
COMPARISON OF THE STRUCTURE OF THE SLOVAK ECONOMY AND THE MOST DEVELOPED EU COUNTRIES

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Abstract

The constant economic growth associated with the growth of energy and raw material demand has reached the point where we begin to observe significant environmental changes, especially global warming. These processes changed the view of the development of technology and the economy. Attention to the environment and the minimization of emitted emissions are coming to the fore. This transition is closely linked to the industrial revolution represented by Industry 4.0. This article aims to analyze the current structural maturity of the Slovak economy in comparison with the developed countries of the European Union. We offer a specific insight and identify the development trend in highly developed EU countries, which Slovakia should follow regarding increasing competitiveness, macroeconomic indicators, and, last but not least, the standard of living. Using the analysis of employment in individual sectors, we identified prospective and reductive areas of the economy. The recovery plan brings a unique opportunity to invest in these promising areas from the package of money intended for the economy's recovery after the Covid-19 pandemic.

Keywords: environment, economy, green deal, emissions, employment

JEL Classification: A10, J11, F60

Introduction and theoretical background

Slovakia faces significant challenges brought by the transformation of the economy, generally called Industry 4.0, and the global climate crisis, which creates pressure to reduce emissions and pollution of the air and the environment. In the context of these two crucial factors, the economy's structure also develops. The industries that most significantly burden the environment are gradually going into decline. Gradual changes in the economy to meet modern standards require significant investments.

The recovery plan after the COVID-19 pandemic offers a unique opportunity to finance these investments.

On the contrary, green industries are increasingly supported and favored, which makes them more attractive to entrepreneurs and investors. In this article, we focused on comparing the structural development of the most developed economies of the European Union and Slovakia. This comparison will reveal to us at what stage the economy of Slovakia is. Identification and knowledge of prospective industries are essential, as it is also necessary to adjust the education system, legislation, labor market, and people's thinking and perception. In today's dynamically changing world, it is necessary to change the approach to education, as the knowledge gained through education quickly becomes obsolete. It is necessary to emphasise lifelong education, which is still minimally developed in Slovakia, as most of the population perceives education as a one-time stage of their lives.

The Slovak economy is dominated by the so-called "dirty" industries, representing the largest share of employment and GDP. Since the trend within the European Union is in the opposite direction when industries that do not burden the environment are supported, gradually, more and more pressure will be exerted on the structural transformation of the Slovak economy. As part of the European Green Deal, the Slovak Republic has also committed to achieving carbon neutrality by 2050. This will require a change in the approach to setting goals, measures, and legislative changes. Since these "dirty" industries employ the most significant part of the population, these structural changes will also majorly impact the labor market, which must adapt to the changes.

According to the Environmental Performance Index (EPI), Slovakia has a negative downward trend; in 2010, it was ranked 10th, which meant the best position among the V4 countries, but in 2020 it was in 26th place. This decrease can be justified mainly by the focus of the Slovak economy on the manufacturing sector, where the automotive industry is dominant (Andrejovský et al., 2022). Slovakia lags in shifting the tax mix from the labor tax burden to green taxes. Most environmental taxes are from energy carriers, which do not reflect the level of pollution (Gyurián & Nagy, 2022).

One hundred ninety-five countries have signed the Paris Agreement, where they have committed to the goal of limiting global warming to 1.5C to 2C. The total carbon budget for climate stabilization at the level of 1.5 to 2C is assumed to be 2900 to 3600 Gt of CO₂ emissions, while 2300 Gt of CO₂ has already been emitted from this budget. The USA and the EU28 are responsible for a third of cumulative historical emissions. The massive economic development of the past 50 years has been fueled primarily by fossil fuels. Limiting global warming to 2C requires world carbon neutrality by 2070. Limiting global warming to 1.5C requires world carbon neutrality by 2050. Within the European Union, this is more of a political than an economic or technological challenge, as it is an interstate community where it will be necessary to introduce legislative frameworks into the legislative system of each country separately for the sake of carbon neutrality (Schreyer et al., 2020).

The essence of the European Green Deal (EGD) is to avert climate change. The reason for the gradual depletion of natural resources is mainly the constant increase in global competitiveness and the rate of growth of the world population. Supporting the sustainable growth of dynamic bio-economy sectors contributes to the transition from a society based on the use of fossil resources to an innovative, resource-efficient, and competitive society (Morone & Clark, 2020).

In the middle of the 19th century, the chemical composition of the stratosphere began to change more significantly. Since then, burning coal, petroleum, and wood

has produced more carbon dioxide than the planet can absorb through oceans and photosynthesis. This difference began to increase radically, especially in the 1950s. In this context, the term “moral economy” gradually began to be mentioned. It is a concept that emphasizes the balance between the material needs of society and the integrity of nature and the entire ecosystems on which it rests (Palaeologu, 2020). An important sector in the implementation of Industry 4.0 is science and research. Investments in developing new technologies are necessary for the subsequent increase in productivity, energy efficiency, and reduced intensity of produced emissions (Ulusoy et al., 2021). In every socio-economic system, growth must be recalibrated in terms of alignment with the production and carrying capacity of natural systems and energy resources on which the health of the human population depends. Based on this reasoning, we can conclude that the development of human society supported by economic growth is healthy only if this growth is gradually transformed with the gradual reaching of the limits of carrying capacity and production capacity of natural capital (Mieila, 2017).

Economic and technological changes leading to green economy goals in the EU are currently proceeding too slowly. A much more noticeable, profound, and permanent change in the EU economy and society is required to create new opportunities and substitution processes throughout the economic structure. To achieve this, studying and understanding the enabling factors and mechanisms at the intersection of policies and fundamental economic dynamics that could accelerate and guide the transformation is vital. Indeed, environmental policies within EU states directly affect environmental standards and regulations in countries outside the EU, e.g. emission standards of road vehicle engines. Fiscal reforms are also one critical factor. Economic instruments such as environmental taxes and emissions trading systems are political instruments that can change the prevailing price systems, which is essential to start the transformation process to a resource-efficient ecological economy. The reform of environmental taxation and the gradual cancellation of subsidies harmful to the environment are also closely related to this issue. Implementing resource-efficient technologies is often not economically viable under current economic conditions. For example, higher energy prices – driven by economic instruments – could trigger a more extraordinary creation and diffusion of green technologies. Achieving the expected benefits from economic instruments and environmental fiscal reforms, however, fundamentally depends on environmental taxation, which could otherwise have adverse effects such as the loss of competitiveness of businesses on the world market (European Environment Agency, 2014).

Definitions of the green economy according to the EEA are generally characterized by these three objectives (European Environment Agency, 2014):

- a) improving the efficiency of resource use: a green economy is an economy that efficiently uses energy, water, and other material inputs;
- b) ensuring the resilience of the ecosystem: it also protects the natural environment, the structures of its ecosystems, and the flows of ecosystem services;
- c) enhancing social justice: promotes people’s well-being and fair sharing of burdens between societies.

Existing economic models have primarily looked at the use of resources in terms of rationalizing their consumption and reducing human needs. However, this view has proven inappropriate as consumption continues to grow. Because of this, it was necessary to build an economic model to support the design of activities related

to renewable resources, which are determined from economic, social, and natural foundations. Such a model is the circular economy, which is based on three principles: waste design and pollution reduction, maintenance of used products and materials, and regeneration of the natural system. The importance of the circular economy model and care for its implementation is also reflected in the fact that the European Commission adopted an action plan for the circular economy in 2015, which was fully completed in 2019. However, its activities and development are still ongoing. The assumption is that the transition of society to a circular economy strengthens and accelerates the building of sustainable economic development, strengthens global competitiveness, and opens new jobs (Nestorovic & Radicevic, 2019). As a result of globalization, which has dramatically increased the interconnection and interdependence between all actors of the global economy, whether they are multinational corporations, small companies, or countries, finding a long-term solution is complex and requires global cooperation. The reason is that when tightening environmental protection regulations in one country or community (for example, the EU), the multinational companies concerned moved production to another country where these regulations were not so strict. Global governance and global regulations may be a solution to this type of situation. However, such a solution on a global scale is not realistic in the near or even foreseeable future (Bonviu, 2014).

The EGD document stipulates that all unreduced emissions will be eliminated by 2050, e.g. through natural carbon sinks such as forests and carbon capture and storage technologies. However, due to possible negative ecological impacts, there is still uncertainty regarding carbon storage in geological structures related to long-term release and safety, as well as ocean storage. Furthermore, these carbon storage technologies are expensive. Considering the growing demand for biological resources, the options for increasing natural carbon sequestration could be more precise. This confirms that the primary emphasis must be reducing emissions to the maximum already in the production phase. Given the progress made so far in reducing emissions, the introduction of EGD will require an entirely new approach to the economy and relatively drastic measures in all sectors of the economy. It will represent a severe challenge to all EU countries. However, it is also clear that the starting point varies widely between countries, bringing about differences in the level of challenge (Zlaugotne et al., 2020).

Achieving carbon neutrality requires a structural change in the economy, which means a significant change in the labor market. From the point of view of the labor market, the name green workplace has become established. The International Labor Organization (from now on referred to as the ILO) defines this term as follows: "Green jobs are decent jobs that contribute to the protection or restoration of the environment, whether in traditional sectors such as manufacturing and construction, or in new, emerging ecological sectors, such as renewable energy and energy efficiency. At the corporate level, green jobs can produce goods or provide services that benefit the environment, such as green buildings or clean transportation. However, these green outputs (products and services) are not always based on ecological production processes and technologies. Therefore, ecological workplaces can also be distinguished by contributing to more environmentally friendly processes. For example, green workplaces can reduce water consumption or improve recycling systems. However, green jobs defined through production processes do not necessarily produce environmental goods or services" (International Labor Organization, 2016).

According to Stilwell, the appropriate measure is "green stimulus" programs, which combine fiscal policy to direct investment to create more green jobs.

These programs would be particularly appropriate during the economic recovery from the current COVID crisis, when businesses could use them to change the transformation process towards reducing emissions, given the environmental change related to the commitment to climate change mitigation. (Stilwell, 2021) However, not all areas of the economy were affected by the pandemic in the same way, so it is necessary to set these incentives concerning the pandemic's impact on individual sectors. According to a study conducted on a sample of Slovak companies, the most affected sectors were construction, services, gastronomy, retail, consulting, and accounting, which showed a problem with liquidity (Papíková et al., 2022).

According to the study by Dolge and Blumberga, an essential factor in reducing emissions is energy efficiency. The results showed that over the ten years from 2010 to 2019 in the EU, reducing energy intensity had more than twice the impact on greenhouse gas emissions compared to reducing emissions intensity. In order to achieve more significant reductions in greenhouse gas emissions, more outstanding efforts should be made to develop effective energy efficiency policies and accelerate the adaptation of energy efficiency measures in all sectors of the economy (Dolge & Blumberga, 2021).

Material and methods

The main goal of this article is the comparison the structure of the economic sectors according to employment in selected countries of the European Union and the identification of promising sectors that will grow in the coming decades in the context of the economic transformation of Industry 4.0 and the climate requirements established by the European Union as part of the European Green Deal.

This work used the basic scientific methods of analysis, synthesis, deduction, and comparison. We drew data on employment in the age group 15 to 64 in individual sectors from Eurostat. For comparison, we converted the data in units of thousands of employed persons into the percentage share of the given industry in the total number of employed persons in the economy.

As it follows from previous research that more developed countries (in terms of GDP) are further along in the process of introducing Industry 4.0 and reducing emissions, we divided the countries of the European Union according to GDP per capita into three categories:

- a) Less developed countries (HDP/pc <20 000 EUR),
- b) Medium developed countries (HDP/pc \geq 20 000 EUR a HDP/pc \leq 35 000 EUR),
- c) Highly developed countries (HDP/pc > 35 000 EUR).

After an initial analysis and comparison of the structure of employment in the Slovak Republic with a group of highly developed EU countries, we identified individual sectors of the economy, which we divided into three categories according to the difference between the individual sectors:

- a) Prospective industries (difference <-0.3%),
- b) Industries with little potential (difference from \leq -0.3% to \geq 0.3%),
- c) Reductive industries (difference > 0.3%).

We used bar graphs and tables to interpret the data graphically. In the summary graph showing the share of employment in individual sectors in total employment, we compared the Slovak economy only with the category of highly

developed EU countries. In the graphs presenting data for individual industries, we also compared the Slovak economy with other categories:

- a) EU-27,
- b) countries V4,
- c) Eurozone,
- d) Medium developed countries EU,
- e) Highly developed countries EU,
- f) Less developed countries EU.

Results and discussion

Based on data on employment in individual sectors of the economy, we calculated the average for highly developed EU countries (HDP/pc>35.000 EUR).

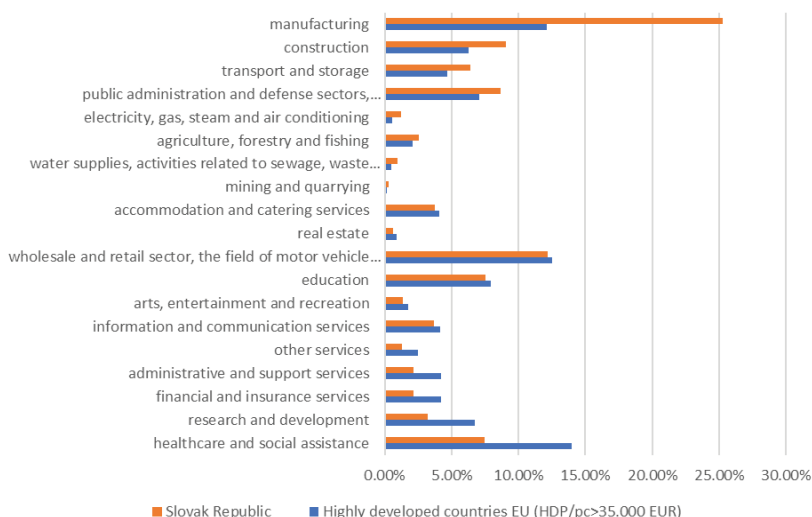
Table 1 Comparison of the share of employment in individual areas in total employment (%)

Industry	Highly developed countries EU	Slovak Republic	Difference
healthcare and social assistance	13.96	7.46	-6.50
research and development	6.70	3.24	-3.46
financial and insurance services	4.23	2.16	-2.07
administrative and support services	4.22	2.18	-2.04
other services	2.47	1.29	-1.18
information and communication services	4.15	3.70	-0.45
arts, entertainment, and recreation	1.78	1.33	-0.45
education	7.95	7.56	-0.39
wholesale and retail sector, the field of motor vehicle and motorcycle repair	12.53	12.18	-0.35
real estate	0.90	0.60	-0.30
accommodation and catering services	4.06	3.77	-0.29
mining and quarrying	0.15	0.29	0.13
water supplies, activities related to sewage, waste and sanitation	0.52	0.93	0.41
agriculture, forestry, and fishing	2.08	2.56	0.48
electricity, gas, steam, and air conditioning	0.58	1.21	0.63
public administration and defense sectors, mandatory social security	7.10	8.66	1.57
transport and storage	4.69	6.38	1.69
construction	6.25	9.06	2.81
manufacturing	12.15	25.29	13.15

Source: Author's editing according to Eurostat.

Based on the above comparison, we see that the most significant difference is achieved by the manufacturing sector, 13.15%, which means that this sector is represented much more in the structure of employment in the Slovak Republic than in highly developed EU countries. On the other hand, the healthcare and social assistance sector achieves the most considerable negative difference of 6.5%, which means that this sector is more prominently represented in the employment structure of highly developed EU countries than in the Slovak Republic. For a better overview, we also present a graphic representation of this comparison (chart 1).

Chart 1 Share of employment in individual areas in total employment



Source: Author's editing according to Eurostat. (Eurostat, 2022)

Significant differences can be observed in 16 sectors out of 19. Based on this, we deduce that the structure of the Slovak economy achieves significant differences compared to highly developed EU countries.

Based on the above procedure, we divided the individual industries into categories according to the difference. We present this distribution in the following table (table 2).

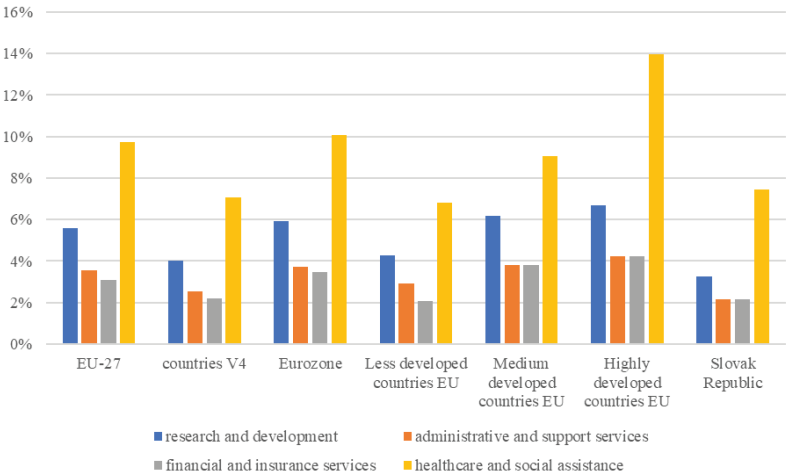
Table 2 Division of industries by difference

Prospective industries (difference <-0.3%)	healthcare and social assistance; research and development; financial and insurance services; administrative and support services; other services; information and communication services; arts, entertainment, and recreation; education; wholesale and retail sector, the field of motor vehicle and motorcycle repair
Industries with little potential (difference from =< -0.3% to >= 0.3%)	real estate; accommodation and catering services; mining and quarrying
Reductive industries (difference > 0.3%)	water supplies, activities related to sewage, waste and sanitation, agriculture, forestry, and fishing; electricity, gas, steam, and air conditioning; public administration and defense sectors, mandatory social security; transport and storage; construction; manufacturing

Source: Author's editing

In order to find out in more detail the position of the Slovak economy compared to the EU-27, the V4 countries, the Eurozone, less developed countries, and medium-developed countries, we also analyzed individual sectors that were classified in the perspective or reductive category. In the following summary charts, we have focused on selected prospective industries.

Chart 2 Comparison of employment in the healthcare and social assistance sectors, financial and insurance services, administrative and support services, and research and development



Source: Author's editing

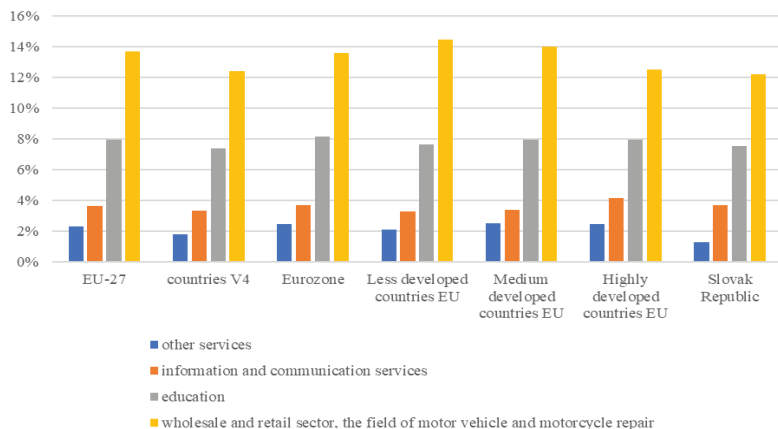
From this summary chart, we can see that in the healthcare and social assistance sector, the Slovak Republic achieves the highest employment agreement, with the surrounding countries included in the V4, 7.46%. On average, EU-27 countries, medium-developed EU countries, and Eurozone countries achieve higher employment in this sector.

This industry is the engine of economic growth and productivity, as new technologies and procedures are an essential determinant in the current Industry 4.0 change era. When we focus on the comparison in the field of research and development, we can observe from the graph that the Slovak Republic, with only 3.24% value, lags significantly behind highly developed countries, and these countries reach more than twice the share of this sector in employment. Slovakia also lags behind the average of the V4 countries and the average of less developed EU countries.

Within the administrative and support services sector, SR is again significantly behind the highly developed countries of the EU, which again achieve twice the employment in this sector. Just as in the research and development sector, the SR also lags behind V4 and less developed countries.

In the financial and insurance services sector, the SR again achieves poor results, only 2.16%, compared to the highly developed countries of the EU, 4.23%. Compared to less developed countries and V4 countries, SR achieves average results. So this is another sector with growth potential.

Chart 3 Comparison of employment in the other services, information and communication services, wholesale and retail sector, the field of motor vehicle and motorcycle repair, and education



Source: Author's editing

In the wholesale and retail sector, the area of motor vehicle and motorcycle repair, SR achieves average results within the category of V4 countries. Compared to highly developed countries (12.53%), Slovakia (12.18%) achieves similar results. Less developed countries in this sector achieve significantly higher employment than Slovakia.

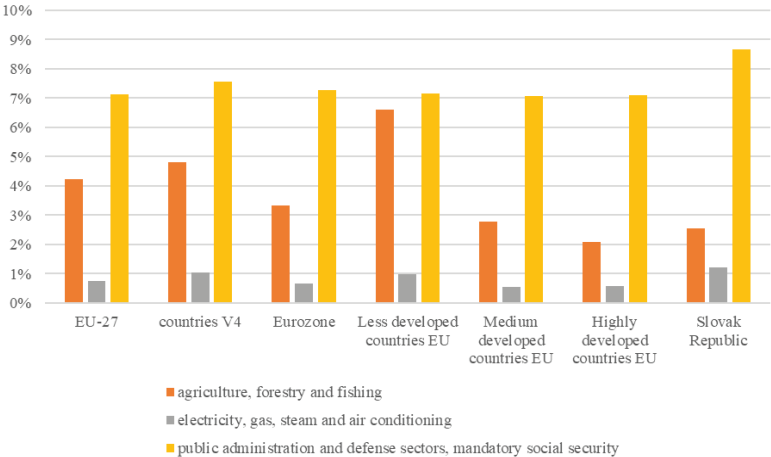
Slovakia is again at the level of V4 countries and less developed countries within the education sector. Employment in this sector reaches 7.56%, while in highly developed EU countries, employment reaches 7.95%. In the case of Eurozone countries, employment reaches the level of 8.14%. In the other services sector, Slovakia again achieves the weakest results of all monitored groups. While highly developed EU countries have an employment rate of 2.47%, in Slovakia, it is only 1.29%. Again, this is about a two-fold difference.

We have also identified the scope for increasing employment through green jobs in the information and communication services sector. Slovakia reaches an employment level of 3.70%, a higher value than the average of V4 countries and less developed EU countries. Highly developed EU countries reach an average of 4.15%.

Reductive industries

In the following section, we analyze in more detail the position of the Slovak economy in comparison with other groups of countries in the sectors we have identified as reductive.

Chart 4 Comparison of employment in the agriculture, forestry and fishing, electricity, gas, steam, and air conditioning, public administration and defense sectors, mandatory social security



Source: Author's editing

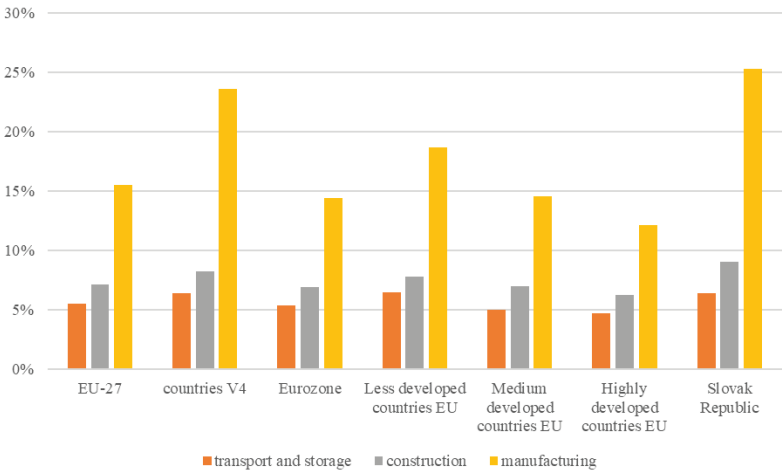
The electricity, gas, steam, and air conditioning supply sector employs 1.21% of the population in Slovakia, while in highly developed EU countries, it is only 0.58%. Slovakia also achieves higher values than the average of V4 countries, 1.03%, and the average of less developed EU countries, 0.98%.

In the field of public administration and defense, mandatory social security, we see a significantly higher value achieved by Slovakia compared to other investigated groups. Slovakia reaches 8.66%, highly developed EU countries 7.10%, V4 countries

7.57%, and less developed countries 7.16%. These results indicate the exuberance of state administration compared to other groups of countries. Other countries need significantly fewer state employees to operate than Slovakia, which means higher efficiency and productivity per employee.

Natural factors and the fragmentation of the country significantly influence the sector of agriculture, forestry, and fishing. Therefore, the results may differ from the context of the examined issue of the economy's structure. Slovakia achieves similar results (2.56%) to highly developed EU countries (2.08%). However, the surrounding countries of the V4 group achieve a significantly larger share of employment at 4.81%. The category of less developed EU countries reaches an even higher level of 6.61%.

Chart 5 Comparison of employment in the transport and storage, construction, and manufacturing



Source: Author's editing

We have identified transport and storage as a reductive industry, where Slovakia has an employment rate of 6.38%. Highly developed countries employ only 4.69% in this industry. The average of the V4 countries and less developed EU countries is approximately at the same level as Slovakia, namely 6.40% and 6.43%, respectively.

In construction, employment in the Slovak Republic (9.06%) reaches significantly higher values compared to highly developed EU countries (6.25%). However, it also reaches higher values than the average of V4 countries (8.24%) and less developed EU countries (7.76%).

We found the most prominent difference within the manufacturing industry. While Slovakia reaches 25.29% employment in this sector, it is only 12.15% in highly developed countries. The only group of countries that comes close to the Slovak Republic is only the group of V4 countries, while the less developed countries of the EU reach a significantly lower value of 18.70%.

Suggestions and recommendations

Based on our findings, the Slovak economy structurally lags significantly behind the average of highly developed EU countries. Due to the necessity of a significant change in the economy's structure, it is also necessary to pay significant attention to the reform of the education system, which must reflect the new requirements of the labor market. From the research results, the education sector is represented in the Slovak Republic to a similar extent as in highly developed countries, which is an essential prerequisite for the successful transformation of the economy in the sense of Industry 4.0. However, the educational process must be innovated in order to be able to reflect the high dynamics of the labor market and to be flexible enough in the preparation of job seekers, as technologically, the time and environment change so quickly that the classic concept of education is dysfunctional, as knowledge and skills can already be 5 - 10 years out of date. In Slovakia, the concept of lifelong education still needs to be represented to a minimal extent, which causes problems with the employment of people of higher productive age.

Based on the research, we propose creating a motivating business environment in promising sectors where employment should increase. The tool can be various subsidy schemes, tax breaks, simplification of bureaucracy or grants so that potential investors decide to do business in prospective industries, from which the Slovak economy will benefit in the longer term, rather than in reductive industries, which will have to be a few years in the future decade dampened mainly because of EGD and the resulting commitment to carbon neutrality, but also because of the natural decrease in demand for these goods caused by a change in the lifestyle of the population. We suggest using positive motivational tools in promising industries at the expense of harmful tools in reductive industries, such as tax increases, which could have short-term adverse effects on employment. At the same time, a smoother and more natural transition of capital from reductive industries to promising ones would be ensured. For this purpose of changing the business environment, we propose to create a working team within the Ministry of Economy of the Slovak Republic, which would deal with the transformation of the economy in the long term.

Conclusion

In this article, we compared the employment structure of the Slovak economy and various groups of European Union countries, based on which we found differences and identified prospective industries, industries with little potential, and reductive areas. Our findings are essential mainly because they offer a particular insight and identify the development trend in highly developed EU countries, which Slovakia should follow regarding increasing competitiveness, macroeconomic indicators, and, last but not least, the standard of living. Technological changes, globalization, outsourcing, robotization, automation, and so on caused structural changes in the economy in the group of highly developed EU countries, which can show us the development trend that the Slovak economy will gradually have to follow to increase productivity and competitiveness across Europe. It is also necessary to introduce changes and guide the development of the economy of the Slovak Republic due to the obligations arising from the European Green Deal initiative, where the Slovak Republic is committed to achieving climate neutrality by 2050.

The sectors with the tremendous potential for growth, resulting from our research, are health and social assistance, where the average of highly developed EU countries is higher by 87%, research, and development, where the average of highly developed EU countries is higher by 106%, administrative and support services, where the average of highly developed EU countries is higher by 93% and financial and insurance services, where the average of highly developed EU countries is higher by 94%.

On the contrary, we have identified the manufacturing industry as the most significant reductive sector, where the average employment value in highly developed EU countries reaches only 48% of the value in the Slovak Republic.

These results should be taken as a basis for further research, which will be more complex, and focused on individual sectors since many other geographical, socioeconomic, and legislative factors influence the results. It is, therefore, necessary to be aware of the limits of this research, overcoming which can be the subject of further scientific research.

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