 30%	14.90	12.40

In the 2021 study, experts see changes in construction costs in a positive way under any market growth scenario. One of the explanations is that this is related to the significant dependence of construction costs on international trade trends, and not on Latvian domestic market trends. Consequently, even in the scenario, if a decrease in the volume of construction output were expected in Latvia, according to experts, costs would continue to increase anyway.

The situation is slightly different when looking at the construction sub-sectors, as the experts representing them have different views on the profit margin of their sub-sector.

Table 9.
Expert assessment of profit margin, which would be acceptable for Latvian entrepreneurs in different sub-sectors under certain growth scenarios of construction output.

Construction volume change scenarios	Building construction s ub-sector	Transport object construction sub-sector	City infrastructure object construction sub-sector	Specialized construction s ub-sector	Architectural and engineering services, technical testing and analysis sub-sector
-20% to -10%	3.8	2.2	4.2	7.4	7.5
-10% to -0%	4.5	3.2	4.6	5.8	7.5
0% to + 10%	7.0	3.8	5.4	8.8	16.7
+ 10% to + 20%	8.8	5.5	9.7	10.2	20.0
+ 20% to + 30%	10.8	7.7	9.4	12.2	21.7

Similar to the situation in previous studies, the sub-sector that is ready to accept the lowest profit margin in the event of a market downturn is the transport construction sub-sector. In previous studies, there were situations where this sub-sector was also willing to accept a negative profit margin, but in the current circumstances, estimates suggest otherwise. The highest profit margin in all scenarios is expected by the sub-sectors of architecture and engineering services, technical testing and analysis, which on average expect a profit margin of 7.5% with negative growth rates, but with positive profit margins from 16.7% to 21.7%. In contrast, the transport construction industry would expect a negative market growth rate of 2.2% to 3.2%, while a market growth rate of 3.8% to 7.7% would be expected. The hypothetical reason for such a willingness to lower profit margins could be a higher share of public procurement, which provides less speculative opportunities, but at the same time provides a certain amount of guarantee. Also, the largest players in the transport construction industry would have a larger turnover.

1.3.3. Subsector forecasts

Within the framework of the study, representatives of different sub-sectors were addressed separately in order to assess in detail the forecasts of changes in the volume of construction output and costs of each sub-sector for the period from 2021 to 2025. Predictions were obtained for the following objects:

1. Residential buildings;
2. Non-residential buildings;
3. Roads and highways;
4. Railways and metros;
5. Bridges and tunnels;
6. Urban infrastructure;
7. Specialized buildings;
8. Architectural and engineering services, technical testing and analysis of production volume changes.

From the point of view of the growth of construction output, the highest growth is expected in the sub-sectors related to the construction of transport facilities. In this case, experts predict a significant increase in the construction of railways, roads and highways, as well as bridges and tunnels. Growth forecasts are related both to the planned public procurement support in construction and to the entry of the Rail Baltica project into the construction phase. Experts also see a significant increase in the sub-sector of architectural and engineering services, technical testing and analysis. In turn, the lowest growth is expected in the non-residential building construction sub-sector.

In the building construction sub-sector, a moderate amount of construction output is forecast in 2021 and 2022, however, estimating 2023-2025. Faster building construction volumes are expected for the period 2007-2013. In general, according to experts, the residential building segment is expected to grow faster than the non-residential segment.

The development of the transport sector is related to the implementation of significant municipal, state and European Union projects. In 2021, according to both expert forecasts and combined forecasts, an increase is expected in all sub-sectors of construction of transport facilities. However, in 2022 in some sub-sectors a decline is expected - in the construction of roads and highways and in the construction of bridges and tunnels. This is explained by fluctuations in the Structural Funds and, consequently, the impact of expert opinion. In the period from 2023-2025. Road and motorway construction trends are estimated to be a period of moderate growth with a slight increase in market volume. At the same time, the construction of railways, bridges and tunnels is experiencing a rapid leap, which is related to the significant construction works of the Rail Baltic project. Given that this sub-sector is highly cyclical, these large jumps may be followed by equally significant declines in the long run. Also in the last decade, the railway sub-sector has observed alternating years of rapid increases and decreases.

Table 10.
Forecasts of changes in the volume of construction output as a percentage of the previous year according to the average assessment of sub-sector experts in 2021-2025.

	2021	2022	2023	2024	2025
Building construction forecasts					
Expert forecast of changes in the volume of construction output of residential buildings	64	6.14	11.29	12.57	11.86
Expert forecast of changes in the volume of construction output of non-residential buildings	3.29	4.57	7.86	9.71	8.86
Combined forecast of changes in the volume of building construction output	5.94	5.96	7.91	8.54	8.01
Transport object construction forecasts					
Expert forecast of changes in the volume of road and highway construction output	7.00	-10.83	3.20	3.20	2.20
Combined forecast of changes in the volume of road and highway construction output	4.66	-4.64	2.02	1.70	0.90
Expert forecast of changes in the volume of railway and metro construction output	7.50	23.75	30.67	40.67	50.33
Expert forecast of changes in the volume of bridge and tunnel construction output	7.00	1.00	26.75	40.50	49.25
Combined forecast of changes in the volume of bridge and tunnel construction output	2.35	-0.25	12.99	20.20	24.89
Forecasts of construction of urban infrastructure objects					
Expert forecasts of changes in the volume of construction output of urban infrastructure objects	6.86	12.14	10.57	10.14	7.29
Combined forecast of changes in the volume of construction output of urban infrastructure objects	2.74	4.98	3.81	3.26	1.51
Production forecasts for specialized construction works					
Expert forecast of changes in the volume of production of specialized construction works	9.86	12.29	8.86	5.86	6.00
Combined forecast of changes in the volume of specialized construction output	8.17	9.31	7.52	5.96	5.97

Architectural and engineering services, technical testing and analysis forecasts					
Expert forecast of changes in the volume of architectural and engineering services, technical testing and analysis	6.43	11.43	14.29	17.86	12.14

In the sub-sector of urban infrastructure, experts' view of further development is relatively optimistic with rapid growth of over 10% per year from 2022 to 2024. Adjusting this view for statistical forecasts and thus obtaining complex forecasts, it is estimated that in the short term this sub-sector would have moderate growth below the 10% threshold, which will become more moderate in 2022 and only a few percent per year in the medium term.

In the sub-sector of architectural and engineering services, technical testing and analysis, only expert evaluation is used, because there is not enough information in the accounting of statistical data of this sector for statistical analysis. Consequently, the authors of the paper believe that based on the trends of other sub-sectors, a hypothetical combined forecast would be lower than the obtained expert assessment. In general, experts forecast the peak of growth of the sub-sector in 2024. In the period from 2022 to 2025, an annual volume growth of over 10% is forecast, which can be assessed as relatively high.

Forecasts of changes in construction costs by subsectors

In general, the forecasts for changes in construction costs set by sub-sector experts maintain similar trends as the forecasts for changes in the volume of construction output. In the period from 2021-2025. The largest increase in costs is forecast for the construction of transport facilities (roads, railways, bridges, tunnels, etc.). In other sub-sectors, in almost all sub-sectors in 2021, more than 10% of cost growth is forecast, which will consistently decrease in the coming years.

Table 11.
Forecasts of changes in construction costs as a percentage of the previous year according to the average assessment of sub-sector experts in 2021-2025.

	2021	2022	2023	2024	2025	Average per year
Changes in the construction costs of residential buildings	11.6	6.7	5.5	4.8	8.6	7.4
Changes in the construction costs of non - residential buildings	11.6	6.6	5.0	4.4	8.2	7.1
Changes in the road and highway construction costs	10.0	7.8	6.4	7.6	6.8	7.7
Changes in the railway and metro construction costs	11.3	11.0	12.8	15.3	15.3	13.1
Changes in the bridge and tunnel construction costs	4.0	12.0	14.3	15.5	13.0	11.7
Changes in the construction costs of urban infrastructure objects	9.6	8.6	7.6	5.8	5.6	7.4
Changes in the construction costs of specialized construction works	15.7	6.9	5.7	5.0	3.7	7.3
Changes in the architectural and engineering services, technical testing and analysis construction costs	13.6	15.7	4.9	6.1	4.6	8.9

In the building construction sub-sector, the increase in costs will have the greatest impact in 2021, when an increase of 11.6% compared to 2020 is forecast. In the following years, it will decrease and will be similar to the pre-pandemic level and in the four years from 2022 will be on average 6.4% per year compared to the previous year.

The largest increase in costs is expected in the construction of transport facilities in the medium term, although in the short term in 2021 this sub-sector will have a relatively low increase in projected costs. In the construction of roads and highways, a high cost increase of 10.0% is forecast in 2021, but in the following years it will decrease below the 10% limit. At the same time, the lowest cost growth of 4.0% is forecast for the construction of bridges and tunnels in 2021, which will increase significantly in the coming years already in 2022, reaching 12.0% according to expert forecasts and in the assessment of 2023-2025. An average annual growth rate of 14.3% is forecast for. For railway and metro construction products, the largest increase in costs is forecast at 11.0% and 15.3% per annum over the whole period under review.

In the construction of urban infrastructure objects, an increase in costs is also forecasted, which will not exceed the limit of 10% in any given period. In 2021, the largest increase in costs is forecast at 9.6%, but in the coming years it will be smaller and lower and is estimated to be 5.5% in 2025 compared to the previous year.

The specialized construction sub-sector is forecast to have the fastest cost increase of all sub-sectors in 2021 with a jump of 15.7%, which will be followed by a jump to 6.9% in 2022 and the assessment envisages further slower cost growth up to 3.7% in 2025. in.

In the sub-sector of architectural and engineering services, technical testing and analysis, 2021 and 2022 are marked by a projected high cost increase of 13.6% and 15.7% compared to the previous year. In further periods 2023-2025. On average, the increase in costs in 2006 is estimated at 5.2% compared to the previous year.

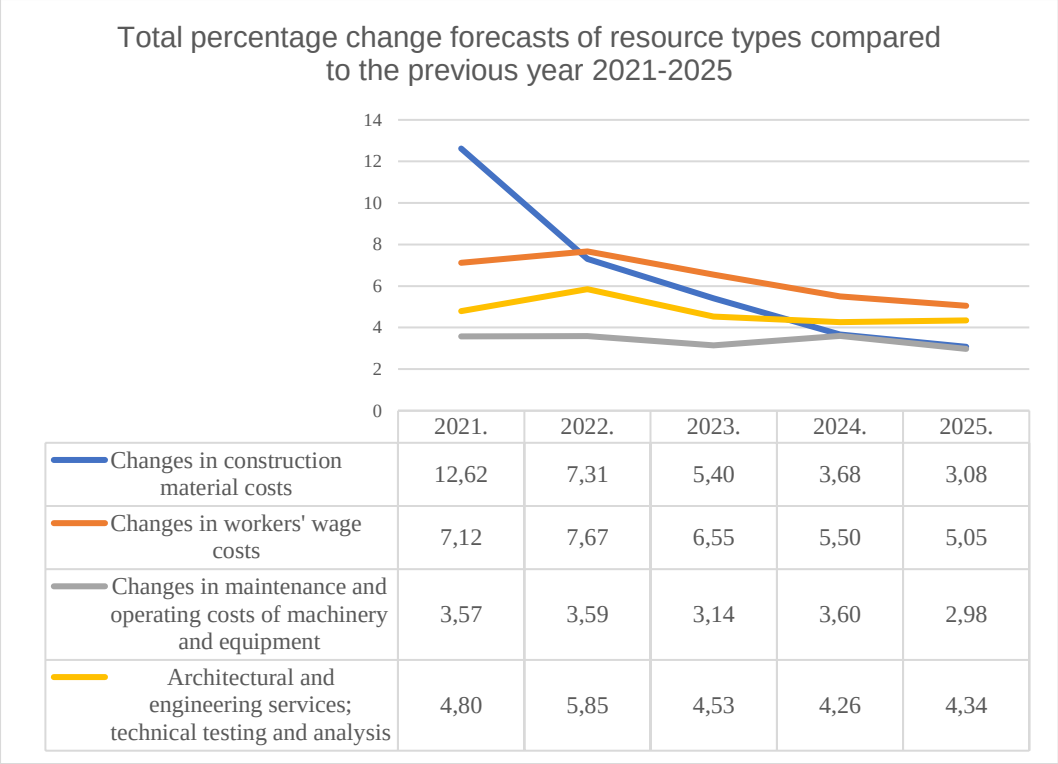
1.3.4. Changes in construction costs by type of resource

Changes in construction costs by type of resource were assessed in each of the sub-sectors. The following division into types of resources was analyzed within the study:

1. Changes in construction material costs;
2. Changes in workers' wage costs;
3. Changes in maintenance and operating costs of machines and mechanisms;
4. Architectural and engineering services; technical testing and analysis.

In addition to the overall breakdown of cost types, changes in costs were also considered in combination with the sub-sector breakdown.

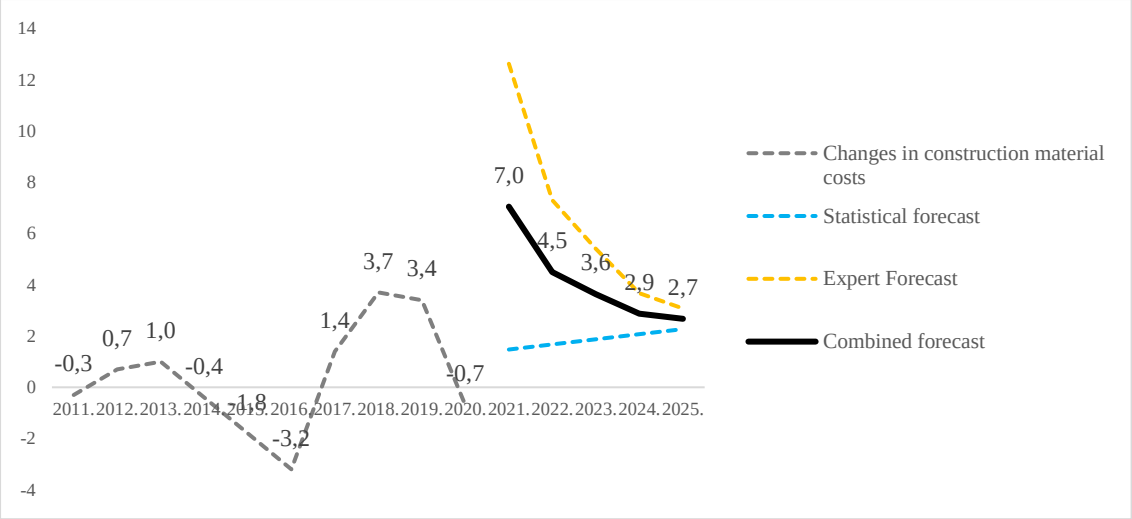
The largest increase is forecast in the cost of construction materials, which is ahead of the leading position of workers' wages in previous years. However, according to experts, this will rather be a phenomenon in 2021, because in 2022 forecasts, changes in construction material costs will decrease in the second position, with changes in workers' wages in the first place. Until 2025, the growth of construction material costs is forecast to be smaller and smaller.



	2021.	2022.	2023.	2024.	2025.
Changes in construction material costs	12,62	7,31	5,40	3,68	3,08
Changes in workers' wage costs	7,12	7,67	6,55	5,50	5,05
Changes in maintenance and operating costs of machinery and equipment	3,57	3,59	3,14	3,60	2,98
Architectural and engineering services; technical testing and analysis	4,80	5,85	4,53	4,26	4,34

Fig 9. Forecasts of changes in the types of resources according to the assessments of general and trade experts.

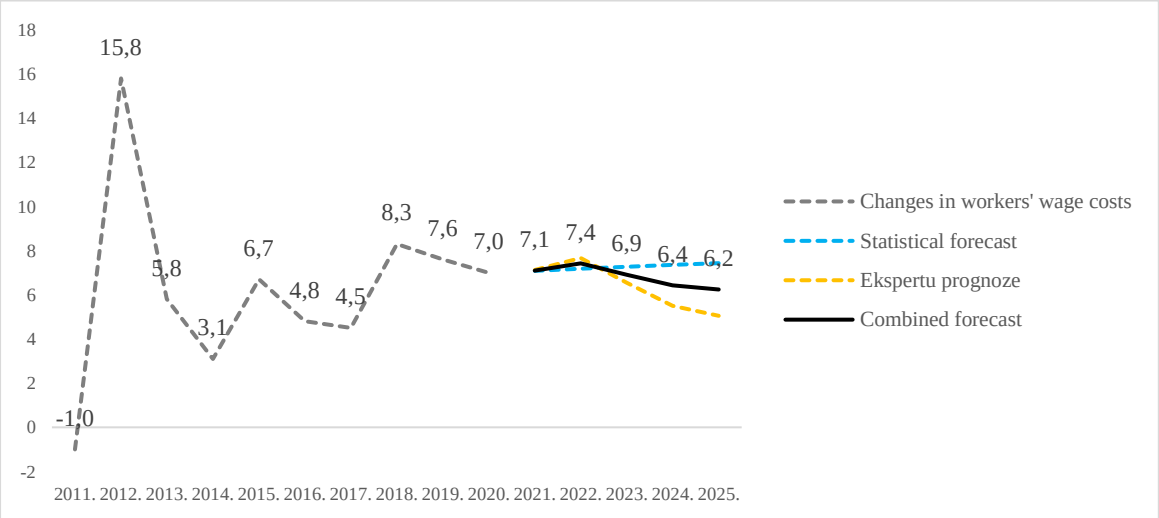
Building materials in 2021 are characterized by a significant and topical increase already during the research. Contrary to the constant trends of previous years, in 2021 for the first time a jump in the cost of construction materials was observed higher than a jump in wages. Significant differences are also observed between the statistical forecast and the expert forecast, as the trend of previous years' data does not show a significant jump in costs for construction materials from an extrapolation point of view, as costs have generally fluctuated between -3.2 and + 3.7% each year. However, based on the sharp jumps in the prices of timber and metal products in the first 6 months of 2021, the experts also took into account the current extraordinary increase in prices and therefore the experts' forecasts exceed the 12% annual increase in costs. The authors of the study, based on the experience of previous years' research, believe that the combined forecast (statistically-expert) could be the most plausible scenario in this case, identifying 7.1% increase in construction material costs in 2021 and 4.5% in 2022. There are also concerns that the experts' assessment was based on the situation in the first half of 2021, as already in the second half of 2021 a fall in timber prices was observed in some world markets, which could refer to a fall in prices in Latvia with several months delay.



	2021	2022	2023	2024	2025
Statistical forecast	1,5	1,7	1,9	2,1	2,3
Combined forecast	**7,0**	**4,5**	**3,6**	**2,9**	**2,7**
Expert forecast	12,6	7,3	5,4	3,7	3,1

Fig 10. Percentage change in construction material costs compared to the previous year since 2011 and forecasts for 2021-2025.

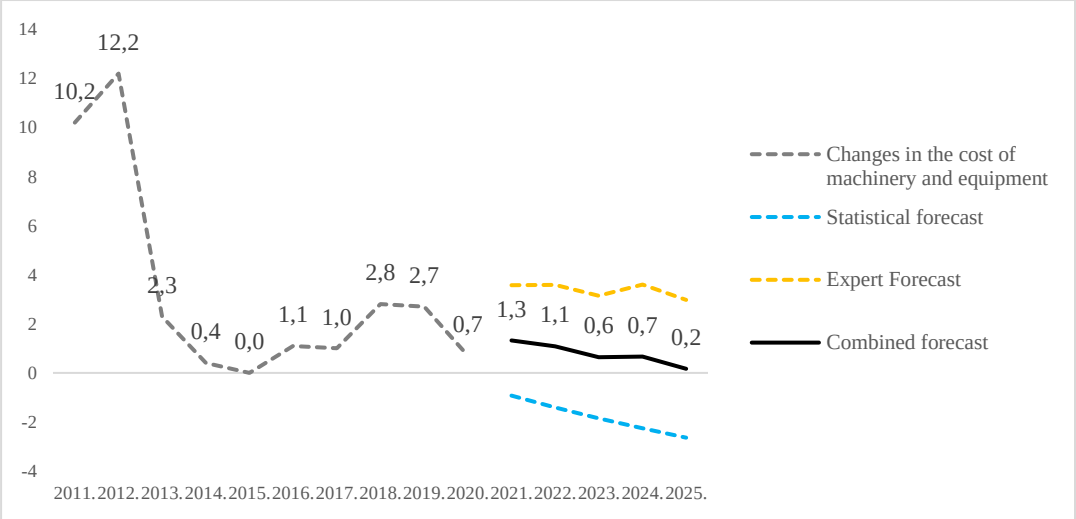
The opposite situation is observed in the context of workers' labor costs - the opinions of experts coincide very closely with the obtained statistical forecast for 2021 and 2022. Thus, it can be relatively unanimously assumed that workers' labor costs could increase by 7.1% in 2021 and 7.4% in 2022. In subsequent periods, the increase in annual workers' wages will not exceed 7% per year. In essence, it can be argued that over the next five years, according to the current assessment, similar trends are expected to prevail in the area of workers' wages as in 2013.



	2021.	2022.	2023.	2024.	2025.
Statistical forecast	7,1	7,2	7,3	7,4	7,4
Combined forecast	**7,1**	**7,4**	**6,9**	**6,4**	**6,2**
Expert forecast	7,1	7,7	6,5	5,5	5,1

Fig 11. Percentage change in workers' wage costs over the previous year since 2011 and forecasts for 2021-2025.

In terms of the cost of machinery and equipment, very small changes in costs have been observed since 2013. The lowest increase was in 2015, when costs did not increase in principle, and the highest was in 2018, when it increased by 2.8%. The obtained forecasts, both expert and combined, also indicate that such trends will continue. In the coming years - in 2021 and 2022, an increase in costs of 1.3% and 1.1% compared to the previous year is forecasted.



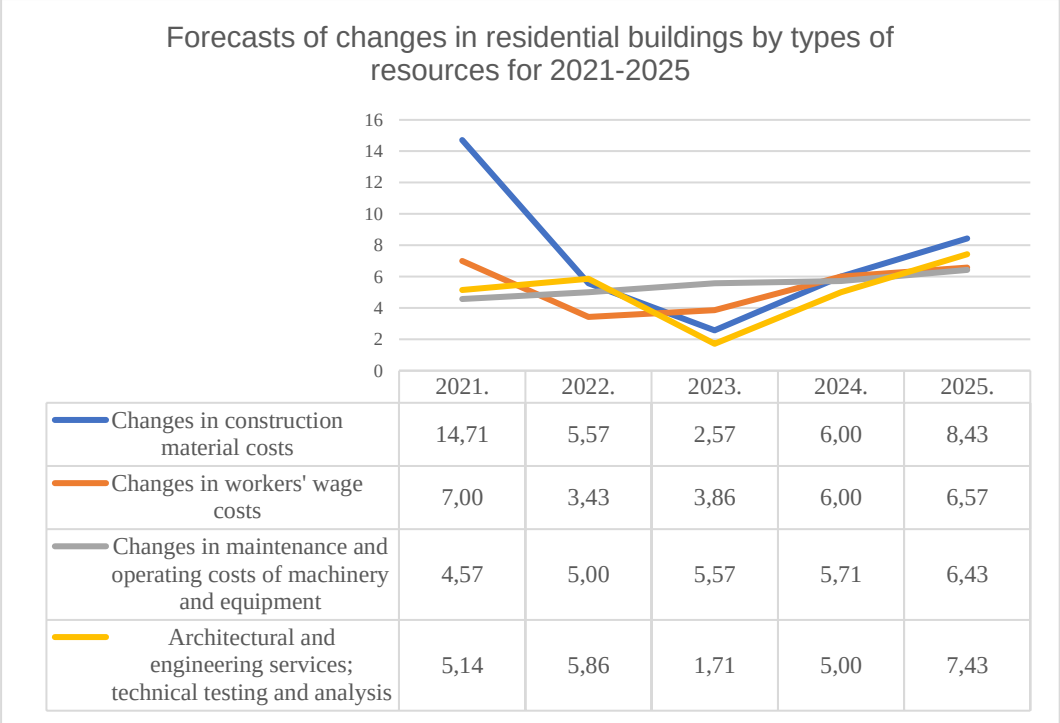
	2021	2022	2023	2024	2025
Statistical forecast	-0.9	-1.4	-1.9	-2.3	-2.6
Combined forecast	**1.3**	**1.1**	**0.6**	**0.7**	**0.2**
Expert forecast	3.6	3.6	3.1	3.6	3.0

Fig 12. Percentage change in the cost of machinery and equipment compared to the previous year since 2011 and forecasts for 2021-2025.

Cost forecasts by type of resources were also considered by sub-sectors, with experts of each sub-sector forecasting costs within their competence. As a result, various sections were obtained, which were evaluated in depth.

In the case of construction of residential buildings, the largest increase in costs in 2021 is forecasted for the cost of construction materials in the amount of 14.71%, which according to forecasts will decrease significantly next year.

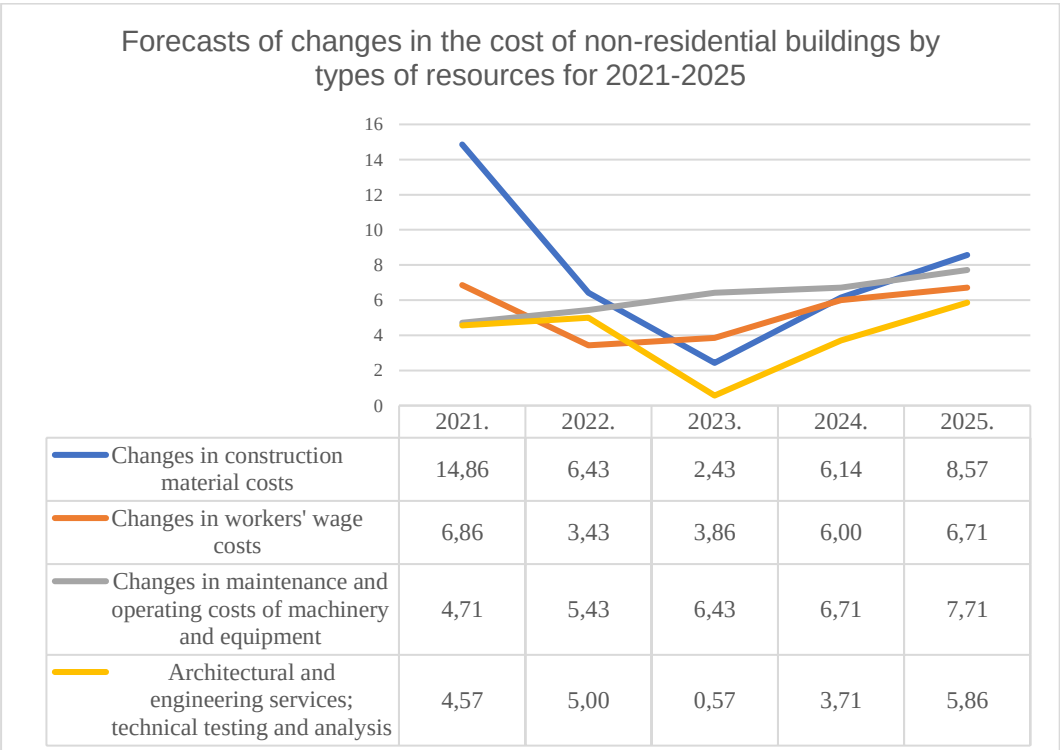
Repeated growth of construction materials is forecast in 2024 and 2025. Workers' wages are projected to increase by 3.43% and 7.00%.



	2021.	2022.	2023.	2024.	2025.
Changes in construction material costs	14,71	5,57	2,57	6,00	8,43
Changes in workers' wage costs	7,00	3,43	3,86	6,00	6,57
Changes in maintenance and operating costs of machinery and equipment	4,57	5,00	5,57	5,71	6,43
Architectural and engineering services; technical testing and analysis	5,14	5,86	1,71	5,00	7,43

Fig 13. Forecasts of changes in the cost of residential buildings by types of resources 2021-2025.

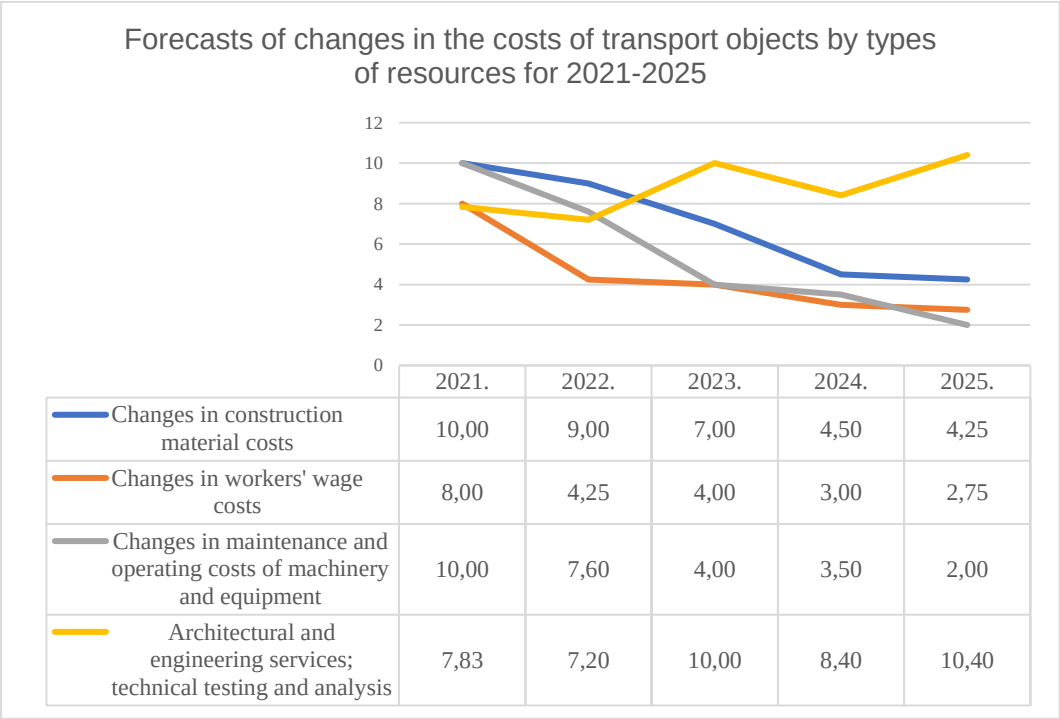
Changes in the cost of non-residential buildings are generally characterized by the same trends as in the construction of residential buildings. In this case, too, building materials in 2021 will rather be the position with the fastest growth, which is forecasted at 14.86%. Over the longer term, lower cost growth is projected, which could be lowest at 2.4% in 2023, but could rise again to 8.6% per year by 2025.



	2021.	2022.	2023.	2024.	2025.
Changes in construction material costs	14,86	6,43	2,43	6,14	8,57
Changes in workers' wage costs	6,86	3,43	3,86	6,00	6,71
Changes in maintenance and operating costs of machinery and equipment	4,71	5,43	6,43	6,71	7,71
Architectural and engineering services; technical testing and analysis	4,57	5,00	0,57	3,71	5,86

Fig 14. Forecasts of changes in the cost of non-residential buildings by types of resources 2021-2025.

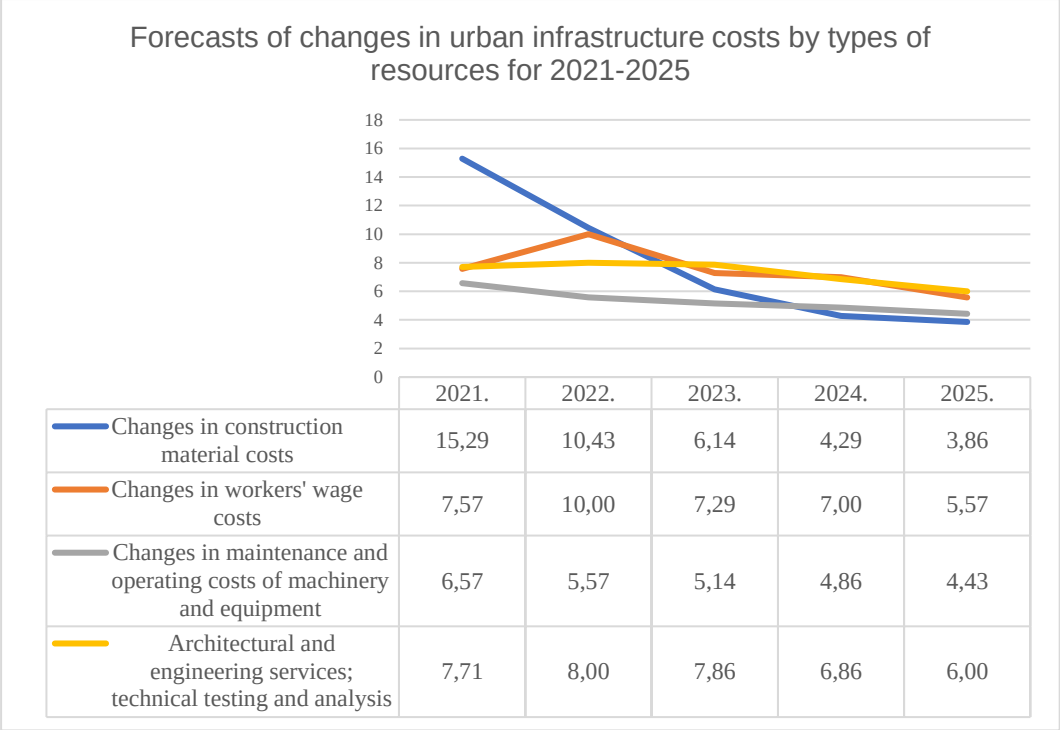
The sub-sector of transport construction stands out with relatively pessimistic estimates and high increase of costs forecasted by experts in all positions. Both the cost of construction materials and the cost of machinery and equipment in 2021 are forecast to increase by 10.0%. In later years, however, these forecasts will decrease in these positions, reaching pre-pandemic levels in 2023-2025. annual evaluations. However, a specific situation arises with the expenses of architectural and engineering services, technical testing and analysis, where, conversely, in 2021 and 2022 a more moderate increase in costs is forecast of 7.8% and 7.2% compared to the previous year, but in the period 2023-2025. The average annual growth is estimated at 9.6% per year. Such a situation could be related to a large workload of specialists in this sub-sector in Latvia directly in the construction of transport facilities in the context of the Rail Baltica project.



	2021.	2022.	2023.	2024.	2025.
Changes in construction material costs	10,00	9,00	7,00	4,50	4,25
Changes in workers' wage costs	8,00	4,25	4,00	3,00	2,75
Changes in maintenance and operating costs of machinery and equipment	10,00	7,60	4,00	3,50	2,00
Architectural and engineering services; technical testing and analysis	7,83	7,20	10,00	8,40	10,40

Fig 15. Forecasts of changes in the costs of transport objects by types of resources 2021-2025.

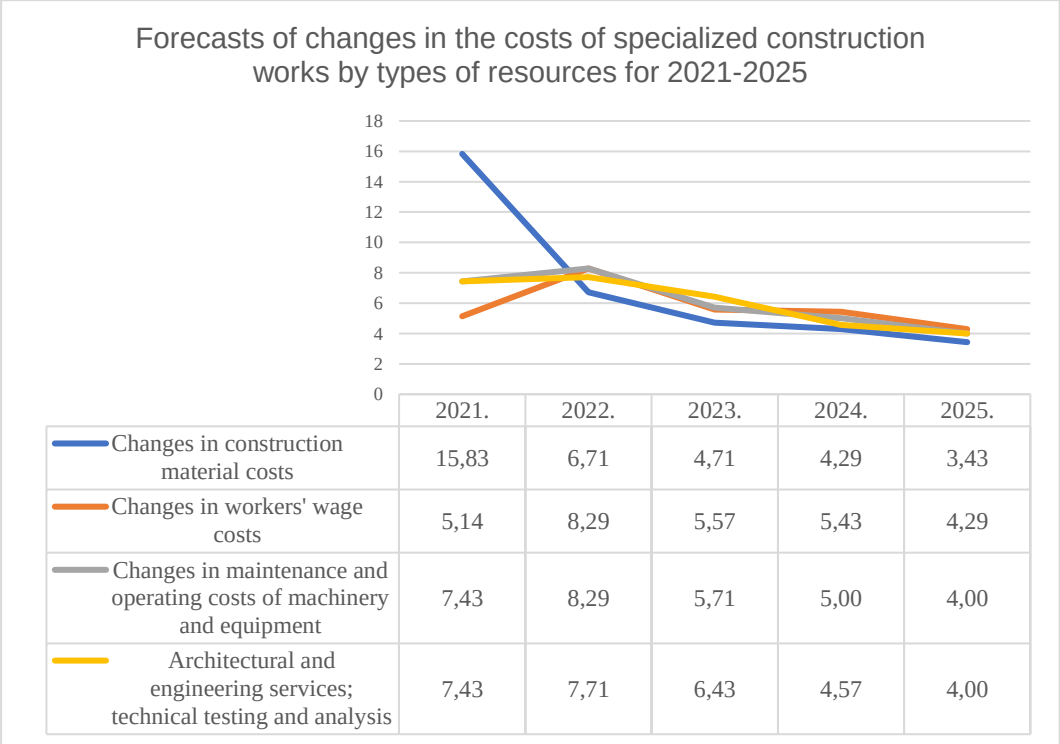
Also in the sub-sector of urban infrastructure, a significant increase in costs is forecasted in the context of building materials. In 2021, this increase is forecast at 15.3%, which will not be so large in later years, but also in 2022 will be the most significant cost item. Workers' wage costs could increase by 7.6% in 2021 and by more than 10.0% in 2022, but in later years the increase will not be as large.



	2021.	2022.	2023.	2024.	2025.
Changes in construction material costs	15,29	10,43	6,14	4,29	3,86
Changes in workers' wage costs	7,57	10,00	7,29	7,00	5,57
Changes in maintenance and operating costs of machinery and equipment	6,57	5,57	5,14	4,86	4,43
Architectural and engineering services; technical testing and analysis	7,71	8,00	7,86	6,86	6,00

Fig 16. Forecasts of changes in urban infrastructure costs by types of resources 2021-2025.

The specialized construction sub-sector also has similar trends to other sub-sectors, where the cost of construction materials has become the most important position in 2021 and could increase by 15.8%, and already next year only by 6.7% and lower in subsequent years. Atypically for other sub-sectors, below-wage growth is projected to be only 5.1% in 2021, which could grow slightly faster in 8.322 by 8.3%, but return to the level of the 2021 forecast and 2023-2025. to grow by an average of 5.1% per year over the period.



	2021.	2022.	2023.	2024.	2025.
Changes in construction material costs	15,83	6,71	4,71	4,29	3,43
Changes in workers' wage costs	5,14	8,29	5,57	5,43	4,29
Changes in maintenance and operating costs of machinery and equipment	7,43	8,29	5,71	5,00	4,00
Architectural and engineering services; technical testing and analysis	7,43	7,71	6,43	4,57	4,00

Fig 17. Forecasts of changes in costs of specialized construction works by types of resources 2021-2025.

The study shows a clear tendency that in 2021, the cost of construction materials will be the main item, which will create an increase in costs in all sub-sectors related to construction. Therefore, for the first time, the survey also conducted a survey of manufacturers and traders of construction materials in order to assess trends in the nature of changes in the costs of various construction materials.

1.3.5. Changes and structure of construction material costs

In order to find out the changes in the costs of various construction materials in 2021 and the expected next years, manufacturers of building materials, traders and their representatives were interviewed in order to assess the forecasts of changes in the costs of the most important construction materials, finishing materials and systems.

Based on the research materials in the field of international construction, within the framework of the study, a classification of construction materials was created by dividing them into three main groups:

1. Basic building materials;
2. Finishing materials;
3. Main system equipment.

In the group of basic building materials, experts predict the most significant increase in costs. The main increase is forecast for timber and metal products. In 2021, the average estimate of experts for the increase in the cost of metal products is 24.3%, while for timber an increase of 30.0% is forecast. Estimates of all other basic building materials are within one digit.

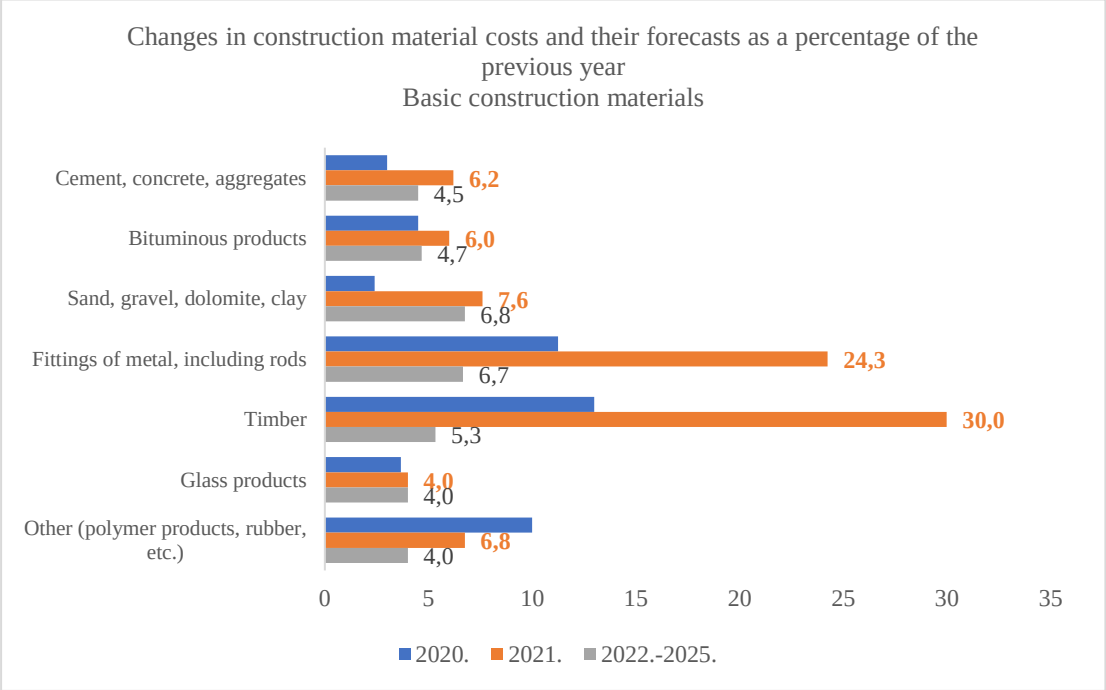


Fig 18. Expert assessments of changes in the cost of basic building materials.

In the category of finishing materials, relatively lower cost increase trends are observed. However, here too, parallels can be seen with the significant increase in timber costs in 2021. In this case, the only item for which the projected cost increase exceeds the 10% mark is interior decoration materials with 11%, which may be related to the woods often used in them.

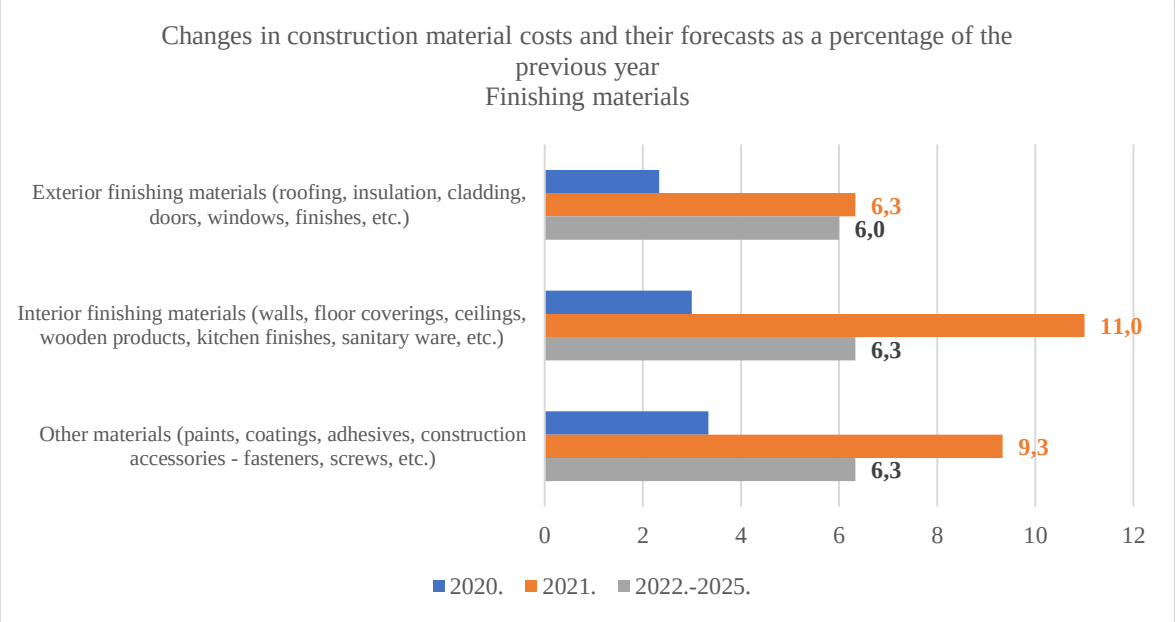


Fig 19. Expert evaluations of changes in the cost of finishing materials.

In the case of the main construction system equipment, experts predict a moderate increase in costs, with the exception of electricity systems with a 16% increase in costs and lifts and escalators with a 7.67% increase in 2021.

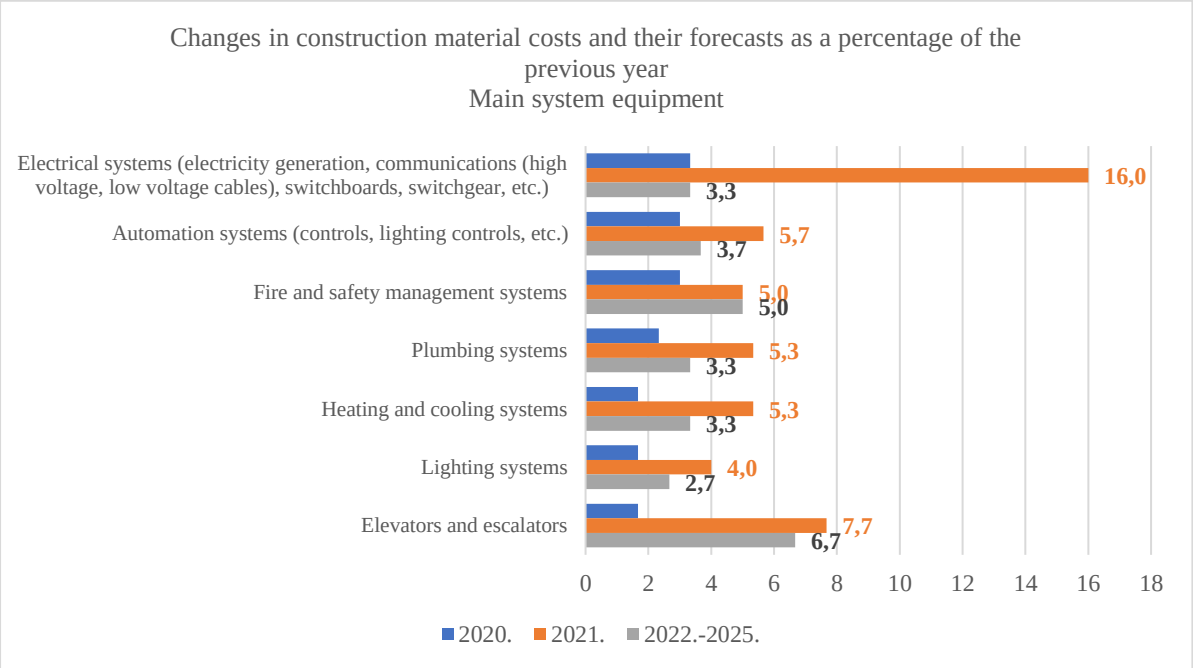


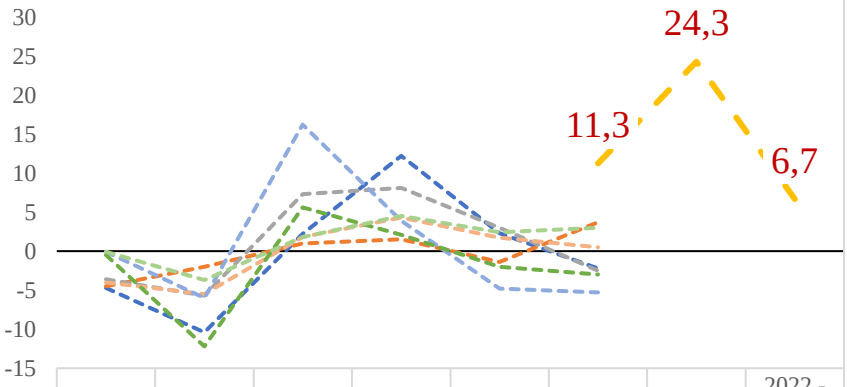
Fig 20. Expert evaluations of changes in the costs of the main system equipment.

The main cost growth items are directly or indirectly related to two basic raw materials - metals and wood, whose price increase is related to the breakdown of the market demand and supply balance in 2021 due to a significant increase in market supply, which cannot be maintained by the current market supply. Such a trend can be observed not only on a national or regional scale, but also on a global scale, which reduces the possibility of influencing prices on the Latvian scale by intervening in the market.

In parallel with the expert forecasts, the current trends in the field of construction material prices were considered, using the CSB data specially compiled for the Study on the price dynamics of various goods from 2015 to 2020. Particular emphasis was placed on the category of timber and metal products.

In the category of metal products, data were collected on metal products such as rolled steel, metal structures, products, bars and meshes, frames, various steel pipes, etc. In the period from 2015, changes in costs in these various categories have been observed in the range of -12.2% to + 16.2% compared to the previous year, thus it can be concluded that no price stability has been observed. Due to the lack of information on the share of metal products in the total production structure, it is not possible to accurately estimate the average cost of metal products, therefore in 2020, an expert estimate is used as an average.

Price dynamics of individual metal products and expert forecast of metal product costs as a percentage of the previous year

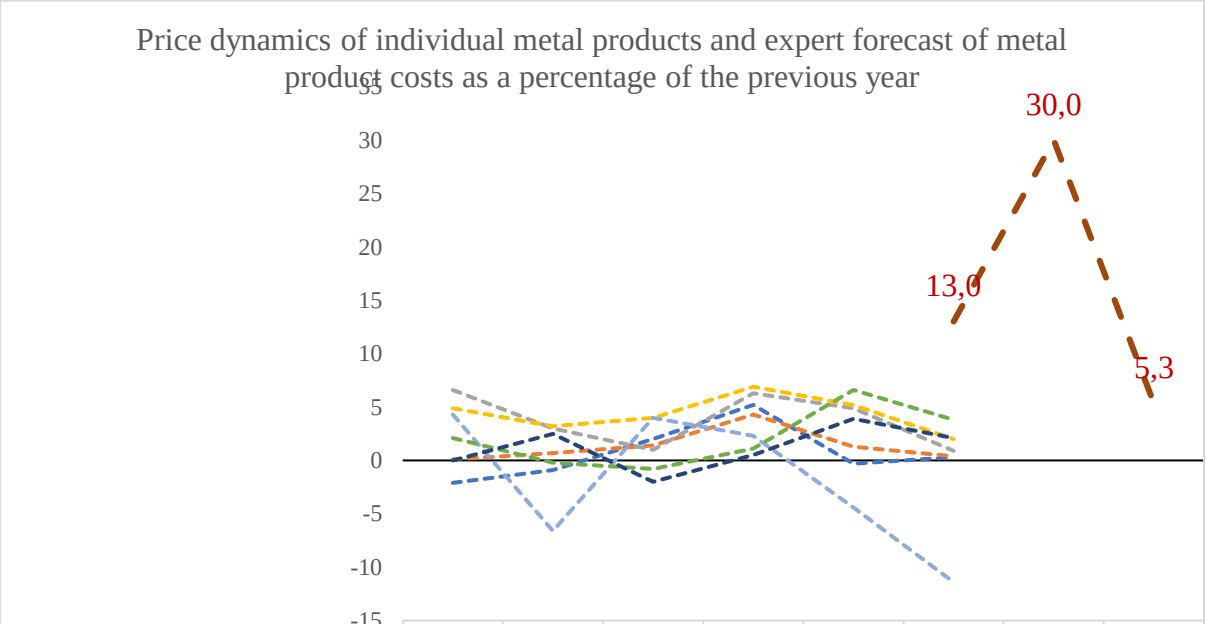


	2015.	2016.	2017.	2018.	2019.	2020.	2021.	2022.-2025.
Rolled steel	-4,7	-10,4	2,2	12,2	2,3	-2,2		
Metal construction and small met. articles	-4,5	-2	1	1,5	-1,4	3,7		
Reinforcements, reinforcing meshes, frames	-3,6	-5,7	7,3	8,1	3	-2,5		
Stainless steel	-4	-5,5	1,8	4,3	1,7	0,5		
Steel pipes (ordinary)	-0,1	-6	16,2	3,9	-4,8	-5,3		
Steel pipes (galvanized)	-0,5	-12,2	5,6	2,1	-2	-3		
Industrial insulated steel tubes with an inside diameter of 200 mm	-0,1	-3,7	1,8	4,5	2,4	3		
Total expert forecast of metal products						11,25	24,25	6,67

Fig 21. Changes in the costs of individual metal products and assessments of building materials trade experts on the average dynamics of metal product costs.

In the timber category, available data on items such as logs, beams, unplaned boards, parquet, plywood, wood fiber and particle board were considered. Unlike metal products, no such large fluctuations in costs were observed in this category between 2015 and 2020. Changes in the costs of the considered positions can be observed in the range from -11.4% compared to the previous year to + 6.9% increase. Thus, the 30.0% increase in costs in 2021, based on the estimates of building materials trade experts, is a significant leap in the context of the current dynamics. At the same time, it is estimated that from 2022

the increase in costs could return to the current growth rate, however, there is no view that a significant reduction in costs would take place.



	2015.	2016.	2017.	2018.	2019.	2020.	2021.	2022.-2025.
Total timber expert forecast						13,00	30,00	5,33
Logs	-2,1	-0,9	2	5,2	-0,3	0,3		
Beams, unplaned boards	0,1	0,7	1,4	4,3	1,3	0,4		
Planed, grooved floor boards	6,6	3	1	6,3	4,9	0,9		
Parquet	4,9	3,2	4	6,9	5,2	2		
Plywood (veneer)	4,3	-6,6	4	2,3	-4,4	-11,4		
Fibreboard	2,1	-0,2	-0,8	1,1	6,6	3,8		
Particle board	0	2,5	-2	0,5	3,9	2,1		

Fig 22. Changes in timber prices from 2015 and assessment of the average trend in 2020-2025.

One of the main issues that is relevant in the context of 2021 is the uncertainty about the adjustment of the price of timber and metal products. In essence, the jump in prices in these two categories was caused by the imbalance between supply and demand, when there has been a sharp increase in demand with stable or reduced supply.

On the demand side, the reasons for its growth are explained by several trends in various world markets, including:

- growth in demand as economies recover in major world markets (US, China),
- the increasing pace of construction caused by public support programs aimed at economic recovery following the COVID-19 pandemic and the economic downturn or stagnation caused by epidemiological measures;
- more intensive use of timber in construction,

On the supply side, the main causes of stagnation are related to such causes as:

- failure to restore production capacity to pre-pandemic levels due to technological reasons, such as plant closures at the beginning of the pandemic;
- delays in logistics routes due to the growing demand for transport services due to the rapid development of e-commerce in an isolated population and the inability of logistics hubs to operate at full capacity due to the impact of epidemiological measures on labor availability,

- natural cataclysms, such as forest fires, storms, floods, forest disruptions,
- Invasion of bark beetles in European forests, resulting in a large accumulation of dead and dying wood.

Fig 23. Timber price changes from September 2020 to July 2021 on the US Timber Exchange (Chicago). Source: Trading Economics.

According to experts, building material prices could stop rising sharply after peaking, but the growth rate could remain modest. The assessment of expert forecasts has not identified a downward trend in construction material prices. The authors' analysis indicates that in the more competitive positions of timber and metal products, a price correction could be expected back to the 2019 price level plus an average price increase of two to three years. This forecast is based on the assumption that as supply increases and demand for economic theory decreases, prices should decrease. If this trend is not observed, it may indicate unfair practices and price fixing.

In some markets, a return to the levels before the sharp rise was already observed in the final phase of the study. For example, on the US timber exchanges, the timber price index rose several times from 500 points in November 2020 to over 1600 points in May 2021. However, already in July, the price level returned to the previous level of around 500. This situation was explained by the decline in market demand due to the jump in prices when construction companies refused to buy construction materials at such a significant increase in prices. This leads to a market correction and reduced demand to existing supply leads to lower prices, incl. prices at the previous level.

1.4. Impact of measures to combat the shadow economy on the construction industry

The study experts were asked to assess the impact of the measures planned and implemented by public administration institutions to combat the shadow economy on the labor and construction material costs of the construction sector. Analyzing the obtained answers of both general and sub-sectoral experts, the average expert evaluation was calculated. The impact of measures to combat the shadow economy on construction costs was assessed on a scale from -10 to +10 points, where a higher score means that the factor of combating the shadow economy significantly increases or decreases the cost of labor or building materials in construction.

Examining the obtained expert assessments, it can be concluded that, in general, experts representing the construction industry see a greater impact of measures to combat the shadow economy on labor costs than on the costs of construction materials. Overall, there are also moderately positive assessments, indicating that these measures are mainly cost increases rather than savings.

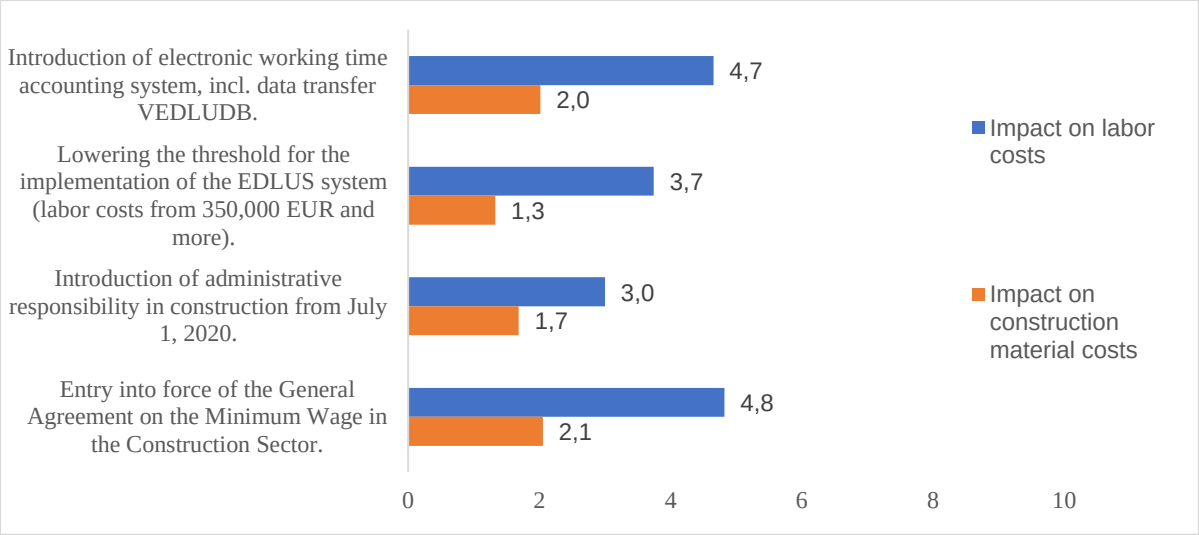


Fig 24. Expert assessment of the impact of measures to combat the shadow economy on labor and construction material costs.

The most significant impact on labor costs is the entry into force of the general agreement on the minimum wage in the construction sector and the introduction of an electronic working time accounting system. In both cases, the impact of these measures was assessed as mediocre. On the other hand, in the case of the impact of construction material costs, all evaluations are low and in the range between 1.08 out of 10 points for the implementation of the EDLUS system and 1.81 out of 10 minimum wages in the case of a general agreement. It can be concluded that measures to combat the shadow economy have little effect on the cost of building materials.

1.5. Impact of Covid-19 on the construction industry

During the study, the Covid-19 pandemic continued for the second year in a row and, in part, epidemiological measures to combat it continued. Consequently, there is reason to believe that these measures and the pandemic itself continue to affect the construction sector. In order to assess the degree of impact, the impact on both changes in labor costs and changes in construction material costs was assessed.

Evaluations were performed on a 10-point scale, with the possibility to indicate both positive and negative degree of impact. Overall, the impact of Covid-19 was assessed by experts as positive, meaning that it increases rather than decreases construction costs. The cost of building materials is more affected than the cost of labor. The average expert assessment of the impact of Covid-19 on building materials iMacs is 5.52 out of 10, which indicates a moderate impact. At the same time, the average impact on labor costs is 3.85 out of 10, indicating a weak impact.

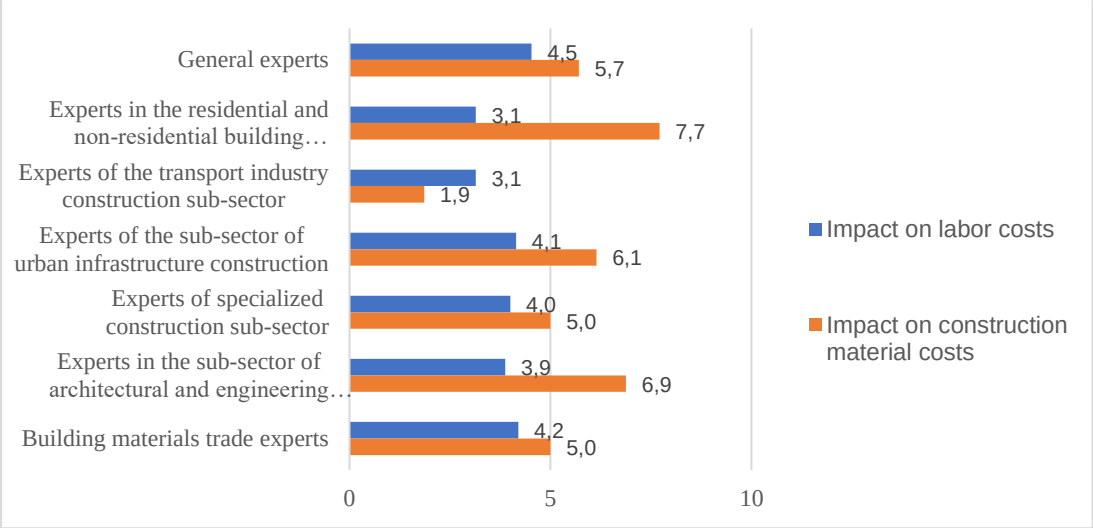


Fig 25. Covid-19 impact assessment by different expert groups.

A detailed analysis of the assessment by expert groups also reveals differences of opinion. The overall assessment identified that the cost of Covid-19 building materials had a more significant impact, however, the sub-sector of construction of transport facilities is an exception, where the opposite trend was identified. The construction of residential and non-residential buildings is the most sensitive to Covid-19 and has therefore suffered the most in the context of building material costs.

In conducting the study in 2021, the authors were confronted with the strong influence of Covid-19 and a relatively larger situation of heterogeneity, marked by sharp fluctuations in the components of construction. The development of the industry is currently associated with unstable development, characterized by marked changes in development vectors. Statistical forecasts are too moderate, but expert forecasts are extremely rapid. In such situations, the question arises as to the reliability of the combined forecast. To address such a situation, the authors recommend the use of a weighted combined (expert-statistical) forecast.

2. RESEARCH METHODOLOGY

The research uses the forecasting methodology developed in 2018 and later supplemented for data acquisition and analysis, which allows to achieve the goals set in the research "Development of research methodology and research on forecasted changes in labor and construction costs in the construction industry in Latvia" and to assess the quality of results. The methodology is based on well-established quantitative and qualitative methods, which were selected in accordance with the specifics and objectives of the Research. The tasks to be achieved by the methodology are:

1) Identify the indicators for which statistical information is to be compiled;
2) Identify indicators for which expert assessments are required;
3) To choose calculation methods to be used in statistical processing of obtained data and estimates;
4) To select quantitative methods to be used in determining development trends and assessing the quality of the obtained models;
5) To develop a combined method for the development of forecasts of changes in construction costs of different types;
6) To determine a method for identifying internal and external factors influencing changes in construction costs and assessing their impact.

The steps of the research envisage data acquisition and survey of experts in general in the construction industry, as well as in subgroups by type of objects and by types of resources.

The following correspondences of concepts are accepted within the framework of the methodology [1]:

A. Construction sub-sectors are considered as groups of objects, according to the terminology used by the CSB;
B. Changes in construction costs by segments are considered to be changes by type of resources, according to the terminology used by the CSB;
C. Cost changes are considered as construction cost indices (BII), according to the terminology used by the CSB.

2.1. Obtaining data characterizing changes in construction costs

The research data set will consist of statistical data obtained using the statistical information available in the CSB database on changes in construction industry costs, incl. by sub-sectors and types of resources, as well as expert assessments obtained from experts of the researched sub-sectors. Within the framework of expert interviews, the factors influencing changes in construction costs, the level of their impact, and expert assessments of price change trends were identified. For the identified factors that can be quantified, the series of dynamics with their previous development were retrieved.

The developed cost change methodology is intended for forecasting the main trends, it includes the use of both statistical and expert methods, combination of methods.

Statistical data

The set of statistical data consists of the listed statistical data, which characterize the nature of changes in construction costs in Latvia. The study used indicators compiled by the CSB, which correspond to the researched indicator, called BII - Construction Cost Index. These indices were used both to study the changes in total construction prices and to study the changes by resource types and by groups of objects in the sections where such data exist.

[1]Construction cost indices, Central Statistical Bureau, 29.05.2018, available at http://www.csb.gov.lv/statistikas-temas/metodologija/buvniecibas-izmaksu-indeksi-34819.html (accessed on 01.06.2018)

The groups of objects to be considered, based on the information collected in the national statistics, are:

1. Residential buildings;
2. Non-residential buildings;
3. Transport objects;
4. Urban infrastructure objects.

Statistical information by type of resources was used:

A. construction materials,
B. workers' wages,
C. costs for maintenance and operation of machinery and equipment,
D. architectural and engineering services; technical testing and analysis.

The codes of the statistical information to be used according to the CSB classification, names and units of measurement in which they are listed are summarized in Table 1.

Table 1.
Data tables to be used, their names and data accounting units.

	Name	Unit of measurement
RCG01	Price indices, Construction cost index	Index against the base period
RCG04	Business service price indices	Index against the base period
RCG06	Construction cost indices by type of resources	Index against the base period As a percentage of the previous year
RC061	Construction cost indices and changes in object groups by months	Index against the base period Change from previous period (%) Changes compared to the corresponding period of the previous year (%)
RC07	Construction cost indices by type of resources by months	Index against the base period
RC08	Construction cost indices by quarters	Index against the base period
RC082	Construction cost indices by groups of objects and types of resources by quarters	Index against the base period
RC091	Construction cost indices and changes in object groups by quarters	Index against base period Index against base period Change from previous period (%) Changes compared to the corresponding period of the previous year (%)
BU07	Indices of hours worked, number of employees and wages and salaries and their changes in construction by quarters	Index against the base period As a percentage of the previous period
DIG01	Hourly labor costs by kind of activity (F, F41, F42, F43)	Euro
DIG011	Hourly labor costs in statistical units with 10 or more employees by kind of activity (F, F41, F42, F43)	Euro

State statistical data do not collect information on changes in construction costs in such groups of objects:

A. Industrial production companies of complex buildings in construction;

B. Construction of other civil engineering works.

Due to the fact that statistical data on the researched indicator of interest are not available in these groups of objects, the changes in their costs were assessed using the method of expert assessments by interviewing experts representing these groups of objects. The situation is also relevant for the resource type “services (design, construction supervision, author supervision, engineering research and

construction expertise)", therefore changes in the costs of this type of resource were also assessed in the expertise.

Analyzing the impact of other indicators on changes in construction costs, statistical data on various construction-related indicators, which may have correlations with changes in costs, were compiled.

Table 2.
Data tables to be used, their names and data accounting units.

	Name	Unit of measurement
IVG01	Non - financial investment by type of activity	At constant prices in 2016, million euro
UFG021	Net turnover of merchants by kind of activity (E, F41, F42, F43)	Million euro
UFG022	Profit or loss of merchants by taxes by kind of activity (E, F41, F42, F43)	Million euro
BUG01	Construction output volume indices and changes	Change compared to the corresponding period of the previous year,%
BUG04	Number of issued building permits and estimated area by type of buildings in statistical regions and cities of the Republic	Number of Area, thous. m^2
BUG05	Number and area of new dwellings put into operation in statistical regions, cities and counties of the Republic	Apartments, number, Area, thous. m^2
BUG06	Commissioned buildings in statistical regions and cities of the Republic	Thousands m^2
BUG07	Index of the number of new buildings	Index against the base period

Statistics on these indicators are available not only in index and percentage growth units, but also in absolute units - number, area, euro.

When summarizing statistical information for the indicators indicated in Tables 1 and 2, separate surveyed indicators in both the public and private sectors are considered in case of data availability.

Expert evaluations

The main goal of applying expert methods is to raise the professional level of decisions. Expert evaluations in the context of this study are evaluated as essential information for making informed, informed decisions in complex, non-standard situations, as well as for making very important decisions that are important for society.

Expert methods are used in two cases to forecast trends in construction cost changes:

A. if series of dynamics have been identified, which are not characterized by a development trend and qualitative forecasts cannot be obtained with statistical forecasting methods;
B. if it is necessary to forecast an indicator of development of territorial units for which statistical information has not been accumulated.

In such cases, within the framework of the study, the task of experts is to forecast the indicator of interest as a growth rate. In the context of this study, there are items where the level of detail of the information is higher than that collected in national statistics. Thus, the second case manifests itself when statistical information is not accumulated. Expert assessments from the relevant groups of objects were used to assess the extent of cost changes. The first situation when expertise is required for dynamic series without a pronounced development trend was also covered within the study, if any of the statistical indicators were without a pronounced development trend. The experts were provided with closed-ended questions with the researched indicators in certain groups of objects and by types of resources. The experts provided their assessment of the rate of change in costs for the time periods specified for each item, thus forming an expert forecast.

Table 3. Example of obtaining expert estimates of cost change estimates

	Expert estimates of cost changes			
	2020	2021	...	2024
Object group				
- type of resources				
- type of resources				
Object group				
- type of resources				
- …				

As part of the expertise, expert assessments of external and internal factors influencing cost changes were obtained. The degree of influence of factors was assessed on the scales of scores, scores and direct ratings.

Ranking rating was used to identify the most significant influencing factors. For the proposed list of factors, the experts ranked the factors in a certain order from 1 to n, where n is the number of factors in the group. Several groups were distinguished for the factors, for example, external and internal factors, or additional groups depending on the specifics of the studied group of objects. The specified factor rank of 1 indicates the factor with the highest impact on cost changes.

The most important influencing factor was used in the evaluation of the score scale to assess the degree of impact. In the list of factors, the experts gave an assessment on a 10-point scale, where a higher score indicates a greater impact of the factor under consideration on changes in construction costs in the relevant group of objects and / or in the form of resources.

The expertise has two main stages - a general expert interview and an expert interview in groups of objects. Each of the expert groups has a different approach to defining the pool of experts.

In the general expert interview, experts from the construction industry were involved, without dividing them into groups of objects. As well as in the general expert interview, macroeconomic experts were involved in the assessment, whose area of competence includes the assessment of the impact of construction on the economy. The task of this group of experts was to identify factors that have a significant impact on changes in construction costs, as well as to make a general assessment of the development trends of the construction industry and costs.

Experts representing:

1. professional trade unions and associations,
2. construction councils and expert groups,
3. construction-related vocational and higher education institutions and research institutes,
4. Non-governmental organizations involved in the construction sector,
5. public authorities that manage, supervise and otherwise interact professionally with the construction industry,
6. public and private sector institutions that are competent to assess the general development of the national economy, incl. from a construction perspective.

16 experts were reached to the General Expert Group. The composition and selection of the expert group took place in stages:

1. Identification of the organizations whose activities correspond to one of the above groups;
2. Establishment of lists of experts representing organizations;
3. Coordination of the list of organizations and the experts representing them with the contracting authority, in which experts or organizations may be supplemented or excluded;

4. Communication with organizations and coordination of the interview process of the persons nominated for the examination.

In the expert interview in the object groups, experts from each object group were involved and the interviews were conducted for each group separately, because they assessed the changes in the construction costs of the specific object group.

Experts representing companies with activities related to such sub-sectors were recruited to this group:

1. construction of residential and non-residential buildings,
2. construction of transport facilities,
3. construction of urban infrastructure objects,
4. other civil engineering.

At least four experts are involved in each expert group. The composition and selection of the expert group took place in stages:

1. Identification of enterprises whose activities correspond to the group of objects;
2. Ranking of enterprises by turnover ranking, main region of operation;
3. Ranking of companies according to the level of competence, based on diversification according to the 2nd level criteria;
4. Coordination of the list with the customer, in which the rank of competence may be changed, companies may be supplemented and companies to be excluded may be determined;
5. Identifying the company and identifying the persons nominated for the expert examination and coordinating the course of the expert interview.

The research questions were separated for expert groups. The general group identified the factors influencing changes in construction costs from the proposed list and supplemented with its own factors, as well as provided a general forecast of changes in the construction industry and costs during the study period. In the expert interview in the groups of objects, the general group of experts was assessed as the degree of influence of the most significant selected factors on the score scale, as well as forecasting of changes in construction costs in groups of objects and by types of resources.

2.2. Data analysis

Various analysis methods were used for the analysis of the obtained statistical data and expert evaluations, according to the research task, data development trends and the scale of expert evaluations. To determine the further development of cost changes, various types of models were used, which characterize the further development of the main trends of the dynamics series over time, based on the extrapolation of previous trends. The obtained models were evaluated for quality with variance indicators.

Depending on the form and scale of the questions used, calculations of aggregate means, structure means, scatter and variation indicators were used in the processing of expert assessments. In addition to a separate analysis of statistical information and expert judgment, combined forecasts that will combine different sources of information were used as the final forecasting tool. This provided an opportunity in the study to compensate for errors and improve the reliability of the final forecast.

Time series extrapolation

The main goal of the analysis of time series is to determine the regularity of the development of the studied phenomenon. The study performed an analysis of the cost change dynamics series in order to assess the current development trend and the possible future direction.

The analysis of the time series within the study provided an opportunity to solve the following tasks:

1. to study the nature of the process dynamics - to determine the main development tendency and to assess random fluctuations;
2. identify and analyze periodic, such as seasonal, fluctuations;
3. to study causal relations between processes and phenomena that appeared in the form of correlations between dynamics series;
4. to develop a research process development model;
5. predict the future development of an object, process or phenomenon.

The object of research, which is socio-economic processes, is characterized by the main trend, which has a certain constant nature of change over a period of time. The analytical approach of the method in the study is based on the assumption that it is possible to find a type of function that describes the regular, determined components of the time series. For example, in the visual and economic analysis of the time series, it was assumed that the main trend could be described by some model. Then, in the next stage of the research, the model parameters were statistically evaluated and the theoretical values, which are already equalized values, were calculated.

The set of models for forecasting the main trends in the development of cost changes used in the study included the following models[1]:

- Exponential model $\tilde{y}_t = e^{a+bt}$
- S-type model $\tilde{y}_t = e^{a+\frac{b}{t}}$
- Logistic model $\tilde{y}_t = \frac{c}{c+ab^t}$
- Modified exponential model $\tilde{y}_t = c + ab^t$
- Saturation model $\tilde{y}_t = c - ab^t$
- Pearl-Reed model $\tilde{y}_t = \frac{c}{1+ae^{-bt}}$
- Hyperbola with horizontal asymptote model $\tilde{y}_t = a + \frac{b}{t}$

Designations:
y_t – time series level at time t (actual data);
$\tilde{y}_t$ – theoretical or predicted level of the time series at time t (according to the calculated value of the model).

For the evaluation of model parameters, the considered models were divided into two groups: linearizable models, for which the parameters can be estimated by the least squares method (LSM) and real nonlinear trend models, for which only the initial values of the parameters can be estimated and the optimal parameters were found iteratively.

Analysis of expert evaluations

For those expert evaluations that were provided using a closed form with rank, score or direct rating scales, it was possible to calculate indicators that allowed the rating to be divided as a single indicator of average opinion, or a dispersion of opinions. Aggregate means, structure means and variables were used to process the peer reviews for direct forecasting.

Average expert evaluation:

[1] Fox, John, Applied regression analysis and generalized linear models / John Fox. Third Edition Los Angeles : SAGE, [2016], p.425-476

$$\bar{v}_j = \frac{\sum_{i=1}^{k} v_{ij}}{k},$$

k – number of experts,

j – number of problem,

v_{ij} – Evaluation of the j-th question of the i-th expert.

Standardized average expert evaluation:

$$\bar{v}_{j(n)} = \frac{\sum_{i=1}^{k} v_{ij}}{\sum_{i=1}^{k}\sum_{j=1}^{m} v_{ij}},$$

k – number of experts,

j – number of problem,

v_{ij} – Evaluation of the j-th question of the i-th expert.

The structure means - median and fashion average expert evaluation were used.

Standard deviation of expert assessments:

$$S_{v_j} = \sqrt{\frac{\sum_{i=1}^{k}\left(v_{ij} - \bar{v}_j\right)^2}{k}}$$

Factor weight or significance was calculated for the indicators that were summarized as ranking values:

$$\beta_j = \frac{{}^{1}/_{R_j}}{\sum_{j=1}^{m}\left({}^{1}/_{R_j}\right)} \times 100$$

Depending on the studied indicator, different characteristic values were used, which are selected in Table 4.

Table 4.

Application of means and variance indicators in the analysis of expert evaluations.

	Average expert rating	Normalized average expert assessment	Structure averages (Me, Mo)	Variance indicators	Factor weight or significance
Expert direct cost change forecasts	✓			✓	
Identification of the most important influencing factors					✓
Assessment of the degree of influence of factors	✓	✓	✓	✓	

The obtained indicators characterizing the opinion of experts were summarized in a graphical form to facilitate their perception, as well as their interpretation was provided. If necessary, the indicators were recalculated in order to facilitate their interpretation and to equate them with other indicators, which do not match the unit of measurement with the studied indicator.

Development of a combined forecast

Taking into account the division of the changes in construction costs into groups by types of objects and types of resources, in different sections there was a need to combine statistical information and expert assessments for the development of forecasts.

Table 5.

Use of statistical data (D) and expert estimates (E) to estimate cost changes by object groups and resource types.

	Building materials	Workers' wages	Costs for maintenance and operation of machines and mechanisms	Services	Total
Residential and residential buildings	E	E	E	E	D+E
Transport objects	E	E	E	E	D+E
Urban infrastructure objects	E	E	E	E	D+E
Other civil engineering	E	E	E	E	E
Total	D+E	D+E	D+E	E	D

At the aggregated levels, a combined indicator was used to analyze changes in the cost of a common group of objects or common types of resources. It combined the predictions obtained in the analysis of the statistical data with the assessment provided by the experts.

As a final product, three types of cost change forecasts were proposed, depending on the principle of obtaining them.

Option I - extrapolating forecast of statistical data.

The forecast was obtained on the basis of statistical data by modeling the possible further development, if the current trends were maintained. The forecast of this variant was intended for cases when it was not possible to obtain the forecast of another variant in the required time frames and an operative solution is required.

Option II - combined (expert-statistical) forecast.

The forecast was developed on the basis of extrapolation of dynamic series, which was adjusted with the obtained average future values estimated by experts. The adjusted forecast was developed as a weighted average expert and model forecast. The forecast of this variant is intended as a final forecast for groups of objects and types of resources where statistical information is available.

Option III - expert forecasts.

The expert forecast was used as the final forecast for cases when statistical data were not available for certain groups of researched indicators. In this case, the average expert forecasts with their standard deviations were used.

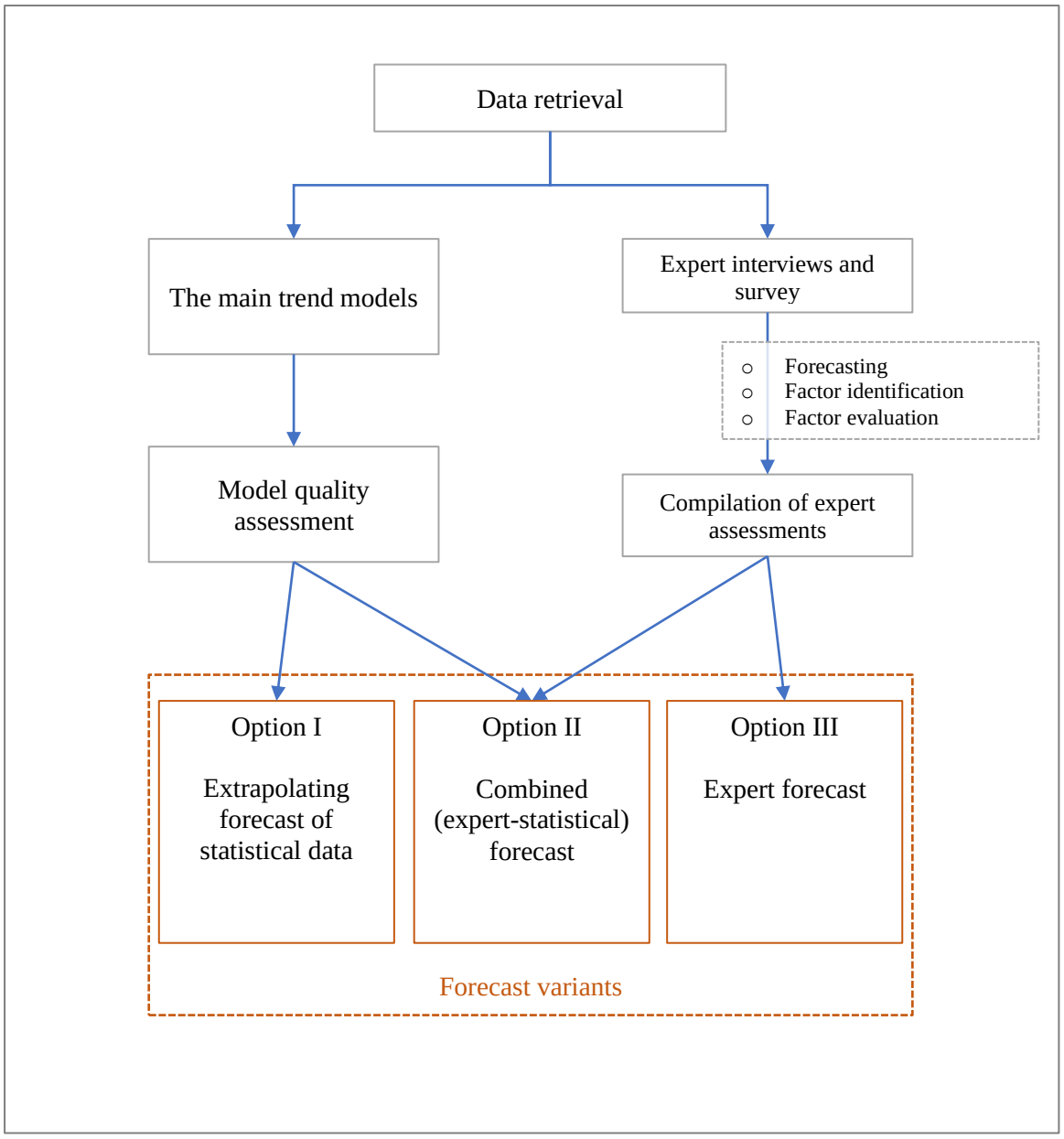


Fig 1. Scheme of data collection, data extrapolation, compilation of expert assessments and development of forecast variants.

Repeated studies require a re-aggregation of the available information to identify the amount of new information. In case new data that have not been collected so far are publicly available, it is possible to transfer forecasts of certain groups of objects and types of resources to another variant group. Equally, it is possible to calibrate the weighting coefficients of statistical forecasts and expert forecasts if new arguments have emerged in favour of converting some weights.

In the development of all three forecast variants, it is possible to extend the forecasting horizon for additional years if a certain period of time has changed, which requires the development of a forecast.

Factor impact assessment

Assessing the impact of various internal and external factors on changes in construction costs, the study uses expert assessments. With the help of expert opinion, the most important factors were identified and the degree of influence of the factors was determined.

Within the framework of the expert examination, the list of internal and external factors influencing the studied indicators was handed over to the experts for evaluation. When assessing the impact of factors, they were ranked and evaluated on a score scale. The advantage of ranking within the research is the identification of the most important factors. Unlike normal valuation or the selection of key factors, ranking eliminates a number of potential problems:

A. Ranking ruled out a situation where certain factors are not assessed;
B. Ranks in the study allowed to evaluate the sequence of factor effects, without allowing several factors to be evaluated with equal force.

After the identification of the most significant factors in the initial phase, the statistical processing of the obtained results was performed, and the factor weights or significance were calculated. Based on the obtained indicator, the most important factors were selected, which were used in the next phase. In the second phase, the most important factors selected were evaluated on a score scale. In this case, the task was to determine the degree of influence of the factors.

Factors were identified that significantly affected the changes in construction costs during the examination phase. From these factors, those that were quantifiable and for which dynamics series are available with the nature of the changes in the period corresponding to the period of changes in construction costs were selected. Where such information was available, the correlations of all selected factors with the corresponding changes in construction costs were assessed.

Approbation of influencing factors is required within the research. The examination determined which factors experts consider to be significant factors influencing changes in construction costs. After the approbation of the factors in the examination, it is possible to supplement the methodology by including those factors that have been recognized as the most important.

CONCLUSIONS

MAJOR FACTORS AFFECTING CONSTRUCTION COSTS

The study obtained estimates of the degree of impact of various factors on the labor and construction material costs of the construction industry and drew the most important conclusions.:

1. Labor wages in the construction sector are most significantly affected by the volume of construction in Latvia, as well as the level of labor wages and the demand of the construction sector in other EU countries.

2. The costs of construction materials are most significantly affected by the prices of metal and timber, as well as the total volume of construction.

3. The sub-sector of urban infrastructure construction has the smallest impact on timber prices, but has a high impact on the overall growth rate of the EU economy.

4. In the sub-sector of construction of transport facilities, labor costs are most significantly influenced by the number of learners in Latvia.

5. The digitization of construction processes has the most significant impact on architectural and engineering services, technical testing and analysis.

FORECASTED CHANGES

The central object of the study was the forecasts of changes in the volume of construction output and changes in construction costs for 2021 and 2022 and the assessment for the period from 2023 to 2025.

6. The growth of construction output in 2021 is forecasted at 6.6% and in 2022 at 7.15%. Between 2023 and 2025, the average estimate is an increase of 5.5% per year.

7. The main driving forces of the construction industry in 2021-2025. There will be a post - pandemic economic recovery, national and EU support for economic recovery and major infrastructure projects.

8. Construction costs are expected to increase significantly in 2021, estimated at 6.6% according to the combined forecast of researchers, but in case of unfavorable global situation (logistics problems, high market demand, non-increase of producer capacity) could reach 11.4%.

9. Between 2022 and 2025, the increase in construction costs will decrease, but in 2022 it will still be higher than in the pre-pandemic years with 5.5% but will return to the average level of the last decade in 2023-2025. with an average annual increase of 3.3% per year, which is lower than in 2018 and 2019.

10. According to the information and assessments summarized in the Study, the risks of overheating of the construction sector increase dynamically from 2020 to 2021, however, these risks are significantly lower than in 2006-2008 per year.

If at the end of 2021 the significant short-term jumps in the costs of timber and metal products decrease, then the dynamics for 2022 is expected to reduce the risk of overheating of construction and a similar trend until 2025.

DETAILED FORECASTS FOR THE CONSTRUCTION SUB - SECTORS

The study involved experts representing various construction sub-sectors - buildings, transport facilities, urban construction, special facilities and architectural and engineering services, technical inspection and analysis sub-sector. As a result, specific forecasts for sub-sectors were obtained.

11. In the construction of residential buildings, faster growth is expected than in the segment of non-residential buildings. The forecast for the growth of building construction in 2021 is 5.9% and in 2022 6.0%. In the period 2023-2025. Growth is expected to accelerate to 8.2% on average in 2007.

12. Costs in building construction are forecast to increase by 11.6% in 2021, followed by a more moderate increase in the coming years, with an average annual increase of 6.1% by 2025.

13. The transport construction industry will face volatile trends in the short term, experts are not entirely clear about the expected funding in 2022, with a projected market reduction of 4.6% in road and motorway construction and 0.25% in bridge and tunnel construction during this period. in production.

14. In the medium term 2023-2025. In the road and highway construction sub - sectors, moderate growth of 1.5% on average is forecast for. At the same time, construction of railways, bridges and tunnels is projected to grow at an average rate of 40.3% per year (expert forecast) in railway construction and between 19.2% (combined forecast) and 38.5% (expert forecast) per year in bridge and tunnel construction.

15. In the short term, in the sub-sector of construction of transport facilities, the largest increase in costs is expected in specialized construction works (15.7%) and in the sub-sector of architecture and engineering services, technical testing and analysis (13.6%), but on average high increase (10.0-11.6%) is forecast for the railway and metro construction sub-sector, road and motorway construction and building construction. The smallest increase in costs is forecasted for urban infrastructure with 9.6% and for construction of bridges and tunnels with 4.0%.

16. In the medium term, the transport sector could face significant cost increases in the construction of transport facilities, in particular railways, bridges and tunnels. On average in 2022-2025. Construction costs of roads and motorways could increase by 7.1% per year, construction of railways by 13.6% per year and construction of bridges and tunnels by 13.7% per year.

17. The sub-sector of architecture and engineering services, technical testing and analysis in the period from 2021 to 2024 is forecast to grow faster from 6.4% in 2021 to 17.9% compared to the previous year in 2024.

18. The costs of the sub-sector of architectural and engineering services, technical testing and analysis in 2021 and 2022 could increase significantly by 13.6% and 15.7%, respectively, however, in the medium term the increase in costs is estimated to be lower on average in 2023-2025. per year than 5.2% per year.

In a more detailed breakdown, construction costs by type of resources were studied - workers' wages, construction materials, maintenance and operation of machines and mechanisms, as well as architectural and engineering services, technical testing and analysis.

19. A significant increase in costs in 2021 is expected for construction materials, which is estimated at 7.0% annually, in 2022 an increase of 4.5% is forecast, and in the following years until 2025, an average of 3.1% per year.

20. The steady increase in workers' wages is projected to be equivalent to the previous five years, increasing by 7.1% in 2021 and by 7.4% in 2022. In the following years, the growth could decrease and is estimated at an average of 6.5% per year.

21. The cost of machinery and equipment is projected to increase relatively insignificantly by 1.3% in 2021 and 1.1% in 2022. In the further period, the growth is estimated to be even lower and could reach 0.2% growth in 2025.

22. In the construction of residential and non-residential buildings in 2021, the most significant increase in the cost of construction materials should be taken into account in the amount of 14.7-14.8%, while the increase in wages is estimated at 6.9-7.0%.

23. A significant increase in the costs of construction of transport facilities in 2021 is forecasted for both construction materials (10%) and maintenance and operation of machinery and equipment (10%), while an increase in wages is estimated at 8.0%, followed closely by architectural and other services with 7.83% increase. This sector is characterized by specific forecasts that the costs of services alone will grow faster and faster and in 2023-2025. could increase by 9.6% on average per year.

24. The largest increase in the construction of urban infrastructure objects is also forecasted for construction materials with 15.3% in 2021, with other types of resources growing less - workers' wages by 7.6%, machinery and equipment expenditure by 6.6% and service expenditure by 7, 7%.

25. In the sub-sector of specialized construction works, the increase of construction material costs in 2021 is forecasted in the amount of 15.83%, while the increase of wage costs is estimated as the smallest of the types of resources - 5.1%.

FORECASTS OF CHANGES IN BUILDING COSTS

The novelty of the current research is the attraction of experts from the trade industry to assess the development trends of construction material costs.

26. The most significant increase in the cost of basic building materials in 2021 is forecasted for timber in the amount of 30.0%, which in the period 2022-2025. year could average 5.3% per year. The second most significant growth in 2021 is forecast for metal products at 24.3%, which is estimated at an average annual growth of 6.7% over the next four years.

27. In the category of finishing materials (external, internal, other), the most significant increase in costs in 2021 is forecasted for interior finishing materials in the average amount of 11.0%, which in the next four years is estimated at 6.3% on average.

28. In the category of main system installations, the most significant increase in costs in 2021 is forecasted for electricity systems in the amount of 16.0%, which could significantly stabilize and grow by 3.3% per year on average by 2025. In other positions, cost increases are expected to be below 8% per year.

29. According to trade experts, the largest share of construction materials is cement, concrete, aggregates, sand, gravel and other materials in the amount of 21.0%, followed by metal products in the amount of 17.3% and finishing materials in the amount of 16.0%.

SPECIFIC IMPACTS

Specific factors affecting the construction sector include measures to combat the shadow economy and the COVID-19 pandemic and the overall impact of related measures on the construction sector.

30. Measures to combat the shadow economy have a mediocre impact on labor costs, with the introduction of an electronic time-recording system and the setting of a minimum wage in the construction sector having the greatest impact.

31. Measures to combat the shadow economy have a negligible effect on the cost of building materials.

32. COVID-19 has had a mediocre impact on construction material costs, but the impact on labor costs is almost weak.

33. COVID-19 had a greater impact on the cost of construction materials than on wages. The greatest impact of COVID-19 on the cost of building materials is seen by the building construction sub-sector, while the greatest impact on labor costs is seen by experts in the building materials trade.

RESEARCH ANNOTATION (EN)

“Research on projected changes in labour and construction costs in the construction industry in Latvia” has been prepared in accordance with the agreement concluded on April 20, 2021, between the Ministry of Economics of the Republic of Latvia and the research company SIA InnoMatrix.

The aim of the research is to forecast changes in labour and construction material costs in the construction sector in Latvia in the period from 2021 to 2025 using a reusable research methodology.

The study includes a detailed assessment and forecasts for the period from 2021 to 2025 both on the total construction volume and costs, and on the following sub-sectors of the construction industry - residential buildings, non-residential buildings, transport objects, urban engineering, special construction, as well as architectural services, technical monitoring and analysis and also trade in construction materials.

In the course of the research, the factors influencing the costs of labour and construction materials were assessed and analysed, including the proportions of both directly and indirectly influencing indicators, such as measures to combat the shadow economy, lending, availability of financing and labour. The study also assessed the impact of external factors such as the EU single market and EU decisions.

The methodology developed and used in the study included the use of both statistical and expert methods and a combination of methods. The data used in the study were data available from the CSB and expert interviews with representatives of the construction industry and experts from the construction industry sub-sectors. To assess the impact of general factors, the study also included forecasts from macroeconomic experts. At least four experts were involved in each expert group. The staffing and selection of the expert group took place in stages by identifying the companies according to the ranking of turnover, the main region of operation, the level of competence, which is based on diversification according to the criteria of the 2nd level.

The research data set consists of statistical data. Within the framework of expert interviews, the factors influencing changes in construction costs, the level of their impact, and expert assessments of price change trends were identified. For the identified factors, the series of dynamics with their previous development were retrieved.

Various analysis methods were used for the analysis of statistical data and expert evaluations obtained in the evaluation, according to the research task, data development trends and the scale of expert evaluations. To determine the further development of cost changes, various types of models were used, which characterize the further development of the main trends of the dynamic’s series over time, based on the extrapolation of previous trends. The obtained models were evaluated for quality with variance indicators.

Depending on the form and scale of the questions used, the calculations of aggregate means, structure means, scatter and variation indicators were used in the processing of expert assessments. In addition to a separate analysis of statistical information and expert judgment, combined forecasts were used as the final forecasting tool, combining the various sources of information used in the Study. This was done with the aim of compensating for errors and improving the reliability of the final forecast.

LIST OF EXPERTS

Organizations involved in the general expert survey

Ministry of Finance	Diana Onge	Experts
Latvian Partnership of Construction Contractors	Gints Miķelsons	Director
Association " Passive House Latvia "	Mārtiņš Prīsis	Director
Ministry of Environmental Protection and Regional Development (MEPRD)	Maris Klismets	Strategy and Sustainable Development Division
Latvian Association of Heat, Gas and Water Technology Engineers	Dainis Ģegers	Member of the Board, Head of the Construction Specialists Certification Center
Department of Architecture and Construction, Latvia University of Agriculture	Andris Steinerts	Associated professor
Latvian Union of Civil Engineers	Raimonds Vītiņš	Civil engineer
AS “SEB banka”	Dainis Gašpuitis	Economist
University of Latvia	Mikhail Hazans	Professor
Latvian Builders Association	Normunds Grinbergs	Director
Rezekne district construction board	Inga Alexandrovich	Head of the Construction Board
SIA “BIM Solutions”	Eriks Vitols	Business manager
SIA “NEVERENC”	Dzintars Neverovskis	Board loc.
SIA “CEL ”	Māra Vītiņa	Member of the Board
SIA “PEPE ”	Vents Vīksna	Member of the Board
SIA “SCHWENK Latvija ”	Maris Gruzniņš	Commercial Director, Member of the Board
AS “Sakret Holdings”	Juris Grīnvalds	Member of the Board, Commercial Director
IK “Gamma ”	Juris Karss	Civil engineer

Organizations involved in the sub - sector expert survey

1. Construction of residential and non-residential buildings

Real accordance estate development alliance	Mārtiņš Vanags	Chairman of the Board
SIA “Rigensi”	Andris M a čs	Member of the Board
SIA “Zemgales Būvserviss ”	Zigmars Vaitaitis	Member of the Board
Selfemployed	Sandris Liepins	B civil engineer
SIA “Baltic Construction Consultancy ”	Oscar Lumpov	Member of the Board
SIA “Zehnder Grupa ”	Rūdolfs Birnbaums	Latvian Sales Manager
SIA “UPTK ”	Juris Gulbis	Commercial Director

2. Construction sub-sectors of transport facilities (construction of roads and motorways, construction of railways and underground railways, construction of bridges and tunnels)

Association "Latvian Road Builder "	Andris Berzins	Chairman of the Board
Latvian State Roads, State Limited Liability Company	Mārtiņš Lazdovskis	Chairman of the Board
SIA “Limbažu ceļi”	Andris Garklavs	Chairman of the Board
SIA “MIKOR”	Guntis Ozols	Director
SIA “Ostas celtnieks”	Andris Bukovskis	Head of Development Department
SIA “Juris Rozīte”	Juris Rozite	Member of the Board
SIA “Aqua-Brambis ”	Aivars Brambis	Chairman of the Board

3. Construction sub-sector of urban infrastructure objects

Latvian Association of Electricians and Power Engineers	Gunārs Valdmanis	I Executive Director
Association of Transport Engineers	Mārtiņš Liepiņš	Chairman of the Board
Ogre County Construction Board	Raitis G ultnieks	Chief construction inspector
SIA “Ditra Networks”	Yuri Kokorevich	Chairman of the Board
SIA “ARČERS”	Ravis Tautietis	Project manager
SIA Citrus Solutions	Raimonds Gerbis	Director of the Service

4. Specialized construction sub-sector

Latvian Geotechnical Union	Kaspars Bondars	Chairman of the Board
SIA “KULK”	Edgars Rihters	Commercial Director
SIA “BIANT”	Mikhail Kramarenko	Member of the Board
SIA “LAFIVENTS”	Daina Kona	Member of the Board
SIA “KORO BŪVE”	Renārs S kavronskis	Chairman of the Board
SIA “Newcom Construction”	Mārtiņš Bubens	Chairman of the Board
SIA “Grobiņas SPMK”	Ilgonis Jēčis	Member of the Board

5. Architectural and design services and technical testing and analysis sub-sectors

Latvian Union of Architects	Gatis Didrihsons	The architect
Valmiera city municipality	Juris Mellēns	Construction inspector
Ventspils City Council	Lilita Zeltina	Ventspils city landscape architect
Kuldiga municipality	Elīna Zīle	Lead project manager, the Public Procurement Commission
Selfemployed	Līga Saulespurēna	Architect
SIA “VIRTU”	Anda Kursiša	Chairman of the Board , architect
SIA “ ARKA ”	Uldis Ekšteins	Board member, architect
SIA “ AR.4 ”	Andris Vitols	Chairman of the Board , architect

6. Manufacturers and traders of construction materials

Building Materials Manufacturers Association	Leonīds Jākobsons	Executive director
Latvian Traders Association	Henrik Danusevich	President
JSC “Latvian State Forests” (LVM)	Kristīne Ansone	LVM Earth Subsoil Director
SIA “Optimera Latvia”	Ainars Kursītis	Board pr iekšsēdētājs
SIA “Timber Trade Group”	Andris Ozols	Director
SIA “Baumit”	Andris Vēciņš	Product Manager