

The Influence of the Quality of Education on the Knowledge Economy: the Czech Republic in International Comparison

Vliv kvality vzdělání na znalostní ekonomiku: Česká republika v mezinárodním srovnání

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Abstract

The knowledge economy consists in the creation of added value based on the use of knowledge not only due to manual production but especially due to the growing importance of education and the use of scientific knowledge in terms of the overall competitiveness of the country. The education of the population is thus a crucial factor determining the level of economic development and quality of life. The educational structure of the population affects the performance of the whole economy, as well as the performance of individual companies. Human development indicators, which are published in the UN Human Development Report, include education quality indicators. The paper aims to perform a comparative analysis of education quality indicators in the Czech Republic and an international comparison. Based on selected statistical results of comparative analysis, determine the order of states in the evaluation of the quality of education. Furthermore, using the results, compile a SWOT analysis of the quality of education in the Czech Republic, based on which the fundamental problems of Czech education will be defined and recommendations for improving the quality of education in the Czech Republic as one of the key determinants of the knowledge economy.

Keywords

education, knowledge economy, human development, comparative analysis, Czech Republic, international comparison

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Abstrakt

Znalostní ekonomika spočívá v tvorbě přidané hodnoty na základě zúročení znalostí nejen díky manuální výrobě, ale zejména kvůli růstu významu vzdělání a využití vědeckých poznatků z hlediska celkové konkurenceschopnosti země. Vzdělání obyvatelstva tak představuje zásadní faktor určující míru ekonomického rozvoje a kvalitu života. Vzdělanostní struktura obyvatelstva ovlivňuje výkonnost celé ekonomiky, jakožto i výkonnost jednotlivých podniků. Součástí indikátorů lidského rozvoje, které jsou zveřejňovány ve zprávě o lidském rozvoji vydávané organizací OSN, jsou indikátory kvality vzdělání. Cílem příspěvku je provést komparativní analýzu indikátorů kvality vzdělání v ČR

a v mezinárodním srovnání. Na základě vybraných statistických výsledků komparativní analýzy určit pořadí států v hodnocení kvality vzdělání. Dále s využitím výsledků provést sestavení SWOT analýzy kvality vzdělání v ČR, na základě které budou definovány zásadní problémy českého školství a formulována doporučení pro zvýšení kvality vzdělání v ČR jako jednoho z klíčových determinantů úrovně znalostní ekonomiky.

Klíčová slova

vzdělání, znalostní ekonomika, lidský rozvoj, komparativní analýza, Česká republika, mezinárodní srovnání

Introduction

The knowledge economy is a term that is currently used in all areas of life. For the first time, the term "knowledge economy" appears in works by Drucker (1998). The knowledge economy is a term for an economic system that is based on the use of knowledge (Hislop, 2013). The market environment is shaped by technological progress, especially ICT. Knowledge of all forms thus plays a decisive role in economic processes. The knowledge economy is therefore mainly associated with education, learning, and innovation.

Education is thus a key area for countries to move towards an economy based on an educated, motivated and creative workforce (Čechák, 2006). Countries, regions, and cities that develop and effectively manage their knowledge resources contribute to increasing their productivity. Firms with higher knowledge potential outperform those whose knowledge is weaker. At the same time, individuals who have more knowledge and a better education get better-value jobs. The strategic role of knowledge thus lies in the growth of investment in development and research, in the support of innovation, in the transfer of modern technologies, in education, science, and in the development of human resources (Popková, 2019).

The importance of human resources in the organization is thus constantly growing with the development of the knowledge economy. People are a key resource for a business to achieve long-term success. Human knowledge brings inexhaustible competitive advantages to the company. Today, the goal of organizations is not only to hire new employees and maintain existing ones but also to systematically create conditions for their work, satisfaction, further development, and education. The quality of human resources together with their education is therefore absolutely essential for the creation and transfer of knowledge and represents one of the factors influencing the quality of life in individual countries of the world and every organization doing business in it (Severová and Šrédl, 2010).

The mutual interconnection of education and the knowledge economy is thus completely unquestionable. The level of the knowledge economy in a given country is conditioned by the quality of its education. The level of quality of education is one of the key factors in economic development and the subsequent process of improving the country's competitiveness. The issue of the quality of human resources is therefore currently at the forefront of general interest and was chosen as the subject of this study. The contribution

of the work is to provide a comprehensive view of the quality of education in the Czech Republic, which is evaluated for the needs of the study on the basis of human development indicators with a focus on indicators of quality of education published by UNDP. Evaluation based on a range of indicators of the quality of education provides a broader insight into the current issues of quality of human resources, their education, and the impact on the future development of the knowledge economy of the Czech Republic.

The aim of this article is to perform a comparative analysis of education quality indicators in the Czech Republic. Compare these indicators in an international comparison and, based on statistical results, determine the ranking of countries in assessing the quality of education. Furthermore, using the results, compile a SWOT analysis of the quality of education in the Czech Republic, based on which the fundamental problems of Czech education will be defined and recommendations for improving the quality of education in the Czech Republic will be formulated. The starting point for defining the goal and setting research questions for comparative analysis is a search of professional literature, which summarizes the existing knowledge in the field of education. The methodology used focuses on a comparative analysis of the quality of education in the Czech Republic and in selected countries and the compilation of a SWOT analysis of the quality of education in the Czech Republic. The chapter devoted to the results presents the findings on the quality of education based on the evaluation of the total number of indicators determining the quality of education systems. Furthermore, the chapter devoted to the results presents the results of the SWOT and proposals for recommendations for improving the current situation. The conclusion then contains a summary of knowledge about the quality of education in the Czech Republic.

1 Theoretical background

The knowledge economy is the use of knowledge to generate tangible and intangible value. The country's involvement in the knowledge economy depends on the following pillars: information infrastructure, education, economic incentives, and the institutional framework and innovation system (Unger, 2019). The characteristic features of the knowledge economy and examples of changes are shown in Table 1.

Table 1: Characteristics of the knowledge economy

Characteristics	Examples of specific changes
The growing importance of ICT	⇒ Digitalization of communications ⇒ Connecting companies, cooperation, partnerships
Reduced dependence on the physical concentration of resources	⇒ Offshoring, a new division of labour ⇒ Growing share of GDP in intangible capital
Integration of economic sectors	⇒ Loss of the line between industry, organizations and technology

Characteristics	Examples of specific changes
The growing role of the customer	⇒ Customization of the product to the customer ⇒ Establishment of customer communities
Growing dynamics of pricing	⇒ Possibility of quick comparison of offers and prices ⇒ Adjusting prices to customers

Source: Soukup and Rathouský, 2013

The globalization of the knowledge economy and digital technologies has a significant impact on the state and dynamics of human capital development (Belly, 2017). On the one hand, companies can gain access to human capital around the world, on the other hand, employees gain access to the global labor market (Angelopoulos et al., 2017). Creating a new generation of employees equipped with modern executive competencies is possible not only in the process of formal education, training, and learning. Transnational digital technologies contribute to the globalization of the economy and thus accelerate the development of new qualities of human capital through the digitization of jobs, the provision of electronic services, or the use of the Internet of Things (Giorcelli, 2019).

Today, it is necessary to use a highly qualified workforce for the development of production, capable of performing a number of functions requiring a high level of professional training. Most employers are already aware of the need to attract highly qualified workers, but also to invest in improving human knowledge. On the other hand, employees must be prepared for the constant acquisition of new knowledge and rapid retraining. Thus, in the knowledge economy, there is a transition from the use of simple production work to highly qualified human resources equipped with special physical and mental abilities (Novikov et al., 2020).

Previous empirical research has shown that human capital and ICT have a positive impact on organizational efficiency, social development, and accelerating the growth of knowledge production (Chen, 2008; Oreopoulos, and Petronijevic, 2018). The entry of human capital into the digital age began through the organization of open digital portals that change the way human communication communicates with the fields of education, health, culture, leisure, and other social services. Education and professional development are priorities in the models of digital development of society (Filippone et al., 2012). To master skills, it is important to develop measures that express the state of readiness for the use of ICT (Good et al., 2015).

According to Castleman (2019), the basic framework for digitization consists of research and development activities aimed at increasing the production of public goods and gaining competitive advantages. Some empirical studies of economic growth have assessed the role of human capital and ICT as determinants of the effectiveness of long-term economic growth based on an indicator of human capital and ICT-based literacy (Bakry and Al-Ghamdi, 2008; Ehrlich et al., 2017). Research by Petrakis and Stamatakis (2002) has shown that the link between economic growth and education varies from country to country due to levels of economic development. Thus, research, science, and education are the main

drivers of economic progress. The task of educational policy is to contribute to sustainable human development, mutual understanding between people, and the development of democracy (Žítek et al., 2011). The role of education in tackling global trends, limiting the development of the knowledge economy, and promoting sustainable development is crucial. With the help of educational sectors, knowledge of the economies of individual countries and their targeted development become a basic prerequisite for equitable and sustainable development (Bureš and Hájek, 2007).

According to Kostrovská et al. (2017) are the problems of education in the Czech Republic and Slovakia, the migration of the productive population abroad, and the widening of the gap of the missing labor force in the productive age. According to Andrei et al., Another problem of education in the Czech Republic is. (2012) study failure rate. Another problem of the education sector in the Czech Republic and Slovakia is the low quality of vocational education (Soukalová and Gottlichová, 2015). According to Herbst and Wojciuk (2014), the Czech Republic, Slovakia, Hungary, and Poland have completely different national approaches to education reforms.

Human capital is considered an important factor in the economic development of countries at the theoretical and empirical level. The results of the above-mentioned empirical studies have shown the indirect positive impact of human capital on the economic development of countries in the form of the human factor contributing to the development and dissemination of modern technologies or contributing to the creation and transfer of knowledge in countries' knowledge economy. At the same time, the studies emphasize the importance of the quality of education for the development of the country's workforce. A large part of the authors of the mentioned studies agrees on the problem of capturing the quality of human capital (lack of data, their quality, differences in calculation methodology, etc.). The quality of human resources is therefore often defined through the quality of education. Based on a literature search, a difference was found in the authors' approaches to measuring the quality of education.

I consider the shortcomings of previous empirical studies (Romer, 1990; Jones and Romer, 2009; Isola and Alani, 2012; Teixeira and Fortuna, 2003; Abbas and Peck, 2008) to evaluate the quality of education based on the use of the vast majority of one selected indicator or a combination of two indicators of the quality of education (most often indicators of the highest achieved education, the average time of education and literacy rate). This study used an analysis of a wider range of education quality indicators (education index, average and expected length of study, government expenditure on education, the share of people with at least secondary education, evaluation in the international PISA survey), which would increase their value on a comprehensive scale to improve the quality of education in a country. The information obtained thus enables an objective and as reliable as a possible assessment of the overall state of the country's education system and the formulation of recommendations for improvement. Based on a search of professional literature, the absence of studies dealing with the influence of the quality of education on the knowledge economy in the conditions of the Czech Republic and in comparison with other countries was also proved. For this reason, too, I consider the subject of the study, which is the analysis of the quality of education in the Czech Republic and in an international comparison, to be current and suitable for study.

2 Methodology

In order to fulfil the set goals of this article, a mainly quantitative approach to data processing is chosen, supplemented by qualitative knowledge resulting from a search of the literature. Work with secondary data includes the study of publicly available data on the quality of education in the Czech Republic and in an international comparison. The main source of data is the Human Development Report (HDR) from 2019. The HDR report publishes the Human Development Index (HDI), which is the geometric average of the three indices. The calculation of the Human Development Index (HDI) is as follows:

$$HDI = \sqrt[3]{(LEI \times EI \times II)} \quad (1)$$

where LEI (Life Expectancy Index) is an indicator of life expectancy, EI (Education Index) is an education index and II (Income Index) is an index of gross national income per person. For the indicators of life expectancy and GNP per person, standardized values are determined at the same time as the values of partial indices. For the indicator of life expectancy (years), the minimum is 20 and max. 85. For the GNP indicator per person (in dollars), the minimum is 100 and max. 75 000.

However, there are two indicators for EI, and therefore it is necessary to calculate it from two indicators. The education index measures the combination of average adult years of schooling with expected years of schooling, with each attendee having a weight of 50% (UNDP, 2010). The calculation of the Education Index (EI) is as follows:

$$EI = \frac{MYSI + EYSI}{2} \quad (2)$$

where the MYSI (Means Years of Schooling Index) is a calculation of the average number of years of education that people aged 25 and over have obtained, based on the educational attainment of the population converted to years of schooling according to the theoretical duration of each level of education attended. The planned max. MYSI for the year 2025 is 15. The calculation of the MYSI indicator is as follows:

$$MYSI = \frac{MYS}{15} \quad (3)$$

where the Expected Years of Schooling Index (EYSI) is a calculation of the number of years a child is expected to attend school, including years of repetition. It is the sum of age-specified enrolment ratios for primary, secondary, post-secondary and tertiary education. The expected years of schooling are limited to 18 years. The calculation of the EYSI indicator is as follows:

$$EYSI = \frac{EYS}{18} \quad (4)$$

In addition to the comparison of the Czech Republic in the international comparison in terms of the EI indicator, a comparison is made of other selected indicators of the quality of education. This broadly affects the area of indicators determining the level of quality of education. Research questions for comparative analysis are:

1. What is the order of the Czech Republic in the evaluation of the quality of education of selected countries?
2. According to the monitored indicators of the quality of education, can the quality of education in the Czech Republic be described as above-average, average, or below-average in an international comparison?

Within statistical data processing using Microsoft Excel, the indicator average (usual value from a set of values), indicator min and max, variation range – VR (the difference between max and min), variance (characteristic of the variability of the probability distribution of a random variable), standard deviation – SD (quadratic mean of deviations of character values from their arithmetic mean), median (mean value) and mode (most common value).

The evaluation of the quality of education in selected countries is then determined as follows:

- in the case of a higher than average value of the monitored indicator of the quality of education, the given state is assigned a rating of 1;
- in the case of a lower than average value of the monitored indicator of the quality of education, the given state is assigned a rating of 0;
- in the case of the same value as the average value of the monitored indicator of the quality of education, the given rating is assigned a rating of 0,5.

The order of states is determined by the sum of all assigned evaluations of education quality indicators. For international comparison with the Czech Republic, its neighbouring countries (Germany, Slovakia, Poland, and Austria) are selected. Furthermore, a comparative analysis is used with the countries that achieve the best EI values in 2018 (New Zealand, Australia) and a comparison with the countries that achieve the worst EI values (UAE, Portugal, and Andorra, which was omitted due to missing data).

Based on a comparative analysis of indicators of the quality of education and a search of professional literature, a SWOT matrix is compiled. SWOT analysis is a universal tool aimed at mapping and analysing a given phenomenon (Grasse, 2006). Based on the SWOT analysis of the quality of education in the Czech Republic, five fundamental problems of Czech education are presented, within which draft recommendations for improving the current situation and the impact of these recommendations on the monitored indicators of quality of education are set.

3 Analysis of the quality of education in the Czech Republic and selected countries

This chapter presents a key part in the form of the results of a comparative analysis of the quality of education in the Czech Republic and in selected countries. The evaluation of the quality of education is supplemented by knowledge about the evaluation of selected countries according to the HDI indicator. Based on the statistical results of the comparative analysis, the order of states in the evaluation of the quality of education is determined and a SWOT analysis of the quality of education in the Czech Republic is compiled.

3.1 Human Development Index

The Human Development Index (HDI) is one of the attempts to express the quality of human life. Of the 189 countries for which the HDI was calculated in 2018, 62 countries fell into the category of very high levels of human development, 54 countries into the category of high levels of human development, 37 countries into the category of intermediate levels of human development and 36 countries into the category of the low level of human development. According to the HDI, Norway (0,954), Switzerland (0,946) and Ireland (0,942) took the first three places. The last places ranked were the Republic of Chad, the Central African Republic, and Nigeria.

The Czech Republic was in 26th place (0,891). In a comparative analysis of the Czech Republic with neighbouring countries based on the HDI value in 2018, the best place was taken by Germany, which ranked 4th (0,939), followed by Austria with 20th place (0,914), followed by Poland to 32nd place (0,872), and Slovakia 36th place (0,857).

3.2 Education quality indicators

According to EI, Germany, Australia, and New Zealand took the first three places in 2018. The last places in the EI evaluation were occupied by Portugal, the UAE, and Andorra. The Czech Republic had an EI of 0,892 and thus took 16th place. Of the Czech Republic's neighbouring countries, only Germany achieved better EI values in 2018, while Austria, Poland, and Slovakia showed worse EI values. Table 2 below shows the EI values in the world in 2018, for simplification, out of 40 countries with a very high level of HDI, only selected countries are shown for comparative analysis.

The quality of Czech education is thus based on this European comparison as average. Cooperation between academia and the private sector is an important part of the quality of education. In this cooperation, i.e. the so-called dual education, the Czech Republic lags behind neighbouring countries. While in the Czech Republic only 25% of companies cooperate with schools, in Slovakia it is 33%, in Austria 44,5% and Germany as much as 63% of companies.

Table 2: World Education Index (EI) in 2018 (countries with very high HDI levels)

HDI Position	Country	Education Index (EI)
4	Germany	0,946
6	Australia	0,923
14	New Zealand	0,923
20	Austria	0,871
26	Czech Republic	0,892
32	Poland	0,866
35	United Arab Emirates	0,744

HDI Position	Country	Education Index (EI)
36	Andorra	0,708
36	Slovakia	0,824
40	Portugal	0,759

Source: author from data UNDP

Table 3 presents a summary of all monitored indicators of the quality of education in the comparative analysis of the analysed countries. For the simplification of names, abbreviations of their English names are created for individual indicators of education quality, i.e.: EI (Education index), EYS (Expected Years of Schooling – years), MYS (Mean Years of Schooling – years), GE (Government expenditure on Education – % of GDP), GER_1 (Gross enrolment ratio, primary – % of primary-school-age), GER_2 (Gross enrolment ratio, secondary – % of secondary school-age), GER_3 (Gross enrolment ratio, tertiary – % of tertiary school-age), SE (Population with at least some secondary education), PISA score in maths, reading, science.

Table 3: Summary of indicators of education quality in states according to HDR 2019

Indicator	CZ	SK	PL	AT	DE	AU	NZ	UAE	PT
EI	0,892	0,824	0,866	0,871	0,946	0,923	0,923	0,744	0,759
EYS	16,8	14,5	16,4	16,3	17,1	22,1	18,8	13,6	16,3
MYS	12,7	12,6	12,3	12,6	14,1	12,7	12,7	11,0	9,2
GE	5,8	4,6	4,8	5,5	4,8	5,3	6,3	–	4,9
GER_1	100	98	110	104	103	101	100	111	105
GER_2	105	91	107	102	102	151	115	96	118
GER_3	64	48	67	86	68	114	82	–	63
SE	99,8	99,3	85,3	100	96,3	90,4	96,9	70,7	54,2
PISA maths	492	475	504	497	506	494	495	427	492
PISA reading	487	453	506	485	509	503	509	434	498
PISA science	493	461	501	495	509	510	513	437	501

Source: author from data UNDP

In the Czech Republic, the EYS indicator was 16,8 years, and the MYS indicator 12,7 years, which may be a consequence of a socially generous state. In the PISA measurement in 2018, the Czech Republic ranked ninth lowest among the then 28 EU countries. The data show that the Czech Republic spent 5,8% of GDP on education. Slovakia showed lower EI values than the Czech Republic. According to PISA, Poland can be described as a jumper who rose to the top. However, Poland had a lower EI than the Czech Republic, as well as lower education expenditures. Interesting is the smaller share of the population with at

least secondary education, which is 85% in Poland. In Austria, education is different in connection with practice. Here, students spend about 80% of their time practicing.

According to EI, Germany, Australia, and New Zealand took first place. Indicator EI was highest in Germany, although government spending on education was 4,8% of GDP. Germany achieves above-average results in PISA. EI Australia reached lower values than Germany but at the same time higher values than the Czech Republic. The expected duration of the study was the longest in Australia (22,1 years).

New Zealand achieved higher EI values compared to the Czech Republic. In New Zealand, the government has also invested more in education (6,3% of GDP). Interestingly, Germany, which had the best EI compared to the second best-rated Australia and New Zealand, had the lowest government spending on education. The last places according to EI were Portugal, the UAE, and Andorra. In addition to the Ministry of Education, Portugal also has a Ministry of Science, Technology, and Further Education (E15, 2018). Portugal achieved the third-lowest EI value in the category of countries with a very high level of human development. The proportion of people with at least a secondary education was 54,2% in Portugal (Table 3).

3.3 Statistical results of a comparative analysis of the quality of education

As part of the statistical processing of data on the quality of education in selected countries, basic statistical indicators were calculated for each of the monitored indicators (Table 4).

Table 4: Statistical calculations of monitored indicators of education quality

Indicator	Average	MIN	MAX	VR	Dispersion	SD	Median	Modus
EI	0,861	0,744	0,946	0,202	0,005	0,068	0,871	0,923
EYS	16,9	13,6	22,1	8,5	5,4	2,3	16,4	16,3
MYS	12,2	9,2	14,1	4,9	1,7	1,3	12,6	12,7
GE	5,3	4,6	6,3	1,7	0,3	0,6	5,1	4,8
GER_0	101,9	70	166	96	642,8	25,4	95	105
GER_1	103,6	98	111	13	18,0	4,2	103	100
GER_2	109,7	91	151	60	276,4	16,6	105	102
GER_3	74,0	48	114	66	348,8	18,7	67,5	-
SE	88,1	54,2	100	45,8	223,7	15,0	96,3	-
PISA maths	486,9	427	506	79	517,4	22,7	494	492
PISA reading	487,1	434	509	75	630,5	25,1	498	509
PISA science	491,1	437	513	76	578,3	24,0	501	501

Source: author

The order of states in the evaluation of the quality of education is determined as follows: in the case of higher than the average value of the indicator – 1 point is assigned; in case of lower than the average value of the indicator – assigned 0 points; in case of identical value – 0,5 points assigned. The order of the states is then determined by the sum of all the assigned ratings for each state. The Czech Republic achieved a higher value than the average of the given indicator for the indicators EI, MYS, GE, GER_0, SE, PISA maths score, and PISA science).

The Czech Republic, therefore, received 7 points in the evaluation. Worse was Slovakia, which achieved higher average values only in the case of MYS and SE (2 points). Poland had higher than average values for 6 indicators. Austria was better than CZ, SK, PL, and DE and achieved higher than average values for 9 indicators. Australia had the highest number of points. New Zealand had the second-highest number of points. The worst values in the evaluation of the quality of education were achieved by the UAE, which received only 1 point in the evaluation. Portugal received 5 points in the evaluation (Table 5).

Table 5: Ranking of states in the evaluation of the quality of education according to the indicators of the quality of education

Indicator	CZ	SK	PL	AT	DE	AU	NZ	UAE	PT
EI	0,892	0,824	0,866	0,871	0,946	0,923	0,923	0,744	0,759
EYS	16,8	14,5	16,4	16,3	17,1	22,1	18,8	13,6	16,3
MYS	12,7	12,6	12,3	12,6	14,1	12,7	12,7	11,0	9,2
GE	5,8	4,6	4,8	5,5	4,8	5,3	6,3	–	4,9
GER_0	105	93	70	105	108	166	95	82	93
GER_1	100	98	110	104	103	101	100	111	105
GER_2	105	91	107	102	102	151	115	96	118
GER_3	64	48	67	86	68	114	82	–	63
SE	99,8	99,3	85,3	100	96,3	90,4	96,9	70,7	54,2
PISA maths	492	475	504	497	506	494	495	427	492
PISA reading	487	453	506	485	509	503	509	434	498
PISA science	493	461	501	495	509	510	513	437	501
Number of points	7 p.	2 p.	6 p.	9 p.	8 p.	10,5 p.	10 p.	1 p.	5 p.
Order of states	5.	8.	6.	3.	4.	1.	2.	9.	7.

Source: author from data UNDP

The ranking of states in the evaluation of the quality of education is AU (10,5 points), NZ (10 points), AT (9 points), DE (8 points), CZ (7 points), PL (6 points), PT (5 points), SK (2 points), and UAE (1 point). If we focus on the comparison of the ranking of states in terms of EI and the ranking of states according to the proposed evaluation in this study, we will find that Germany,

Australia, and New Zealand ranked first according to EI. According to the evaluation of the quality of education in this study, the ranking of the first countries that achieve higher than average values in the monitored indicators and thus received the most assigned evaluations is as follows: Australia in 1st place, New Zealand in 2nd place and Austria in 3rd place.

The last places according to EI were occupied by Portugal, the UAE, and Andorra. According to the evaluation of the quality of education in this study, the ranking of the last countries that achieve lower than average values in the monitored indicators and thus obtained the least assigned points is as follows: Portugal in 7th place, Slovakia in 8th place and UAE in 9th place. Compared to the Czech Republic, only Germany achieved better EI values, while Austria, Poland, and Slovakia showed worse values. According to the evaluation of the quality of education, Germany and Austria achieved a better position according to the assigned evaluations about the Czech Republic, while Slovakia and Poland achieved a worse position.

4 Results and discussion

According to EI, Germany, Australia, and New Zealand took the first three places. Portugal, the UAE, and Andorra took the last places according to EI. The Czech Republic ranked 16th out of 40 monitored countries. The evaluation of the level of education was also performed based on other indicators of the quality of education. The first indicator compared was the indicator of the expected length of study, which was at the level of 16,8 years in the Czech Republic, but the average length of the study was 12,7 years. When comparing this indicator, Australia reached the highest value (22,1 years). In terms of expenditure on education, the Czech Republic is above the EU average. Within our comparison, New Zealand (6,3% of GDP) invested the most in education, followed by the Czech Republic (5,8% of GDP), Austria (5,5% of GDP), Australia (5,3% of GDP), Portugal (4,9% of GDP), Poland and Germany (4,8% of GDP) and Slovakia spent the least on education (4,6% of GDP).

Another monitored indicator of the quality of education was the indicator population with at least secondary education. Austria, the Czech Republic, Slovakia, New Zealand, Germany, Australia, and Poland have the highest shares of people with secondary education. The lowest values of young people with secondary education were recorded in the UAE countries and Portugal. The Czech Republic ranked 9th lowest in the PISA measurement in 2018. The Czech Republic achieves a better score than Slovakia in all areas of measurement. According to PISA, Poland could be described as a jumper. The best values of the PISA score in the field of mathematics, reading, and science within the neighbouring states of the Czech Republic are achieved by Germany. Australia is one of the non-European countries with better PISA results. Despite the low value of EI, Portugal achieves a better score than the Czech Republic (CSICR, 2019).

Ranking of countries in the evaluation of the quality of education based on indicators of quality of education according to assigned evaluations as follows: 1st place – Australia, 2nd place – New Zealand, 3rd place – Austria, 4th place – Germany, 5th place – Czech Republic, 6. place – Poland, 7th place – Portugal, 8th place – Slovakia and 9th place – UAE. The Czech Republic thus ranked 5th out of 9 analysed countries.

If we focus on comparing the ranking of countries in terms of EI and the ranking of countries according to the evaluation of the quality of education in this study, which includes a wider range of indicators determining the quality of education, we find that the first three places according to EI were Germany, Australia, and New Zealand. According to the evaluation of the quality of education in this study, the order of the first three countries is as follows: Australia, New Zealand, and Austria. The last places in the EI ranking were occupied by Portugal, the UAE, and Andorra. According to the evaluation of the quality of education in this study, the order of the last countries is as follows: Portugal in 7th place, Slovakia in 8th place, and the UAE in 9th place.

Based on a comparative analysis of education quality indicators from the HDR report (2018) and a search of the literature, it is possible to identify strengths and weaknesses, opportunities and threats of the education system in the Czech Republic, which are the basis for compiling a SWOT matrix (Table 6).

Table 6: SWOT analysis of education in the Czech Republic

	STRENGTHS	WEAKNESSES
INTERNAL FACTORS	<ul style="list-style-type: none"> + a stable and developed system of public education + high proportion of graduates with secondary education + increasing trend of the Education Index indicator + diversity of pedagogical approaches between individual schools + average to above-average results in the evaluation of pupils literacy in international comparison (TIMSS, PIRLS, ICILS) 	<ul style="list-style-type: none"> – below-average level of public education funding – insufficient cooperation between public education and private sector – disagreement over the objectives of education between political parties – low expenditure on science compared to OECD – lack of teachers and the aging generation of teachers – missing system concept of education development – low proportion of university graduates within the EU
	OPPORTUNITIES	THREATS
EXTERNAL FACTORS	<ul style="list-style-type: none"> + increase state funding for education, science and research + closer links between business, science, research and education and teaching + change of goals, content of education and ways of learning connected with the preparation of the Strategy of educational policy until 2030+ + increasing teachers' salaries and their further education 	<ul style="list-style-type: none"> – low interest in technical fields will increase dependence on labour imports – outflow of teachers from education due to low financial value – inconsistency between market needs and job offers of graduates – dependence on EU resources in the implementation of projects – underestimation of preparation for demographic aging of teachers

Source: author

Based on the SWOT analysis of the quality of education in the Czech Republic and the resulting knowledge, I further define 5 key problems of Czech education, which are ranked in order of importance: the absence of a concept for the development of Czech education; insufficient funding for education, science, and research; the content and way of education do not meet the needs of the 21st century; insufficient interconnection of public education and the private sector; insufficient support for teachers, principals, and other education staff.

The first and fundamental problem of the education sector in the Czech Republic is the non-existence of the concept of development of Czech education, here I propose to focus on:

- the creation of a systemic state policy that is not subject to immediate effects and has a clear and long-term goal, the introduction of uniform entrance examinations;
- creation of a structure of tools for measuring the quality of the outputs of the education system;
- promoting unity in the management of regional education;
- amendment of the Act on Teachers to facilitate entry into education;
- setting up a system of political independence from the city and regional representatives,
- drawing on foreign experience from countries with successful educational reforms.

Another problem of the education sector in the Czech Republic is insufficient funding for education, science, and research, here I recommend concentrating on:

- increasing the financing of education in the Czech Republic to the level of the OECD average;
- introducing a change in the method of financing towards the promotion of strategic priorities and needs;
- ensuring transparency and stability for all levels of education system management;
- salary growth in education; motivation of young teachers; changes in the remuneration system;
- improving the funding system for basic and applied research; support for pedagogical research, support for financing regional RandD centres;
- reducing the administrative burden of RandD funding.

Another defined problem of Czech education is that the content and method of teaching and education do not meet the needs of the 21st century, in this area I propose to focus on:

- increasing the real level of key competencies (critical thinking, agility, and adaptability, entrepreneurship, ability to find and analyse information, curiosity) and digital literacy, thanks to which the individual can respond to a changing world;
- avoiding overloading students with information, discussing the curriculum with the aim of deeper understanding, in a broad context without several irrelevant knowledge;
- introduction of new and innovative methods in education in all types of schools and out-of-school facilities (podcasting, digital storytelling, lip oak, action research, school wiki, eTwinning, smartphone measurement, modelling, and simulation, etc.);
- expanding civic education, leading to mutual respect and tolerance, critical thinking, and an active interest in public affairs and life around them;

- creating a higher degree of the link between formal and non-formal education;
- attractiveness and support especially of those fields of education that the current labor market requires (technical education, IT fields).

Another significant problem of education in the Czech Republic is the insufficient interconnection of public education and the private sector, in this issue I recommend focusing on:

- extension of professional training and practice at secondary schools and vocational schools;
- excursions and visits of students in companies, the participation of people from practice in teaching;
- participation of schools and companies in research or other projects;
- participation of interns in students' final exams;
- introduction of a profile school-leaving examination and a master's examination;
- improvement of the regional information system for future employment, linking career counselling with the dynamically changing labour market.

The last defined fundamental problem of Czech education is the insufficient support of teachers, principals, and other workers in education, here I suggest:

- defining the professional competence standards of teachers and principals;
- creation of transparent systems of qualification paths to pedagogical activities;
- reducing the non-pedagogical burden of principals as guarantors of quality pedagogical work of the school;
- improvement of conditions for pedagogical work of the school (improvement of the support system, strengthening of support staff, improvement of the provided counselling system);
- adjustment of preparatory professional education (description of the graduate's key competencies);
- support for further education of pedagogical staff.

The above recommendations for individual areas of problems of Czech education represent only an outline of recommendations for improving the current situation. The implementation of the proposed recommendations for the improvement of the situation related to the problem of "content and way of education not meeting the needs of the 21st century" would subsequently primarily result in an improvement in the value of the education index. The implementation of the proposed recommendations to improve the current situation dealing with the problem of "insufficient interconnection of public education and the private sector" would subsequently be reflected in particular in improving the value of the indicator of the share of people with at least secondary education. The implementation of the recommendations related to the problem of "insufficient support for workers in education and insufficient funding for education, science, and research" would subsequently increase the value of the government expenditure on the education index. In the case of the implementation of recommendations that would solve the problem of "non-existence of the concept of development of Czech education", the value of the education index and the human development index, as well as the PISA evaluation, would subsequently be improved.

Conclusion

The subject of this text was to present conclusions on the quality of education in the Czech Republic based on a comparative analysis of selected indicators of the quality of education. Compare these indicators in an international comparison and, based on statistical results, determine the ranking of countries in assessing the quality of education. Furthermore, using the results, compile a SWOT analysis of the quality of education in the Czech Republic, based on which the fundamental problems of Czech education were defined and recommendations for improvement were formulated. Two comparative questions were identified for comparative analysis.

According to EI, Germany, Australia, and New Zealand took the first places in the comparison. The latest EI rankings are in Portugal, the UAE, and Andorra. The Czech Republic ranked 16th out of 40 countries. Of the Czech Republic's neighbouring countries, only Germany achieved a better value for the EI indicator. The quality of Czech education is based on a comparison based on the EI indicator as average. Based on the evaluation of education quality indicators according to the assigned evaluations, the Czech Republic ranked 5th out of 9 countries, thus answering the first research question. Not only based on evaluation according to EI, but also other indicators, the second research question can be answered, and that is that the quality of education in the Czech Republic in comparison with selected countries can be described as average (UNDP, 2018).

Based on the SWOT analysis of the quality of education in the Czech Republic and a search of professional literature, 5 key problems of Czech education were defined, which were ranked according to importance: the absence of a concept for the development of Czech education; insufficient funding for education, science, and research; the content and way of education do not meet the needs of the 21st century; insufficient interconnection of public education and the private sector; insufficient support for teachers, principals, and other education staff. Recommendations for improving the quality of education in the Czech Republic were formulated for these problems in the "results and discussions" section of the article.

The Czech economy is currently an integral part of the global knowledge economy. In this competitive environment, it can succeed either by reducing the price of the labour force or by the quality of the labour force, which is mainly related to its qualifications, increasing the educational structure of the population and the quality of education. An economy based on the importance of education thus represents a knowledge economy in which its connection with education is essential. With its findings, this contribution contributes to the debate on the position of the Czech Republic in international comparison in terms of quality of life indicators in the field of education as one of the key determinants of the level of the knowledge economy.

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