

Investigating the Efficiency of the Logistics Performance Index (LPI) Weighting System Using the Technique for Order of Preference by Similarity to Ideal Solution (TOPSIS) Method

Karim Aboul-Dahab¹, Mohamed Ali Ibrahim²

¹The Graduate School of Business (GSB), The Arab Academy for Science, Technology and Maritime, Cairo, Egypt

²Professor, The Arab Academy for Science, Technology and Maritime Transport, Transport, Cairo, Egypt

Abstract: *Logistics performance, both in international and domestic trades, is crucial to the economic growth and competitiveness of countries. On the other hand, high quality logistic performance is the key capability for the economic growth of any country. Well-functioning logistics both domestically and internationally are necessary preconditions for national competitiveness. The Logistics Performance Index (LPI) laid down by the World Bank provides a snapshot of the supply chain performance of countries. Based on a worldwide survey of global freight forwarders and express carriers, the IPI consists of six specific indicators, namely efficiency of the clearance process, quality of trade and transport related infrastructure, ease of arranging competitively priced shipments, competence and quality of logistics services, ability to track and trace consignments, and timeliness of shipments in reaching destination within the scheduled or expected delivery time. These six indicators of have been considered as equally important when the overall index score is calculated, which seems highly unlikely within the complex system of logistics. For this reason, some attempts have been worked on to set differentiated weight values to the LPI indicators. This paper presents a methodology by which more justified weight values are determined. The proposed approach is based upon utilizing The Technique for Order of Preference by Similarity to Ideal Solution (TOPSIS), which is a multi-criteria decision analysis method, to calculate the weight values. The ranking of countries according to the calculated weight values is compared with that of the World Bank and to other ranking results available in literature.*

Keywords: Logistics Performance Index (LPI), Trade, Weighted LPI, Economic Development, Bilateral Trade

1. Introduction

Logistics performance, both in international and domestic trades, is crucial to the economic growth and competitiveness of countries. On the other hand, high quality logistic performance is the key capability for the economic growth of any country. Well-functioning logistics both domestically and internationally are necessary preconditions for national competitiveness. The Logistics Performance Index (LPI) laid down by the World Bank provides a snapshot of the supply chain performance of countries. Based on a worldwide survey of global freight forwarders and express carriers, the IPI consists of six specific indicators, namely efficiency of the clearance process, quality of trade and transport related infrastructure, ease of arranging competitively priced shipments, competence and quality of logistics services, ability to track and trace consignments, and timeliness of shipments in reaching destination within the scheduled or expected delivery time.

“Logistics is part of the supply chain process that plans, implements, and controls the efficient, effective flow and storage of goods, services, and related information from the point of origin to the point of consumption in order to meet customers’ requirements” (Julien Bramel David et al, 1997)

(Samet Guner et al, 2012) defined Logistics as the activity that manages the flows of goods, cash and information between the point of supply and the point of demand and includes activities like transportation, warehousing, packaging, material handling, etc. Logistics is vital for companies, as well as countries.

Trade logistics include the range of services and processes that are involved in moving goods from one country to another: customs and administrative procedures, organization and management of international shipment operations, tracking and tracing, and the quality of transport and information technology infrastructures. (Jane Korinek, et al, 2011)

Mentzer and Konrad (1991) defined logistics performance as effectiveness and efficiency in performing logistics activities.

De Souza et al. (2007) define logistics as part of the value chain that plans, implements and controls the efficient flow of goods, services and information from the source to the consumer.

According to (Chris Caplice, et al, 1995) a logistics performance measurement system should be comprehensive, causally oriented, vertically integrated, horizontally integrated, internally comparable and useful.

The World Bank has published the Logistics performance index (LPI) in 2007 to help countries identify the challenges and opportunities in their trade logistics performance, The index rate the countries logistics performance based on the logistics professionals satisfaction with it. The report referred to the following six factors as the main indicators of logistics performance;

- 1) Efficiency of the clearance process (i.e., speed, simplicity and predictability of formalities) by border control agencies, including customs;
- 2) Quality of trade and transport related infrastructure (e.g., ports, railroads, roads, information technology);
- 3) Ease of arranging competitively priced shipments;
- 4) Competence and quality of logistics services (e.g., transport operators, customs brokers);
- 5) Ability to track and trace consignments;
- 6) Timeliness of shipments in reaching destination within the scheduled or expected delivery time.

2. The LPI Methodology

The first part of the LPI survey (questions 10–15) provides the raw data for the international LPI. Each survey respondent rates eight overseas markets on six core components of logistics performance. The eight countries are chosen based on the most important export and import markets of the country where the respondent is located, on random selection, and—for landlocked countries—on neighboring countries that form part of the land bridge connecting them with international markets. The method used to select the group of countries rated by each respondent varies by the characteristics of the country where the respondent is located. Respondents take the survey online. For the 2018 edition, the survey was open between September 2017 and February 2018. The web engine for 2018 was the same as the new engine put in place in 2012. It incorporates the Uniform Sampling Randomized (USR) approach to gain the most possible responses from underrepresented countries. Because the survey engine relies heavily on a specialized country selection methodology for survey respondents based on high trade volume between countries, The Criticism for the current LPI methodology

LPI is a questionnaire that applied to the logistics firms' managers. Questionnaire consists of qualitative statements which depend on personal experiences and interpretation rather than quantitative data. Participants contributed this study by their own experiences in each country. So it can be accepted that LPI is mostly subjective and measures the perceptions of participants. Accordingly, countries with high social indicators can be perceived better by participants. Because successful social indicators allow logistics service providers to operate smoothly and formally within a country. As a result, perspectives of logisticians can determine the country scores.[7]

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Changes in the LPI score reflect negative or positive private sector perceptions of logistics performance. The LPI score is thus not purely a metric of current performance. It incorporates expectations, trends, and the perceived pace of improvement. This can create a rebound effect from one survey to the next. For example, a country with large positive changes in one survey may be adjusted downward the next time because positive changes were perceived as happening more slowly than anticipated during the preceding survey. [45]

Low-income countries, landlocked countries or countries with political instability are at the bottom of the LPI ranking. They have high transport costs, long delivery delays, and heavy dependence on the logistic performances of transit countries [47]

Several researches conducted to study the different factors affecting the LPI performance using the LPI data available, for example (Varbanova 2017) An analysis of the Bulgarian logistics performance and the policy actions required to enhance the country ranking in the LPI index among the suggested actions were mainly directed to the development of the infrastructure and the Ability to track and trace consignments which will directly affect Timeliness of shipments in reaching destination and the Ease of arranging competitively priced shipments, (Lauri OJALA, Dilay Çelebi, 2015) studied the effect of the policy actions, competitive forces, economic and political environment in turkey's logistics performance, Although the Turkish port service charges were much lower than charges incurred in other major ports the cost advantage was surpassed by longer times spent at ports due to delays and longer and complicated import procedures, The research has suggested that the promotion of the single-window system will enhance the efficiency of customs clearance. Also the liberalization of the Turkish railway transportation will probably enhance the quality of rail transport services that will positively affect the competitively priced shipments. The political instability and wars in neighboring countries has been seen as one of the major reasons for delays in delivery times, Also (Hellen Xavier das Chagas etl, 2014) overviewed the Brazilian logistics performance and its effect on trade, the efficiency of the clearance process and the ease of arranging competitively priced shipments were having the lowest ranking among the six LPI indicators which were seen to be affected by the very high tax burden, The report has suggested the policy makers to reduce the average tax burden which were almost double the average tax burden of other countries that are part of the BRICS (the five major emerging economies Brazil, Russia, India, China and South Africa)

Research Hypothesis

The general LPI of a country is the weighted average of the above mentioned components assuming that the six of them are equally important. However, not all of the LPI components have equal effect on the country's logistics and economic performance. Therefore there is a need to set weighting criterion for the LPI components, and a relevant mechanism to implement such a criterion. Although some weighting criteria had been proposed in literature, other criteria ought to be investigated.

H1: The Current LPI methodology doesn't provide enough explanation for the countries logistics performance

(Turkay Yildiz, 2014) has used the 2014 LPI data to examine the correlation between the countries LPI score and their GDP per capita and Doing Business (DB) scores, A moderately strong correlations was found between the logistics performance variables and the country's GDP also the countries' DB scores were found correlated with the six LPI variables as well. "This finding implies that the lower the GDP or the DB score of a country, the more likely it is to have a low logistics performance score and vice versa" .A clustering algorithm was used to indicates the connections between the countries economic development and their logistics performance to provide policy recommendations to achieve a higher logistics performance

(Vivek Roy, et al, 2017) have developed a Multivariate Adaptive Regression Spline (MARS) model to examine the relationship between the LPI dimensions and Per Capita GDP using the LPI data 2014, A K-means clustering algorithm has been employed to divide the countries LPI in to five clusters, Although all the LPI dimensions were mainly having a Significant effect in the country's GDP the Competence and quality of logistics services dimension might not having a direct influence towards Per Capita GDP, Cluster 3 which primarily comprises of developing countries indicates a top priority to focus in the development of their current telecommunication and transport infrastructure to enhance their LPIs ranking

In an attempt to analyse the efficiency of economic indicators as the country GDP to predict the country logistics performance, the research will test the following hypothesis

H2: The country GDP is enough predictor for the country logistics performance

Based on literature, the results of the previous study (Luisa Martía, et al 2014, Muster et al, 2007, Bernard Hoekman, Alessandro, Nicita 2011 Dilay C, elebi, 2017, Azmat GANI-2017) support that that an enhancement in the logistics performance would likely generate large trade gains, An increasing number of studies (Turkay Yildiz, 2014, Vivek Roy, et al, 2017) have found that the LPI score is highly correlated with their score in the Global Competiveness Index (GCI) and their Gross Domestic Product (GDP), on the other hand some other researchers Jane Korinek, Patricia Sourdin, OECD, 2011) suggest that countries trade somewhat more with others that have a similar quality of logistics services or (Lauri OJALA, Dilay Çelebi, 2015) The political instability and wars in neighbouring countries has been seen as one of the major reasons for delays in delivery times.

Wai Peng Wong & ChorFoon Tang, 2018) had analyzed the impact of economic and social indicators (such as corruption, political stability, infrastructures, technology readiness, education, training competitiveness and supply of labour) on the country's overall logistics performance. The study concluded that the level of infrastructure and

technology development had the highest significant effect on the countries Logistics Performance.

(Samet Guner and Erman Coskun 2012) used the year 2010 LPI data to examine the correlation of the countries logistics performances with their economic data (of the World Bank, OECD) and social indicators (from the human development index). The research had found a weak relationship between GDP and logistics performance. Moreover, the logistics performances of the surveyed countries were not significantly correlated with the countries spending on transport infrastructure. However, A significant relationship between the government effectiveness and control of corruption was found. The research concluded that the LPI is mostly subjective and measures the perceptions of participants. Accordingly, countries with high social indicators can be perceived better by participants. This is true because successful social indicators allow logistics service providers to operate smoothly and formally within a country.

H3: The Current six core LPI components don't provide enough explanation for the countries logistics performance

Problem Statement

The general LPI of a country is the weighted average of the above mentioned components assuming that the six of them are equally important. However, not all of the LPI components have equal effect on the country's logistics and economic performance. Therefore there is a need to set weighting criterion for the LPI components, and a relevant mechanism to implement such a criterion. Although some weighting criteria had been proposed in literature, other criteria ought to be investigated.

Research Objectives

The aim of this study is to select an appropriate criterion for the weighting the LPI components, in addition to proposing a mechanism (or an algorithm) to implement the selected criterion. The results of the selected criterion and relevant algorithm shall be investigated and compared to those of the existing similar criteria.

Data and methodology

In this study, two main types of data sources are used, all of which are drawn from the World Bank and the LPI ranking using the best-worst method (BWM) as multi-criteria decision-analysis tool. First data are about the perceptions of countries' logistics performance (LPI) based on the World Bank methodology. Second data ranked the same countries based on alternative methodology.

This research also follows the true experimental research design to examine the efficiency of the Current LPI methodology in providing an explanation for the countries logistics performance.

3. Literature Review

Significance of logistics performance index

Many researchers analyzed the LPI data to review a country logistics performance (Anju Ilangasekara and Wasantha Premarathne, 2018, Varbanova A., 2017, W. Hwang, et al,

2017; Lauri Ojala and Dilay Çelebi, 2015, Ratko Stanković et al 2014, Aldis Bulis, Roberts Skapars, 2013). On the other hand, the effect of logistics performance on the countries trade volume has been addressed in literature (Azmat Gani 2017, Luisa Martíá, et. Al. 2014, Daniel Saslavskya and Ben Shepherd 2013, Jesus Felipe and Utsav Kumar, 2012, Jane Korinek, Patricia Sourdin, OECD, 2011, Bernard Hoekman and Alessandro Nicita 2011, Stephen W. Hartman 2010, Muster et al, 2007, Alberto Behar and Phil Manners, 2008). However, some other researchers have studied the effect of logistics performance on trade from a country perspective (Hellen Xavier das Chagas et .al, 2014).

The LPI data has also been used to carry out correlation analysis between the LPI indicators and the Economic Forum Global Competitiveness Index (WEF's GCI) (Turkey Yildiz, 2016). Regression analysis has been conducted by Birol Erkan, in 2014. to study the effect of one of the components, namely the infrastructure, of the Global Competitiveness Index (GCI) to the Logistics Performance Index (LPI) for a sample of 113 countries, The Study concluded that the quality of railroad infrastructure and quality of port infrastructure are the major determinants of logistics performances.

(Vivek Roy, et al, 2017) have developed a Multivariate Adaptive Regression Spline (MARS) model to examine the relationship between the LPI dimensions and Per Capita GDP using the LPI data of the year 2014. In this model, a K-means clustering algorithm has been employed to divide the countries LPI in to five clusters based on the country's GDP. Analysis of cluster 3, which primarily comprised the developing countries, indicated that these countries need to focus on the development of their current telecommunication and transport infrastructures, as top priorities to enhance their LPIs ranking. (Turkey Yildiz, 2014) has used the year 2014 LPI data to examine the correlation between the countries LPI score and their GDP per capita and Doing Business (DB) scores. Moderately strong correlations had been found between the logistics performance variables and the country's GDP. In addition, the countries' DB scores were found correlated with the six LPI variables as well. The researcher concluded that "the lower the GDP or the DB score of a country, the more likely it is to have a low logistics performance score and vice versa". A clustering algorithm had been used by (Turkey Yildiz, 2014) to indicate the connections between the countries economic development and their logistics performance to provide policy recommendations to achieve a higher logistics performance.

(Nagehan Uca et al 2016) had analyzed the LPI data for ninety two countries in four time periods (2007, 2010, 2012 and 2014) to examine the mediator effect of Logistics Performance Index (LPI) on the relation between Corruption Perception Index (CPI) and Foreign Trade Volume (FTV). The results had shown that the mediator effect of the LPI on the relation between CPI and FTV was statistically significant. (Vittorio d'Aleo, 2015) used the LPI data of the same time periods (2007-2010-2012-2014) as a mediator variable to test the statistical significance of the relationship between the Global Competiveness Index (GCI) and Gross Domestic Product (GDP). Also (Murat Çembercia, et al,

2015) have demonstrated the moderator effect of Global Competiveness Index (GCI) on the dimensions of Logistics Performance Index (LPI). (Wai Peng Wong & Chor Foon Tang, 2018) had analyzed the impact of economic and social indicators (such as corruption, political stability, infrastructures, technology readiness, education, training competitiveness and supply of labor) on the country's overall logistics performance. The study concluded that the level of infrastructure and technology development had the highest significant effect on the countries Logistics Performance.

(Samet Guner and Erman Coskun 2012) used the year 2010 LPI data to examine the correlation of the countries logistics performances with their economic data (of the World Bank, OECD) and social indicators (from the human development index). The research had found a weak relationship between GDP and logistics performance. Moreover, the logistics performances of the surveyed countries were not significantly correlated with the countries spending on transport infrastructure. However, a significant relationship between the government effectiveness and control of corruption was found. The research concluded that the LPI is mostly subjective and measures the perceptions of participants. Accordingly, countries with high social indicators can be perceived better by participants. This is true because successful social indicators allow logistics service providers to operate smoothly and formally within a country. As a result, "respective of Logistics can determine the country scores".

b) Disparity of the Impact of the LPI Components

Analysis of the LPI has revealed that, in most cases, one of its components has more significant effect on the country's logistics and hence its economic performance than the others (Vivek Roy, et al, , 2017). Developing countries, for instance, need to focus on the development of their current telecommunication and transport infrastructure to enhance their LPIs ranking, (Birol ERKAN, 2014). In general, the quality of railroad infrastructure and quality of port infrastructure are the major determinants of logistics performances, (Jane Korinek, Patricia Sourdin, OECD, 2011) .Trade between countries that have similar quality of logistics services has higher rates than among countries having differentiated ones (Sami Bensassia, et al 2014). An improvement in the logistics infrastructure would reduce trade costs and boost flows of goods among countries and regions, (Jesus Felipe and Utsav Kumar, 2012). In the exporting Central Asian countries, the improvement in infrastructure has more significant impact, whereas for the importing countries, customs efficiency was the most important factor (N. Limao, A.J. Venables). The same authors had concluded that the transportation costs depend both on countries ' geography and on their levels of infrastructure.

4. Related Work

Previous research (Jafar Rezaei et al, 2018) used the best-worst method (BWM) as multi-criteria decision-analysis tool to assign new weights to the six LPI components instead of the average (equal weight) approach. A number of 107 experts from 58 countries have responded to a the research questionnaire that was prepared to extract the necessary

weight values. Most respondents to this questionnaire considered transport infrastructure to be the most important criterion followed by logistics services. The lowest weight was assigned to tracking and tracing, which most respondents considered to be the least important criterion. The results show a relatively high difference in components weights: infrastructure 0.24 comes up as most important followed by logistics services (0.22), timeliness (0.16), customs (0.16), international shipments (0.13) and tracking and tracing (0.10).

The BWM as a multi-criteria tool relies mainly upon the response of the selected experts to the relevant questionnaire. The questionnaire needs to be conducted on a biannual basis since the LPI report is issued biannually. In this case, experts may not be the same every time the questionnaire is conducted, and hence diversified opinions are expected. In other words, the human factor has a dominating effect on the results. Up to our knowledge, no other weighing criterion had been proposed for investigating the importance of each of the LPI components.

5. Proposed Criterion

The present work is designed to consider a more feasible weighing criterion for the LPI components that is based upon the Technique for Order of Preference by Similarity to Ideal Solution (TOPSIS) method.

The TOPSIS method is relies upon constructing a decision matrix that is required prior to the beginning of the process. This matrix contains competitors (countries) row-wise, with their criteria ratings column- wise. Normalization process is the carried out to make these scores conform to or reduced to a norm or standard. To compare the competitors on each criterion, the normalized process is usually made column-wise, and the normalized value will be a positive value between 0 and 1. Weight values are then assigned according to the importance of the criteria so that the sum of weights is constrained to 1. The normalized criteria are then multiplied by the assigned weight values to form the elements of a “weighted normalized decision matrix”. From this matrix, we determine the “ideal” and “negative-ideal” solutions, and then calculate the separation measure of all matrix elements in both solutions. The relative closeness to the ideal solution is calculated, and is used to rank the countries in a descending order. The step of this process is explained as follows:

Step one: Create a decision matrix X consisting of "m" rows (countries) and "n" columns (criteria). Rows are denoted by alternative and columns are denoted by attributes. The element at the intersection of ith alternative with the jth attributes is denoted by xij

	X_1	X_2	X_i
A_1	X_{11}	X_{12}	X_{1i}
A_2	X_{21}	X_{22}	X_{2i}
.
.
A_i	X_{i1}	X_{i2}	X_{ij}

Step II: Calculate the normalized matrix using the following formula:

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

Step III : Normalize the decision matrix using the following equation:

$$P_{ij} = \frac{x_{ij}}{\sum_{i=1}^m x_{ij}}$$

Step IV : Compute ej value using this formula

$$e_j = -K \sum_{i=1}^m P_{ij} \cdot \ln p_{ij}$$

Where

$$K = \frac{1}{\ln m}$$

Step V: Compute di value using this formula;

$$d_j = 1 - e_j$$

Step VI: Calculate Wj value where the sum of the weights equals 1

$$W_j = \frac{1 - e_j}{\sum_{j=1}^n (1 - e_j)}$$

Step - VII: construct the weighted normalized decision matrix by multiplying:

$$V_{ij} = w_{ij} \cdot r_{ij}$$

Step - VIII: Determine the positive ideal solution and the negative ideal solution

$$A^+ = \{ (\max v_{ij} | j \in J), (\min v_{ij} | j \in J^+) \}$$

$$A^- = \{ (\min v_{ij} | j \in J), (\max v_{ij} | j \in J^+) \}$$

Step - IX : Calculate the separation measure

$$S^+ = - \sqrt{\sum_{j=1}^n (v_{ij} - v_j^+)^2}$$

$$S^- = - \sqrt{\sum_{j=1}^n (v_{ij} - v_j^-)^2}$$

Step - X : Calculate the relative closeness to the ideal solution :

$$C_i^+ = S_i^- / (S_i^+ + S_i^-), 0 \leq C_i^+ \leq 1$$

Step - XI : Calculate the total score and select the closest alternative to 1.

Weight Selection Techniques

The weight values as described in TOPSIS can be selected arbitrarily to give the appropriate significance of the criteria under consideration. There are different approaches that could be used in this respect. These approaches are described as follows.

a) Equal Weight Approach

The simplest way of selecting the weight values is based upon assuming equal importance of the six criteria under consideration. This means that we multiply each component in the normalized matrix by w, where w = 1/ n. This ensures that

$$\sum w = 1$$

b) Weight Based upon Entropy Approach

In this case, the information content in each criterion for all the competitors is used as basis for calculating the corresponding weight values. This information content is called “Entropy”, and is used to calculate the weights as follows:

$$p = \sum_{k=0}^n \binom{n}{k} x^k a^{n-k} \frac{n}{k} v t.$$

This approach has the advantage of using the available data to calculate the weight values. The weight values are not constants, since they depend upon the available data at a specific year. On the other hand, there is no need to get experts opinions or to conduct questionnaires. This ensures that the human factor is avoided.

c) Experts Opinion Approach

This approach is based upon conducting a questionnaire among a number of experts in the field of logistics. The feedback of such a questionnaire is analyzed to get the weight values of the criteria under consideration. The larger the number of responding experts to the questionnaire, the more reliable the weight values. However, the questionnaire need to be conducted on biannual basis, with no guarantee that the same experts would be involved. It is also quite notable that the human factor is there in the process.

6. Analysis of Data

Country	Unweight TOPSIS	
	Rank	Difference
Germany	4	-3
Portugal	34	3
Panama	43	-4
Iceland	39	4
Indonesia	66	-3
Argentina	62	3
Algeria	78	-5
Ecuador	80	-4
Kazakhstan	74	5
Ukraine	77	4
Bangladesh	89	-5
Guyana	85	3
Iran	94	-5
Bosnia and Herzegovina	87	3
Colombia	95	-3
Dominican Republic	90	3
Costa Rica	91	3
Togo	92	5
Tunisia	108	-3
Mali	110	-3
Burundi	105	5
Benin	116	-3
Zambia	114	3
Albania	124	-4
Venezuela. RB	119	3
Nepal	128	-3
Cuba	130	-4
Montenegro	133	-5
Guinea	126	4
Fiji	129	4
Djibouti	131	3
Angola	141	-3
Madagascar	143	3

Table (1-1) shows the countries ranking difference using the Un-weighted weighted Topsis method; this table includes

the countries which observed significant changes in their ranking upward or downwards.

In this analysis we only include the countries which observed a ranking increase or decrease of more than three.

The majority of the country’s that had significant increase or decrease in their ranking were mostly developing countries except for Germany, Portugal and Iceland.

The results shows 27 countries with significantly different position with a maximum change of 5 positions upward (Togo, Burundi, Kazakhstan) and 5 positions downward (Iran, Algeria, Montenegro

Country	Entropy-Based TOPSIS	
	Rank	Difference
Portugal	34	3
Iceland	39	4
Uruguay	66	-4
Algeria	78	-5
Kazakhstan	74	5
Ukraine	77	4
Bangladesh	89	-5
Iran	94	-5
Bosnia and Herzegovina	95	-5
Mozambique	87	4
Togo	92	5
Nicaragua	98	3
Macedonia. FYR	108	-4
Papua New Guinea	105	3
Benin	116	-3
Zambia	122	-5
Trinidad and Tobago	114	4
Belarus	120	3
Ethiopia	130	-6
Nepal	128	-3
Cuba	123	3
Congo. Dem. Rep.	132	-5
Senegal	125	4
Guinea	127	3
São Tomé and Príncipe	135	4
Fiji	129	4
Guinea-Bissau	131	4
Liberia	146	-4
Gabon	147	-3
Madagascar	142	4

Table (1-2) shows the countries ranking difference using the Entropy-Based TOPSIS method; this table includes the countries which observed significant changes in their ranking upward or downwards.

In this analysis we only include the countries which observed a ranking increase or decrease of more than three.

The majority of the country’s that had significant increase or decrease in their ranking were mostly developing countries except for Portugal and Iceland .

The LPI ranking using the Topsis Entropy method had shown significant change in the ranking of 25 countries with a maximum change of 5 positions upwards in the case of Kazakhstan and Togo however the change in the countries position downward shows a maximum of 6 positions

downward in the case of Ethiopia, 5 positions in the case of Iran, Algeria, Bangladesh, Zambia, Congo DR and Bosnia and Herzegovina. Although most top ranking countries didn't change significantly, however the position of Iceland moved 4 positions upward and the position of Portugal moved three positions upwards

Country	Best-Worst Method	
	Rank	Difference
New Zealand	37	3
Poland	33	-3
Iceland	39	-4
Chile	46	-3
Uruguay	65	3
Rwanda	62	-4
Namibia	79	5
Bahamas. The	78	3
Burkina Faso	81	4
Cambodia	73	-7
Ghana	88	3
Nigeria	90	3
Guyana	85	-3
Iran	96	7
Bosnia and Herzegovina	97	7
Mozambique	84	-7
Costa Rica	89	-5
Moldova	93	-3
Togo	92	-5
Tunisia	110	5
Sudan	103	-3
Papua New Guinea	105	-3
Burundi	107	-3
Uzbekistan	118	4
Honduras	112	-4
Zambia	114	-3
Trinidad and Tobago	121	3
Congo. Rep.	125	6
Albania	117	-3
Belarus	120	-3
Cuba	131	5
Montenegro	123	-5
Senegal	132	3
Fiji	136	3
Guinea-Bissau	128	-7
Bolivia	138	-3
Gabon	148	5

Table (1-3) shows the countries ranking difference using the Best Worst Method; this table includes the countries which observed significant changes in their ranking upward or downwards.

In this analysis we only include the countries which observed a ranking increase or decrease of more than three.

The majority of the country's that had significant increase or decrease in their ranking were mostly developing countries except for New Zealand Portugal and Iceland.

7. Conclusion

This research proposed a weighting approach is based upon using The Technique for Order of Preference by Similarity to Ideal Solution (TOPSIS), which is a multi-criteria decision analysis method, to calculate the weight values. The

ranking of countries according to the calculated weight values was compared with that of the World Bank and to other ranking results available in literature.

The data included in the LPI index of the World Bank 2016 is used as basis to illustrate the performance of TOPSIS as compared to the Best-Worst Method introduced by Dr. Jafar Rezaei in 2015.

The Research investigated the efficiency of the current methodology of the World Bank in conducting the report, the comprehensive nature of the nature supported many studies (DilayC-elebi, 2017, Turkay Yildiz, 2014, Amrita Jhawar S. K. Garg, Shikha N. Khera, 2014) especially in examining the effect of logistics performance and trade, the importance of some other factors like green logistics (Warren H. Hausman, et al, 2012, Hellen Xavier das Chagas, et al, 2014) to be included in the index while others found that the greater the level of public-private logistics market growth occurs in the forms of encouraging third-party logistics 3PL and green initiatives (David W. Hwang, et al, 2012).

The availability of the LPI data biannually opened the way to conduct correlation-analysis (Samet Gunerand Erman Coskun 2012, Azmat Gani. 2017, TurkayYildiz, 2014, Jane Korinek, Patricia Sourdin, 2011,)or comparative analysis between countries levels of logistics performance and economic development (Luisa Martía, et al 2014, BERNARD HOEKMAN, et al 2011, Stephen W. Hartman, 2010, Muster et al, 2007, Jane Korinek, et al, OECD, 2011), also it provides a very rich data for policy makers to efficiently asses their logistics performance (Varbanova A., 2017, W. Hwang, Paul, et al 2015, Hellen Xavier das Chagas, et al, 2014, Ratko Stanković, et al 2014).

Description of findings

To create the weighted LPI, the scores of the last LPI report on each of the components are multiplied with the weights we identified. Table1 shows that 106 countries are On a different place using the Entropy based Topsis while 107 countries are on a different place using the Un-weighted Topsis, with an average place movement of 0.08 places using the Entropy based Topsis and 0.03 using the Un-weighted Topsis When comparing the research results with the LPI latest ranking, we observed that the differences between the two rankings are relatively small, due to the small difference in the overall scores using the TOPSIS normal weight and the TOPSIS Entropy weight which might neglect the research hypothesis H1 that the Current LPI methodology doesn't provide enough explanation for the countries logistics performance

Although the ranking didn't change dramatically using the topsis un-weighted method however the results shows 27 countries with significantly different position with a maximum change of 5 positions upward (Togo, Burundi, Kazakhstan) and 5 positions downward (Iran, Algeria, Montenegro), Although the majority of the countries that had significantly different position in the index were not among the top performers which support H2 of this research that the country GDP is enough predictor for the country logistics performance

The LPI ranking using the Topsis Entropy method had shown significant change in the ranking of 25 countries with a maximum change of 5 positions upwards in the case of Kazakhstan and Togo however the change in the countries position downward shows a maximum of 6 positions downward in the case of Ethiopia, 5 positions in the case of Iran, Algeria, Bangladesh, Zambia, Congo DR and Bosnia and Herzegovina. Although most top ranking countries didn't change significantly, however the position of Iceland moved 4 positions upward and the position of Portugal moved three position upwards.

The small difference in ranking does not mean that weight assignment is not useful for addressing logistics performance. however the overall impression of the countries services affect the LPI ranking which support H3 of this research that the Current six core LPI components don't provide enough explanation for the countries logistics performance and the results of (Samet Guner and Erman Coskun 2012) that the countries with high social indicators can be perceived better by participants. This is true because successful social indicators allow logistics service providers to operate smoothly and formally within a country"

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