Comparative study of Malaysia human capital with selected ASEAN and Developed Countries: A fuzzy TOPSIS method

Lai Wei Sieng[1], Ishak Yussof[1]

[1]School of Economic, Faculty Economics and Management, Universiti Kebangsaan Malaysia

Correspondence: Ishak Yussof (email: iby@ukm.edu.my)

Abstract

Comparative study on human capital performance between countries is important especially for developing countries to measure their gap with developed countries. This article uses the unconventional TOPSIS method to compare Malaysia and other selected countries in terms of human capital achievement with education being the main measure of human capital. Results indicate that Malaysia is doing great among her ASEAN peers but more need to be done in order to catch up with the developed nations.

Keywords: developed countries, developing countries, economic growth, fuzzy TOPSIS, human capital, Human Development Index

Introduction

Human capital has become the main focus in explaining economic growth of a country since the emergence of the endogenous growth theory introduced by Uzawa (1965), Lucas (1988) and Romer (1990). As evidences confirmed the positive relationship between human capital development and economic growth, human capital development has become one of the key factors in deciding fund allocation in a country's development plan. Malaysian government is committed in enhancing human capital with 20% to 25% of total government expenditures spent on education.

In 1990, an economist from Pakistan, Mahbub ul Haq created Human Development Index (HDI), which is a composite statistic of life expectancy, education, and income indices to rank countries into four tiers of human development with an explicit purpose, "to shift the focus of development economics from national income accounting to people-centered policies". It was then followed by economist Amartya Sen in 1990, published by the United Nations Development Programme. HDI is now used as the indicator to a country's human capital development achievement. Malaysia ranked 64 among 186 countries in 2013 HDI report with a score of 0.769 and was categorized in the group of countries with high human development. Compared to other ASEAN countries, Malaysia's HDI rank is the third highest as shown in Table 1. Brunei and Singapore were categorized in the "very high human development" group whereas the rest were "medium human development" except for Myanmar, which was in the "low human development" group.

Table 1. HDI report for ASEAN countries, 2011

Country	HDI Rank	HDI value
Singapore	18	0.895
Brunei	30	0.855
Malaysia	**64**	**0.769**
Thailand	103	0.690
Philippines	114	0.654
Indonesia	121	0.629
Vietnam	127	0.617
Cambodia	138	0.543
Laos	138	0.543
Myanmar	149	0.498

Source: UNDP Human Development Report 2013

Another similar official report, The Human Capital Report was published by World Economic Forum in 2013. The report ranked 122 countries according to Human Capital Index (HDI). The index contained 51 indicators in total, consisting of four pillars, with 12 indicators in the Education pillar, 14 in the Health and Wellness pillar, 16 in the Workforce and Employment pillar and 9 in the Enabling Environment pillar. Brunei and Myanmar were not included in the report and the ranking reported for ASEAN countries was almost identical to UNDP's report, and Malaysia was still behind Singapore as shown in Table 2.

Table 2. Human Capital Report for ASEAN countries, 2013

Country	HCI Rank	HCI value
Singapore	3	1.232
Malaysia	**22**	**0.644**
Thailand	44	0.158
Indonesia	53	0.001
Philippines	66	-0.161
Vietnam	70	-0.202
Laos	80	-0.297
Cambodia	96	-0.505

Source: World Economic Forum, The Human Capital Report 2013

According to the two published reports, even though those indices were calculated using different formulae, the ranking of most of the ASEAN countries remained the same. However, the indices could not measure the relative performance for each country in human capital development, and thus could not be a suitable tool to measure the gap between countries. The objective of this article is to compare the performance of Malaysia in terms of human capital development with selected ASEAN countries of Singapore, Thailand, Philippines, Indonesia and Vietnam, and with selected developed countries:, namely, United States, Australia, Japan, United Kingdom, Italy, and France. The most important goal of this article is to measure the gap between Malaysia as a developing country and developed countries. An unconventional method is applied to realize the objective of this study.

Literature review

Since the emergence of endogenous growth theory, various studies had investigated the relationship between human capital and economic growth. Most of them had found positive relationship between human capital's variables and economic growth. Middendolf (2006), Park (2006), Altar et al. (2008), Yueliang (2009), Soukiazis and Antunes (2012) and Roseline and Esman (2012) are among the

researchers who confirmed the impact of human capital on economic growth at various countries. Despite numerous evidences found, there are very few studies conducted to compare the performance of different countries in terms of human capital. Many of the studies on this topic utilized the econometric methods. Neycheva (2010) examines the impact of education on growth in the EU members and makes comparison with post-communist economies. Lee at al. (1994) compares the relationship between education, human capital enhancement and economic development in South Korea and Taiwan. Bhatta and Lobo (2000) analyze the extent to which human capital differences can explain the differences in gross state product per capita levels between the richer and poorer states of the US. Musai et al. (2011) study information relating to Iran and 78 other countries to determine the relationship between education and economic growth. Moses (2006) identifies the two-way links between human resource development produced by formal schooling and economic growth, and between investment in physical capital and growth of African countries. There had also been comparisons between countries in terms of the role of human capital on economic growth. For example, the comparison between China and India (Andreosso, 2003). Nadir and Hatidje (2007) constructed human capital index for 105 countries. They gathered international surveys analyzing children's learning achievement on a common scale in order to allow an international comparison of children's learning achievement across countries. The ranking of each country's index calculated was almost the same as Human Development Index and Human Capital Index. All in all, there were very few studies that actually compared the human capital development among countries. As past studies on comparing human capital of Malaysia and other countries are hardly found, this article aims to fill the reference gap.

Data and methodology

Based on previous studies, the variables of human capital in growth used in this study are labor force, school enrolment rate and adult mean years of schooling. This study employs the TOPSIS (Technique for Order Preference by Similarity to Ideal Solution) method which is developed by Hwang and Yoon (1981). TOPSIS is commonly applied in management science but scarcely being applied in the field of economics. One of the few studies which applied TOPSIS method in economics is the study done by Karimi et al. (2010). They applied TOPSIS to examine the location decision for foreign direct investment in ASEAN countries. Sait (2011) applied TOPSIS and WSA (Weighted Sum Approach) in analysis of economic activities of European Union Member States and candidate countries. In fact, this method is a suitable tool in comparing human capital factor among countries; and is, therefore applied in this study.

The concept behind this method is that the selected best alternative should have the shortest distance from the ideal solution and the farthest distance from the negative-ideal solution in the geometrical (Euclidean) sense. In other words, the ideal alternative has the best level of all attributes considered, whereas the negative ideal is the one with the worst attribute value. A TOPSIS solution is defined as the alternative that is simultaneous, farthest from the negative-ideal and closest to the ideal alternative. There are two main advantages in this method: its mathematical simplicity and high flexibility in the definition of the choice set. Chia and Liang (2009) listed three advantages of TOPSIS: simple, rationally comprehensible concept, good computational efficiency, and ability to measure the relative performance for each alternative in simple mathematical form.

The TOPSIS method evaluates the following decision matrix (A) for this study:

$$A = [a_{ij}]_{mxn} = A_i \begin{bmatrix} a_{11} & a_{12} & a_{13} & a_{14} & a_{15} \\ a_{21} & \dots & \dots & \dots & \dots \\ a_{31} & \dots & \dots & \dots & \dots \\ a_{41} & \dots & \dots & \dots & \dots \\ a_{51} & a_{52} & \dots & \dots & a_{55} \end{bmatrix} \begin{matrix} \\ \\ \\ \\ \\ \end{matrix} C_j$$

Where A_i is the ith alternative (Malaysia, Indonesia, Thailand, Philippines, Vietnam, Australia, France, Italy, Japan, United Kingdom and United States), C_j is the jth criterion (enrolment rate in primary, secondary and tertiary education, adult mean years of schooling, and labor participation rate), and a_{ij} is the performance measure of the ith alternative in terms of jth criterion. The TOPSIS method consists of the following steps (which are adaptions of the corresponding steps of the ELECTRE method).

Step 1: Calculate the weights of the evaluation criteria. To find the relative normalized weight of each criterion, first of all, the geometric mean of ith row in the pair-wise comparison matrix is calculated by

$$GM_i = \sqrt[n]{\prod_{j=1}^{n} X_{ij}} \qquad i = 1, 2, \dots m \tag{1}$$

Then, geometric means of the rows in the comparison matrix are normalized as:

$$W_i = GM_i \Big/ \sum_{i=1}^{m} GM_i \qquad i = 1, 2, \dots m \tag{2}$$

Where w_i is the weight or the importance of criterion C_j, $\sum_{i=1}^{n} w_i$=1 and W = $[w_1, w_2, \dots w_n]$ be the criteria weight vector.

Step 2: Construct the normalized decision matrix. This involves converting the various attribute dimensions into non-dimensional attributes. As in the ELECTRE method, an element of r_{ij} of the normalized decision matrix R is calculated as follows:

$$R_{ij} = \frac{x_{ij}}{(\sum_{i=1}^{m} x_{ij}^2)^{1/2}} \qquad t = 1, 2, \dots n \tag{3}$$

Where N = $[R_{ij}]_{mxn}$ (4)

Step 3: Calculate the weighted normalized decision matrix (V). The weighted normalized value v_{ij} is calculated as:

$$V_{ij} = w_j r_{ij} \qquad i = 1, 2, \ldots m; j = 1, 2, \ldots n \tag{5}$$

Where $V = [v_{ij}]_{mxn}$ (6)

Step 4: Identify the positive ideal solution and negative ideal solution.

$$A^* = \{V_1^*, V_2^*, \ldots V_n^*\} = \{(\max v_{ij}; i \in I'), (\min v_{ij}; i \in I'')\}$$
$$A^* = \{V_1^-, V_2^-, \ldots V_n^-\} = \{(\min v_{ij}; i \in I'), (\max v_{ij}; i \in I'')\}$$

Where I' is associated with benefit criteria and I'' is associated with cost criteria.

Step 5: Calculate the separation measure. In this step the concept of the n-dimensional Euclidean distance is used to measure the separation distances of each alternative to the ideal solution and negative-ideal solution. The corresponding formulas are:

$$S^* = \sqrt{\sum_{j=1}^{n} (v_{ij} - v_j^*)^2} \quad , i = 1, 2, \ldots m \tag{7}$$

$$S^- = \sqrt{\sum_{j=1}^{n} (v_{ij} - v_j^-)^2} \quad , i = 1, 2, \ldots m \tag{8}$$

Step 6: Calculate the relative closeness to the ideal solution. The relative closeness of the alternative A_i with respect to A^* is defined as:

$$C_i^* = \frac{S^-}{S^- + S^*}, \qquad i = 1, 2, \ldots . m \tag{9}$$

Where $0 \leq C^* \leq 1$which is, an alternative i is closer to A^* as C_i^* approaches to 1.

Step 7: Rank the preference order. Choose an alternative with maximum C_i^* or rank alternatives according to C_i^* in descending order.

Data

According to literature review, indicators for human capital are literacy rate, mean years of schooling, mortality, life expectancy, health expenditure per capita, unemployment rate, labor participation rate and internet users. Literacy rate is omitted in this research since literacy rate is high in most countries selected for this study. In other words, human capital in this study captured education, health, labor and environment. Table 3 shows the detailed description of data used in this study. Data of indicators used in this study are obtained from the World Development Indicators from World Bank and United Nation Development Programme (UNDP) for the years 2006, 2008, 2010 and 2012.

Table 3. Description of data

Indicator	Definition
Mean years of schooling	Average years of total schooling, 15+, total is the average years of education completed among people over age 15 (Barro-Lee).
Mortality rate, infant (per 1,000 live births)	Infant mortality rate is the number of infants dying before reaching one year of age, per 1,000 live births in a given year.
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.
Health expenditure per capita, PPP (constant 2005 international $)	Total health expenditure is the sum of public and private health expenditures as a ratio of total population. It covers the provision of health services (preventive and curative), family planning activities, nutrition activities, and emergency aid designated for health but does not include provision of water and sanitation.
Unemployment, total (% of total labor force)	Unemployment refers to the 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+)	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.
Internet users (per 100 people)	Internet users are individuals who have used the Internet (from any location) in the last 12 months. Internet can be used via a computer, mobile phone, personal digital assistant, games machine, digital TV etc.

Source: World Bank, 2014

Results and discussion

Normalization of the data used has been done first and the normalized criterion matrix and criterion weights for year 2006 are is shown in Table 4. The weights for mean year of schooling, health expenditure and labor participation rate are given 0.2 due to their proven importance as indicator for human capital.

Table 4. Normalized Criterion Matrix and Criterion Weights (year 1996)

	Mean (Max)	Mortality (Min)	Life (Max)	Health (Max)	Unemploy (Min)	Labor (Max)	Internet (Max)
Malaysia	0.284656	0.154717	0.279437	0.0439785	0.104865	0.275588	0.042890467
Philippines	0.266012	0.458576	0.256612	0.0136505	0.310402	0.296547	0.002816228
Thailand	0.198427	0.323373	0.2736	0.034327	0.046141	0.33133	0.005812671
Indonesia	0.153148	0.67741	0.255285	0.0087347	0.184563	0.301452	0.002850355
Vietnam	0.155479	0.400034	0.280947	0.0093919	0.079698	0.349167	6.78627E-06
Singapore	0.250031	0.05436	0.29757	0.1496339	0.092282	0.292088	0.420322714
United States	0.421157	0.107326	0.294663	0.7063775	0.230704	0.293871	0.826522259
Australia	0.391194	0.078055	0.302734	0.305622	0.356542	0.283615	0.164870499
Japan	0.354238	0.055754	0.310962	0.2967078	0.142617	0.283615	0.220128463
France	0.29198	0.069692	0.302252	0.3863835	0.520132	0.24794	0.130075869
Italy	0.278663	0.083631	0.304455	0.2804474	0.499159	0.210481	0.051510671
United Kingdom	0.282658	0.082237	0.298894	0.2565031	0.348153	0.27425	0.207577534
Weights	**0.2**	**0.1**	**0.1**	**0.2**	**0.1**	**0.2**	**0.1**

Next, the weighted criterion matrix is formed as shown in Table 5. Ideal and non-ideal values obtained after weighted criterion matrix is formed and are shown at the bottom of Table 5.

Table 5. Weighted Criterion Matrix (year 1996)

	Mean (Max)	Mortality (Min)	Life (Max)	Health (Max)	Unemploy (Min)	Labor (Max)	Internet (Max)
Malaysia	0.056931	0.015472	0.027944	0.0087957	0.010487	0.055118	0.004289047
Philippines	0.053202	0.045858	0.025661	0.0027301	0.03104	0.059309	0.000281623
Thailand	0.039685	0.032337	0.02736	0.0068654	0.004614	0.066266	0.000581267
Indonesia	0.03063	0.067741	0.025528	0.0017469	0.018456	0.06029	0.000285036
Vietnam	0.031096	0.040003	0.028095	0.0018784	0.00797	0.069833	6.78627E-07
Singapore	0.050006	0.005436	0.029757	0.0299268	0.009228	0.058418	0.042032271
United States	0.084231	0.010733	0.029466	0.1412755	0.02307	0.058774	0.082652226
Australia	0.078239	0.007806	0.030273	0.0611244	0.035654	0.056723	0.01648705
Japan	0.070848	0.005575	0.031096	0.0593416	0.014262	0.056723	0.022012846
France	0.058396	0.006969	0.030225	0.0772767	0.052013	0.049588	0.013007587
Italy	0.055733	0.008363	0.030445	0.0560895	0.049916	0.042096	0.005151067
United Kingdom	0.056532	0.008224	0.029889	0.0513006	0.034815	0.05485	0.020757753
Ideal	**0.084231**	**0.005436**	**0.031096**	**0.1412755**	**0.004614**	**0.069833**	**0.082652226**
Non-ideal	**0.03063**	**0.067741**	**0.025528**	**0.0017469**	**0.052013**	**0.042096**	**6.78627E-07**

The final outcome of TOPSIS analysis for year 2006 is shown in Table 6. The rankings are the outcome of applying equations (7) to (9).

Table 6. Final ranking of countries (year 1996)

Ranking	Country	S*	S^-	C_i^*
1	United States	0.022218	0.391937	0.946353
2	France	0.110785	0.283269	0.718858
3	Japan	0.104088	0.255404	0.710458
4	Australia	0.109451	0.256928	0.701263
5	United Kingdom	0.117641	0.233827	0.665286
6	Italy	0.130022	0.241978	0.650478
7	Singapore	0.123989	0.190575	0.605838
8	Malaysia	0.157476	0.111314	0.414131
9	Thailand	0.165941	0.096377	0.367405
10	Vietnam	0.174073	0.06014	0.256775
11	Philippines	0.171508	0.052037	0.232781
12	Indonesia	0.182541	0.038173	0.172952

As shown in the table, developed countries are on top of the table. The first three are United States, France and Japan. Malaysia ranked number 8, behind all developed countries, as expected and ahead of other ASEAN countries. In other words, human capital development is better compare to other developing countries in ASEAN. However, there are gap between Malaysia and developed countries. In order to confirm the ranking obtained, the rankings for year 1998, 2000, 2002, 2004, 2006, 2008, 2010

and 2012 are constructed following the same procedure. Table 7 to 14 display the TOPSIS analysis for the year 2008, 2010 and 2012.

Table 7. Final ranking of countries (year 1998)

Ranking	Country	S*	S^-	C_i^*
1	United States	0.015405	0.172772	0.918137
2	Australia	0.081844	0.11593	0.586173
3	Japan	0.092278	0.102129	0.525336
4	France	0.095182	0.100799	0.514331
5	United Kingdom	0.102022	0.089016	0.465961
6	Italy	0.111588	0.086393	0.43637
7	Singapore	0.117287	0.089454	0.432685
8	Malaysia	0.144354	0.071556	0.331417
9	Thailand	0.155765	0.056379	0.265758
10	Vietnam	0.163188	0.056095	0.25581
11	Philippines	0.161606	0.036025	0.182286
12	Indonesia	0.172338	0.031687	0.155311

Table 8. Final Ranking of Countries (Year 2000)

Ranking	Country	S*	S^-	C_i^*
1	United States	0.015192	0.165081	0.843888
2	Australia	0.077786	0.111828	0.679718
3	France	0.086952	0.105915	0.54916
4	Japan	0.087027	0.098619	0.531222
5	Italy	0.099645	0.097092	0.493511
6	United Kingdom	0.095061	0.088464	0.482026
7	Singapore	0.117244	0.082125	0.411924
8	Malaysia	0.137665	0.064904	0.320404
9	Philippines	0.160754	0.049833	0.236637
10	Thailand	0.151727	0.042838	0.220173
11	Vietnam	0.158957	0.038015	0.192995
12	Indonesia	0.168476	0.024198	0.125589

Table 9. Final ranking of countries (Year 2002)

Ranking	Country	S*	S^-	C_i^*
1	United States	0.021886	0.166385	0.883755
2	Australia	0.081144	0.106468	0.56749
3	France	0.081815	0.101155	0.55285
4	Japan	0.091181	0.099322	0.521367
5	United Kingdom	0.091955	0.096742	0.512684
6	Italy	0.10094	0.086559	0.46165
7	Singapore	0.121379	0.083216	0.406733

Ranking	Country	S*	S^-	C_i^*
8	Malaysia	0.138109	0.072979	0.345729
9	Thailand	0.150453	0.059625	0.283821
10	Vietnam	0.158061	0.054453	0.256232
11	Philippines	0.161804	0.030048	0.156623
12	Indonesia	0.169649	0.019608	0.103607

Table 10. Final ranking of countries (Year 2004)

Ranking	Country	S*	S^-	C_i^*
1	United States	0.022679	0.166671	0.880228
2	Australia	0.082393	0.105398	0.561249
3	France	0.087195	0.0977	0.528408
4	Japan	0.09377	0.100424	0.517132
5	United Kingdom	0.091853	0.097304	0.514409
6	Italy	0.103167	0.085168	0.452215
7	Singapore	0.119814	0.086316	0.418746
8	Malaysia	0.138495	0.074085	0.348503
9	Thailand	0.150769	0.062199	0.292057
10	Vietnam	0.157512	0.05551	0.260582
11	Philippines	0.163973	0.027977	0.14575
12	Indonesia	0.170999	0.0183	0.096671

Table 11. Final ranking of countries (Year 2006)

Ranking	Country	S*	S^-	C_i^*
1	United States	0.042375	0.156822	0.787269
2	Australia	0.080877	0.097803	0.547363
3	France	0.086568	0.094324	0.521436
4	Japan	0.090171	0.093363	0.508695
5	United Kingdom	0.091444	0.089743	0.495308
6	Singapore	0.104104	0.08441	0.447765
7	Italy	0.102588	0.079419	0.436352
8	Malaysia	0.135098	0.064362	0.322683
9	Thailand	0.145026	0.057602	0.284273
10	Vietnam	0.150696	0.047704	0.240445
11	Philippines	0.155382	0.027328	0.149572
12	Indonesia	0.163043	0.021201	0.115072

Table 12. Final ranking of countries (Year 2008)

Ranking	Country	S*	S^-	C_i^*
1	United States	0.028842	0.160253	0.847472
2	Australia	0.082506	0.099268	0.546108
3	France	0.08572	0.095867	0.527941
4	United Kingdom	0.088799	0.092764	0.510919
5	Japan	0.092599	0.094876	0.506073
6	Italy	0.100046	0.082392	0.451616
7	Singapore	0.10812	0.084391	0.43837
8	Malaysia	0.136914	0.066893	0.328217
9	Thailand	0.146314	0.057572	0.282374
10	Vietnam	0.152664	0.047302	0.23655
11	Philippines	0.159125	0.024822	0.13494
12	Indonesia	0.167086	0.016753	0.091129

Table 13. Final ranking of countries (Year 2010)

Ranking	Country	S^*	S^-	C_i^*
1	United States	0.042376	0.156822	0.787267
2	Australia	0.080877	0.097803	0.547363
3	France	0.086569	0.094324	0.521435
4	Japan	0.090171	0.093363	0.508695
5	United Kingdom	0.091444	0.089744	0.495308
6	Italy	0.102588	0.079419	0.436352
7	Singapore	0.104104	0.08441	0.447765
8	Malaysia	0.135098	0.064362	0.322683
9	Thailand	0.145026	0.057602	0.284273
10	Vietnam	0.150696	0.047704	0.240444
11	Philippines	0.155383	0.027328	0.149572
12	Indonesia	0.163043	0.021201	0.11507

Table 14. Final ranking of countries (Year 2012)

Ranking	Country	S^*	S^-	C_i^*
1	United States	0.035517	0.156402	0.81494
2	Australia	0.080271	0.09706	0.547336
3	Japan	0.087653	0.095039	0.520214
4	France	0.088566	0.091647	0.508548
5	United Kingdom	0.093688	0.086626	0.480418
6	Italy	0.108737	0.075355	0.409333
7	Singapore	0.099391	0.086426	0.465114
8	Malaysia	0.134093	0.065591	0.328474
9	Thailand	0.143966	0.060743	0.296728

Ranking	Country	S^*	S^-	C_i^*
10	Vietnam	0.150262	0.050896	0.253017
11	Philippines	0.153846	0.0302	0.164091
12	Indonesia	0.161267	0.024964	0.134048

According to Tables 7 to 14, United States, Australia and Japan were among the developed countries with excellent human capital performance in recent years. Malaysia's human capital performance was relatively low compared to other developed countries. The gap between Malaysia and developed countries such as Australia, United States and Japan can be seen from the calculated index (C_i^*), where the calculated index for the top country is at least thrice of Malaysia's. In fact, the gap did not get smaller for the past 8 years (Figure 1). The gap between Malaysia and top two countries of United States and Australia was maintained almost the same throughout year 1996 to 2012. However, the gap between Malaysia and United States was reduced by 8.6 percent between year 2012 and 1996.

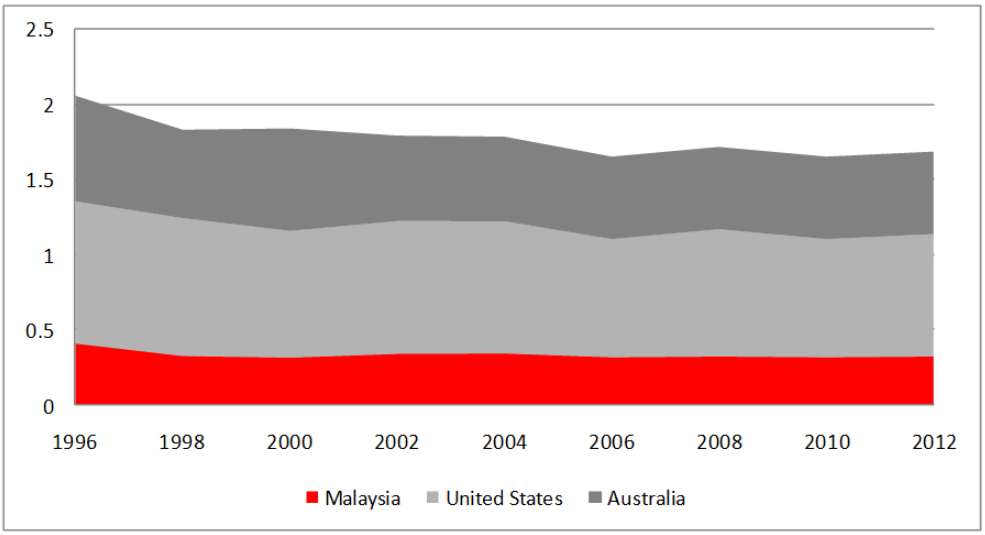

Figure 1. *Gap of Calculated Index between Malaysia, US and Australia*

This indicates that Malaysia needs to work harder in order to achieve the level of developed countries. Compared to developed countries, Malaysia's school enrolment rate was still below 100 per cent indicating that there were still quite a number of Malaysians who did not receive the compulsory education. Furthermore, the average adult schooling year was also low compared with developed countries. As education is the most important factor in measuring human capital, Malaysian government must continue their effort in encouraging people to improve themselves through education. In 2010, Malaysia's public spending on education and health was 7.4 percent of GDP, while United States' public spending on education and health was 13.8 percent of GDP, which was twice of Malaysia's. Thus, more funds should be allocated for the development of education and health in Malaysia.

Conclusion

Although rarely used in the analysis of economics the fuzzy TOPSIS the adoption of this method in comparing the performance of Malaysian human capital with other countries had revealed the gap between Malaysia and developed countries through the calculated indices. Results indicated that Malaysia

was doing exceptionally well among the middle income nations in the ASEAN region. However, the gap between Malaysia and high income nations was still wide. The implication is that Malaysia government's policy on enhancing human capital through education and health should be enhanced in order to catch up with developed countries.

References

Altar M, Necula C, Bobeica G (2008) Modeling the economic growth in Romania. The role of human capital. *Romanian Journal of Economic Forecasting* **9**, 115-128.

Andreosso-O'Callaghan B (2003) Human capital, education and growth: China and India compared. *China Report* **39**, 39-56.

Bhatta SD, Lobo J (2000) Human capital and per capita product: A comparison of US states. Papers in Regional Science. Vol. 79, 393-411.

Chia CH, Liang HC (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.

Hwang CL, Yoon K (1981) Multiple attribute decision making: Methods and applications. Springer-Verlag, New York.

Karimi MS, Yusop Z, Law SH (2010) Location decision for foreign direct investment in ASEAN countries: A TOPSIS approach. *International Research Journal of Finance and Economics* **36**, 196-207.

Lee ML, Liu, BC, Wang P (1994) Education, human capital enhancement and economic development: Comparison between Korea and Taiwan. *Economics of Education Review* **13**, 275-288.

Middendorf T (2006) Human capital and economic growth in OECD countries. *Jahrbucher fur Nationalokonomie und Satatistik* **226**, 670-686.

Moses OO (2006. Determinants of human capital formation and economic growth of African countries. *Economic of Education Review* **25**, 554-564.

Neycheva M (2010) Does public expenditure on education matter for growth in Europe? A comparison between EU member states and post-communist economies. *Post-Communit Economies* **22**, 141-164.

Park J (2006) Dispersion of human capital and economic growth. *Journal of Macroeconomics* **28**, 520-539.

Roseline NM, Esman MN (2012) Financial liberalization, financial fragility and economic growth in Sub-Saharan. *Journal of Financial Stability* **8**, 150-160.

Salt ED (2011) Multi-criteria analysis of economic activity for European Union Member States and candidate countries: TOPSIS and WSA applications. *European Journal of Social Sciences* **21**(4).

Soukiazis E, Antunes M (2012) Foreign trade, human capital and economic growth: An empirical approach for the European Union countries. Vol. 21, 3-24.

The Human Capital Report (2013) World Economic Forum.

UNDP (2011) Human Development Report.

Yueling W (2009) An empirical analysis of human capital effect on the economic growth of eastern, middle and western China. 2nd International Symposium on Electronic Commerce and Security. Vol. 2, 307-311.