2023, 7 (1), 92-103

Uluslararası Ekonomi, İşletme ve Politika Dergisi

International Journal of Economics, Business and Politics

https://dergipark.org.tr/tr/pub/ueip

Identifying The Key Success Factors of E-Logistics in Turkey: AHP-VIKOR Integrated Methodology[1]

Türkiye'de E-Lojistiğin Kilit Başarı Faktörlerinin Belirlenmesi: AHP-VIKOR Bütünleşik Yöntem

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ARTICLE INFO

Article Type
Research Article

Keywords
E-Logistics
MCDM
AHP
VIKOR
Turkey

Received: Jan, 02, 2022
Accepted: Mar, 21, 2023

ABSTRACT

With the rapid development of information and communication technologies (ICT), businesses have addressed to new applications in their operations. Nowadays, almost all activities in logistics sector are carried out in the digital environment through emerging technologies. Accordingly, the purpose of this study to identify the success factors that critical for sustaining e-logistics activities. At first, a comprehensive literature review was conducted, and then expert opinion was taken to determine the criteria. By the help of feedbacks and literature review, five criteria were investigated in this study. The AHP-VIKOR integrated method which is widely used in multi-criteria decision-making methods (MCDM) was applied to evaluating success factors in e-logistics. The criteria weights were determined by the AHP method, and the relevant criteria were ranked by the VIKOR method. The results indicated that the reliability criterion has the highest weights, while transportation criterion has the lowest weight in identifying the key success factors of e-logistics.

MAKALE BİLGİSİ

Makale Türü
Araştırma Makalesi

Anahtar Kelimeler
E-Lojistik
ÇKKV
AHP
VIKOR
Türkiye

Geliş Tarihi: 02 Ocak 2023
Kabul Tarihi: 21 Mart 2023

ÖZ

Bilgi ve iletişim teknolojilerinin (BİT) hızla gelişmesiyle birlikte işletmeler, faaliyetlerinde yeni uygulamalara yönelmişlerdir. Günümüzde gelişen teknolojiler sayesinde lojistik sektöründeki çoğu faaliyet dijital ortamda gerçekleştirilmektedir. Bu noktadan hareketle, bu çalışmanın amacı, e-lojistik faaliyetlerini sürdürebilmek için kritik olan başarı faktörlerini belirlemektir. İlk olarak, kapsamlı literatür taraması yapılmış, ardından kriterlerin belirlenebilmesi için uzman görüşü alınmıştır. Uzman görüşü ve literatür taraması sonucu, bu çalışma kapsamında beş kriter incelenmiştir. E-lojistikte başarı faktörlerinin değerlendirilmesinde çok kriterli karar verme yöntemlerinde (ÇKKV) yaygın olarak kullanılan AHP-VIKOR bütünleşik yöntem uygulanmıştır. AHP yöntemi ile kriter ağırlıkları belirlenmiş ve ilgili kriterler VIKOR yöntemi ile sıralanmıştır. Araştırma sonuçları, e-lojistiğin temel başarı faktörlerini belirlemede güvenilirlik kriterinin en yüksek ağırlığa sahip olduğunu, nakliye kriterinin ise en düşük ağırlığa sahip olduğunu göstermiştir.

1. Introduction

Information and Communication Technologies (ICT) are considered as significant component for gaining competitive advantage of logistics companies. In the modern business world, traditional businesses without any emerging technologies application will have trouble to respond customer needs. Over the last two-decade, the popularity of electronic commerce (e-commerce) has grown exponentially by the help of speed, transparency, cost-effectiveness, and green orientation (Miscevic et al., 2018: 1353). With the rapid development of ICT and the growing importance of information,

[1] This article is derived from the paper presented orally at the 20th International Logistics and Supply Chain Congress.

Atıf/Cite as: Özekenci E. K. (2023). Identifying The Key Success Factors of E-Logistics in Turkey: AHP-VIKOR Integrated Methodology. *Uluslararası Ekonomi, İşletme ve Politika Dergisi,* 7(1), 92-103.

traditional forms of logistics have gained a greater extent toward modernization (Skitsko, 2016: 8). Parallel to these developments, logistics have evolved into e-logistics.

Currently, there is no commonly accepted definition of e-logistics. However, there has been increasing interest on the characteristics of e-logistics by researchers in recent years. For instance, Zunder and Islam (2011) defined the e-logistics as follows: it refers to the usage of internet and ICT tools in order to maintain logistics processes. According to definition by Gunasekaran et al. (2007) e-logistics involves 3PL service providers together with transportation and warehousing networks with appropriate information technologies such as the internet, radio frequency identification (RFID), mobile technologies, wireless and electronic data interchange (EDI). Therefore, e-logistics is also called as internet-based logistics. However, the use of internet itself in logistics processes does not mean that logistics become electronic. E-logistics is a complex system that involves logistics centers, distributors, carriers, resellers, and consumers among which uses mobile (wireless) and wired communication technologies to electronically exchange data over the internet with the goal of reducing data errors and increasing decision making efficiency (Skitsko, 2016: 9).

The multiple-criteria decision methods (MCDM) are considered as the science and art of choosing the optimal alternatives based on the decision maker's goals and preferences (Zarghami and Szidarovszky, 2011: 1). MCDM is widely used to solve complex decision problems in the fields of Social Sciences, such as Business, Accounting, Management, Finance, Economics etc. (Velasquez & Hester, 2013; Rekik et al., 2016). Some well-known examples of MCDM are the Analytic Hierarchy Process (AHP) by Saaty, Simple Additive Weighting (SAW) by Fishburn; Elimination and Choice Expressing Reality (ELECTRE) by Roy; Technique for Order Preference by Similarity to Ideal Solution (TOPSIS) by Hwang and Yoon; Preference Ranking Organization Method for Enrichment Evaluations (PROMETHEE) by Brans and Vincke; Multi-Attribute Utility Theory (MAUT) by Edwards and Newman (Greco et al., 2016). According to Wątróbski (2016) MCDM are commonly utilized in the field of logistics.

Over the last few decades, MCDM has been extensively applied to various logistics problems, such as outline of green logistics (Wątróbski, 2016), evaluation of logistics company website (Özbek and Engür, 2018), MCDM approach and its application in logistics (Zavadskas et al., 2018), evaluation of the logistics firm performance (Özbek, 2018), optimal solution of city logistics (Hanzl, 2020), operational efficiency of logistics service provider (Pamucar et al., 2021), suggesting the logistics service center placement (Stopka et al., 2022). Moreover, the significant number of studies examined the criteria interaction and criteria priorities in logistics field based on MCDM (Li et al., 2011; Önder and Yıldırım, 2014; Zaralı et al., 2018; Pekkaya and Keleş, 2021). So far, however, there has been no study investigating about criteria interaction in the context of e-logistics. Accordingly, the purpose of this study to identify the success factors which are critical for sustaining e-logistics activities.

With the complexity and multiplicity in the problem of identifying key success factors of e-logistics, the AHP-VIKOR integrated method is applied in this study. The main objective of using the AHP method is to obtain weights indicating the relative importance of each criterion. Then, the VIKOR method is applied to find out and rank the key success factors of e-logistics. The remainder of this paper is organized as follows: Section 2 highlights the data and methods. Section 3 demonstrates the application of AHP-VIKOR integrated methods in e-logistics. Section 4 exhibits the general findings and discussion. Section 5 presents the several conclusions and perspectives for the upcoming study.

2. Data and Methods

The aim of this study to identify the key success factors of e-logistics in Turkey by using AHP-VIKOR integrated methodology. The first step of the methodology was begun with identification of the criteria. Therefore, the comprehensive literature review was conducted to determine the criteria. Based on literature review, five criteria were detected which is namely, reliability, maintainability, facility, transportation, and technology effect the e-logistics activities. Then, selected criteria were evaluated by experts and their opinions were taken. The integrated methodology was implemented by steps of the AHP-VIKOR. AHP method was carried out to determine the weight of each criterion, while the VIKOR method was applied for ranking the criteria. The basic concepts and definition of AHP-VIKOR methods was discussed below.

2.1. AHP Method

AHP is one of the well-known MCDM method that was proposed by Thomas L. Saaty in the 1970s. AHP is a method for modelling and quantifying complex decision-making systems of decision makers (Saaty, 1987: 161). Global academic network recognizes that AHP as a robust, adaptable, and dynamic collaborative method for complex decision problems (Abdul et al., 2022, p.1020). AHP has been applied during the last quarter century in numerous decision-making problems in different various fields and determine the priorities of evaluation criteria (Alonso and Lamata, 2006; Büzüközkan and Görener, 2015; Emrouznejad and Marra, 2017). AHP generally involves three main steps (Saaty, 1990; Shokri et al., 2013; Singh et al., 2016; Wang, 2018). At first, the structure of the model is formed. Secondly, pairwise comparison of the alternatives and criteria is generated by using the ratio scale presented in Table 1. Lastly, synthesis of the priorities is presented. According to study conducted by Taha (2007), the determining of the criteria weight using the AHP method includes three primary steps is as follows (Sennaroglu and Celebi, 2008):

1) Once the comparison matrix, **A**, is formed, it is standardized by dividing the elements of each column by the sum of the elements of the same column. The sum of column elements of the resulting normalized matrix **N** is equal to 1.

2) The weight of the criteria is calculated as the row average of the normalized matrix **N**.

3) If the decision maker exhibits perfect consistency in specifying the entries of the matrix A, the columns of the matrix N are identical. The consistency ratio (**CR**) is used in the AHP method to check the judgment of decision makers toward relative importance weights. If CR ≤ 0.1, the level of inconsistency is acceptable. Otherwise, the inconsistency is high, and the decision maker may need to revise the elements of matrix A.

Table 1: The Fundamental Scale of AHP

Intensity of Importance	Definition	Explanation
1	Equal importance	Two criteria equally important
3	Less importance	One criterion is slightly favor over another
5	Strong importance	One criterion is strongly favor over another
7	Very strong importance	One criterion is very strongly favor over another
9	Extreme importance	One criterion is absolutely favor over another
2, 4, 6, 8	Intermediate values	When compromise is needed

Source: Saaty (1987)

2.2. VIKOR Method

The VIKOR method was proposed by Opricovic in 1998. It was introduced as one applicable technique to implement within MCDM. It determines the compromise ranking-list, the compromise solution, and the weight stability intervals for preference stability of the compromise solution obtained with the initial (given) weights. This method focuses on ranking and selecting from a set of alternatives in the presence of conflicting criteria. It introduces the multicriteria ranking index based on the particular measure of "*closeness*" to the "*ideal*" solution (Opricovic, 1998; Opricovic and Tzeng, 2004). In VIKOR method, the utility group is maximized by best alternatives and minimized the regret group. This method calculates the ideal solution's positive and negative ratio (Prasad et al., 2016, p.2).

Assuming that each alternative is evaluated according to each criterion function, the compromise ranking could be performed by comparing the measure of closeness to the ideal alternative. The multicriteria measure for compromise ranking is developed from the L_p-*metric* used as an aggregating function in a compromise programming method (Yu, 1973; Zeleny, 1982; Opricovic and Tzeng, 2004). The compromise ranking algorithm in the VIKOR method are as follows: (1) the decision matrix is formed and normalized based on the information gathered from decision makers. (2) Determine the best (f_j^*) and the worst (f_j^-) values for each criterion. (3) Compute the values of (S_j), (R_j) *and* (Q_j). V is indicated the strategic weight which is commonly assumed consensus by equal 0.5. (4) Rank the alternatives, sorting by the values S, R and Q, in decreasing order. The results are three ranking lists. (5) The acceptance conditions (C1 & C2) are satisfied (Opricovic, 1998; Opricovic and Tzeng, 2004; Tzeng et al., 2005; Opricovic and Tzeng, 2007).

3. Application of the AHP-VIKOR Methods

In this section, the steps of the integrated AHP-VIKOR method for identifying the key success factors in e-logistics operations is described and the findings are presented. In the context of this study, five criteria were evaluated by 7 experts who are experience in e-commerce and logistics sector. The brief information regarding the criteria is presented in Table 2.

Table 2: The Criteria Description

Criteria	Criteria Label	Definition
Reliability	RLB	It's the probability that an item will perform its intended function for a specified interval in a stated condition. Therefore, the frequency of maintenance is dependent on reliability of item.
Maintainability	MAIN	It's an inherent design feature that addresses the ease, correctness, safety, and economy of performing maintenance functions.
Facility	FCLTY	It's play an important role in support activities related to performing active maintenance tasks, providing spare and repair parts for warehousing functions, and providing accommodation for related administrative functions.
Transportation	TRNS	The set of activities regarding transportation causes to increase energy consumption, air pollution, noise, traffic jam and costs.
Technology	TECH	It contains tools and processes relevant to the company, both internally and externally. It's considered a critical component of support many systems in organization.

Source: (Wang and Chen, 2006; Yu and Bae, 2009; Liu, 2017; Iskandar and Ramantoko, 2018)

In order to calculate the criteria weights, AHP method was implemented. Based on judgment of the decision makers, the pairwise comparison matrix with geometric means and normalized matrix was formed and presented in Table 3.

Table 3: AHP Pairwise Comparison Matrix and Normalized Matrix

Pairwise	RLB	MAIN	FCLTY	TRNS	TECH
RLB	**1.00**	1.00	3.00	3.00	3.00
MAIN	1.00	**1.00**	1.00	3.00	3.00
FCLTY	0.33	1.00	**1.00**	3.00	1.00
TRNS	0.33	0.33	0.33	**1.00**	1.00
TECH	0.33	0.33	1.00	1.00	**1.00**
Column Sum	2.99	3.66	6.33	11.00	9.00
Normalized	**RLB**	**MAIN**	**FCLTY**	**TRNS**	**TECH**
RLB	0.3344	0.2732	0.4739	0.2727	0.3333
MAIN	0.3344	0.2732	0.1579	0.2727	0.3333
FCLTY	0.1103	0.2732	0.1579	0.2727	0.1111
TRNS	0.1103	0.0901	0.0521	0.0909	0.1111
TECH	0.1103	0.0901	0.1579	0.0909	0.1111

Afterwards, the weights of each criterion were calculated. As stated on the above, CR should be less than or equal to 0.10. In this study, the value of CR was found as 0.0440. This result is implicit that the level of inconsistency is acceptable. Table 4 demonstrates the weight of each criterion and overall consistency rate.

Table 4: Summary of Key Success Factors for E-Logistics

Criteria	Objective	Weight	Consistency
Reliability	Max	0.3415	0.0440
Maintainability	Max	0.2709	
Facility	Max	0.1833	
Transportation	Min	0.0903	
Technology	Max	0.1138	

Based on the values of criteria weight gathered at the end of the first step, VIKOR was applied in the second step for the ranking alternatives. The best and worst values for each criterion was calculated in below and presented in Table 5.

If it is a benefit criterion that is to be maximized:

f_{rlb}^{*} = max (1,1,1/3,1/3,1/3) = 1 and f_{rlb}^{-} = min (1,1,1/3,1/3,1/3) = 0.33

f_{main}^{*} = max (1,1,1,1/3,1/3) = 1 and f_{main}^{-} = min (1,1,1,1/3,1/3) = 0.33

f_{fclty}^{*} = max (3,1,1,1/3,1) = 3 and f_{fclty}^{-} = min (3,1,1,1/3,1) = 0.33

f_{tech}^{*} = max (3,3,1,1,1) = 3 and f_{tech}^{-} = min (3,3,1,1,1) = 1

If it is a cost criterion that is to be minimized:

f_{trns}^{-} = min (3,3,3,1,1) = 1 and f_{trns}^{*} = max (3,3,3,1,1) = 3

Table 5: The Best (f_j^*) And The Worst (f_j^-) Values For Each Criterion

Criteria	f_j^*	f_j^-
RLB	1.00	0.33
MAIN	1.00	0.33
FCLTY	3.00	0.33
TRNS	1.00	3.00
TECH	3.00	1.00

In the following step, S (utility measure) and R (regret measure) was calculated in below and presented in Table 6 and 7.

$S*$ = min (0.0909; 0.2278; 0.6831; 0.9095; 0.8637) = 0.0903

S^- = max (0.0909; 0.2278; 0.6831; 0.9095; 0.8637) = 0.9095

$R*$= min (0.0903; 0.1375; 0.3415; 0.3415; 0.3415) = 0.0903

R^- = max (0.0903; 0.1375; 0.3415; 0.3415; 0.3415) = 0.3415

Q_{rlb} = 0.5*(0.0903-0.0903)/ (0.9095-0.0903) +(1-0.5) *(0.9003-0.0903)/ (0.3415-0.0903) = 0.0000

Q_{main} = 0.5*(0.2278-0.0903)/ (0.9095-0.0903) +(1-0.5) *(0.1375-0.0903)/ (0.3415-0.0903) = 0.1778

Q_{fclty} = 0.5*(0.6831-0.0903)/ (0.9095-0.0903) +(1-0.5) *(0.3415-0.0903)/ (0.3415-0.0903) = 0.8618

Q_{trns} = 0.5*(0.9095-0.0903)/ (0.9095-0.0903) +(1-0.5) *(0.3415-0.0903)/ (0.3415-0.0903) = 1.0000

Q_{tech} = 0.5*(0.8637-0.0903)/ (0.9095-0.0903) +(1-0.5) *(0.3415-0.0903)/ (0.3415-0.0903) = 0.9720

Table 6: (S_j) and (R_j) Values for VIKOR model

Criteria	RLB	MAIN	FCLTY	TRNS	TECH	S_j	R_j
RLB	0.0000	0.0000	0.0000	0.0903	0.0000	0.0903	0.0903
MAIN	0.0000	0.0000	0.1375	0.0903	0.0000	0.2278	0.1375
FCLTY	0.3415	0.0000	0.1375	0.0903	0.1138	0.6831	0.3415
TRNS	0.3415	0.2709	0.1833	0.0000	0.1138	0.9095	0.3415
TECH	0.3415	0.2709	0.1375	0.0000	0.1138	0.8637	0.3415

Table 7: Values of $[S*, S^-]$ and $[R*, R^-]$

S_j	R_j	$S*$	S^-	$R*$	R^-
0.0903	0.0903	0.0903	0.9095	0.0903	0.3415
0.2278	0.1375				
0.6831	0.3415				
0.9095	0.3415				
0.8637	0.3415				

Following this, the VIKOR index (*Q)* values for each criterion with υ value as 0.5 was computed and presented in Table 8.

Table 8: Values of $[Q_j]$ Function

Criteria	Q_j
RLB	0.0000
MAIN	0.1778
FCLTY	0.8618
TRNS	1.0000
TECH	0.9720

The final ranking of each criterion by the values of *S, R* and *Q* was presented in Table 9.

Table 9: Criteria Ranking by VIKOR

Criteria	S_j	Rank by S_j	R_j	Rank by R_j	Q_j	Rank by Q_j
RLB	0.0903	1	0.0903	1	0.0000	1
MAIN	0.2278	2	0.1375	2	0.1778	2
FCLTY	0.6831	3	0.3415	3	0.8618	3
TRNS	0.9095	5	0.3415	4	1.0000	5
TECH	0.8637	4	0.3415	5	0.9720	4

In order to propose the criteria as the compromise solution, two condition which is acceptable advantage and acceptable stability should be satisfied. Based on calculation, condition 1 is not satisfied when *RLB* and *MAIN* are compared as follows:

Condition 1: Acceptable Advantage

$DQ = 1/(m-1) = 0.25$

$Q_{MAIN} - Q_{RLB} = 0.1778 - 0.0000 = 0.1778$

The value of $Q_{MAIN} - Q_{RLB} < DQ$. Therefore, condition 1 is not fulfilled.

Condition 2: Acceptable Stability in Decision Making

RLB is at the first position on the ranking list S_j *and* R_j. Thus, condition 2 is fulfilled. Since condition 1 is not fulfilled:

$Q(A^{(m)}) - Q(A^{(1)}) < DQ$

$Q_{MAIN} - Q_{RLB} = 0.1778 - 0.0000 = 0.1778 < DQ$

It can be seen from the above, *RLB* and *MAIN* are in compromise group. Final ranking based on S_j, R_j *and* Q_j is shown in Table 10.

Table 10: Final Ranking of All Criteria

S_j	RLB> MAIN> FCLTY> TECH> TRNS
R_j	RLB> MAIN FCLTY> TRNS> TECH
Q_j	RLB> MAIN> FCLTY> TECH> TRNS

3.1. Sensitivity Analysis

A sensitivity analysis was applied by modifying the υ values of the criteria from 0 to 1. The results of the sensitivity analysis were presented in Table 11.

Table 11: Sensitivity Analysis Results

	v=0		v=0.25		v=0.50		v=0.75		v=1.00	
	Q_j	Rank	Q_j	Rank	Q_j	Rank	Q_j	Rank	Q_j	Rank
RLB	0.0000	1	0.0000	1	0.0000	1	0.0000	1	0.0000	1
MAIN	0.1878	2	0.1828	2	0.1778	2	0.1728	2	0.1678	2
FCLTY	1.0000	3	0.9309	3	0.8618	3	0.7927	3	0.7236	3
TRNS	1.0000	4	1.0000	5	1.0000	5	1.0000	5	1.0000	5
TECH	1.0000	5	0.9860	4	0.9720	4	0.9580	4	0.9441	4

Based on sensitivity analysis result, ranking of criteria is the similar as previous major ranking. The results are not sensitive while modifying the value of maximum utility (υ). Thus, the results stated that selected criteria can be considered as key success factors in e-logistics. According to results seen in Table 11, RLB has lowest Q values in all scenarios based on the values of maximum utility (υ). The best ranking result (Q_j) with different υ values are RLB (RLB; υ=0; υ=0.25; υ=0.50; υ=0.75; υ=1.00), as illustrated in above. Hence, RLB is seen as crucial criteria for e-logistics based on its lowest Q value.

4. Results and Discussion

At first, the weights of the five criteria were calculated using AHP method. Table 3 presents the AHP pairwise comparison matrix which includes judgments of the experts. Based on the AHP results, the criteria weights vector as follows: RLB; 0.3415, MAIN; 0.2709, FCLTY; 0.1833, TRNS; 0.0903, TECH; 0.1138. The consistency ratio was computed 0.0440. The results indicated that the reliability criteria have the highest weights, while transportation criteria have the lowest weight in identifying the key success factors of e-logistics.

Once the criteria weights were calculated with expert judgments, the final rank of each criterion was performed by applying VIKOR method. As illustrated in Table 5, the best (f_j^*) and the worst (f_j^-) values for each criterion was computed for the positive and negative attributes. The best and worst values for each criterion were as follows: RLB (f_j^*); 1.00; MAIN (f_j^*); 1.00, FCLTY (f_j^*); 3.00, TRNS (f_j^*); 1.00, TECH (f_j^*); 3.00, RLB (f_j^-); 0.33, MAIN (f_j^-); 0.33, FCLTY (f_j^-); 0.33, TRNS (f_j^-); 3.00, TECH (f_j^-); 1.00. Table 9 shows the S, R and Q values for five criteria. As demonstrated in Table 9, the criteria with the lowest values of (S), (R) and (Q) was selected as the superior factors. Therefore, the first criterion (RLB) was considered as most critical success factor of e-logistics, and rest of the criteria were ranked as shown in Table 10.

Based on the application of VIKOR method, there are two compromise solutions, because the top two are "*close*". The results revealed that the reliability is the most important factor, followed by the maintainability. The sensitivity analysis was performed to monitor the robustness of each criterion ranking by modifying the maximum utility values (υ). According to the sensitivity analysis results, ranking of the criteria is the similar as prior ranking list (Table 11). More clearly, the ranking is not sensitive to changes in υ values. This result proven that solutions gathered from AHP-VIKOR integrated methods were stable.

According to results from the above, it's clear that reliability will be the most critical factor for e-logistics operations. It seems to be decision makers in logistics sector have undergone a significant change. In traditional belief, transportation and technology could be considered as most important factors of e-logistics. However, the reliability was found most critical factor of e-logistics. This finding implicit that reliability is the main component for the sustainability of the systems. As noted by Blanchard (1998) unreliable systems generally require comprehensive maintenance. When the reliability of a system is enhanced, the frequency of maintenance will decline (Yu and Bae, 2009: 31). Parallel to this, the maintenance was placed at second rank as a key success factor of e-logistics. The management of such a complex system as e-logistics is quite difficult. Therefore, the planning, implementation and feedback process should be addressed systematically. Additionally, Turki and Rezg (2017) stated that the profitability of the businesses is mainly depending on maintenance costs.

The decision makers also emphasized that facility and technology is important components for the development of e-logistics. Because e-logistics is commonly associated with radio frequency identification (RFID), electronic data interchange (EDI), the internet of things (IoT) and robots for meeting customer expectations (www.zhenhub.com, 2022). Therefore, it can be concluded that e-logistics cannot be sustained without modern technological infrastructure and facilities. According to decision makers, transportation is considered as least important factor of e-logistics. The environmental consciousness such as air pollution, energy consumption, noise, traffic jam is not considered seriously.

5. Conclusion

In this study, AHP-VIKOR integrated methods was applied to identify key success factors of e-logistics. So far, no study regarding to e-logistics examined with MCDM has been found in the literature. Accordingly, the purpose of this study to identify the success factors which are critical for sustaining e-logistics activities. For this purpose, the comprehensive literature review was conducted to find out relevant criteria. Then, expert opinions were gathered for five criteria. The criteria weight was calculated using AHP method. The VIKOR method was applied for final ranking. Regarding the results obtained from AHP-VIKOR integrated methods, the ranking of the criteria from most important to least important is as follows: RLB> MAIN> FCLTY> TECH> TRNS.

The present study makes some noteworthy contributions to academic and managerial implications. This study can be useful for researchers who are planning to study in the fields of e-logistics with MCDM. Additionally, it is thought that this study will provide an insight to the managers who are in the decision-making position in the logistics sector. To the knowledge of the authors, this study is the first paper which investigate the key success factors of e-logistics by using the AHP-VIKOR methods. Further research might focus on different evaluation criteria includes application of various fuzzy MCDM, such as fuzzy AHP-VIKOR. Besides, it would be useful the results to compare with other MCDM such as TOPSIS, ARAS, COPRAS, etc.

Statement of Support and Appreciation: No external support has been received during the conduct of this study.
Researchers' Contribution Rate Statement: The research was conducted by a single author.
Conflict of Interest Statement: I don't have any conflict-of-interest declaration as the author of the study.
Research and Publication Ethics Statement: All the rules stated in the "Higher Education Institutions Scientific Research and Publication Ethics Directive" were strictly considered at every stage of this research. None of the actions specified under the heading "Actions Against Scientific Research and Publication Ethics" of the directive has not been carried out. During the writing process of this study, the citations were made in accordance with the ethical rules and a bibliography was created. The study was subjected to plagiarism control.

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