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A Comparison of Turkey's Human Capital Stock with Some Selected Mena Countries by Topsis Method

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Abstract: The paper provides a comparison of Turkey with the Middle East and North Africa (MENA) countries in terms of human capital stock by using TOPSIS method. MENA acronym generally refers to the region spanning horizontally from Morocco to Iran. Due to the lack of data Libya, Syria and Palestine are omitted in the study. In the comparison of countries, the Technique for Order Preference by Similarity to Ideal Solution (TOPSIS), which is one of the Multi-Criteria Decision Making (MCDM) methods, has been applied. The infant mortality rate (per 1,000 live births), unemployment rate (percentage of the total workforce), life expectancy at birth, total (years), labour force participation rate (percentage of the total population between 15-64), current health expenditure (percentage of GDP), internet users (percentage of the total population) and population between 15-64 years (percentage of the total population) have been used as the indicators of human capital stock of each country in the study. The data of the countries in 2005, 2010 and 2015 have been used for comparison. The analysis period was terminated in 2015 since no data for the countries were available for the next turn from this date. Qatar, United Arab Emirates and Israel are the countries that share the first three ranks with the highest human capital performance, and Iraq and Yemen are the countries with the lowest human capital performance in all the examined years. Turkey was in the 13th rank among 17 countries in 2005. However, it rose to the eighth rank in 2010 and 2015. Iraq and Yemen, which are the countries most disadvantaged in terms of human capital, should make comprehensive reforms in these subjects and increase the quality of human capital rapidly to grow economically in the future.

Keywords: Human capital, Economic growth, TOPSIS method, Multi criteria decision making techniques.

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INTRODUCTION

Human capital refers to knowledge and skills that people have and may create economic value. A nations human capital endowment can be almost the more important determiner of long-term economic accomplishment than all other sources. It is possible to raise a countrys national income using human capital effectively and developing it. Because human capital is both highly important for the productivity of society and for the operation of political, social and civil institutions. Less developed and developing countries can improve their human capital along with the physical capital to provide potential for their future economic growth. These countries need educated and healthy people for the improvement of human capital.

Empirical studies about human capital show that investment to human capital has many positive effects on economy. For example, it increases productivity in both the agricultural and industrial sectors, leads more equitable income distribution, provides employment opportunities, and eliminates regional inequalities and so on (Bizon, 2016; Eser, Gökmen, & Gökmen, 2009; Wasike, 2017). Current state of the human capital of a country gives an idea and to understand its capacity for the future growth potential

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of the country. A comparison of a country with the other similar countries in terms of human capital will be beneficial to see its place among the countries in the same group.

In this study, Turkeys human capital will be compared with MENA countries and a ranking will be made. MENA acronym generally refers to the region spanning horizontally from Morocco to Iran. MENA countries, most commonly used can be listed as follows: Algeria, Bahrain, Egypt, Iran (Islamic Republic of), Iraq, Israel, Jordan, Kuwait, Lebanon, Libya, Morocco, Oman, Qatar, Saudi Arabia, State of Palestine, Syrian Arab Republic, Tunisia, United Arab Emirates and Yemen. Due to the lack of data Libya, Syria and Palestine are omitted in the study. The TOPSIS method, which is one of the multi-criteria decision-making techniques, will be used for this purpose. The data for the countries used the study include 2005, 2010 and 2015 years. No data are available for years later 2015.

THE METHOD OF THE STUDY

In the study, the TOPSIS method has been used. The TOPSIS acronym refers to Technique for Order Preference by Similarity to Ideal Solutions. This method which is one of the MCDM methods was originally created by Hwang and Yoon (1981) and later developed by Lai, Liu, and Hwang (1994) and Yoon and Hwang (1995). The TOPSIS method makes the alternatives possible to be ranked considering the relative closeness to the best solution (ideal solution) and presents a ranking to the decision makers. The method ranks the alternatives relating to superiority relation according to the shortest distance from the ideal solution and the farthest distance from the worst solution with the help of Euclidean distance (Opricovic & Tzeng, 2004; Rainarli & Aaron, 2015). The TOPSIS method has some advantages given as follows (Özden, 2011):

- Its content is simple and understandable.
- It has strong calculation capability.
- Since numerical values can be used, a good view can be obtained about the differences between the alternatives and how the criteria differ from each other.
- It presents a simple mathematical form when determining the relationship between decision alternatives.
- It allows the comparison of alternatives between the maximum and minimum values that can be taken according to certain criteria and according to the ideal situation.
- It can be applied directly to data without qualitative conversion.
- It is an easy-to-implement method that has robust-based logic structure and considers positive-ideal and negative-ideal solutions at the same time.

An attractive aspect of this method is that it contains very limited subjectivity. The only subjective point in the method is the weights given to the criteria. A standard TOPSIS implementation is completed in seven steps (Janic, 2003). It is possible to explain these steps and the processes to be carried out at each step as follows (Feng & Wang, 2001).

Step 1: Creating a Decision Matrix

In this step, it is determined which alternatives will be ranked and which criteria are to be used. Alternatives (a1, a2, am) to be ranked take place in the rows and the evaluation criteria (X1, X2, Xn) to be used for decision making are placed in the columns of decision matrix. It is possible to show the decision matrix with the help of a table as follows:

Table 1: Data Analysis and Techniques

Alternative	Criteria			
	X_1	X_2	$\cdots$	X_n
a_1	X_{11}	X_{12}	$\cdots$	X_{13}
a_1	X_{21}	X_{22}	$\cdots$	X_{23}
$\vdots$	$\vdots$	$\vdots$		$\vdots$
a_1	X_{31}	X_{32}	$\cdots$	X_{33}

Step 2: Normalization of Criterion Values

In the second step, the matrix is normalized by taking the square root of the sum of the points or characteristics (Xij) of the evaluation criteria in the decision matrix. Equation 1 is used for this process:

$$r_{ij} = \frac{X_{ij}}{\sqrt{\sum_{m}^{i=1} X_{ij}^2}} \tag{1}$$

In this formula where i is the alternative to be listed, j is the jth evaluation criteria, rij is the criterion value after normalization of the ith alternative and jth evaluation criteria, Xij is the original value of criteria for the ith alternative and jth evaluation criteria and, m shows the number of alternatives. The normalized R decision matrix is generated using Equation 2:

$$R_{ij} = \begin{bmatrix} r_{11} & r_{12} & \cdots & r_{1n} \\ r_{21} & r_{22} & \cdots & r_{2n} \\ \vdots & \vdots & \vdots & \vdots \\ r_{m1} & r_{m2} & & r_{mn} \end{bmatrix} \tag{2}$$

Step 3: Weighted Normalization of Values

In this step, normalized values are multiplied by the weight of each criterion. In the choice or ordering of alternatives, the weight (importance) of the criteria on the decision may differ. In addition, the weights given to the criteria may vary from person to person (Opricovic & Tzeng, 2003). Thus, in order to determine the weights well, the opinions of the experts or individuals can be consulted. If these weights are determined by more than one person (group), the arithmetic mean or geometric mean of the person's preferences can be used (Saaty, 2000). An important point to be considered here is that the sum of the weights to be given to each criterion should be equal to 1.

For weighted normalization, the following equation 3 can be used:

$$v_{ij} = w_{ij}.r_{ir} \tag{3}$$

Where wj is the weight of jth evaluation indicator, rij is the indicator value after vector normalization for the ith alternative and jth evaluation indicator and vij is the indicator value after weighted normalization for the ith alternative and jth evaluation indicator. To reflect these weight differences to the TOPSIS solution, the V matrix is generated. The matrix for this process is obtained by means of equation 4:

$$v_{ij} = \begin{bmatrix} w_1 r_{11} & w_2 r_{12} & \cdots & w_n r_{1n} \\ w_2 r_{21} & w_2 r_{12} & \cdots & w_n r_{2n} \\ \vdots & \vdots & \vdots & \vdots \\ w_1 r_{m1} & w_2 r_{m2} & \cdots & w_n r_{mn} \end{bmatrix} \tag{4}$$

Step 4: Determination of Ideal (A+) and Worst (A-) Solution.

In order to create a positive ideal solution set (A+), the biggest of the weighted evaluation indicator, of the column value in the V matrix (if the related evaluation criterion is minimization direction, the smallest) is selected. To find ideal solution, equation 5 is used:

$$A^+ = \left\{ \left({}^{max}{}_i v_{ij} \mid j \in J \right), \left({}^{min}{}_i v_{ij} \mid j \in J' \right) \mid i = 1, 2, ..., m \right\} = \left\{ A_1^+, A_2^+, A_3^+, ..., A_j^+, ..., A_k^+ \right\} \tag{5}$$

Ideal solution to be calculated according to equation 5, can be shown as:

$$A^+ = \left\{ A_1^+, A_2^+, A_3^+, ..., A_j^+, ..., A_k^+ \right\}$$

In order to create a negative ideal solution set (A-), the smallest of the weighted evaluation indicator, of the column value in the V matrix (if the related evaluation criterion is minimization direction, the

biggest) is selected. Equation 6 is used to find worst solution:

$$A^- = \left\{ \left({}^{max}{}_i v_{ij} \mid j \in J \right), \left({}^{min}{}_i v_{ij} \mid j \in J' \right) \mid i = 1, 2, ..., m \right\} = \left\{ A_1^-, A_2^-, A_3^-, ..., A_j^-, ..., A_k^- \right\} \quad (6)$$

Ideal solution to be calculated according to equation above can be shown as:

$$A^- = \left\{ A_1^-, A_2^-, A_3^-, ..., A_j^-, ..., A_k^- \right\}$$

In the both formulas, J benefit criteria (maximization) imply a larger indicator value and a higher performance score; J cost criteria imply a smaller indicator value and a higher performance score.

Step 5: Calculation of the Separation Measure

In this step, distances to positive and worst solutions are calculated separately for each alternative. Distances to ideal solution is called Ideal Separation (S_i^+) and distances to worst solution (S_i^-) is called Worst Separation. Calculations according to both measures are calculated with the formulas in the equation 7.

$$S_i^+ = \sqrt{\sum_{j=1}^{k} \left(v_{ij} - A_j^+ \right)^2} \qquad S_i^- = \sqrt{\sum_{j=1}^{k} \left(v_{ij} - A_j^- \right)^2} \quad (7)$$

Step 6: Calculation of the Relative Closeness to the Ideal Solution

Ideal (S_i^+) and worst (S_i^-) separation measures are used to calculate the relative closeness to the ideal solution (C_i^*). The criterion used here is the share of the worst separation measure (S_i^-) in the total separation measure [(S_i^+)+(S_i^-)]. Relative closeness to the ideal solution is calculated with the equation 8:

$$C_i^* = \frac{S_i^-}{S_i^+ + S_i^-}, 0 < C_i^* < 1 \quad (8)$$

Here value may be between 0 and 1, and value of close to 1 shows the related alternatives closeness to ideal solution while the value of close to 0 shows the related alternatives closeness to worst solution.

Step 7: Ranking of the Preference Order

In this step, alternatives are ranked according to their values from highest to lowest. The best alternative is the closest alternative to the ideal solution. It should also be noted that any alternative closest to the ideal solution is also considered to be the farthest alternative to the negative-ideal solution.

LITERATURE REVIEW

Since TOPSIS method is the most common method used among MCDM Methods, it has been used in many studies both in science and social sciences. Some studies in the literature related to the use of TOPSIS are as follows:

Agrawal, Verma, and Agarwal (1992) used TOPSIS for selection of seals in flexible manufacturing. Agrawal, Kohli, and Gupta (1991) applied TOPSIS for robot selection. Kim, Park, and Yoon (1997) applied TOPSIS for financial investment in advanced production systems. Chau and Parkan (1995) used this when selecting a production process. Parkan and Wu (1999) used TOPSIS in an application that selected robotic processes. Deng, Yeh, and Willis (2000) used TOPSIS to compare company performances. Feng and Wang (2001) used the motor bus industry to compare the financial ratio performance. Karimi, Yusop, and Law (2010) applied to TOPSIS application to examine the position decision of foreign direct investments in ASEAN countries. Dinçer (2011) applied TOPSIS and WSA (Weighted Total Approach) in the analysis of the economic activities of the European Union Member States and candidate countries. Sieng and Yussof (2017) used a fuzzy TOPSIS method to compare performance of Malaysian human capital with other countries. Balcerzak, Pietrzak, et al. (2016) applied the TOPSIS method to examine the progress made by European countries in implementing the concept of sustainable development.

In addition, Wu, Lin, and Tsai (2010) in the evaluation of organizational performances of banks in the management of capital, Tsou (2008) in multi-purpose inventory planning, Tsai, Huang, Wang, et al. (2008) in the evaluation of performance of insurance companies, Pal and Choudhury (2009) to assess the

service quality of the banking sector, Wang and Elhag (2006) and Amiri (2010) in determining the risk of enterprises, Benitez, Martín, and Román (2007) in evaluation of service quality of hotels, and Chu (2002) in determining facility location used the TOPSIS method.

A COMPARISON OF TURKEYS HUMAN CAPITAL STOCK WITH SOME SELECTED MENA COUNTRIES BY TOPSIS METHOD

In the study, human capital performances of the MENA countries and Turkey in 2005, 2010 and 2015 will be compared by TOPSIS method based on some criteria. The countries covered in the study will be compared by 2015 due to lack of data. The explanations regarding the criteria used in the evaluation are given in this section.

Seven indicators has been used to assess the human capital performance of the countries: The infant mortality rate (per 1,000 live births), unemployment rate (percentage of total workforce), life expectancy at birth, total (years), labour force participation rate (percentage of total population between 15-64), current health expenditure (percentage of GDP), internet users (percentage of total population) and population between 15-64 years (percentage of total population) Evaluation criteria and orientations can be seen in Table 2.

Table 2: Evaluation criteria and their orientation

Criteria Code	Evaluation Criteria	Orientation
X1	Mortality rate, infant (per 1,000 live births)	Minimum
X2	Unemployment, total (% of total labor force)	Minimum
X3	Life expectancy at birth, total (years)	Maximum
X4	Labor force participation rate, total (% of total population ages 15-64)	Maximum
X5	Health expenditure, total (% of GDP)	Maximum
X6	Internet users (%of total population)	Maximum
X7	15-64-year-old population (% of total population)	Maximum

In Table 2, the criteria coded by X3, X4, X5, X6 and X7 belong to benefit criteria in which the larger criterion value, the higher performance score. The criteria coded by X1 and X2 belong to cost criteria in which the smaller criterion value, the higher performance score. The definition and orientation of all criteria are as follows:

X1: Mortality rate, infant (per 1,000 live births)

The infant mortality rate is the number of dying babies before reaching an age of 1,000 live births in a given year. The orientation of infant mortality rate is minimum. This means low infant mortality rate means high performance. Infant and child mortality rates and the average life span have important effects on labor supply. It can easily be said that in general societies where infant and child mortality rates are relatively low, people's general health status is better than others. A society with a good health status will have a better quality of human capital, and this may increase productivity and positively affect economic growth (Ardyanfitri & Wahyuningtyas, 2016; Taban, 2007).

X2: Unemployment, total (% of total labour force)

Unemployment refers to the share of those who are looking for a job but cannot find a job in the current wage conditions. Unemployment rates represent the unemployed as a percentage of the labor force. It is not possible for unemployed or underemployed people to contribute effectively to national development. These people will have fewer opportunities to use their rights as citizens. These people will spend less because they do not have revenues as consumers, they can save less on savings and they will not have enough opportunities to change their lives and societies. Non-formal youth unemployment and underemployment are undermining future expectations by preventing companies and countries from creating and developing competitive advantages on the basis of human capital investment.

Unemployment is key to monitoring whether a country has achieved its goals of creating sustainable economic growth, full employment and a decent business opportunity for all. In the analysis, low unemployment rates will be evaluated as high performance. The orientation of this criterion is therefore minimal.

X3: Life expectancy at birth, total (years)

The life expectancy at birth shows the number of years that a newborn baby will live if the current conditions remain the same throughout his or her life. The longer this period, the better the overall health and well-being of the community. Long life expectancy will have positive effects on economic growth. The orientation of this criterion is maximum. So high values mean high performance.

X4: Labour force participation rate (percentage of total population between 15-64)

The labor force participation rate is the proportion of the population between the ages of 15 and 64 years, who are economically active - those who provide labor for the production of goods and services in a given period. A high rate of this means that the desire to participate in economic activities is high. The orientation of this criterion is maximum. So high values mean high performance.

X5: Current health expenditure (percentage of GDP)

The ratio of health expenditures to gross domestic product. The impact of health expenditures, which are considered as one of the important indicators of health system, on economic growth is multifaceted and long-term. Within the scope of human capital approach, health services are considered as a human capital investment. Other writers, especially Schultz (1961), considered health care as investing in human beings by protecting and improving their ability to work and increasing the productivity of the study. For example, according to Mushkin (1958), the resources (labor and goods) used in health services constitute part of health investments. The expenditures made for this purpose save the future health expenditures by maintaining the working power and reducing the diseases that will emerge in the coming years. The human capital stock, which develops in this way, constitutes an important part of human capital. Therefore, health services and investments that will increase the stock of health capital have an important function in the development of the country by increasing human capital. In addition, increasing health expenditures increase the life expectancy and expectation of individuals. Long life expectancy will have the power to influence economic growth positively as described above. The orientation of this criterion is maximum. So high values mean high performance.

X6: Internet users (percentage of total population)

Internet users are people who use the Internet (anywhere) in the last 12 months. Internet can be used by computer, mobile phone, personal digital assistant, game machine, digital TV etc. Digital and information revolution has significantly changed the world's ways of learning, communicating, doing business and treating diseases. New information and communication technologies offer great opportunities for progress in all areas of life in all countries - economic growth, better health, better service delivery, learning through distance learning and social and cultural developments. The orientation of this criterion is maximum. So high values mean high performance.

X7: Population between 15-64 years (percentage of total population)

Total population between 15 and 64 years as a percentage of the total population. The population is based on the de facto population definition which takes into account all residents regardless of legal status or citizenship.

The development of a country is determined in part by the age composition of its populations. Different age groups have different effects on both environmental and infrastructure needs. Therefore, the age structure of a population is useful to analyze resource use, to formulate future policies, and to plan objectives related to infrastructure and development. This indicator is used to calculate age dependency ratio (percentage of working age population). Age dependency ratio is the ratio of the population between the ages of 0-14 and the total population of 65 years and over to the population between the ages of

15-64. The high population between the ages of 15 and 64 can be considered as an opportunity for the country due to the dynamic nature of the population and the potential to channel it into production. The orientation of this criterion is maximum. So high values mean high performance.

All of the data used in this study are compiled from the World Bank's website (The World Bank, 2019).

TOPSIS APPLICATION

In the study, human capital performances of MENA countries and Turkey as of 2005, 2010 and 2015 will be ranked and evaluated with TOPSIS method. After the application of seven steps of TOPSIS method whose theoretical foundations is given in the previous section, it is possible to create the following tables showing the final ranking of countries for 2005, 2010 and 2015.

Table 3, 4 and 5 show the ranking of the overall performance of the countries calculated according to the relative closeness of the ideal solution (C*) for each year studied.

Table 3: Final ranking of countries (2005)

Rank	Countries	C*(2005)
1	United Arab Emirates	0,6947
2	Qatar	0,6410
3	Israel	0,6332
4	Kuwait	0,6261
5	Lebanon	0,5319
6	Saudi Arabia	0,4969
7	Oman	0,487
8	Jordan	0,4617
9	Algeria	0,4588
10	Iran, Islamic Rep.	0,4586
11	Egypt, Arab Rep.	0,4522
12	Bahrain	0,4520
13	Turkey	0,4426
14	Tunisia	0,4171
15	Morocco	0,3630
16	Iraq	0,2842
17	Yemen, Rep.	0,1097

In Table 3, it can be seen that United Arab Emirates, Qatar, Israel share the first three ranks respectively, Iraq and Yemen the last ranks.

Table 4: Final ranking of countries (2010)

Rank	Countries	C*(2010)
1	United Arab Emirates	0,7574
2	Israel	0,7196
3	Qatar	0,7126
4	Kuwait	0,7024
5	Lebanon	0,6831
6	Oman	0,6239
7	Saudi Arabia	0,6147
8	Turkey	0,5225
9	Tunisia	0,5067
10	Morocco	0,5012
11	Jordan	0,4943
12	Algeria	0,4118
13	Iran, Islamic Rep.	0,4050
14	Bahrain	0,3983
15	Egypt, Arab Rep.	0,3914
16	Iraq	0,3386
17	Yemen, Rep.	0,1720

In Table 4, it can be seen that United Arab Emirates, Israel, Qatar share the first three ranks respectively, Iraq and Yemen the last ranks.

Table 5: Final ranking of countries (2015)

Rank	Countries	C*(2015)
1	Qatar	0,7820
2	United Arab Emirates	0,7777
3	Israel	0,7747
4	Kuwait	0,7648
5	Oman	0,7242
6	Saudi Arabia	0,7143
7	Lebanon	0,7014
8	Turkey	0,5481
9	Tunisia	0,4902
10	Jordan	0,4837
11	Morocco	0,4689
12	Bahrain	0,3950
13	Iran, Islamic Rep.	0,3770
14	Algeria	0,3710
15	Egypt, Arab Rep.	0,3710
16	Iraq	0,3550
17	Yemen, Rep.	0,1543

In Table 5, it can be seen that Qatar, United Arab Emirates and Israel share the first three ranks respectively, Iraq and Yemen the last ranks.

CONCLUSION AND RECOMMENDATIONS

In this study, human capital performances of MENA countries and Turkey have been evaluated with TOPSIS method according to seven criteria with equal weight (1/7) and countries are ranked for 2005, 2010 and 2015. Since the data for recent years are not available for all countries, the analysis has been terminated in 2015.

According to Table 3, United Arab Emirates is the closest country to the ideal solution in 2005 and 2010. Then it leaves its place to Qatar in 2015.

Qatar has the second rank in 2005 and Israel follows it in third rank. In 2010 Israel has the second rank and Qatar follows it in the third rank. In 2015 United Arab Emirates has the second rank and Israel follows in in third rank. It can be said that Qatar, United Arab Emirates and Israel are in the first three ranks in all periods. The countries with the lowest performance in terms of human capital have been Iraq and Yemen for all the years studied.

Iraq and Yemen remaining behind in terms of human capital performance may face some problems in the future if they do not already take some measures for the development of human capital.

The results may change when the number of countries, criteria and weights are changed. Other studies can be done in this regard by removing the limitations. In the same way, similar studies can be done using other multi-criteria decision-making techniques such as ELECTRE, AHP, PROMETHEE, VIKOR, MOORA.

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