THE IMPACT OF HUMAN CAPITAL ON THE EFFECTIVENESS OF ENTERPRISES IN THE V4

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Purpose: Identification and assessment of the impact of human capital on the effectiveness of enterprises of the Visegrad Group (V4).

Design/methodology/approach: In the theoretical part, content analysis was used - a library query on the Google Scholar website. In the empirical part, a statistical analysis was applied, which included the characteristics of the sample of selected features, the analysis of a series of correlations examining the matching of features, and the analysis of the results obtained. The collected data was compiled using descriptive statistics - average values, dynamics of changes, trend function and Pearson's correlation coefficient.

Findings: In each V4 country, as the turnover of enterprises increased, the number of unemployed people with higher education decreased, and vice versa. The increase in the turnover of enterprises determined the increase in the number of research and development personnel in each country of the Visegrad Group (and vice versa). In turn, the turnover of V4 enterprises turned out to be strongly correlated with labor costs. Along with the decrease in the number of research and development personnel, as well as labor costs, the gross operating index of companies from the Visegrad Group increased.

Practical implications: It was attempted to show which of the examined attributes of human capital had the greatest impact on the effectiveness of enterprises in individual V4 countries. This gives a certain field, on the one hand, to combat unemployment by applying a targeted state policy aimed at reducing its level, and on the other hand, to introduce incentives promoting the employment of R&D personnel.

Limitations: Short time series containing the attributes of human capital and enterprise efficiency, as well as the lack of current and complete statistical data, which resulted in a reduced number of predictors tested.

Keywords: human capital, enterprise efficiency, Visegrad Group.

Category of the paper: Research paper.

1. Introduction

Looking at different educational and economic processes, it is possible to observe a complex and constant interaction between them. This issue has been discussed since the 1960s in both politics and economics, which suggests a strong relationship between education and work. It is assumed that knowledge is a kind of economic capital. At the same time it is emphasized that education is perceived as preparation for work (Marginson, 2019). The economy plays a key role in maintaining and developing the education system. Each element of the economic system (e.g. education) in turn has an impact on society. The qualification potential, as well as the intellectual potential most often generated in the education system, plays an important role in the economy. The concept of human capital, proposed by the Nobel Prize winners T. Schulz, J. Mincer and G. Becker, proves that knowledge, abilities, skills and motivations are the elements of individual human capital (Galiakberova, 2019).

The importance of the discussed subject results from the fact that the characteristics of both the employee, the employer and the job itself are changing dynamically. In order for people employed in the organization to feel satisfaction from joint activities, it is necessary to know a number of factors that affect these entities (for example on the part of the organization it can be the way of organizing work, and on the part of the employee the characteristics of a given generation). This is particularly important for Polish business entities, which for many years have been one of the weakest innovators in the European Union, especially in terms of the number of patents both filed and granted (Eurostat, 2022).

As efficiency does not exist without competences, and competences are an important element of human capital, it is worth looking at the extent to which human capital affects the effectiveness of enterprises. Although the professional literature in this field is rich both in foreign works (Andriessen, 2004; Iazzolino, Laise, 2013; Pulić, 2005; Tan et al., 2008; Kozera, Kalinowski, 2012), as well as in Polish entries (Król, Ludwiczyński, 2014; Mentel et al., 2014); the research gap, however, identified on the basis of the analysis of the literature (Jamal, Saif, 2011; Seleim et al., 2007; Singh, 2004; Channar et al., 2015; Josan, 2013; Oforegbunam, Okorafor, 2010) covers the determinants describing the effectiveness of enterprises in the Visegrad Group countries, which have not yet been examined in this context. Taking into account the presented premises, the main research problem was formulated in the form of the following question: Is there a relationship between the attributes of human capital and the effectiveness of enterprises in the Visegrad Group countries? The aim of the considerations was to identify and assess the impact of human capital on the effectiveness of the Visegrad Group enterprises.

The following research hypotheses were adopted:

H1: The effectiveness of enterprises in the Visegrad Group countries is determined by the variables defining the R&D personnel, the unemployed with higher education, and labor costs.

H2: There is a strong relationship between the attributes of human capital and gross turnover and operating ratios of enterprises in the Visegrad Group countries.

2. Human capital in the context of enterprise efficiency in the light of literature studies

The aspect of guaranteeing, maintaining and improving the efficiency of the organization is particularly important in a modern business environment. This is due to the fact that nowadays this environment is characterized by heterogeneity, complexity, unpredictability and dynamics (Kareska, Davcev, 2016; Stepanova, Melnikova, 2020). For many economic operators, the challenge is already how to achieve this issue, let alone improve it. When it comes to efficiency improvement, it refers to production efficiency (i.e. productivity), cost efficiency (i.e. profitability) and the efficiency of using the company's assets and capital (i.e. profit gaining). In other words, we can talk about production efficiency (productivity and cost efficiency) and trade efficiency (profitability) (Domanović, Janjić, 2018).

P.A. Samuelson and W.D. Nordhaus (2019) saw efficiency as using economic resources in the most efficient way possible. However, what should be considered is what happens when the availability of resources is limited or the dynamics of changes in the business environment is so great that it requires constant changes in operation. R.S. Kaplan and D.P. Norton (1992) proposed using a balanced score-card approach to deal with the need for multiple performance metrics. However, their approach tends to link stakeholder groups to impact categories (economic or social). It includes measuring performance from four perspectives: financial, customer, internal processes and growth and innovation. A.A. Atkinson et al. (1997) argued that this approach ignores some key stakeholder groups (particularly suppliers, employees and the wider community within which the organization operates and may have indirect but significant impacts).

Effective organization is important in the long-term development of business entities. It allows organizations to run more smoothly while focusing on their goals. The benefits of an effective organization include: increasing productivity and employee involvement, improving management communication, ensuring budget savings by eliminating areas of waste, improving the use of technology, maximizing customer value.

The guarantee of an increase in the competitiveness of a given organization is the close cooperation of all components of intellectual capital, human capital included (Dziwulski, Skowron, 2019) . In the literature, human capital is defined in various ways. It can be seen

through the prism of economics and psychology. From an economic perspective, we are talking about the knowledge, skills and health in which people invest and accumulate throughout their lives, and which allow them to realize their potential as productive members of society (World Bank, 2022). In the second half of the 20th century, the term 'knowledge-based economy' was coined. The advent of the knowledge economy has strengthened the link between the acquisition of human capital and institutionalized education, in particular in higher education (Aparicio et al., 2021). Entering prestigious professions (such as, for example, professor, lawyer, doctor etc.) requires appropriate references, which are obtained only after years of study (Kell et al., 2018). The economic return to education is large, both at an individual and national level. From the psychological point of view, human capital is closely related to such aspects as, for example, motivation and perseverance, which have a significant impact on learning success, which, in turn, may translate itself into professional success (Credé, Kuncel, 2008).

The literature on the subject recognizes the importance of human capital for improving the company performance (Crook et al., 2011). Given the different disciplinary approaches, it is not surprising that different studies focus on slightly different aspects and levels of human capital in organizations. There exists a strong relationship between human capital and economic growth. This is due to the fact that people join the enterprise with various skills and knowledge. This relationship can be measured by how much money is spent on educating people or how many of them are employed in different research and/or development activities (Weil, 2014; Sultana et al., 2022). Some governments recognize that this link between human capital and the economy is particularly important, and therefore provide subsidies for education and/or R&D. People employed with higher education often have higher salaries, which means that they can spend more, which translates itself into the economic situation.

When the potential of human capital increases in areas such as science, education and management, it leads to increased innovation, social well-being, equality, increased productivity and the improvement of various indicators, all of which contribute to economic growth. An improvement in the economic situation usually translates itself into an improvement in the quality of life of the population. Z. Zioło (2015) also noticed that the efficiency of a company may have an impact on social and cultural efficiency. Activation of the labor force is achieved as a result of employment growth and contributes to minimizing unemployment, improving or changing professional qualifications. Such activities contribute to the reduction of social pathology and the reduction of social benefits paid out.

Considering the issues of industry, it should be noted that it has a direct impact on the level and pace of economic development. Goods produced by industry are used to meet human needs and increase the quality of life. The development of this sector also affects the absorption of consumer goods, increasing financial resources and investments. The development of enterprises, in turn, determines the demand for qualified staff.

Changes taking place on the market and, in particular, the increasingly widely implemented concept of Industry 4.0, mean that the effectiveness of the organization will be based to an even greater extent on the qualifications of employees. With the introduction of Industry 4.0 technologies, organizations can capture and analyze more information than they managed in the past. In terms of human resources, this is a challenge that involves investing in efficient information systems for human resource management. Such a solution will allow not only large organizations, but also those from the SME sector to improve their business activities. As noted by A. Kucharčíková et al. (2021), this applies in particular to Big Data analysis, where the obtained data can, among others, reduce the costs of employee rotation, employee acquisition (departure from printed CVs (look Piwowar-Sulej, 2020), or monitor work efficiency and interactions between the most effective employees and teams (Kucharčíková et al., 2021). In turn, J.E. Agolla (2018) drew attention to such competences as social/interpersonal, related to action, domain ones, which are particularly important in the case of cooperation between human capital and Industry 4.0. So what one see here is a user-centered approach with focus on tasks and situations.

3. Research methodology

The article uses a critical analysis of the literature and a library query to develop the theoretical part, while the analysis of empirical data uses the methods of descriptive statistics. First, in order to explore the considerations undertaken in the literature, a library query was conducted on the Google Scholar website (more Lotko, 2022). Three phrases were searched on the website, namely: "human capital", "enterprise", and "effectiveness". The literature survey was conducted on October 20-21, 2022. The results from the first pages returned by the search engine were selected for the literature analysis. In total, 10 theoretical and theoretical-empirical studies were analyzed. Next, a qualitative analysis of the text was carried out. The obtained knowledge was compared with the results obtained by other researchers, which contributed to the expansion of knowledge in the discipline.

In the development of the empirical part, the only research method that was used was statistical analysis, which included the following elements:
- characteristics of the sample of selected features,
- analysis of a series of correlations examining the matching of features,
- analysis of the obtained results.

Public statistics were used as the source of the empirical data. The data was obtained from the European Statistical Office "Eurostat". The collected data was compiled using descriptive statistics. For this purpose, calculations of the average and the dynamics of changes in selected values and the trend function were used. In addition, the relationship between the selected

measures was examined with the help of the Pearson correlation. The obtained dependencies can be interpreted as strong, moderate, or weak. However, such an interpretation is arbitrary. It was assumed that the correlation strength: [r] < 0.2 – no linear relationship; 0.2 ≤ [r] < 0.4 – weak dependency; 0.4 ≤ [r] < 0.7 – moderate dependence; 0.7 ≤ [r] < 0.9 – quite strong dependence; and [r] ≥ 0.9 – very strong dependence.

4. Analysis of the results of the empirical study

The further part of the considerations was devoted to the analysis of statistical data of selected measures in the field of the effectiveness of enterprises in the Visegrad Group. First, the gross turnover of enterprises was discussed. They are presented in Table 1.

Table 1.
Gross turnover of enterprises from the industrial sector in the Visegrad Group against the EU average in 2016-2020 (in million euros)

	2016	2017	2018	2019	2020	Arithmetic average [in million euros]	Changes compared to 2016 [%]	Trend function
Czech Republic	160973.30	178105.90	189692.90	193964.70	174511.20	179449.60	108.41	8727.40
Hungary	102005.20	109581.70	115018.10	120423.40	111825.00	111770.68	109.63	117866.90
Poland	288672.30	321925.90	355226.80	372321.70	348759.10	337381.16	120.81	371495.00
Slovakia	72080.50	76382.20	82180.20	82432.00	74 767.30	77568.44	103.73	79853.12
V4	155932.83	171498.93	185529.50	192285.45	177465.65	176542.47	113.22	189312.90
UE average	248762.77	267777.78	285185.69	290605.34	260440.91	270554.50	108.76	279791.30

Source: Own elaboration and calculations after the Eurostat data.

The highest gross turnover of enterprises from the industrial sector in the Visegrad Group in 2016-2020 was recorded in Poland - on average it was EUR 337.38 billion; while the lowest average was observed in Slovakia, - EUR 77.56 billion. In terms of the growth rate of this indicator, the highest was recorded for Polish enterprises (20.81% - from EUR 288.67 billion in 2016 to EUR 348.75 billion in 2020). Hungarian enterprises recorded an increase by 9.63%, Czech enterprises by 8.41%, and Slovak enterprises by 3.73%. In turn, the V4 recorded an increase of 13.22%, i.e. by 4.46 p.p. more than the EU-27.

Table 2 presents the data related to the ratio of gross turnover of enterprises from the industrial sector in Poland to other countries in the Visegrad Group in 2016-2020.

Table 2.

The ratio of gross turnover of enterprises from the industrial sector in Poland to other countries in the Visegrad Group and the EU average in 2016-2020 (in %)

	2016	2017	2018	2019	2020	Trend function
Czech Rep.	55.76	55.33	53.40	52.10	50.04	50.40
Hungary	35.34	34.04	32.38	32.34	32.06	31.60
Poland	100.00	100.00	100.00	100.00	100.00	
Slovakia	24.97	23.73	23.13	22.14	21.44	21.30
V4	54.02	53.27	52.23	51.64	50.88	50.80
EU average	86.17	83.18	80.28	78.05	74.68	74.80

Source: Own elaboration and calculations after the Eurostat data.

It can be observed that in this respect Polish enterprises performed very well against the background of other V4 countries. They generated almost half as much gross turnover as Czech enterprises from the industrial sector (on average: 53.33%). Hungarian business entities obtained on average 33.23% of the turnover of Polish enterprises, while Slovak ones – 23.08%. The gross turnover of Polish enterprises from the industrial sector was also higher than the average values for the V4 and EU-27. Another analyzed indicator of the effectiveness of enterprises is the apparent work efficiency. The data are presented in Table 3.

Table 3.

Apparent labor productivity of enterprises from the industrial sector (gross value added per person employed) in the Visegrad Group against the EU average in 2016-2019 (in EUR thousand)

	2016	2017	2018	2019	2020	Arithmetic average [in thousands. euros]	Changed compared to 2016 [%]	Trend function
Czech Rep.	29.00	30.30	32.00	33.40	n/a	31.17	115.17	33.40
Hungary	29.50	31.90	32.90	33.10	n/a	31.85	112.20	33.60
Poland	24.80	26.50	27.90	29.60	n/a	27.20	119.35	29.60
Slovakia	26.90	28.10	28.90	28.20	n/a	28.02	104.83	28.70
V4	27.55	29.20	30.43	31.08	n/a	29.56	112.79	31.30
EU average	61.00	64.00	65.00	66.30	n/a	64.07	108.69	66.60

Legend: n/a - no data.

Source: Own elaboration and calculations after the Eurostat data.

The highest average indicator of apparent work efficiency of enterprises from the industrial sector was recorded in Hungary (EUR 31.85 thousand). The second in this respect were Czech business entities (EUR 31.17 thousand). The worst in this respect were economic entities from Poland, whose apparent labor productivity in the analyzed period amounted to an average of 27.2 thousand euro. However, it should be emphasized that Polish enterprises showed the fastest growth rate of this indicator (19.35%). Czech entities recorded a growth dynamics of 15.17%, Hungarian 12.20%, and Slovak 4.83%. Labor productivity was definitely higher in the EU-27 (EUR 64.07 thousand on average) than in the Visegrad Group (EUR 29.56 thousand). Then, the ratio of the apparent work efficiency of enterprises from the industrial sector in Poland to other countries of the Visegrad Group was analyzed (Table 4).

Table 4.
The ratio of the apparent labor productivity of enterprises from the industrial sector in
Poland to other countries of the Visegrad Group and the EU average in 2016-2019 (in %)

	2016	2017	2018	2019	2020	Trend function
Czech Rep.	116.94	114.34	114.70	112.84	n/a	112.90
Hungary	118.95	120.38	117.92	111.82	n/a	113.70
Poland	100.00	100.00	100.00	100.00	n/a	
Slovakia	108.47	106.04	103.58	95.27	n/a	97.00
V4	111.09	110.19	109.05	104.98	n/a	105.90
EU average	226.77	227.76	224.91	235.11	n/a	232.00

Legend: n/a – no data.

Source: Own elaboration and calculations after the Eurostat data.

Polish enterprises from the industrial sector showed the largest loss in this respect in relation to Hungarian entities (average loss of 17.27 p.p.). The loss to Czech economic entities was 14.7 p.p., while to Slovak ones it was 3.34 p.p., but in 2019 Polish enterprises had a higher apparent labor productivity index (by 4.73 p.p.) than Slovak ones. The ratio of apparent labor productivity of enterprises from the industrial sector in Poland was definitely lower than the EU-27 average in each analyzed year. In the course of the analysis, the data related to the gross operating index of enterprises from the industrial sector in the Visegrad Group were also approximated (Table 5).

Table 5.
Gross operating index of enterprises from the industrial sector in the Visegrad Group
compared to the EU average in 2016-2019

	2016	2017	2018	2019	2020	Arithmetic mean	Changes - compared to 2016. [%]	Trend function
Czech Rep.	11.30	10.30	9.70	9.50	n/a	10.20	84.07	9.30
Hungary	11.30	11.70	11.70	10.70	n/a	11.35	94.69	11.80
Poland	11.70	11.30	11.30	11.40	n/a	11.42	97.44	11.30
Slovakia	8.00	8.10	7.40	6.50	n/a	7.50	81.25	6.70
V4	10.60	10.30	10.00	9.50	n/a	10.12	90.08	9.60
EU average	9.80	9.80	9.60	9.50	n/a	9.70	96.94	9.50

Legend: n/a – no data.

Source: Own elaboration and calculations after the Eurostat data.

The highest average gross operating index in 2016-2019 was recorded by Polish enterprises from the industrial sector (11.42). Business entities from Hungary were not much worse in this respect (11.35); Czech entities generated an average gross operating ratio of 10.2, while Slovak entities generated 7.5. Unfortunately, in each analyzed case a decrease was recorded between 2016 and 2019. The highest drop was in Slovakia (-18.75%), while the lowest was in Poland (-2.56%). In line with the linear trend, the operating ratio will increase in Slovakia and Hungary (to 6.7 and 11.8, respectively), while in the case of the Czech Republic and Poland it will decrease (to 9.3 and 11.3, respectively). Comparing the gross operating index in the Visegrad Group with the EU-27 index, it can be observed that it was slightly higher in the V4.

As in previous cases, the ratio of the gross operating index of Polish enterprises from the industrial sector was examined compared to other countries in the Visegrad Group (Table 6).

Table 6.
Ratio of the gross operating index of Polish enterprises from the industrial sector compared to other countries in the Visegrad Group and the EU average in 2016-2019 (in %)

	2016	2017	2018	2019	2020	Trend function
Czech Rep.	96.58	91.15	85.84	83.33	n/a	82.50
Hungary	96.58	103.54	103.54	93.86	n/a	98.20
Poland	100.00	100.00	100.00	100.00	n/a	
Slovakia	68.38	71.68	65.49	57.02	n/a	59.60
V4	90.38	91.59	88.72	83.55	n/a	85.10
EU average	83.76	86.73	84.96	83.33	n.a	84.20

Legend: n/a – no data.

Source: Own elaboration and calculations after the Eurostat data.

In most cases, Polish enterprises were the leader in terms of the operating index. Only in 2017 and 2018 Hungarian entities showed a higher ratio than that describing Poland. In both cases, by 3.54 p.p. In general, Hungarian enterprises lost 0.62 pp to Polish enterprises. In the case of a difference between Czech and Polish enterprises, the difference was 10.78 pp, while between Slovak and Polish enterprises it was 34.36 pp. According to the calculations of the linear trend, only in the case of Slovakia the ratio of the gross operating ratio to Poland will increase to 59.6%.

The analysis of human capital issues in the Visegrad Group began with checking the LCI labor costs incurred by industrial enterprises in 2016-2020. The data are presented in Table 7.

Table 7.
Labor costs in industrial companies in the Visegrad Group countries compared to the EU average in 2016-2020

	2016	2017	2018	2019	2020	Arithmetic mean	Changes - compared to 2016 [%]	Trend function
Czech Rep.	4.20	8.40	8.70	8.70	5.00	7.00	119.05	7.40
Hungary	5.50	9.20	9.40	9.40	6.60	8.00	120.00	8.50
Poland	4.60	6.40	7.80	7.80	5.60	6.40	121.74	7.10
Slovakia	4.20	7.60	8.40	8.40	4.80	6.70	114.29	7.10
V4	4.60	7.90	8.60	8.60	5.50	7.00	118.92	7.50
EU average	1.80	2.40	2.70	3.00	2.30	2.40	127.78	2.80

Source: Own elaboration and calculations after the Eurostat data.

Based on the analysis of the data in Table 7, it can be seen that the highest average labor costs in 2016-2020 were incurred by industrial enterprises from Hungary (8.0 LCI). The second in this respect were economic entities from the Czech Republic (7.0 LCI). Slightly lower average labor costs were incurred by industrial enterprises from Slovakia (6.7 LCI). In terms of labor costs, the smallest burden in the V4 was borne by Polish enterprises (6.4 LCI). The fastest increase in LCI labor costs was observed in Poland (21.74%), while the slowest in Slovakia (14.29%), which in this case should be interpreted positively. Then, the ratio of LCI labor costs

in Polish enterprises from the industrial sector to enterprises in other countries of the Visegrad Group in the years 2016-2020 was examined (Table 8).

Table 8.
The ratio of LCI labor costs in Polish enterprises from the industrial sector to enterprises
from the industrial sector in the Visegrad Group countries and the EU average in 2016-2020

	2016	2017	2018	2019	2020	Trend function
Czech Rep.	91.30	131.25	111.54	111.54	89.29	102.20
Hungary	119.57	143.75	120.51	120.51	117.86	119.10
Poland	100.00	100.00	100.00	100.00	100.00	
Slovakia	91.30	118.75	107.69	107.69	85.71	97.80
V4	100.54	123.44	109.94	109.94	98.21	104.80
EU average	39.13	37.50	34.62	38.46	41.07	39.10

Source: Own elaboration and calculations after Eurostat data.

Only in two cases, LCI labor costs in Polish enterprises from the industrial sector were higher than in enterprises from the industrial sector in other countries of the Visegrad Group. This concerned the years 2016 and 2020, and specifically the situation observed in the Czech Republic and Slovakia. The highest difference was recorded in 2017 between Poland and Hungary. In the course of the analysis, the number of research and development personnel employed in enterprises from the industrial sector in the Visegrad Group countries in 2016-2020 was also examined (Table 9).

Table 9.
Research and development personnel employed in industrial companies in the Visegrad
Group countries compared to the EU average in 2016-2020 (thousands)

	2016	2017	2018	2019	2020	Arithmetic mean	Changes - compared to 2016 [%]	Trend function
Czech Rep.	336.00	358.50	359.00	360.90	360.10	354.90	107.17	365.00
Hungary	183.30	205.20	196.80	206.60	225.60	203.50	123.08	220.70
Poland	886.20	957.00	995.70	1 005.30	991.00	967.04	111.83	1018.60
Slovakia	121.40	125.40	137.50	151.10	166.80	140.44	137.40	163.70
V4	381.70	411.50	422.30	431.00	435.90	416.47	114.20	442.00
EU average	374.30	384.50	392.70	403.10	417.60	394.46	111.60	415.50

Source: Own elaboration and calculations after Eurostat data.

The largest number of research and development personnel employed in enterprises from the industrial sector was observed in Poland (967.04 thousand on average). This value was definitely higher than other countries, but it should be noted that these are absolute values. A definitely more reliable indicator would be at least comparing R&D personnel in relation to the number of inhabitants of a given V4 country, then the classification would be completely different. However, in the proposed analysis, due to the fact that absolute values provide a different type of knowledge, it was decided to use them. The highest dynamics of changes between 2016 and 2020 took place in Slovakia (37.40%), and the lowest in the Czech Republic (7.17%). Poland showed an increase in research and development personnel employed in industrial enterprises at the level of 11.83%. The ratio of research and development personnel

employed in Polish enterprises from the industrial sector to enterprises from other Visegrad Group countries in 2016-2020 was also analyzed (Table 10).

Table 10.
The ratio of research and development personnel employed in Polish enterprises from the industrial sector to enterprises from the Visegrad Group countries and the EU average in 2016-2020

	2016	**2017**	**2018**	**2019**	**2020**	**Trend function**
Czech Rep.	37.91	37.46	36.06	35.90	36.34	35.80
Hungary	20.68	21.44	19.76	20.55	22.76	21.70
Poland	100.00	100.00	100.00	100.00	100.00	
Slovakia	13.70	13.10	13.81	15.03	16.83	16.10
V4	43.07	43.00	42.41	42.87	43.98	43.40
EU average	42.24	40.18	39.44	40.09	42.14	40.80

Source: Own elaboration and calculations after Eurostat data.

The difference in the number of research and development personnel employed in Polish enterprises from the industrial sector in relation to enterprises from the Visegrad Group countries is visible - in favor of Polish enterprises (when absolute values are being analyzed). The highest difference was in Slovakia in 2017 (13.10 p.p.), and the lowest in Czech economic entities in 2016 (37.91 p.p.). The last researched indicator in the field of human capital was the number of unemployed with higher education in the Visegrad Group countries in 2016-2020 (Table 11).

Table 11.
Unemployed with higher education in the Visegrad Group countries against the EU average in 2016-2020 (in thousands)

	2016	**2017**	**2018**	**2019**	**2020**	**Arithmetic mean**	**Changes - compared to 2016 [%]**	**Trend function**
Czech Rep.	23.60	19.30	15.90	13.10	19.00	18.18	80.51	15.10
Hungary	20.90	18.90	17.80	19.50	24.30	20.28	116.27	21.80
Poland	183.90	141.90	119.70	121.90	121.10	137.70	65.85	108.60
Slovakia	35.20	27.10	21.20	18.20	26.00	25.54	73.86	20.10
V4	65.90	51.80	43.65	43.175	47.60	50.425	72.73	41.40
EU average	135.10	122.20	115.20	112.00	129.00	122.697	95.50	118.20

Source: Own elaboration and calculations after Eurostat data.

The highest number of unemployed with higher education in the analyzed period was in Poland in 2016; it was 183.9 thousand. people in the indicated year. The lowest rate was in the Czech Republic in 2019 and it was 13.1 thousand. unemployed with higher education. In the entire V4, the average number of unemployed with higher education in 2016-2020 was 50.43 thousand. people. Only in Hungary an increase of this indicator by 16.27% was observed. On the other hand, in Poland the number of the unemployed with higher education decreased the fastest (-34.15%). The ratio of the number of unemployed with higher education in Poland to the countries of the Visegrad Group in 2016-2020 was also analyzed (Table 12).

Table 12.
The ratio of the number of unemployed with higher education in Poland to the countries of the Visegrad Group and the EU average in 2016-2020

	2016	2017	2018	2019	2020	Trend function
Czechy	12.83	13.60	13.28	10.75	15.69	13.80
Węgry	11.36	13.32	14.87	16.00	20.07	19.10
Polska	100.00	100.00	100.00	100.00	100.00	
Słowacja	19.14	19.10	17.71	14.93	21.47	18.60
V4	0.56	0.66	0.74	0.79	0.99	37.90
Średnia dla UE	4.96	4.96	4.96	4.95	4.95	105.20

Source: Own elaboration and calculations after Eurostat data.

The ratio of the unemployed with higher education in Poland to other countries of the Visegrad Group exceeded 20% only in two cases. This concerned both cases of 2020, specifically Hungary (20.07%) and Slovakia (21.47%). The next step in the study was to analyze the relationship between the selected measures of organizational effectiveness and the measures of human capital. The first stage of the research concerned the determination of the relationship between the turnover of industrial enterprises and the selected measures of human capital. The obtained results are presented in Table 13 below.

Table 1.
Relationship between turnover and particular indicators of human capital

	Turnover and the unemployed with higher education	Turnover and research and development personnel	Turnover and labor costs
Czech Rep.	-0.98	0.81	0.83
Hungary	-0.26	0.47	0.86
Poland	-0.94	0.97	0.75
Slovakia	-0.94	0.25	0.87

Source: Own calculations.

When analyzing the relationship between the gross operating index and the number of unemployed with higher education, it can be seen that among the V4 countries only in Hungary a negative correlation was obtained, with a moderate strength of the relationship, i.e. $r = -0.48$. In the Czech Republic, Poland and Slovakia, the correlation was positive, with at least a strong relationship (in the case of the Czech Republic, even a very strong relationship). The relationship between the gross operating ratio and R&D personnel in each V4 country was characterized by a negative correlation result. In Hungary, there is no linear relationship ($r = -0.18$), while in other countries this relationship should be considered very strong (except for Poland, which was described by a fairly strong relationship). Also in the case of examining the relationship between the gross operating index and labor costs, negative values of the correlation coefficient were obtained for all V4 countries. In Hungary and Slovakia, the relationship turned out to be weak, respectively ($r = -0.21$; $r = -0.37$). On the other hand, in the Czech Republic, a strong correlation between the analyzed features was noted in this case, and in Poland the relationship should be interpreted even as very strong.

5. Discussion of the results

The obtained results allow to conclude that with the increase in the number of research and development personnel, the operational index decreases, which may be related to the fact that employment costs are high due to the high qualifications of R&D employees. Of course, enterprises can use various subsidies for research and development, however, S.-O. Daunfeldt et al. (2022) found no evidence that targeted R&D subsidy programs had any positive and statistically significant impact on the number of employees employed in these SMEs, or that subsidies are associated with an increase in demand for high-human capital workers. Interestingly, the study conducted by L. Lanahan et al. (2021) suggests that grants do not increase the employment of R&D personnel, as companies receiving grants look for external partners to implement the project.

The conducted analysis suggests that the operating index decreases with the increase in labor costs. Similar results were obtained by R. Chłąd (2012), who pointed out that a large share of remuneration costs in relation to the obtained revenues is reflected in the achieved income, the lower the income, the lower the income tax is paid, but also the lower the net profit. In addition, D.S. Hamermesh (2021) pointed out that higher labor costs, unaccompanied by technological changes that increase productivity, reduce the willingness of employers to hire workers and reduce the total amount of work performed in each economy. Less work means less production.

In addition, the obtained results suggest that the number of unemployed people with higher education increases along with the increase in the gross operating index. This situation may be the result of the fact that the education systems in the Visegrad Group produce too many people with higher education, which, in turn, may be related to the low quality of education in these countries. This theory may be supported by the fact that the best university from the Czech Republic, Charles University, was ranked 209th in the world ranking, while the next in the ranking was the University of Warsaw, which was ranked 342nd. In turn, the best Hungarian university, Loránd Eötvös University took 438th place, and the Slovak one, Comenius University was ranked the 765th place (Ranking WEB of Universities, 2022). A. Pelle and E. Kurczeleki (2016) paid particular attention to this problem.

6. Conclusions

Human capital is one of the most important resources of an organization in the fight to maintain/strengthen its competitive position and organizational effectiveness. The ability of enterprises to compete in highly competitive markets depends on the accumulation of

knowledge and skills of their employees. People are the ultimate resource of an organization, therefore there is no doubt that the ability of enterprises to compete in markets by creating value-added products and services depends on the accumulation of knowledge and skills of their employees, in other words, depends on the effectiveness of human capital. The analysis made it possible to achieve the assumed aim of the work and to verify both research hypotheses positively. In addition, it enabled the formulation of the following conclusions:

- along with the increase in the turnover of enterprises, the number of unemployed people with higher education decreases in each V4 country, and vice versa,
- the increase in the turnover of enterprises determined the increase in the number of research and development personnel in each country of the Visegrad Group (and vice versa),
- turnover of V4 enterprises turned out to be strongly correlated with labor costs,
- along with the decrease in the number of research and development personnel, the gross operating index of enterprises from the Visegrad Group increases,
- along with the decrease in labor costs, the gross operating index of enterprises from the Visegrad Group increases, and vice versa.

Identification of the strength of the relationship between the examined relationships may, at least partially, contribute to focusing on those activities that have the greatest impact on improving the situation of business entities in terms of their efficiency. However, due to the limitations encountered in the research process, it was unfortunately not possible to conduct a multi-faceted analysis. This noticed imperfection of the research results from the limitations, which primarily include:

- insufficient length of time series containing the attributes of human capital and enterprise efficiency,
- lack of current and complete statistical data, which results in a significantly reduced number of analyzed predictors.

The proposed considerations should be treated as an introduction to much deeper research in the future. Firstly, it is planned to extend the analysis by examining further predictors, especially in the field of:

- efficiency of enterprises (e.g. return on capital, assets, sales),
- staff education (share of adult learners, number of people with higher education employed in science and technology, number of scientists and engineers),
- intellectual property rights (number of applications for EU trademarks, number of applications for Community designs, number of patents granted).

Secondly, the directions of further research will include the extension of research facilities to other EU countries, as well as NUTS 2 regions forming the Visegrad Group. The aim of the intensified research will be an attempt to develop a few practical recommendations addressed especially to business entities.

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