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Assessment of Human Capital Performance for E-7 and G-7 Countries Based on Topsis Method

E-7 ve G-7 Ülkelerinin Beşeri Sermaye Performansının Topsıs Yöntemi ile Değerlendirilmesi

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Abstract

Human capital, which is defined as an investment in human beings, is important in terms of economic development. In the changing and developing world, it is seen as an important tool for economic growth as well as social development. For this reason, the subject of human capital is an area that attracts the attention of academics. In this study, the performances of E-7 and G-7 countries on human capital have been tried to be measured. In this context, the variables that are thought to affect human capital for countries were evaluated using the TOPSIS (Technique for Order Preference by Similarity to Ideal Solution) technique. In addition, Spearman's rank correlation analysis was applied to determine the relationship between TOPSIS and HDI (Human Development Index) rankings. From the analysis results, it was determined that the country with the highest human capital performance was the USA, and the lowest country was India. In addition, as a result of investigating the relationship between the ranking made by the TOPSIS method and the ranking of HDI, it was determined that the rankings overlapped with each other in accordance with the expectation. In other words, it has been concluded that the human development of countries with high human capital performance is also successful.

Keywords: Human Capital, HDI, E-7 and G-7 Countries, TOPSIS.

Jel Codes: E24, O15, C44

Öz

İnsana yapılan yatırım olarak tanımlanan beşeri sermaye, ekonomik kalkınma açısından önem taşımaktadır. Değişen ve gelişen dünyada,

beşeri sermaye ekonomik büyüme yanında ekonomik gelişme için de önemli bir araç olarak görülmektedir. Bu nedenle beşeri sermaye konusu akademisyenlerin ilgisini çeken bir alandır. Bu çalışmada, E-7 ve G-7 ülkelerinin beşeri sermaye üzerindeki performansları ölçülmeye çalışılmıştır. Bu kapsamda ülkeler için beşeri sermayeyi etkilediği düşünülen değişkenler TOPSIS tekniği kullanılarak değerlendirilmiştir. Ayrıca TOPSIS ve İGE (İnsani Gelişmişlik Endeksi) sıralamaları arasındaki ilişkiyi belirlemek için Spearman'ın Sıralama Korelasyon analizi uygulanmıştır. Analizden elde edilen sonuçlara göre; beşeri sermaye performansı en yüksek olan ülkenin ABD, en düşük olduğu ülkenin ise Hindistan olduğu belirlenmiştir. Ayrıca TOPSIS yöntemi ile yapılan beşeri sermaye sıralaması ile İGE sıralaması arasındaki ilişkinin incelenmesi sonucunda, sıralamaların beklendiği gibi birbiriyle örtüştüğü tespit edilmiştir. Diğer bir deyişle, insan sermayesi performansı yüksek olan ülkelerin insani gelişiminin de başarılı olduğu sonucuna varılmıştır.

Anahtar Kelimeler: Beşeri Sermaye, İGE, E7 ve G7 Ülkeleri, TOPSIS

Jel Kodları: E24, O15, C44

Introduction

The term human capital came to be used by economists in the 1950s and 1960s who recognized the link between economic growth, income growth, and the level of workforce education. This concept has become widespread, especially with Theodore Schultz's two ground-breaking studies, "Investment in Human Capital" (Matei, and Ceche, 2018, p. 226) in 1961 and "The Economic Value of Education" in 1963. In the late 1980s and early 1990s, it became a more important concept. Previously, capital accumulation was largely evaluated in terms of physical aspects, but after that period, it began to be dealt with in an integrated manner with the productivity quality of individuals (Mehrotra, 2005, p. 300).

Human capital is expressed in the form of knowledge, skills, and health that people have accumulated throughout their lives. It is also the main driver of sustainable growth and poverty reduction. The development of human capital is associated with criteria including higher earnings for individuals, higher incomes for countries, poverty reduction, economic development, and stronger cohesion in societies (Anyanwu, and Erhijakpor, 2009; Worldbank, 2020). Ultimately, in the present knowledge economy, the success of modern companies also depends on human capital (Gamerschlag, and Moeller, 2011, p. 145). However, the human capital accumulation for each country is not the same (Sarwar *et al.*, 2012, p. 87).

The countries evaluated within the scope of this study are G-7 (USA, Japan, Germany, United Kingdom, France, Italy, and Canada) and E-7 (China, India, Brazil, Russia, Indonesia, Mexico, and Turkey) nations. After the oil crises in 1973, G-7 was first founded by the largest economies in the world, the USA, Germany, England, and France to be able to find solutions for contemporary economic problems. After they were joined in the same year by Japan and then in 1975 by Italy and lastly in 1976 by Canada, G-7 was set up as a platform to determine political approaches to global challenges (Baker, 2008, p. 104; Dilek, 2018, p. 2). E-7 countries are important in terms of being the largest emerging economies. G-7 countries, which are developed nations, are still 80% larger than E-7 countries. However, it is expected that the rapidly growing E-7 countries will grow by 3.8% on average between 2014 and 2050, while the G-7 countries are expected to grow by 2.1% (PWC, 2015, p. 6-9). If we look at the general characteristics of the E-7 countries, we observe low living standards, a weak industry, a fragile and uncertain economic outlook, and poor infrastructure. In developed countries, it is noteworthy that the GDP per capita is high, the industrialization and commercial infrastructures are developed, the living standards are high and the infrastructure is developed (Kowal and Roztocki, 2013, p. 1). As Barua (2021) states, emerging economies give priority to economic growth, while human capital is of secondary importance.

There are many studies in the literature on the contribution of human capital to economic performance (Schultz, 1993; Nafukho *et al.*, 2004; Barro and Lee, 1996; Benhabib and Spiegel, 1994; Lee, and Francisco, 2012; Wibowo; 2019). There are also studies that analyze human capital in terms of economic indicators using the TOPSIS method (Balcerzak, and Pietrzak, 2016; Chou *et al.*, 2019; Karbasian, Khayambashi, and Tavakoli, 2016; Masum *et al.*, 2019; Pietrzak and Balcerzak, 2016). However, according to our investigations, the only study which has investigated human capital with development and applied the TOPSIS method was conducted by Sieng and Yussof (2015). Although the aforementioned studies are very valuable, in our study, we analyzed the human capital data of the E-7 and G-7 countries. There are no studies that deal with E-7 and G-7 countries together. In this study, to determine the human capital performance in developed and developing countries, the human capital data of E-7 and G-7 countries were analyzed with the TOPSIS method. This aspect of the study is thought to contribute to the literature. In addition, we have analyzed the relationship between the ranking made by the TOPSIS method and the ranking made according to the Human Development Index (HDI) values of the countries in question.

Thus, the accuracy of the TOPSIS ranking has been tested, and it has become possible to evaluate in terms of development by making use of HDI data for emerging and developed countries

First of all, under the title of literature, we have examined various studies on the effects of human capital on economic growth and development and additionally, we have investigated other studies analyzed with the TOPSIS method based on human capital data. Then we have given the statistical methodology and the data set explanations that we have used throughout our analysis. The findings of the TOPSIS method, which was carried out under the title of empirical findings and discussion, were discussed and the most striking findings were shared in the conclusion section.

Literature

The subject of economic growth and development, which is the area of interest and work of economists, is also among the most important goals of countries. One of the most significant determinants of a nation's long-term economic success is well-equipped human capital. This success is achieved by using the talents and capacities of people more productively and efficiently (World Economic Forum, 2015, p. 3). There are studies that show human capital affects economic performance positively (Schultz, 1993; Chiu, 1998; Bloom ve Canning 2003; Nafukho *et al.*, 2004). For example, Barro and Lee (1996) concluded that education and life expectancy, which they accept as determinants of human capital, positively affect economic growth.

Benhabib and Spiegel (1994) concluded that total factor productivity is based on human capital accumulation. Again, Blundell *et al.* (1999) stated that human capital accumulation and education contribute to innovation and economic growth by increasing labor productivity. Lee (2001) emphasized the importance of increasing the quality and quantity of education and improving the role of the government in education in a way that can respond to changing demands. Human capital factors such as employee motivation, professional skills, and learning opportunities increase the knowledge support system and innovative ability (Dakhli ve Clercq, 2004; Lund Vinding, 2007; Zapata-Cantu, 2020).

Besides, there is a wide range of studies that draw attention to the importance of human capital for economic development and welfare. For example, Lee and Francisco (2012) emphasized the importance of increasing educational quality and secondary and tertiary education

participation rates for sustainable human development. Wibowo (2019) indicated that the quality of human capital has influenced the economic development of a country. As Acemoglu (2012) stated, human capital investment is effective in achieving faster and more equitable growth. In their study of China's economic growth, Fleisher, Li, and Zhao (2008) stated that investing in human capital is effective in eliminating the imbalance between regions as well as providing economic growth for the whole nation. Again, Amany and Ayomikun (2021) stated that human capital is effective in terms of the sustainable development of employees and societies.

There are also studies on human capital using TOPSIS analysis. For example, Sieng and Yussof (2015) tried to analyze the differences between developing and developed countries with the TOPSIS method, by determining the human capital performances of Malaysia and selected countries in the context of education. According to the results obtained, while Malaysia has a good position among Asian countries, it should make more efforts to catch up with developed countries. Masum *et al.* (2019) applied the AHP-TOPSIS Hybrid method for ranking human capital indicators in Bangladesh and concluded that strategy integration is the most important factor for ranking performance. In their research using the TOPSIS method in 24 EU countries between 2004-2010. Masca (2019) tried to analyze the human capital stock in the Middle East and North African Countries and Turkey with the TOPSIS method. According to the results obtained, Qatar, United Arab Emirates and Israel are in the top three in terms of human capital performance. Turkey ranks 13th among 17 countries.

Balcerzak and Pietrzak (2016) stated that the quality of human capital is more effective in the development of new member countries in the Union. Again, Pietrzak and Balcerzak (2016) analyzed the Quality of Human Capital Indicators and Total Factor Productivity with TOPSIS and panel methods in new EU countries between 2000 and 2010. The results confirmed that the influence of the quality of human capital on Total Factor Productivity is very important. Chou *et al.* (2019) analyzed human capital and competitiveness in Southeast Asian countries with the AHP-TOPSIS method. According to the results obtained, human resource competitiveness is the most important factor in achieving national competitiveness. In addition, Singapore, South Korea, and Taiwan have successful performances in this context. Karbasian, Khayambashi, and Tavakoli (2016) analyzed the human capital performance of the Malek-Ashtar University of Technology Departments with the TOPSIS

method and concluded that the most successful departments were the Department of Sciences, The Department of Electrical Engineering, and Material Engineering. Tavakoli, Esfahani, and Shirouyehzad (2013) state that human capital is very important in the development of organizations. They have concluded that the oil and gas engineering units are the most successful units in terms of human capital in the organization they analyzed with the TOPSIS method.

Data Set and Methodology

In this study, it is aimed to compare the E-7 and G-7 countries by ranking them according to their current performance in terms of variables expressing human capital. First, data on seven variables that determine the human capital of these countries were compiled from the World Bank database for the most recent year available, 2019. The variables in the research were included in the analysis as criteria determining the human capital of the countries in question. These indicators, which are expressed as criteria, are presented in Table 1 and their explanations are given in the following lines.

Table 1

Basic indicators that compose human capital

Criteria	Code	
Mean years of schooling	C1	max
Mortality rate, infant (per 1000 live births)	C2	min
Life expectancy at birth, total (years)	C3	max
Current health expenditure per capita (current US $)	C4	max
Unemployment, total (% of total labor force)	C5	min
Labor force participation rate, total (% of total population ages 15+)	C6	max
Individuals using the Internet (% of population)	C7	max

Mean years of schooling: Average number of completed years of education of a country's population aged 25 years and older, excluding years spent repeating individual grades.

Mortality rate, infant (per 1000 live births): Infant mortality is the death of an infant before his or her first birthday. The infant mortality rate is the number of infant deaths for every 1,000 live births.

Life expectancy at birth, total (years): Life expectancy at birth indicates the number of years a newborn infant would live if prevailing patterns of mortality at the time of its birth were to stay the same throughout its life.

Current health expenditure per capita (current US $): The amount that each country spends on health, for both individual and collective services.

Unemployment, total (% of total labor force): Share of the labor force that is without work but available for and seeking employment.

Labor force participation rate, total (% of total population ages 15+): Labor force participation rate is the proportion of the population ages 15 and older that is economically active: all people who supply labor for the production of goods and services during a specified period.

Individuals using the Internet (% of population): Internet users are individuals who have used the Internet (from any location) in the last 3 months.

TOPSIS Method

TOPSIS (Technique for Order Preference by Similarity to Ideal Solution) is a multiple criteria method that defines finite set of alternatives solutions developed by Hwang and Yoon (1981). While this method is widely applied in fields such as finance, logistics, engineering and management sciences, its applications are rarely encountered in the field of economics. While the ideal solution (positive ideal solution) is a solution that maximizes the benefit criteria and minimizes the cost criteria, the negative ideal solution (anti-ideal solution) is a solution that maximizes the cost criteria and minimizes the benefit (Wang, and Elhag, 2006, p. 310). The essential principle is that the selected alternative is to have the shortest distance from the positive ideal solution and the farthest distance from the negative ideal solution. The TOPSIS method offers two ''reference'' points, but it does not take the relative importance of the distances from these points into account (Jahanshahloo et al., 2006, p. 1377). The advantages of methodology include simplicity, good computational efficiency, ability to measure the relative performance for each alternative in a simple mathematical form and rationally comprehensibility (Hung, and Chen, 2009, p. 1).

In an MCDM problem, assume that there are n alternatives, $A_1,\ldots,A_n$ and m criteria between $C_1,\ldots,C_m$ All values assigned to alternatives according to each criterion form an $X=¿$ decision matrix. The TOPSIS procedure can be expressed with the following steps, including the relative weight

vector for the criteria that meet the $W=(w_1,\ldots,w_m)\quad \sum_{j=1}^{m} w_j=1$ condition.

Step 1: Decision matrix is normalized using the following equation, r_{ij} stands for normalized criteria value.

$$r_{ij}=\frac{x_{ij}}{\sqrt{\sum_{k=1}^{n} x_{ij}^2}} \tag{1}$$

Step 2: Weighted normalized decision matrix $V=¿$ is calculated w_j j.

shows the relative weight of the criterion and $\sum_{j=1}^{m} w_j=1$ is valid.

$$v_{ij}=w_j r_{ij} \qquad i=1,\ldots,n; \qquad j=1,\ldots,m \tag{2}$$

Step 3: The ideal and negative-ideal solutions are determined; in this case Ω_b ve Ω_c are the sets of benefit criteria and cost criteria, respectively.

$$A^{\square}=\{v_1^{\square},\ldots,v_m^{\square}\}=\left\{\left(\max_j v_{ij}\ \forall j\in\Omega_b\right)\left(\min_j v_{ij}\ \forall j\in\Omega_c\right)\right\} \tag{3}$$

$$A^{-}=\{v_1^{-},\ldots,v_m^{-}\}=\left\{\left(\min_j v_{ij}\ \forall j\in\Omega_b\right)\left(\max_j v_{ij}\ \forall j\in\Omega_c\right)\right\} \tag{4}$$

Step 4: The Euclidean distances of each alternative from the ideal solution and the negative-ideal solution are calculated respectively:

$$D_i^{\square}=\sqrt{\sum_{j=1}^{m} \square} \qquad i=1,\ldots,n \tag{5}$$

$$D_i^- = \sqrt{\sum_{j=1}^{m} \square} \qquad i = 1, \ldots, n \tag{6}$$

Step 5: The relative closeness of each alternative to the ideal solution is calculated. The relative closeness of the alternative A_i regarding to $A^{\square}$ is depicted as

$$RC_i = \frac{D_i^-}{D_i^{\square} + D_i^-}, \qquad i = 1, \ldots, n \tag{7}$$

Step 6: The alternatives according to the relative closeness to the ideal solution are ranked. The bigger the RC_i the better alternative A_i. The best alternative is the one which has the greatest relative closeness to the ideal solution.

Empirical Findings and Discussion

In this study, we compiled data for seven criteria that determine the human capital values of a total of fourteen countries. The data in question, which are the elements of the decision matrix that constitutes the first step of the analysis, are presented in Table 2.

Table 2

Data determining human capital

Countries/Criteria	C1	C2	C3	C4	C5	C6	C7
China	7.80	6.0	77.0	535.13	4.5	69.0	65.0
India	6.00	28.0	70.0	63.75	5.3	48.0	41.0
Russia	10.70	5.0	73.0	653.42	4.5	62.0	83.0
Brazil	7.58	13.0	76.0	853.39	3.5	63.0	74.0
Mexico	8.60	12.0	75.0	540.37	3.5	60.0	70.0
Turkey	7.60	9.0	78.0	396.47	14.0	53.0	74.0
Indonesia	7.98	20.0	72.0	120.12	3.6	68.0	48.0
Germany	14.13	3.0	81.0	5440.25	3.1	62.0	88.0
USA	13.41	6.0	79.0	10921.01	3.7	62.0	89.0
England	13.16	4.0	81.0	4312.89	3.7	63.0	93.0
Canada	13.8	4.0	82.0	5048.37	5.7	66.0	97.0

France	11.35	3.0	83.0	4491.74	8.4	55.0	83.0
Italy	10.16	3.0	83.0	2905.5	9.9	50.0	76.0
Japan	12.80	2.0	84.0	4360.47	2.4	62.0	93.0

When the data in Table 2 regarding the mean years of schooling, which is one of the determinants of human capital, are examined, it is seen that the longest education periods are in Germany, Canada, USA and England, and the shortest education periods are in India, Brazil, Turkey and China. The countries with the highest amount of current health expenditure per capita are USA, Germany and Canada, respectively, and the countries with the lowest expenditure levels are India, Indonesia and Turkey. According to the data in the table, the countries with the highest mortality rate of infants are India, Indonesia, Brazil and Mexico, while the countries with the lowest are Japan, Italy, France and Germany. Turkey is the 5th country with the highest rate in this variable ranking. Japan, France and Italy are the countries with the longest life expectancy at birth, while India, Indonesia and Russia are the shortest. Turkey, on the other hand, was in the middle in this ranking. While Turkey, Italy and France have the highest rates of unemployment, these rates are the lowest in Japan, Germany and Mexico.

In this study, before applying the TOPSIS method, weights were determined for the criteria by using the Entropy weighting method, one of the objective weighting methods. The findings obtained as a result of the Entropy method are as in Table 3.

Table 3

Entropy method findings

Countries/Criteria	C1	C2	C3	C4	C5	C6	C7
China	-0.157	-0.151	-0.187	-0.057	-0.168	-0.205	-0.170
India	-0.132	-0.341	-0.176	-0.010	-0.186	-0.163	-0.125
Russia	-0.192	-0.134	-0.181	-0.066	-0.168	-0.192	-0.198
Brazil	-0.154	-0.243	-0.185	-0.081	-0.142	-0.194	-0.184
Mexico	-0.167	-0.232	-0.184	-0.057	-0.142	-0.188	-0.178
Turkey	-0.154	-0.196	-0.188	-0.045	-0.312	-0.174	-0.184
Indonesia	-0.160	-0.301	-0.179	-0.017	-0.145	-0.203	-0.139
Germany	-0.227	-0.093	-0.193	-0.269	-0.131	-0.192	-0.205
USA	-0.220	-0.151	-0.190	-0.353	-0.147	-0.192	-0.206

England	-0.218	-0.115	-0.193	-0.238	-0.147	-0.194	-0.212
Canada	-0.224	-0.115	-0.194	-0.259	-0.195	-0.199	-0.217
France	-0.199	-0.093	-0.196	-0.243	-0.244	-0.178	-0.198
Italy	-0.186	-0.093	-0.196	-0.189	-0.266	-0.168	-0.187
Japan	-0.214	-0.069	-0.197	-0.239	-0.109	-0.192	-0.212
ej	0.987	0.883	0.999	0.805	0.948	0.998	0.991
dj	0.013	0.117	0.001	0.195	0.052	0.002	0.009
wj	**0.033**	**0.302**	**0.001**	**0.501**	**0.135**	**0.005**	**0.023**

According to the findings in Table 3, the Entropy method gave the highest weight to the current health expenditure per capita criterion and the lowest weight to life expectancy at birth. The criterion of current health expenditure per capita with the highest weight was followed by the criteria of the mortality rate of infants, unemployment total, mean years of schooling, individual using the Internet, labor force participation rate, and life expectancy at birth, respectively. Therefore, the most important criterion in the ranking to be made with the TOPSIS method will be the criterion of current health expenditure per capita and the least important criterion will be the criterion of life expectancy at birth. The matrix and positive and negative ideal solution values obtained as a result of the normalization and standardization of the decision matrix created in the first stage of the TOPSIS method are given in Table 4 after the criterion weights are determined.

Table 4

Weighted normalized matrix and positive and negative ideal solution values

Countries/ Criteria	C1	C2	C3	C4	C5	C6	C7
China	0.00643	0.04523	0.00287	6.69235	0.01512	0.00903	0.03760
India	0.00495	0.21108	0.00261	0.79726	0.01780	0.00628	0.02372
Russia	0.00882	0.03769	0.00272	8.17169	0.01512	0.00812	0.04802
Brazil	0.00625	0.09800	0.00283	10.67252	0.01176	0.00825	0.04281
Mexico	0.00709	0.09046	0.00280	6.75788	0.01176	0.00785	0.04050
Turkey	0.00627	0.06785	0.00291	4.95826	0.04703	0.00694	0.04281
Indonesia	0.00658	0.15077	0.00268	1.50222	0.01209	0.00890	0.02777
Germany	0.01165	0.02262	0.00302	68.03591	0.01041	0.00812	0.05091
USA	0.01106	0.04523	0.00294	136.57845	0.01243	0.00812	0.05149

England	0.01085	0.03015	0.00302	53.93712	0.01243	0.00825	0.05380
Canada	0.01138	0.03015	0.00306	63.13505	0.01915	0.00864	0.05612
France	0.00936	0.02262	0.00309	56.17382	0.02822	0.00720	0.04802
Italy	0.00838	0.02262	0.00309	36.33626	0.03326	0.00654	0.04397
Japan	0.01055	0.01508	0.00313	54.53216	0.00806	0.00812	0.05380
A+	0.01165	0.01508	0.00313	136.57845	0.00806	0.00903	0.05612
A-	0.00495	0.21108	0.00261	0.79726	0.04703	0.00628	0.02372

Among the values in Table 4, it would be appropriate to comment on a few criteria that were given the highest weight as a result of Entropy method calculations, since they affect the ranking obtained as a result of the TOPSIS method. In this context, considering the current health expenditure per capita criterion, USA represents the positive ideal solution value and India represents the negative ideal solution value. Therefore, in terms of this criterion, USA is the country with the highest performance and India is the country with the lowest. Turkey is in the 3rd place from the last with 4,958265 points. The country with the best performance in terms of mortality rate of infants was Japan and the country with the lowest performance was India. Turkey is in the 5th place from the bottom in this ranking. In terms of total unemployment, Japan is the best performing country and Turkey is the lowest performing country. When the mean years of schooling criterion is taken into account, Germany represents the positive ideal solution value and India represents the negative ideal solution value. In terms of this criterion, while Germany is the country with the highest performance and India is the country with the lowest, it is observed that Turkey ranks 3rd from the bottom with a score of 0.00627. The ranking of the countries in terms of the criteria taken into consideration is given in Table 5 as a result of the findings obtained using TOPSIS method.

Table 5

Si, Si- and Ci+ values and ranking*

Countries	**Ranking**	**Si***	**Si-**	**Ci***
USA	1	0.03084	135.78130	0.99977
Germany	2	68.54253	67.23893	0.49520
Canada	3	73.44340	62.33807	0.45911
France	4	80.40463	55.37689	0.40784
Japan	5	82.04629	53.73528	0.39575

England	6	82.64133	53.14019	0.39137
Italy	7	100.24219	35.53951	0.26174
Brazil	8	125.90596	9.87599	0.07273
Russia	9	128.40676	7.37658	0.05433
Mexico	10	129.82059	5.96197	0.04391
China	11	129.88610	5.89753	0.04343
Turkey	12	131.62020	4.16351	0.03066
Indonesia	13	135.07629	0.70842	0.00522
India	14	135.78133	0.02922	0.00022

In Table 5, the distances to the positive and negative ideal points and the relative closeness values to the ideal solution are given for the countries. In addition, countries are ranked according to their relative closeness values to the ideal solution. When these values are examined, it is seen that the country in the best situation in terms of human capital performance is the USA, followed by Germany, Canada, and France. It has been determined that the countries with the lowest performance are India, Indonesia, Turkey, and China, respectively. High levels of current health expenditure per capita, low levels of the mortality rate of infants, and unemployment total contributed positively to the effective performance of the countries. It has been determined that the G-7 countries are at the top of the ranking, as expected, while the E-7 countries are located in the lower ranks. In order to investigate the accuracy of the ranking made with the TOPSIS method, the comparison with the ranking made according to the HDI[2] score is given in Table 6.

Table 6

TOPSIS and HDI ranking

	TOPSIS	**HDI**	
Countries	**Rank**	**Index**	**Rank**
China	11	0.761	12
India	14	0.645	14
Russia	9	0.824	8
Brazil	8	0.765	11
Mexico	10	0.779	10

2 The United Nations Development Program emphasizes with HDI that "people and their abilities should be the ultimate criterion, not economic growth alone, to evaluate a country's development" (UNDP, 2019).

Turkey	12	0.82	9
Indonesia	13	0.718	13
Germany	2	0.947	1
USA	1	0.926	4
England	6	0.932	2
Canada	3	0.929	3
France	4	0.901	6
Italy	7	0.892	7
Japan	5	0.919	5
Spearman rho	**0.890**	**p_value**	**0.000**

In Table 6, the results of Spearman's rank correlation analysis performed to determine the relationship between these two rankings are also presented. When these results are examined, it is seen that Spearman's rank correlation coefficient was calculated as 0.890 and it was statistically significant. These values indicate that there is a strong positive correlation between ranking using the TOPSIS method and ranking based on HDI scores. The findings can be interpreted as the ranking made is consistent with the HDI ranking.

These results from the pre-findings of the study are consistent with previous empirical studies. For instance, in their study, Sieng and Yussof (2015) state that Malaysia's human capital performance is at the same level as that of middle-developed Asian countries, but it is important to invest in human capital in order to close the gap with developed countries. Pietrzak and Balcerzak (2016) concluded that the effect of human capital quality on Total Factor Productivity in Central European countries is positive, especially in new member countries. Similarly, Masum et al. (2019) indicate that human capital plays a significant role in the field of economic growth. They also state that it is very important for developing countries to make progress, especially in human capital and knowledge-based economy.

In this study, as a result of the analysis made in terms of HDI, which is accepted as an important indicator of development with HCI, it is concluded that the performance of HCI is in line with HDI and that the performance of E7 countries is lower than that of G7 countries. In this direction, it can be said that it may be important for emerging economies to invest in human capital to increase the level of welfare.

Conclusions

The importance of human capital investments is recognized by everyone. On the other hand, economic growth alone is not enough to increase the welfare level of a society. Since the priority of states is social benefit and welfare, the importance of investing on individual citizens is increasing. In this research, human capital data of fourteen E-7 and G-7 member countries for 2019 were analyzed with the TOPSIS method. Within the scope of the analysis, seven variables known to determine human capital were taken into account as decision criteria and a performance ranking was tried to be made for the related countries. From the results of the analysis, it was determined that the country with the highest human capital performance was USA, and the lowest country was India. It has been understood that Germany, Canada and France are the countries with high performance, while Indonesia, Turkey and China are among the countries with the lowest performance. In addition, as a result of the investigation of the relationship between the ranking made by the TOPSIS method and the HDI ranking, it was determined that the rankings overlapped with each other in accordance with the expectation.

In line with the results obtained, it is possible to say that countries that are successful in terms of human capital performance have the same performance in terms of development levels. Germany, England, Canada, USA, and Japan are in the top 5 places in the HDI ranking, while India, Indonesia, China, Brazil and Mexico are in the last 5 places, and Turkey followed Mexico. However, although many of these countries have a problem of lack of financing, sometimes their political priorities may change. As Tsauri (2018) also stated in his study, the investments of emerging economies in the fields of frastructural development, financial development, trade openness and Foreign Direct investment can also contribute to human development. However, human capital accumulation, which has been hard-won in many economies, is at risk of erosion due to the COVID-19 pandemic. This situation adversely affects especially the poor and vulnerable nations. It is important to take urgent measures in this area. Policy measures in the fields of health, education and social protection can enable today's generation to overcome the difficulties of the past (Worldbank, 2020). Emerging economies should review and intensify their human capital policies, priority should be given to the human within the framework of social state responsibility, and they should be conscious that economic growth without improving the living standards of the poorest people means little.

Declaration

In all processes of the article, TESAM's research and publication ethics principles were followed.

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References

Acemoglu D. (2012). What does human capital do? A review of Goldin and Katz's The race between education and technology[J]. *Journal of Economic Literature, 50*(2), 426-463.

Amany, E. and Ayomikun, I. (2021). Crowdwork as an elevator of human capital. A sustainable human development perspective. *Scandinavian Journal of Information Systems, 33*(2), 103-136.

Anyanwu, J. C. and Erhijakpor, A. E. O. (2009). Health expenditures and health outcomes in Africa. *African Development Review, 21*(2), 400-433.

Barua S. (2021). Human capital, economic growth, and sustainable development goals: An evaluation of emerging economies. In: Shahbaz M., Mubarik M.S., Mahmood T. (Eds.) *The Dynamics of Intellectual Capital in Current Era*. Singapore: Springer.

Barro, R.J. and Lee, J.W. (1996). International measures of schooling years and schooling quality. *The American Economic Review, 86*(2), 218-223.

Bloom, D. E and Canning, D. (2003). Health as human capital and its impact on economic performance. *The Geneva Papers on Risk and Insurance. 28*(2), 304-315.

Blundell, R., Dearden, L., Meghir, C. and Sianesi, B. (1999). Human capital investment: the returns from education and training to the individual, the firm and the economy. *Fiscal Studies, 20*(1), 1-23.

Benhabib, J. and Spiegel, M. M. (1994). The role of human capital in economic development evidence from aggregate cross-country data.

Journal of Monetary Economics, 34(2).143-173.

Baker, A. (2008). The group of seven. *New Political Economy, 13*(1), 103-115.

Balcerzak, A.P. and Pietrzak, M.P. (2016). TOPSIS analysis of changes of quality of human capital in european union countries. In I. Simberova, O. Zizlavsky and F. Milichovsky (Eds.). *ICEM 2016 International Scientific Conference Economics and Management. Smart and Efficient Economy: Preparation for Future Innovative Economy* (pp. 80-85). 21 International Scientific Conference. Proceedings of Selected Papers. Brno.

Chiu, W.H. (1998). Income inequality, human capital accumulation and economic performance. *The Economic Journal, 108*(446), 44–59.

Chou, Y.-C., Yen, H.-Y., Dang, V. T. and Sun, C.-C. (2019). Assessing the human resource in science and technology for Asian Countries: Application of fuzzy ahp and fuzzy topsis. *Symmetry, 11*(251), 1-16.

Dakhli, M. and Clercq, D. D. (2004). Human capital, social capital, and innovation: a multi-country study. *Entrepreneurship and Regional Development, 16*(2), 107-128.

Dilek, Ş. (2018). G7 zirvesinde çatırdayan batı ittifakı. *SETA Perspektif, 202*, 1-5.

Fleisher, B. M.; Haizhen, L., and Zhao, M. Q. (2008). Human capital, economic growth, and regional inequality in China. IZA Discussion Papers, No. 3576, Institute for the Study of Labor (IZA), Bonn, http://nbn-resolving.de/urn:nbn:de:101:1-2008071112.

Gamerschlag, R. and Moeller, K. (2011). The positive effects of human capital reporting. *Corporate Reputation Review, 14*(2), 145–155.

Hung, Chia C., Chen and Liang H. (2009). A fuzzy topsis decision making model with entropy weight under intuitionistic fuzzy environment, Proceedings of the International Multi Conference of Engineers and Computer Scientists, Vol. 1, IMECS 2009, March 18 - 20, Hong Kong.

Hwang, C.L.and Yoon, K. (1981). Multiple attribute decision making: methods and applications: A state-of-the-art survey. New York: Springer-Verlag

Jahanshahloo, G. R., Lotfi, F. H., and Izadikhah, M. (2006). An algorithmic method to extend topsis for decision-making problems with interval data. *Applied Mathematics and Computation, 175*(2), 1375-1384.

Karbasian, M., Khayambashi, B. and Tavakoli, M. M. (2016). Performance evaluation of education system with human capital approach by data envelopment analysis and topsis-with a case study. *International Journal of Management in Education, 10*(4), 414-432.

Kowal, J., and Roztocki, N. (2013). Information and communication technology management for global competitiveness and economic growth in emerging economies. *The Electronic Journal of Information Systems in Developing Countries, 57*, 1–12.

Lee, J.-W., (2001). Education for technology readiness: prospects for developing countries. *Journal of Human Development 2*(1), 115–151.

Lee, J.-W., and Francisco, R. (2012). Human capital accumulation in emerging Asia, 1970–2030. *Japan and the World Economy, 24*(2), 76–86.

Lund Vinding, A. (2006). Absorptive capacity and innovative performance: A human capital approach. *Economics of Innovation and New Technology, 15*(4-5), 507-517.

Masca, M. (2019). A comparison of Turkey's human capital stock with some selected mena countries by topsis method. *International Journal of Business and Economic Affairs, 4*(1), 21-30.

Masum, A. K. M., Karim, A.N.M. R,. Bin Al Abid, F., Islam, S. and Anas, M. (2019). A New hybrid ahp-topsis method for ranking human capital indicators by normalized decision matrix. *Journal of Computer Science, 15*(12), 1746-1751.

Matei, A. and Ceche, R. (2018). Assessment of human capital and development. Contributions from Structural Funds, Proceedings of the 5-th ACADEMOS Conference, 226-231.

Mehrotra, S. (2005). Human capital or human development? Search for a knowledge paradigm for education and development. *Economic and Political Weekly, 40*(4), 300-306.

Nafukho, F. M., Hairston, N., and Brooks, K. (2004). Human capital theory: Implications for human resource development. *Human Resource Development International, 7*(4), 545-551.

Pietrzak, M. B. and Balcerzak, A. P (2016). Quality of Human Capital and Total Factor Productivity in New EU Member States. In T. Loster and T. Pavelka (Eds.), *The 10th International Days of Statistics and Economics Conference Proceedings* (pp. 1492-1501). September 8-10, 2016. Prague:

Libuse Macakova, Melandrium.

PWC (2015). The World in 2050 Will the shift in globaleconomic power continue? Access date: 28.03.2023, https://www.pwc.com/gx/en/issues/the-economy/assets/world-in-2050-february-2015.pdf.

Sarwar, A., Khan, M. A., Sarwar, Z. and Khan, W. (2021). Financial development, human capital and its impact on economic growth of emerging countries, *Asian Journal of Economics and Banking, 5*(1), 86-100.

Schultz, T. W. (1993). The economic importance of human capital in modernization. *Education Economics, 1*(1),13-19.

Sieng, L.W. andYussof, I. (2015). Comparative study of Malaysia human capital with selected ASEAN and developed countries: A fuzzy topsis method. *Malaysia Journal of Society and Space, 11*(6), 11- 22.

Tavakoli, M. M., Esfahani, A. N. and Shirouyehzad, H. (2013). Ranking organisational units with a human capital management approach using fuzzy topsis: A case study. *International Journal of Services and Operations Management, 16*(2), 205 – 224.

Tsaurai, K. (2018). Investigating the determinants of human capital development in emerging markets. *International Journal of Education Economics and Development, 9*(2), 172- 181.

UNDP (2019). Human Development Reports, Access date: 20.02.2023, http://hdr.undp.org/en/ content/human-development-index-hdi.

Wang, Y. M., and Elhag, T. M. S. (2006). Fuzzy topsıs method based on alpha level sets with an application to bridge risk assessment. *Expert Systems with Applications, 31*(2), 309-319.

Wibowo, M.G. (2019). Human capital relation with welfare in Indonesia and Asean Countries. *Economics Development Analysis Journal, 8*(1), 81-93.

World Economic Forum (2015). The Human Capital Report 2015, Access date: 18.02.2023, https://www3.weforum.org/docs/WEF_Human_Capital_Report_2015.pdf.

World Bank. (2020). The Human Capital Index 2020 Update: Human Capital in the Time of COVID-19. World Bank, Washington, DC. Access date: 16.03.2023, https://openknowledge.worldbank.org/handle/10986/34432 License: CC BY 3.0 IGO

Zapata-Cantu, L. (2021). Boosting innovation in emerging markets: the moderating role of human capital. *International Journal of Emerging Markets, 16*(3), 604-624.