DEVELOPMENT OF HUMAN CAPITAL IN THE REGIONS OF THE SR

Dana Jašková

Abstract

People are a key factor in the socio-economic development of the region. Human capital is a set of person´s abilities and skills, having direct impact social activity potential. Measuring and monitoring the development of human capital in the region is an important part of regional policy. Measuring the level of human capital is a difficult task, since human capital is a qualitative property of man. Links, correlations and causal links between the different human resource datasets should be sought. When measuring the level of human capital, it must be captured by a quantitative indicator. It would be subjective to express such a complex characteristic by one indicator. A more objective approach is to evaluate by means of several indicators that capture the essence of human capital. In this paper, the development of human capital in the regions of Slovakia is monitored using an aggregated, composite indicator. It is constructed using selected recommended indicators. Using multivariate statistical methods, weights are assigned to the indicators and aggregated into a composite indicator. The development of human capital is then compared with some socio-economic indicators.

Key words: Human capital, composite indicator, statistical methods

JEL Code: C34, C52, R23

Introduction

Nowadays, in the time of the knowledge economy, human capital represents increased attention in both public and academic areas. Human capital, knowledge and skills are more important to the economic prosperity of the region than physical capital. Private and public investment in human capital, in the form of education and training expenditure, accounts for more than 10 percent of national income in most OECD countries. Knowledge of human capital must therefore be in the interests of politicians, economists and development strategies. The definitions of human capital usually emphasize individual education, skills, abilities and knowledge of an individual, which increase the productivity of his economic activity. However, the concept of human capital is broader.

Human capital is the driving force of profit in the knowledge-based economy and is considered an essential element of intellectual capital. It has a positive impact on the economic development and quality of life in the region. (Männasoo et al., 2018). Human capital is

knowledge and experience. These are the skills of the workforce in the region, factors that create prerequisites or opportunities for people to innovate and increase productivity. Human capital affects economic growth and increases regional competitiveness. It affects the growth of other types of capital. (Lange et al., 2006; Vaitkevičius et al., 2015). Human capital statistics can help to understand the drivers of economic growth and the functioning of the labour market, as well as driving the path of sustainable development in the region.

Some studies define human capital as the individual's knowledge, skills, abilities and other characteristics. These are relevant to the economic activity of the region. Based on results from Conference of European Statisticians (CES) was established Force on Measuring Human Capital in 2013. The aim of the document is to promote the conceptual process of measuring human capital. The report recommends focusing on the following areas: researching the differences between the cost-based approach and the income-based approach; improving the quality of the data analysed, estimating the uneconomic return on human capital. At present, a robust method of financial valuation of human capital potential is preferred. It includes not only the total volume of human capital, but also its evolution over time. This is important information for sustainability monitoring.

Human capital contributes directly to the prosperity of society by increasing labour productivity, enabling faster technology adoption. Indirectly, the results of his work in other areas are important, such as improving the health level of the population, improving the quality of human relations, creating an environment of higher motivation and civic participation. Human capital in society also contributes to reducing crime. Investing in human capital helps to reproduce human capital itself.

Human capital can be divided into general and specific. By general human capital we mean universal abilities and skills that are usable in almost every human activity. Specific human capital is understood as special knowledge and special skills that are usable only in a particular field or activity.

Human capital has its specifics not only in the process of acquisition, but also in the process of exploitation and reproduction. When we talk about human capital and its content, it is also necessary to talk about education, which is part of the acquisition of human capital. Investments in education and human capital are the foundation of human and society-wide development. Education is a lifelong process, because nowadays practice requires not only school education, but also a continuous refinement of knowledge and skills. Education and practice are decisive factors contributing to the individual's personal development and social inclusion (Navickas et al., 2019). The importance of human capital is reflected in various areas.

It helps the individual to integrate into society, enables better orientation in society, in the system of legal norms, in the system of technical progress, flexibility in communication, in management, flexibility in acquiring new knowledge and its application in practice.

The presented article analyses the quantitative dimension of the value of human capital in the regions of Slovakia (NUTS 3) using an aggregated indicator. The years 2015 and 2018 are compared in order to assess the change in human capital potential in the regions under review.

1 Materials and methods

The definition of human capital is “knowledge, skills, competences and attributes embodied in individuals that facilitate the creation of personal, social and economic well-being”. Human capital is a complex concept, has many dimensions and can be obtained in different ways (at home, at school, at work, etc.). Human capital is intangible, its state not directly observable as physical capital reserves. Therefore, the estimation of human capital is indirect.

The conventional way of measuring human capital consists of three approaches. These approaches are based on outputs, costs and revenues. The proportion of enrolments, educational attainment, adult literacy and average length of schooling include output-based copper approaches. The cost-based approach is based on calculations of educational costs incurred. The latter approach is based on the income that an individual derives from the knowledge and skills acquired during the training program. Some authors associate human capital with visits to educational institutions. (Barro and Lee, 2000) attempted to measure the relationship between human capital and students "accumulated years of study" at an employable age. Other studies suggest a ratio between skilled adults and total adults to measure human capital stock in the national economy. The OECD uses the International Adult Literacy Survey (IALS), the ratio between literate adults and the total number of adults.

1.1 Measurement of human capital

To compare regions in terms of human capital quality, this phenomenon must be quantified. Some approaches to this issue have been mentioned in the previous section. At present, the methodology of constructing a composite indicator, which is called a composite indicator, is preferred. A detailed methodology for its construction was published by the OECD in 2008 (OECD, 2008). The OECD’s Handbook on Constructing Composite Indicators (Nardo

et al., 2005) describes different methodologies that can be applied to combine varied information into a QoL index and the difficulties associated with each part of the process.

A composite indicator (*CI*) is an indicator that is constructed from several indicators. They evaluate the region from different perspectives. The composite indicator should allow a more comprehensive, coherent and synthesizing view of the level of the region. (Minařík, 2013). Composite indicators which compare region performance are increasingly recognized as a useful tool in policy analysis and public communication. The number of *CI*s in existence around the world is growing year after year. Bandura (2008) cites more than 160 composite indicators.

Despite the growing interest, composite indicators represent a controversial object. The lack of a standard method of calculating it and, in particular, the presence of subjectivity involved in its method of construction, cause distrust. (Booysen, 2002). This raises questions: What is the overall phenomenon of the aggregated indicator; What sub-indicators should be included in its design; How they should be merged; What about missing data?

Aggregation fulfils the important purpose of comparing several regions. The development of the landscape can be monitored using a composite indicator. It summarizes and completes the view of such phenomena as human capital, social inclusion, knowledge economy, competitiveness. However, the summarizing process inevitably leads to a loss of basic information. If more than one indicator enters the aggregation, it may happen that the first country is better according to one indicator and the second one is better than another indicator. (Micklewright, 2001).

1.2 Properties of composite indicator

The evaluation of the human capital of the region is diverse, taking into account the purpose pursued, the choice of method and its correct application. The selection of indicators for their evaluation is also important. A key role is played by the way they are integrated into a single indicator and the subsequent correct interpretation of the results. The indicator must be significant, relevant, understandable, transparent, analytical, complete, internally comparable, and externally comparable. These requirements must be respected in their selection. The number of indicators should be neither small (distorted real situation) nor too large (loss of clarity and transparency of interpretation). Indicators must be regularly measured and officially published.

Logically, when assessing the human potential of regions, there is a need for an integrated approach to the issue being examined. This is related to the construction of the

composite indicator. There are currently several ways to calculate it. The construction of *CI* can be described by the following steps: creation of a theoretical framework, selection and combination of input indicators, assessment of their material significance, statistical characteristics, weighting, normalization, aggregation, relation to input indicators, visualization of results. Summary indicators have both advantages and disadvantages. They are discussed in detail by Saisana and Tarantola (2002).

1.3 Methods of construction of summary indicator

Methods of construction of the aggregate indicator can be divided into statistical-analytical methods, which are focused on the selection of input indicators and statistical-descriptive methods, which allow calculation of the aggregate indicator.

One-dimensional statistical methods provide an overview of the analysed indicators. Multidimensional methods are used in the construction of composite indicators to find the optimal number of input indicators, reduce them and reveal the similarity of the examined objects (cluster analysis, correlation analysis and analysis of main components).

The statistical-descriptive methods allow the computation of the aggregate indicator using aggregation techniques and the analytical-hierarchical process, which is based on different ways of determining weights for individual indicators in their aggregation.

Throughout this section, we will use the following designation: $y_{i,t}^{r}$ - the original value of the indicator *i*, of the region r in year t (2015, 2018), where $i = 1, \dots, n; (n = 13)$, I_i^t - normalized indicator value *i* in year *t*, $w_{i,\upsilon}$- weight associated with indicator *i*, υ=1,…,V means the method of determining the weight of the indicator, CI^t- value of composite indicator over time *t*. The following methods can be used to normalize input indicators: Normalisation based on interval scales, Standardisation z-scores, Min-Max, Distance to a reference, Methods for cyclical indicators and Percentage of annual differences over consecutive years.

The weight of the indicator can be determined by subjective methods, expert decision and Point method. Objective methods include methods (υ=1,…,7): Equal weighting (EW), Principal component analysis (PCA), Benefit of the doubt (BOD), Unobserved components models (UCM), Budget allocation process (BAP), Analytic hierarchy process (AHP), Conjoint analysis (CA.)

There is no uniform approach for aggregating individual indicators into one aggregate indicator. Saisana and Tarantola (2002) list several basic types of aggregation techniques that they consider as representative of the basic methods of aggregation. These methods are divided

according to the method of inclusion of input indicators into the calculation into linear, geometric and multicriterial. Aggregation methods also vary. While the linear aggregation method is useful when all individual indicators have the same measurement unit, provided that some mathematical properties are respected. Geometric aggregations are better suited if the modeller wants some degree of non-compensability between individual indicators or dimensions. The MCA method is recommended in the case when highly different dimensions are aggregated in the composite, as in the case of environmental indices that include physical, social and economic data.

The following table shows the compatibility between the different methods of aggregation and weighting:

Tab. 1: Compatibility between different methods

Weighing methods	**Aggregation methods**		
	Linear methods	*Geometric methods*	*Multicriterial*
EW	+	+	+
PCA/FA	+	+	+
BOD	+ (Min-Max)	-	-
UCM	+	-	-
BAP	+	+	+
AHP	+	+	-
CA	+	+	-

Source: OECD, 2008

2. The research results and discussion

Empirical analyses show different rates of human capital. 26 indicators from the World Bank's international data set (World Development Indicators) represent a representative example of quantifiable human capital rates. Selection of suitable indicators for further analysis is based on this database. Barro and Lee (2000) offer an expanded database based on a combination of basic demographic data and commonly used human capital rates. The Human Capital Index contains two horizontal themes—Learning and Employment—running across five vertical age group pillars of the Index. These two cross-cutting themes assess countries' success in developing people's skills and competences through learning and in deploying this acquired knowledge through productive employment. (The Human Capital Report, 2015)

For our purposes, the relevant indicators (Statistical Office of SR), which were officially published at the regional level of Slovakia, NUTS III, were selected. The comparison period

was 2015 and 2018. For the sake of comparability, some data have been recalculated to the population of the region in that period ($y_{9,r} - y_{13,r}$). Table 2 shows the input indicators:

Tab. 2: Input indicators

sign	Indicator name	Type	Unit
$y_{1,r}$	ratio of pupils to teachers - grammar school	min	%
$y_{2,r}$	ratio of pupils to teachers – secondary vocational school	min	%
$y_{3,r}$	ratio of pupils to teachers - primary school 1- 4	min	%
$y_{4,r}$	ratio of pupils to teachers - primary school 5 - 9	min	%
$y_{5,r}$	Crude birth rate	max	‰
$y_{6,r}$	Crude death rate	min	‰
$y_{7,r}$	Crude rate of natural increase of population	max	‰
$y_{8,r}$	Crude rate of migration	max	‰
$y_{9,r}$	Economically active population – basic and uneducated	min	‰
$y_{10,r}$	Economically active population – upper secondary	max	‰
$y_{11,r}$	Economically active population – tertiary (academic)	max	‰
$y_{12,r}$	Criminal offences	min	‰
$y_{13,r}$	Gross domestic expenditures on research and development	max	‰

Source: own processing

The input data were initially subjected to statistical analysis. Data consistency and multicollinearity were excluded. Given the different unit of data examined, they were normalized by the Min-Max method according to the relation:

$$I_i^r = \frac{y_{i,r} - y_{min}}{y_{max} - y_{min}} \qquad (1)$$

in case of positive scope and in case of negative scope of the indicator according to the relationship

$$I_i^r = \frac{y_{max} - y_{i,r}}{y_{max} - y_{min}} \qquad (2)$$

where x_{max} is a maximal value of i-th indicator and x_{min} is a minimal value of i-th indicator over the reporting period $t = 2015;\ 2018$.

The first EW method was used to determine the weights of each indicator. Using equal weighting method, the equal weight is calculated for each indicator:

$$w_{1,i} = \frac{1}{Q} \qquad (3)$$

where Q is number of indicators. In this case there is a risk that pillar with more indicators will have a higher influence in the composite indicator. But in our case is only one pillar. The main strength of the method is the simplicity. Subsequently, a composite indicator was calculated for each region using a linear aggregation method based on the following formula:

$$CI^t = \frac{\sum_{i=1}^{n} I_i^r . w_{1,i}}{\frac{\sum_{i=1}^{n}\sum_{r=1}^{R} I_i^r w_{1,i}}{T}} \qquad (4)$$

The composite indicator takes values around an average of 1. The higher the value, the better is the assessment of human capital in the region. Resulting values CI_r^t are in the following table:

Tab. 3: Composite indicator for individual regions

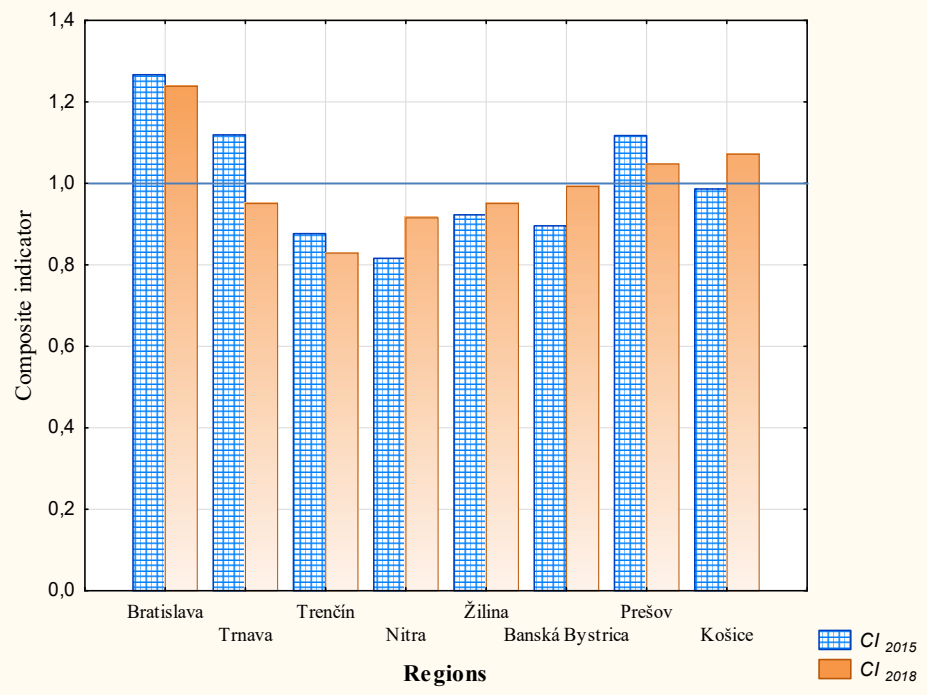
Region	***CI 2015***	***Rank 2015***	***CI 2018***	***Rank 2018***	***difference***
Bratislava	1,2666	1	1,2392	1	-0,0274
Trnava	1,1189	2	0,9509	6	-0,1680
Trenčín	0,8765	7	0,8294	8	-0,0470
Nitra	0,8159	8	0,9160	7	0,1001
Žilina	0,9227	5	0,9509	5	0,0282
Banská Bystrica	0,8959	6	0,9928	4	0,0970
Prešov	1,1173	3	1,0483	3	-0,0690
Košice	0,9862	4	1,0723	2	0,0862

Source: own computation

The first place in the evaluation of human potential is the Bratislava region, in 2015 and 2018. The Bratislava region has long been the best in most socio-economic analyses compared to other regions. Therefore, in some analyses it is not recommended to include in the joint evaluation. The second place in 2015 was the Trnava region. In three years the value of the constructed indicator decreased from the value $CI_{TT}^{2015} = 1{,}27$ to $CI_{TT}^{2018} = 1{,}24$. It is the largest decline among other regions. A negative shift occurred in most of the indicators examined. A significant decrease was recorded in the indicators $y_{10,TT}$ and $y_{12,TT}$. Trnava region fell from the second position to sixth. Overall, the region of Trenčín and Nitra was the worst. In particular, the values of demographic indicators decreased in the period under review, which has long been known for these regions. While CI_{TN} decreased, the value of CI_{NR} increased most of all monitored regions.

The comparison of the composite indicator, which quantifies the observed human potential in the region, is illustrated by the following bar graph.

Fig. 1 Comparison of human capital in regions of Slovakia



Source: own work

The value $CI_r^t = 1$ represents the average position of the region in comparison with the others. The value $CI_r^t < 1$ characterizes the region as below average. The regions of Trenčín, Nitra, Žilina and Banská Bystrica are below average in the long term. The Trenčín region recorded a decline over the period under review. In the other three regions, the value of human potential has increased. The Trnava region was ranked as an undervalued region from the 2015 above-average ranking. The Košice region was rated below average in 2015. In 2018 is his $CI_{KE}^{2018} > 1$, which means an above average rating. The increase occurred mainly in the number of teachers per pupil at all schools in the Košice region, the number of crimes decreased, the number of economically active population of higher education increased. Overall, it is not possible to state the development of human capital in the regions of Slovakia from the point of view of performed analysis and monitored indicators.

Conclusion

The proper assessment and exploitation of the potential of human capital is the basis for the development of the region. P When examining the development of the region, it is recommended to follow the indicators of three key areas. These are indicators of economic development, indicators of competitiveness, innovation and ecological efficiency and indicators

of the labour market. However, regional development in the socio-economic and environmental fields is not possible without good human capital. Human potential should also be taken into account when assessing regional disparities. One of the possibilities of assessing the region in terms of multiple human capital rates is through an aggregate, composite indicator.

Composite indicators as tool for a ranking of objects become more and more popular. The article evaluates the human capital of Slovakia´s region. It is constructed from thirteen indicators that are officially published for the regions of Slovakia. From the results it was possible to deduce some comparison of regions. Furthermore, the change in human potential in 2015 and 2018 was assessed. We concluded that based on the performed analysis, no significant development of human potential in the regions of Slovakia was shown. For this reason, it would be advisable to pay more attention to the issues raised from the point of view of regional policy.

References

Bandura, R. (2008). *A Survey of Composite Indices Measuring Country Performance*: Update. United Nations Development Programme – Office of Development Studies. Available at: https://www.undp.org/content/dam/undp/library/corporate/Development%20Studies/indices_2008_bandura.pdf

Barro, R. J., Lee, J. W. (2000). *International data on educational attainment updates and implications.* National Bureau of Economic research, Cambridge

Booysen, F. (2002). *An Overview and Evaluation of Composite Indices of Development.* Social Indicators Research. 59 (2), 115-151.

Guide on Measurong Human Capital. (2016). UNECE Task Force on Measuring Human Capital. United Nations, Geneva

Lange, F., Topel, R. (2006). The social value of education and human capita. In E. A. Hanushek, F. Welch. *Handbook of the Economics of Education,* 1Amsterdam: North Holland, 459 -509.

Männasoo, K., Hein, H., Ruubel, R. (2018). The contributions of human capital, R&D spending and convergence to total factor productivity growth. *Regional Studies*, 52 (12), 1598-1611.

Micklewright, J., Stewart, K. (2002). Poverty and social exclusion in Europe: European comparisons and the impact of enlargement. *New Economy*, 104-109.

Minařík, K., Borůvková, J., Vystrčil, M. (2013). *Analýzy v regionálním rozvoji.* Professiobnal Publishing, Příbram.

Nardo M, Saisana M., Saltelli A., Tarantola S., Hoffman A., Giovannini E. (2005). *Handbook on constructing composite indicators: methodology and user guide,* OECD Statistics Working Paper, Paris.

Navickas, V., Grenčíková, A., Španková, J. (2019). The Use of Social Media Job Search. *Mediterranean Journal of Social Sciences.* Vol 10 No 1.

OECD (2008). *Handbook on Constructing Composite Indicators. Methodology and User Guide.* Paris: Organisation for Economic Co-operation and development.

Saisana M., Tarantola, S. (2002). State-of-the-art report on current methodologies and practices for composite indicator development, EUR 20408 EN, European Commission-JRC: Italy.

Vaitkevičius, S., Čiutiene, R., Meiliene, E., Savanevičiene, A. (2015). Typology of Human Capital Development in EU countries. *Procedia Economics and Finance* 23, 1647 – 1648

https://databank.worldbank.org/reports.aspx?source=3698&series=HD.HCI.OVRL.UB.MA

The Human Capital Report 2015. *Employment, Skills and Human Capital Global Challenge Insight Report*. World Economic Forum

Contact

Dana Jašková

Alexander Dubček University of Trenčín, Faculty of Social and Economic Relations

Trenčianska univerzita Alexandra Dubčeka v Trenčíne

Študentská 2, 911 50 Trenčín, Slovenská republika

dana.jaskova@tnuni.sk