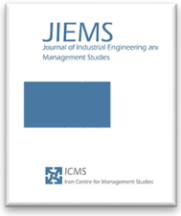
Vol. 11, No. 1, 2024, Pages 97-109

JIEMS
Journal of Industrial Engineering and Management Studies

journal homepage: www.jiems.icms.ac.ir



Using a hybrid multi-criteria decision-making approach to evaluate the financial and operational performance of third-party logistics providers

Roya Yousefi[1], Hossein Amoozad Khalili [*2], Maryam Khalili Araghi[1], Adel Pourghader Chobar [4]

[1] Department of Management and Economics, Sciences and Research Branch, Islamic Azad University, Tehran, Iran
[2] Department of Industrial Engineering, Sari Branch, Islamic Azad University, Sari, Iran.
[3] Department of Industrial Engineering, Faculty of Industrial and Mechanical Engineering, Qazvin Branch, Islamic Azad University, Qazvin, Iran

Received: Dec 2023-06/ Revised: Apr 2024-11/ Accepted: May 2024-01

Abstract

In today's world, international exchanges have become more prosperous due to trade and globalization. In this competitive environment, availability of products is as important as price, quality of materials, and construction. This issue doubles the importance of logistics in today's era. In this paper, a new hybrid multi-criterion decision-making MCDM technique for choosing third-party logistics service providers is developed. With having the necessary capacities and facilities, third-party logistics, or 3PLs, can take on logistic activities in a specialized manner so that manufacturers can focus on the important issues related to production optimization. To outsource logistics activities, evaluation, ranking, and selection of 3PLs are strategic decisions. By using the BWM, Best-Worst Method, the identified criteria were weighted to evaluate the financial and operational performance of third-party logistics companies. After that, the EDAS technique was used to rank 3PLs listed on Tehran Stock Exchange. According to the calculations made in this research, Tidewater Co was ranked first, Iran Shipping Co was ranked second, and Tuka Transport, Persian Gulf Transportation, and Rail Seyr Co was ranked third to fifth.

Keywords: Performance Evaluation, Third Party Logistics Service Providers, Best-Worst Method (BWM), EDAS Technique.

Paper Type: Original Research

1. Introduction

Due to specialization, increase of competitions, and the need to respond faster, organizations require to focuse on their main competencies and outsorce their secondary activities to specialized organizations which provide those services. Third-party logistics service providers bring more operational flexibility and efficiency to companies. (Pal Singh et al., 2021) In response to the ever-increasing need for this, 3PLs have grown in popularity. To outsource their logistics activities, companies must choose the most appropriate logistics service provider out of many. It is common for international companies to rely heavily on third-party logistics companies to lower their budgets, form strategic alliances and enhance expertise, reengineer logistics, access new technologies, and create virtual companies that focus on their core businesses. As the supply chain has become increasingly complex, global competition has increased, and customers are demanding more timely, and flexible service, 3PL's role has changed drastically (Pamucar et al., 2019). Additionally, 3PL financing leads to greater supply chain efficiency by encouraging the retailer to order more. (Hua et al. 2021) Due to the high overhead costs involved with logistics assets, 3PLs often distribute financial costs through subcontracting. In this case, choosing the right third-party logistics provider is a critical strategic choice for businesses that want to focus on their core competencies as competitive assets, while outsourcing their other operations to technical and specialized companies. (Sahebi,2022) It is considered very important for organizations to evaluate their performance as the main tool to improve performance. To enhance their financial and operational performance, organizations need to become aware of their current situation and then analyze the results derived from evaluation, using multiple techniques. Performance evaluation is done with two different goals. First, organizations periodically evaluate their financial, operational, and human resource performance in order to ensure their plans are implemented and to have sufficient information for future planning. In addition, when making a decision to cooperate with other companies, for example, in supply chain and outsourcing matters, organizations should analyze the data regarding them, so that they can choose the best alternative. Evaluating the operational performance of companies shows the quality of their services. Therefore,

*Corresponding Author: Amoozad92@yahoo.com

performance evaluation which is a managerial responsibility is considered a valuable aid to managerial decision-making. (Yalcin et all.,2021) Through the MCDM approach, complex decision-making problems can be structured in a practical manner. by hybridizing MCDM models, it appears that Supply Chain management can be more efficiently implemented. (Laganà, I. R., & Colapinto, C. 2022) In order to gaine more practical result, we combined two MCDM methods. Logistics companies in Iran have potential capacities. In addition, due to the geographical location of Iran and being located on the Silk Road, there are special conditions for the growth and maturity of Iranian logistics companies at the international level. Better and more up-to-date research can help these companies become more visible. By ranking at the level of listed companies, we can create a competitive environment that allows Iranian 3PL companies to prosper at the international level. As research objectives, this article presents a weighting scheme for financial and operational factors associated with evaluating third-party logistics companies that are listed on Tehran Stock Exchange, along with evaluating their performance using the best-worst method, and ranking them using the EDAS method.

2. Literature review

The present research was conducted in this direction to evaluate the third-party logistics service providers listed on Tehran Stock Exchange and to provide competitive situation and growth of the companies as much as possible. Chajarla et al. (2022) emphasize the importance of logistics performance in business because it impacts timely service delivery and the achievement of sustainable profitability. Their study shows the dominance of third-party service providers has led to the growth of outsourcing in logistics, as well as an increased awareness and regulation of sustainability that have made forward and reverse logistics vital. The researchers reviewed 124 academic articles published between 2010 and 2019 in prestigious academic journals in order to identify common research methods, MCDM tools. They also identified the hybrid methods and analysis that individuals use most frequently. Keshavarz Ghorabai et al. (2017) studied the financial and operational evaluation of 3PLs using the CRITIC weightening technique and the WASPAS technique. In their research, they have paid attention to the uncertainty in the information obtained in the decision-making process. In this research, the IT2FS type interval fuzzy set is suitable for MCDM modeling. In this method, the objective weights obtained from the CRITIC method are combined with the subjective weights expressed by the decision makers, to be more realistic weights for the criteria. The research results show that the proposed approach has been able to solve the uncertainty problems in multi-criteria decision making of MCDM with IT2FS. Ecer (2018) in research to find a competitive advantage for large organizations, introduced companies that provide third-party logistics services. Due to the uncertainty level in the selection process, this research has presented a new integrated model by combining fuzzy AHP and evaluation based on the distance from the average solution of EDAS, which is used to calculate the weights of the criteria from fuzzy AHP and from EDAS for the final ranking. Third-party logistics service providers have been used. The result of this research is to present a simple model that cost, along with quality and professionalism, are the most important factors for choosing companies. Pamucar et al. (2019) tried to find a solution for the lack of accurate and sufficient information to evaluate the criteria and eliminate these problems that existed in previous techniques. Therefore, an integrated IRN interval approximate number approach, based on the Best-Worst Method (BWM) and the weighted aggregated product evaluation method, WASPAS, together with the MABAC technique, is presented to evaluate third-party logistics service providers. The final results of this research show the stability in the ranking of alternatives. Gwami et al. (2020) evaluated the operational performance of third-party logistics companies in India with the help of SEM technique. In this research, it provides evidence, which supports the systemic relationships between internal enablers of logistics companies and external factors in the background of environmental sustainability. Major findings show that transportation and distribution network planning and commodity considerations with top management support can improve environmental performance. By linking the literature related to environmental sustainability and information exchange related to logistics companies, this study shows that it can help the main pillars of logistics to facilitate the achievement of environmentally sustainable performance. Ulutaş and Topal (2021) have used a new hybrid model to select optimal third-party logistics providers. Their study included a rough step-wise weight assessment ratio analysis (SWARA), Rough preference selection Index (RPSI), and Rough improved operational competitiveness rating analysis (IOCRA). Using this model and carring out a comprehensive analysis, the best option as a 3PL provider may be determined as a partner for logistics. The model's effectiveness has been tested in a real case with a textile business and several 3PL providers. Afum et al. (2021) investigated the mediation effects between logistics outsourcing and financial performance based on time-based competitiveness, cost-based competitiveness, and customer performance. Based on the results, logistics outsourcing significantly improves competitiveness on all four dimensions: time-based competitiveness, cost-based competitiveness, customer performance, and financial performance. Luyen and Thanh (2022) developed a complete approach to evaluate the quality of the logistics service industry. The combined method of the SERVQUAL and FAHP–TOPSIS models provides sufficient answers and allows decision-makers to visualize the impact of different criteria on the outcome. Additionally, they clam these mixed models can provide valuable information and methodologies for other industries that require service quality assessment. Dovbischuk (2022) investigated logistics service providers' dynamic capabilities and firm performance during COVID-19. According to the findings, investing in internal resources and maintaining external relationships with partners and competitors are key

components of the capability-building view. Logistics Service Providers must leverage their innovation power to activate resilience components in order to take on pandemic challenges. Study findings demonstrate that the development of internal and external logistic resources enhances dynamic resilience in times of crisis, such as COVID-19.

3. Methodology

The current study aims to evaluate performance of third-party logistics providers in order to select the most appropriate alternative for businesses to outsource their logistics activities. For this purpose, we examined the factors affecting the financial and operational performance of third-party logistics companies listed on the stock market, and then, using Best-Worst method, calculate their weights. (Rezaei, J. 2015) In this research, the financial and operational criteria available in the companies' financial statements have been used. The alternatives considered, are the third-party logistics service providers listed on the Tehran Stock Exchange, whose financial statements are available on the Kodal website. As part of the preference modeling process, it is important to obtain preferences from the DM. DM can provide preferential information directly (or forward) and indirectly (via the backward approach). It is more intuitive for DMs to compare alternatives pairwise, and it requires less cognitive effort on their part. (Eriskin L.2021) At the next step, using EDAS technique, the alternatives have been ranked. EDAS technique is the concept of evaluating problem alternatives based on the distance from the average solution which has been presented by Keshavarz Ghorabaiee at 2015. The statistical population of this research are the managers and senior experts of the country's auditing organization, who are experts in the field of finance. They audit all kinds of manufacturing and service companies, so they also know the important operational factors in different industries. In order to calculate the weight of the criteria by using the best-worst method, a questionnaire was prepared and twelve experienced experts of the auditing organization of the country were questioned. The questionnaire was evaluated in terms of validity and reliability. After reviewing the questionnaires, based on the similar opinions of the experts, the experts were divided into 3 groups. Therefore, in the calculations of the three selected groups, they have been named the first to the third expert groups.

4. Data Analysis

The first step in the decision-making process is to identify the important indicators. Important criteria have been determined based on the results of the recent restudies and articles. We selected the available criteria from the financial statements of third-party logistics companies listed on the Tehran Stock Exchange. In each of the financial and operational areas, four important criteria have been identified, as shown in Table 1:

Table 1. Financial and Operational Criteria for Performace Evaluation

Financial Criteria		Operational Criteria	
C1	Operating Renenue	C1	Operating Prifit
C2	Price of Service Provided	C2	Number of Employees
C3	Return on Investment	C3	Asset Turnover
C4	Leverage Ratio	C4	Operating Costs

Weighting the criteria using BWM

The proposed approach uses the best-worst method to weight the decision criteria. (Amiri. & Emamat. 2020). This method involves the following steps:

Step 1:

First, the criteria used to rank the desired alternatives should be identified, which was done earlier.

Step 2:

At this stage, the best (most important) criteria for the financial and operational evaluation of 3PLs, as well as their worst (most insignificant) criteria, are determined. Then the matrices of pairwise comparisons of the best criterion with other criteria and other criteria with the worst criterion are prepared. The values of the matrix are

determined based on Saaty's 1 to 9 scale. The data of this step has been prepared by a survey of 3 expert groups, which are managers and senior experts of the country's audit organization.

Step 3:

In this step, using the developed model of BWM linear programming model (Rezaei, J. 2016), the linear programming model is formed. In this method, ξL can be used as a consistency ratio.

min ξL

s.t.

$|wB - aBjwj| \leq \xi L$, for all j,

$|wj - ajWwW| \leq \xi L$, for all j,

$\sum_j Wj = 1$,

$wj \geq 0$, for all j. (1)

Based on the opinion of each of the 3 groups of experts, who were questioned, the weights of the criteria are calculated and finally, the geometric mean is taken from all three weights and the final weight is obtained.

Compute the weight of financial criteria

Expert Group 1:

In Table 2, you can see the views of the first expert group in determining the most important criteria and the least important criteria, as well as the pairwise comparisons:

Table 2. Pairwise comparisons for Financial Criteria as determined by Expert Group 1

Best to Others	C1	C2	C3	C4
Best Criterion (C3)	6	8	1	2
Others to Worst	Worst Criterion (C2)			
C1	3			
C2	3			
C3	8			
C4	7			

Using Lingo software for the first expert group, we solved the linear programming model of financial criteria according to model (1):

W1=0.1, W2=0.06, W3=0.53, W4=0.31

The calculated consistency ratio is 0.08, which is acceptable.

Expert Group 2:

Table 3 shows the most important and least important criteria, as well as the pairwise comparisons, according to the second expert group:

Table 3. Pairwise comparisons for Financial Criteria as determined by Expert Group 2

Best to Others	C1	C2	C3	C4
Best Criterion (C1)	1	7	2	8
Others to Worst	Worst Criterion (C4)			
C1	8			
C2	2			
C3	7			
C4	1			

By solving the linear programming model, based on model (1), the following results are obtained:

W1=0.54, W2=0.09, W3=0.31, W4=0.06

The calculated consistency ratio is 0.09, which is acceptable.

Expert Group 3:

Table 4 shows the most important and least important criteria, as well as the pairwise comparisons, according to the second expert group:

Table 4. Pairwise comparisons for Financial Criteria as determined by Expert Group 3

Best to Others	C1	C2	C3	C4
Best Criterion (C3)	3	7	1	8
Others to Worst	Worst Criterion (C4)			
C1	6			
C2	2			
C3	8			
C4	1			

By solving the linear programming model, based on model (1), the following results are obtained:

W1=0.24, W2=0.10, W3=0.64, W4=0.06

The calculated consistency ratio is 0.12, which is acceptable.

The geometric mean of the obtained weights is considered as the final weight of the financial criteria in Table 5:

Table 5. Final Weight of Financial Criteria

Financial Criteria	Expert1	Expert2	Expert3	Final Weight
C1	0.10	0.54	0.24	0.24
C2	0.06	0.09	0.10	0.08
C3	0.53	0.31	0.64	0.46
C4	0.31	0.06	0.06	0.10

Compute the weight of Operational criteria

Expert Group 1:

In Table 6, you can see the views of the first expert group in determining the most important criteria and the least important criteria, as well as the pairwise comparisons:

Table 6. Pairwise comparisons for Operational Criteria as determined by Expert Group 1

Best to Others	C1	C2	C3	C4
Best Criterion (C1)	1	8	2	2
Others to Worst	Worst Criterion (C2)			
C1	8			
C2	1			
C3	7			
C4	7			

By solving the linear programming model, based on model (1), the following results are obtained:

W1=0.44, W2=0.05, W3=0.26, W4=0.26

The calculated consistency ratio is 0.09, which is acceptable.

Expert Group 2:

In Table 7, you can see the views of the first expert group in determining the most important criteria and the least important criteria, as well as the pairwise comparisons:

Table 7. Pairwise comparisons for Operational Criteria as determined by Expert Group 1

Best to Others	C1	C2	C3	C4
Best Criterion (C3)	2	8	1	7
Others to Worst	Worst Criterion (C2)			
C1	7			
C2	1			
C3	8			
C4	2			

By solving the linear programming model, based on model (1), the following results are obtained:

W1=0.31, W2=0.06, W3=0.54, W4=0.09

The calculated consistency ratio is 0.09, which is acceptable.

Expert Group 3:

In Table 8, you can see the views of the first expert group in determining the most important criteria and the least important criteria, as well as the pairwise comparisons:

Table 8. Pairwise comparisons for Operational Criteria as determined by Expert Group 1

Best to Others	C1	C2	C3	C4
Best Criterion (C1)	1	8	2	9
Others to Worst	Worst Criterion (C4)			
C1	8			
C2	2			
C3	7			
C4	1			

By solving the linear programming model, based on model (1), the following results are obtained:

W1=0.55, W2=0.08, W3=0.32, W4=0.06

The calculated consistency ratio is 0.09, which is acceptable.

The geometric mean of the obtained weights is considered as the final weight of operational criteria, which is shown in Table 9:

Table 9. Final Weight of Financial and operational Criteria

Financial Criteria	Final Weight	Operational Criteria	Final Weight
Operating Renenue C1	0.24	Operating Prifit C1	0.42
Price of Service Provided C2	0.08	Number of Employees C2	0.06
Return on Investment C3	0.46	Asset Turnover C3	0.35
Leverage Ratio C4	0.10	Operating Costs C4	0.11

3PL Ranking Using EDAS

EDAS technique is the concept of evaluating problem alternatives based on the distance from the average solution. In this technique, n alternatives and m indicators are evaluated, and each problem is considered as a geometric system including m points in an n-dimensional space. To evaluate the optimal alternative, we first obtain the average solution for each criterion. For each alternative, we calculate the Positive Distance from the Average (PDA) and the Negative Distance from the Average (NDA). The values show the difference between each alternative and the average. Using this method, higher PDA values and lower NDA values are used to evaluate the optimal alternative. (Keshavarz-Ghorabaee et al. 2015)

Financial Evaluation

Step 1: Choosing Criteria and Alternatives

At first, important alternatives and indicators for decision-making should be determined, as well as the weight of each indicator. The alternatives in this case include Tidewater Co, Tuka Transport, Rail Seyr Co, Persian Gulf Transportation, and Iran Shipping Co. Also, the financial criteria are considered in order of Operating Revenue, Price of Service Provided, Return on Investment and Leverage ratio, which the leverage ratio is a negative criterion.

Step 2: Creating the Decision Matrix

We creat the decision matrix with 4 criteria and 5 alternatives. In this matrix, the columns are the criteria and the rows are the alternatives of the decision problem. The values of the matrix indicate the score assigned to each alternative based on each criterion, and these values are taken from the financial statements of third-party logistics

companies listed on Tehran Stock Exchange. The decision-making matrix related to financial performance evaluation is as follows:

$$XF=[Xij]5\times4=\begin{vmatrix} 17.76 & 10.00 & 0.38 & 0.86 \\ 2.11 & 1.80 & 0.23 & 0.96 \\ 1.36 & 1.04 & 0.05 & 0.43 \\ 5.18 & 5.74 & 0.16 & 1.38 \\ 120.98 & 9.90 & 0.01 & 3.72 \end{vmatrix}$$

Based on the Best-Worst Method, the weight matrix of financial criteria is as follows:

$$WF=[0.24 \quad 0.08 \quad 0.24 \quad 0.10]$$

Step 3: Determine the Average Solution for all Criteria

Each alternative's average solution is calculated in this step. The AV row matrix is formed as follows:

$$AV=[29.48 \quad 5.70 \quad 0.17 \quad 1.67]$$

Step 4: Calculation of the Positive Distance from the Average (PDA) and the Negative Distance from the Average (NDA)

The following equations are used to determine the PDA and NDA for positive and negative criteria:

If the criterion is positive:

$$PDAij=\frac{\max(0,(Xij-AVj))}{AVj},$$

$$NDAij=\frac{\max(0,(AVj-Xij))}{AVj} \qquad (2)$$

If the criterion is negative:

$$PDAij=\frac{\max(0,(AVj-Xij))}{AVj}$$

$$NDAij=\frac{\max(0,(Xij-AVj))}{AVj} \qquad (3)$$

We calculate PDA and NDA values for positive and negative criteria using Equations (2) and (3). The results are shown in Tables 10 and 11. (In these equations, PDAij is the positive distance and NDAij is the negative distance of the i-th alternative, from the average solution of the j-th critrion.)

Table 10. Positive Distance from the Average Solution

alternatives	PDAi1	PDAi2	PDAi3	PDAi4
Tide	**0.00**	**0.76**	**1.31**	**0.48**
Tuka	**0.00**	**0.00**	**0.36**	**0.42**
Seyr	**0.00**	**0.00**	**0.00**	**0.14**
Fars	**0.00**	**0.01**	**0.00**	**0.18**
Shipping	**3.10**	**0.74**	**0.00**	**0.00**

Table 11. Negative Distance from Average Solution

alternatives	NDAi1	NDAi2	NDAi3	NDAi4
Tide	0.40	0.00	0.00	0.00
Tuka	0.93	0.68	0.00	0.00
Seyr	0.95	0.82	0.68	0.00
Fars	0.82	0.00	0.04	0.00
Shipping	0.00	0.00	0.96	1.23

Step 5: Determine the weighted sum of PDA and NDA

Herein, the weighted sum of PAD and NDA are calculated according to equation (4). The results of the calculations are listed in Table 12:

$$SPi = \sum_{j=1}^{m} Wj\ PDAij$$

$$SNi = \sum_{j=1}^{m} Wj\ NDAij \qquad (4)$$

Table 12. agrigated weight of PDA and NDA

Alternatives	Spi	Sni
Tide	0.71	0.10
Tuka	0.21	0.28
Seyr	0.01	0.61
Fars	0.02	0.21
Shipping	0.80	0.56

Step 6: Normalize Sp and Sn values

Table 13 shows the normalized Sp and Sn values for all alternatives:

Table 13. normalized Sp and Sn

Alternatives	NSpi	NSni
Tide	0.88	0.84
Tuka	0.26	0.54
Seyr	0.02	0.00
Fars	0.02	0.65
Shipping	1.00	0.07

Step 7: Calculate the appraisal scores

In this step, the evaluation scores of all alternatives are obtained based on Table 14: (the value of ASi is between zero and one.)

Ranking based on Financial Performance is depicted in Figure1.

Table 14. The Financial Appraisal Scores

Alternatives	Asi	Rank
Tide	0.86	1
Tuka	0.40	3
Seyr	0.01	5
Fars	0.33	4
Shipping	0.53	2

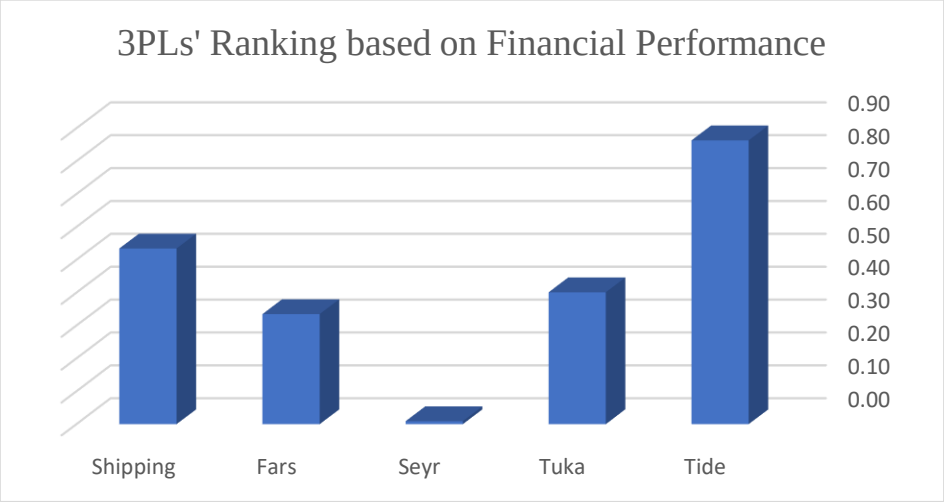


Figure 1. Ranking Based on Financial Performance

Operational Evaluation

Step 1: Choosing Criteria and Alternatives

Operational evaluation follows the same steps as financial evaluation. Operational performance evaluation indicators include Operating Profit, Number of Employees, Asset Turnover, and Operating Costs.

Step 2: Creating the Decision Matrix

$$XO=[Xij]5\times4=\begin{vmatrix} 7.17 & 3527 & 1.06 & 10.00 \\ 0.22 & 670 & 1.64 & 1.80 \\ 0.25 & 49 & 0.39 & 1.04 \\ -0.77 & 1112 & 1.04 & 5.74 \\ 10.23 & 6816 & 0.34 & 9.90 \end{vmatrix}$$

The weight matrix of operational criteria, based on the calculations of the Best-Worst Method, is as follows:

$$WO=[0.42 \quad 0.06 \quad 0.35 \quad 0.11]$$

Based on the financial evaluation method used for 3PLs, the operational appraisal score of the alternatives is presented in Table 15 and Figure 2:

Table 15. The Operational Appraisal Scores

Alternatives	Asi	Rank
Tide	0.81	2
Tuka	0.29	3
Seyr	0.00	5
Fars	0.16	4
Shipping	0.85	1

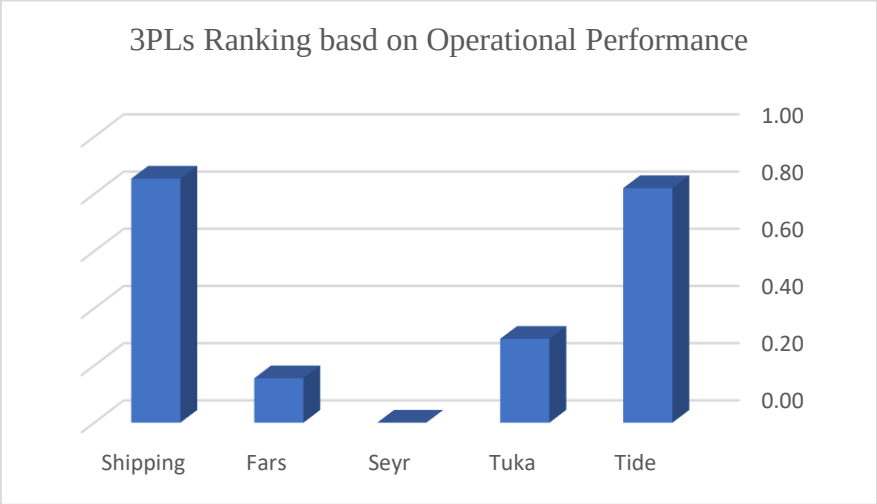


Figure 2. Ranking based on Operational Performance

Findings

First, based on the research literature, we identified the factors that affect financial and operational performance. The financial statements of the companies on the Codal website are used as a basis for evaluating their performance. Financial criteria include: 1. Operating Revenue, 2. Price of services provided, 3. Return on Investment, and 4. Leverage ratio. Operating criteria include: 1. Operating profit, 2. Number of employees, 3. Asset turnover, and 4. Operating costs. Then, they were weighted using the Best-Worst Method. Finally, the EDAS technique was used to rank third-party logistics service providers. The final ranking result is shown in Table 16 and Figure 3.

Table 16. Final 3PLs Ranking

Alternatives	Asi Financial	Asi Operational	Average	Final Rank
Tide	0.86	0.81	0.84	1
Tuka	0.40	0.29	0.35	3
Seyr	0.01	0.00	0.00	5
Fars	0.33	0.16	0.26	4
Shipping	0.53	0.85	0.69	2

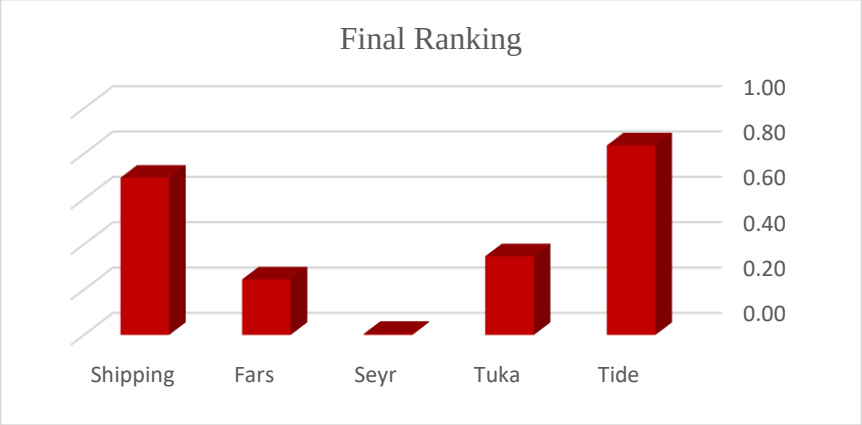


Figure 3. Final Ranking

5. Conclusion

The purpose of this study is to evaluate the financial and operational performance of third-level logistics companies and rank them in order to determine which alternative is the most suitable for outsourcing a company's logistics activities. Choosing the right logistics company for outsourcing transportation activities is one of the most important tasks. A company must make important and effective decisions in order to succeed. Some of the activities of a company may be affected by a wrong choice. Since the quantitative and qualitative review of criteria is associated with ambiguity and uncertainty, this issue will be a multi-criteria decision-making problem. In this case, indicators were weighted based on the Best-Worst Method. According to experts, financial indicators are ranked as follows: 1. Return on Investment, 2. Operating Revenue, 3. Leverage ratio, and 4. Price of services provided. Additionally, operational indicators are ranked in order of importance as follows: 1. Operating Profit, 2. Asset Turnover, 3. Operating Costs, and 4. Number of employees. According to the result of the calculations, using EDAS technique, Tidewater, Shipping, Tuka, Fars, and Seyr were ranked from first to fifth, respectively. The organization should evaluate the performance of third-party logistics companies periodically when selecting and signing contracts so that if the quality of services provided deteriorates, any losses can be avoided at the right time. This will have a significant impact on customer satisfaction. Under strict supervision and control, logistics companies will be able to provide their services more favorably while continuing to cooperate with organizations. The performance evaluation indicators in this research have been extracted from the information available in the financial statements of the companies due to the existing limitations in accessing the information of these companies. In practice, organizations can evaluate logistics companies' performance based on other performance criteria. Depending on the type of activity, organizations can use different performance criteria. It is clear that the weight that organizations assign to financial and operational performance indicators varies, depending on their activities.

References

Ayough, A., Boshruei, S., & Khorshidvand, B. (2022). A new interactive method based on multi-criteria preference degree functions for solar power plant site selection. Renewable Energy, 195, 1165-1173.

Ayough, A., Shargh, S. B., & Khorshidvand, B. (2023). A new integrated approach based on base-criterion and utility additive methods and its application to supplier selection problem. Expert Systems with Applications, 221, 119740.

Afum, E., Agyabeng-Mensah, Y., Acquah, I.S.K., Baah, C., Dacosta, E., Owusu, C.S. and Amponsah Owusu, J. (2021), "Examining the links between logistics outsourcing, company competitiveness and selected performances: the evidence from an emerging country", The International Journal of Logistics Management, 32 (3), 1068-1090.

https://doi.org/10.1108/IJLM-05-2020-0205

Amiri, M. & Emamat, M. (2020). A Goal Programing Model for BWM. INFORMATICA, 2020, 31(1), 21-34. https://doi.org/10.15388/20-INFOR389

Chejarla, K. C., Vaidya, O. S., & Kumar, S. (2022). MCDM applications in logistics performance evaluation: A literature review. *Journal of Multi-Criteria Decision Analysis*, 29(3-4), 274–297. https://doi.org/10.1002/mcda.1774

Delshad, M. M., Chobar, A. P., Ghasemi, P., & Jafari, D. (2024). Efficient Humanitarian Logistics: Multi-Commodity Location–Inventory Model Incorporating Demand Probability and Consumption Coefficients. Logistics, 8(1), 9.

Dovbischuk, I. (2022), "Innovation-oriented dynamic capabilities of logistics service providers, dynamic resilience and firm performance during the COVID-19 pandemic", *The International Journal of Logistics Management*, 33(2), 499-519. https://doi.org/10.1108/IJLM-01-2021-0059

Ecer, F. (2018). Third-party logistics (3Pls) provider selection via Fuzzy AHP and EDAS integrated model. *Technological and Economic Development of Economy*, 24(2), 615–634. https://doi.org/10.3846/20294913.2016.1213207

Eriskin L. (2021). Preference modelling in sorting problems: Multiple criteria decision aid and statistical learning perspectives. *Journal of Multi-Criteria Decision Analysis*. 28(4), 1–17. https://doi.org/10.1002/mcda.1737

Goswami, M., De, A., Habibi, M.K.K., Daultani, Y., 2020. Examining freight performance of third-party logistics providers within the automotive industry in India: an environmental sustainability perspective. *Int. J. Prod. Res*. 58 (24), 7565–7592. https://doi.org/10.1080/00207543.2020.1756504

Hua, S., Sun, S., Liu, Z., Zhai, X. (2021). Benefits of third-party logistics firms as financing providers. *Eur. J. Oper. Res*. 294 (1), 174–187. https://doi.org/10.1016/j.ejor.2021.01.024

Amini Khouzani, M., Sadeghi, A., Daneshvar, A., & Pourghader Chobar, A. (2023). Fuzzy modeling of allocation of financial resources of sustainable projects and Solving with GSSA algorithm. Journal of Industrial Engineering International, 19(1), 82-92.

Keshavarz Ghorabaee, M.; Amiri, M.; Zavadskas, E.K.; Turskis, Z.; Antucheviciene, J. (2017). A new hybrid simulation-based assignment approach for evaluating airlines with multiple service quality criteria. *Journal of Air Transport Management* 2017, 63, 45-60. https://doi.org/10.1016/j.jairtraman.2017.05.008

Keshavarz-Ghorabaee, M., Zavadskas, E. Olfat, L.& Turskis, Z., (2015). Multi-Criteria Inventory Classification Using a New Method of Evaluation Based on Distance from Average Solution (EDAS). *INFORMATICA*, 26(3),435-451. http://dx.doi.org/10.15388/Informatica.2015.57

Laganà, I. R., & Colapinto, C. (2022). Multiple criteria decision-making in healthcare and pharmaceutical supply chain management: A state-of-the-art review and implications for future research. *Journal of Multi-Criteria Decision Analysis*, 29(1-2), 122–134. https://doi.org/10.1002/mcda.1778

Luyen, L.A.; Thanh, N.V. (2022). Logistics Service Provider Evaluation and Selection: Hybrid SERVQUAL– FAHP–TOPSIS Model. *Processes*, 10, 1024. https://doi.org/10.3390/pr10051024

Pal Singh, S., Adhikari, A., Majumdar, A., & Bisi, A. (2022). Does service quality influence operational and financial performance of third-party logistics service providers? A mixed multi criteria decision making -text mining-based investigation. *Transportation Research Part E: Logistics and Transportation Review,* 157, 102558. https://doi.org/10.1016/J.TRE.2021.102558

Pan, H., Bayanati, M., Vaseei, M., & Chobar, A. P. (2023). Empowering solar photovoltaic logistic operations through cloud-enabled blockchain technology: a sustainable approach. Frontiers in Energy Research, 11, 1293449.

Pourghader Chobar, A., Sabk Ara, M., Moradi Pirbalouti, S., Khadem, M., & Bahrami, S. (2022). A multi-objective location-routing problem model for multi-device relief logistics under uncertainty using meta-heuristic algorithm. Journal of Applied Research on Industrial Engineering, 9(3), 354-373.

Pamucar, D., Chatterjee, K., & Zavadskas, E. K. (2019). Assessment of third-party logistics provider using multi-criteria decision-making approach based on interval rough numbers. *Computers & Industrial Engineering,* 127, 383–407. https://doi.org/10.1016/J.CIE.2018.10.023

Rezaei, J. (2015). Best-worst multi-criteria decision-making method. *Omega*, 53, 49–57. http://dx.doi.org/10.1016/j.omega.2014.11.009

Rezaei, J. (2016). Best-worst multi-criteria decision-making method: Some properties and a linear model. *Omega*, *64*, 126-130. https://doi.org/10.1016/j.omega.2015.12.001

Sahebi, D. Improving competitive advantage in 3PL companies in Iran. (2022) *Doctoral thesis. University of Vaasa School of Technology and Management Industrial Management.* 33-39.

Ulutaş, A., & Topal, A. (2021). A new hybrid model based on rough step-wise weight assessment ratio analysis for third-party logistics selection. *Soft Computing 2021,* 26(4), 2021–2032. https://doi.org/10.1007/S00500-021-06374-0

Yalcin, A. S., Kilic, H. S., & Delen, D. (2022). The use of multi-criteria decision-making methods in business analytics: A comprehensive literature review. *Technological Forecasting and Social Change,* 174, 121193. https://doi.org/10.1016/J.TECHFORE.2021.121193