# Examining Operational Efficiency Indicators to Improve the Operational Efficiency of Khorramshahr Port in Iran

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The purpose of this research was to study operational indicators that could effectively improve the productivity of Khorramshahr port operation. A mixed exploratory and qualitative-quantitative research method was used. The research was carried out on the statistical sample of 34 subjects, including the managers, experts and staff of Khorramshahr Port Authority, chosen as a statistical sample using the available sampling method. The data analysis method (DEA), a mathematical method and one of the best non-parametric methods, was used to measure organizational efficiency based on input and output variables. Another method, fuzzy TOPSIS, was used to assist with the decision-making process. In this study, operational indicators were examined to increase the productivity of Khorramshahr port, using the data envelopment analysis method, the multiple CCR model and the fuzzy TOPSIS technique. In the Data Envelopment Analysis method, indicators whose efficiency score equals one are considered effective. The results obtained using the two methods (Data Envelopment Analysis and fuzzy TOPSIS) indicate that there are no sufficiently efficient and productive operational efficiency indicators that could be used to increase the performance of Khorramshahr port wharfs. Therefore, as seen from both research methods, the loading and unloading indices of the Khorramshahr wharfs must be top priority.

**KEY WORDS**
~ Productivity
~ Performance
~ Wharf
~ Data Envelopment Analysis
~ TOPSIS

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## 1. INTRODUCTION

As the pillar of international trade, the shipping industry is directly related to the production, life, economic and social sustainable development worldwide (XF W, 2022). The operational efficiency of ports is an essential indicator of the development of a country's shipping industry. On the global level, more than 85% of international trade is conducted by sea (Li Z, 2022).

Several North American ports were ranked in the bottom of 348 ports around the world. The rankings were based on factors including vessel turnaround time, berth productivity, infrastructure, equipment, and efficiency. Given that in terms of container terminal operations efficiency means profit, a slow port is likely to have low ranking. Higher costs, reduced competitiveness, and slowdowns can all lead to customer dissatisfaction and loss of market share. However, there are high impact changes that port owners and operators can make to improve their efficiency. Investing in a data strategy, a robust terminal operating system (TOS), and efficient resource utilization can all significantly improve the operation of North American ports (Tide-works Technology, 2023)

Globally, ports are continuing to clear backlogs, but there is still room to improve efficiency. The data suggest that further port process digitalization and port infrastructure modernization would increase productivity, improve customer service and reduce emissions (Word bank, 2023).

Domestic and foreign studies dealing with the quantitative evaluation of container terminal operational efficiency have two approaches to efficiency evaluation, i.e., the production function method, which requires parameter estimation, and the data envelopment analysis method, which does not require parameter estimation. The DEA method is more suitable for operational efficiency evaluation due to its ability to handle multiple input and output situations and no need to provide explicit input and output relationships (Li Z, 2022).

The content of the study is as follows: a brief introduction of Khorramshahr port, its location, and its characteristics, followed by prior research, and theoretical knowledge on the operational efficiency of ports. Then, an explanation of the importance of productivity and its improvement, and the methods of measuring performance and productivity indicators in ports, together with data sources and descriptions. After that, research results and findings related to the analysis and empirical study of the corresponding data are given. Finally, the TOPSIS Technique and the conclusion on measures necessary to increase the productivity of Khorramshahr port.

## 2. KHORRAMSHAHR PORT

Khorramshahr port is located at the south-western end of Khuzestan state in Iran. The geographical position of the port is as follows: latitude: 30° 26′N and longitude: 048° 10′E, at the confluence of Karun and Arvand rivers. Khorramshahr is connected with the city of Abadan by a bridge and both are located in the Arvand Free Zone Area.

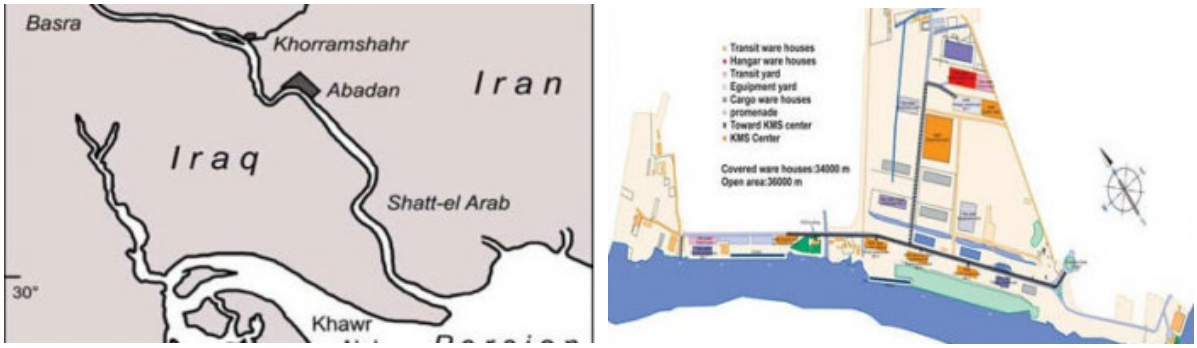


Figure 1. Khorramshahr Port –Iran (Source: Star Marine Services Limited)

Port equipment is one of the most important port components, vital for its proper operation. Efficient turnaround times are crucial for optimizing vessel utilization and maximizing maritime operation profitability. Shorter turnaround times of Khorramshahr port allow for higher vessel productivity, reduced idle periods, and improved transportation efficiency. Port authorities have gained an understanding of their clients' requirements and have been continuously upgrading terminals and equipment. In fact, following the end of the Iran-Iraq war and due to several sunken vessels in the Arvand river, the average river depth during high water is about 4.20 meters.

| | Name of berth | Purpose | Length (m) | Depth (m) |
|---|---|---|---|---|
| 1 | Feileih | Loading Offshore Platforms | 620 | 4.20 |
| 2 | 4 Posts | General /Oil | 720 | 4.20 |
| 3 | Berth 1 | General | 126.59 | 4.20 |
| 4 | Berth 2-7 | Container | 820 | 4.20 |
| 5 | Khanian | General/RoRo | 267 | 4.20 |
| 6 | Passenger Berth | Passenger ship | 100 | 4.20 |
| 7 | Maritime Affair Berth | Service berth | 24 | 4.20 |

Table 1. Khorramshahr berth specifications (Source: Star Marine Services Limited)

It should be noted that there is a need to optimize container loading and unloading times at the Khorramshahr container terminal, as containers have to be transported by trucks between the ship and the container yard. As there is only one quay crane at the port, transportation around the berth has been optimized not only by reducing transportation time, but also usually by synchronizing transportation with loading and unloading activities. The general goal is to increase terminal crane productivity. Crane efficiency depends not only on their technical specifications, but also on their actual performance in practice, which is much lower. Additional time, such as stops, breaks during the shift, equipment movement, technical or operational factors, and horizontal transportation congestion all contribute to time loss.

## 3. THE IMPORTANCE OF PRODUCTIVITY AND ITS IMPROVEMENT

Innovation-based productivity needs to be promoted in a sustained manner in all aspects of national economy through holistic and inclusive approach by addressing the triple bottom line – Economic, Environmental and Social (UNCTAD, 2021).

Productivity is a measure of economic or business performance that indicates how efficiently people, companies, industries and whole economies convert inputs, such as labor and capital, into outputs, such as goods or services. Productivity can be measured at any of the following five levels: personal productivity,

workforce productivity, sector productivity, team or department productivity and national or global productivity (Holliday, 2021). Business development is vital as higher income means a company can meet its obligations to customers, suppliers, employees, shareholders, and governments (taxes and regulation), while remaining competitive or even improving its competitiveness in the marketplace, but can not be achieved without employee productivity (Productivity SA, 2021).

Productivity goes up when output increases at a faster rate than inputs or when a company can generate the same output with lower inputs. Let us look at an example of how this works by exploring the effect of different inputs. Suppose you own an apple orchard, and you're looking at ways to increase the productivity of your annual apple-picking operation. At the moment, the 50 workers in company employment can pick a total of 10,000 large apples per hour by hand, on average. Your hourly labor productivity is therefore 10,000 apples/50 people = 200 apples per hour per picker. Not bad, but there are four improvement options, apart from pushing people to work harder:

1. Technological improvements: You can add inputs in the form of technological improvements that increase output by more than their cost. If you provide each apple-picker with Acme's Super Duper Apple-Picking Machine, labor productivity increases twofold: they can each pick 400 apples per hour.

2. Technical efficiency: Companies can improve technical efficiency by using their existing technology or skills more efficiently. Perhaps your workers can do better than 200 apples per hour if they become more skilled at picking apples by hand.

3. Organizational improvements: You may be able to improve hourly output by reorganizing apple-picking teams so they cover the entire orchard more efficiently.

4. Increasing scale: You may be able to increase productivity by expanding your operations. Doubling your apple output may require you to double the size of your orchard, the number of pickers you employ and the number of devices they use. But it won't require you to build a second headquarters building, hire twice as many administrative employees or double your marketing and advertising budget. Your output will double, but your inputs will not (Holliday, 2021). It should be noted that the European Economic Cooperation Organization has proposed two criteria, "annual gross domestic product" and "gross domestic product per employed person" to measure productivity. In productivity and technology, the American Institute of Labor Statistics has also used the gross domestic product per capita of each working citizen in this regard.

## 3.1. Measuring performance and productivity indicators in ports

The indicators relevant for identifying the most suitable port should be examined, and include multiple factors such as shipping lines, international shippers, ship lessors and goods shippers. Please note that each of these indicators is in some way connected with goods, and ports decide which factors to prioritize, as the importance of each of these indicators varies across sectors when choosing the most suitable port. The UNCTAD has estimated the operational productivity of the world fleet, in terms of cargo carried per unit of fleet capacity for the period 1960 to 2022. During the 1970s and early 1980s, deep recessions, including oil shocks in 1973 and 1979, reduced shipping costs, while fleet productivity declined by over one-third to around five tons per dwt of capacity. Productivity revived in the 1990s and early 2000s, following export-led global growth in Asia, only to decrease again following the global financial crisis. It continued to fall in the 2010s as fleet supply grew at the rate of approximately five per cent per year, while demand increased by only two per cent (UNCTAD, 2022).

Important performance indicators that are of interest to shipping lines and cargo owners, which are presented annually by the United Nations Trade and Development Conference are as follows:

A. Efficiency index: The total amount of work done in a certain period of time. The most important of these indicators are: (The Container Port Performance Index 2021)
   - Wharf operational capacity, which represents the total quantity of tonnage unloaded and loaded at the wharf over a certain period.
   - Ship efficiency, which is the amount of unloading and loading per hour.
   - Efficiency of the work group, which shows the quantity of goods unloaded and loaded over a certain period of time by the work group.

B. Productivity indicators: The ratio between input and output in economic and financial language. They are used to identify operations with the lowest costs.

The unloading and loading indicators used by Iranian Ports and Maritime Organization to evaluate the ports are divided into the following two categories:

- Physical indicators
- Financial indicators

Physical indicators focus on the flow of unloading goods as a service.

Financial indicators focus on the economic costs of the port.

## 3.2. The most important physical indicators in Iranian ports

The main application of sustainable development indicators is to support and reform policies and decision-making at different organizational levels. They are an essential part of the decision-making process used for planning purposes (Majidi et al., 2021).

The findings indicate that the application of green port principles and requirements to develop an environmental performance evaluation method for ports could be used to obtain accurate environmental performance results. (Akbari et al., 2021).

### 3.2.1. Truck density index

Truck density is obtained by dividing the total number of hours trucks spend waiting to get a service by the total hours they are present in the container area or port (over a certain time period).

### 3.2.2. Port performance index

Port performance index is obtained by dividing the quantity of unloaded and loaded goods by the time ships spend in the port over a certain time period.

### 3.2.3. Container yard performance index

Container yard performance index is obtained by dividing the quantity of unloaded and loaded containers by the time trucks are present in the container yard over a certain time period.

### 3.2.4. Operational performance index

This index is also called product performance index. It can be obtained by dividing the quantity of unloaded and loaded goods by vehicle service time over a certain time period.

### 3.2.5. Ship stop time index

In terms of ship servicing, the total time of a ship's stop in the port is a primary indicator for ship owners and port officials. From the point of view of the ship owner, the total time the ship spends in the port is important. This index is obtained by dividing the time spent at the wharf by the number of ships arriving, and it actually indicates how many hours each ship spends at the wharf on average.

### 3.2.6. Truck stopping time index

This index shows how many hours each truck has spent in the area on average, and is obtained by dividing the time spent in the container area by the number of trucks.

### 3.2.7. The components of greenness and intelligence

A new approach has been introduced in the field of port performance evaluation which is based on the components of greenness and intelligence. This approach performs evaluations in two stages and a network. In this study, the performances of 11 Iranian ports were evaluated based using the network data envelopment analysis approach in 2 stages of greenness and intelligence over a period of 4 years. The results indicated that only 5% of the ports met the standards of intelligence and greenness. (Sadri, et al., 2022).

## 4. RESEARCH METHODOLOGY

The data used in this research to evaluate the productivity of Khorramshahr port wharves based on terminal inputs and outputs information were quantitative data for 2022-2023. Exploratory mixed research methods are a type of research methods in which the researcher combines qualitative and quantitative elements and approaches to eliminate obstacles and gain an in-depth understanding of the phenomena. It should be noted that two information collection methods were used: a) the library method where information, statistics, and records of research findings from the research field are gathered from valid resources and by referring to the United Nations Conference on Trade and Development (UNCTAD) (2022) website. b) The field method where the information and data are collected in a manner suitable for the nature of the subject and the research is conducted by means of observations, interviews, questionnaires, etc.

In the mixed method, the research includes purposeful, exploratory and qualitative-quantitative analysis. The first part of this research was conducted using the qualitative method. Successful indicators were identified by an in-depth and extensive study of the literature on the subject, using reliable sources. The indicators were identified, confirmed and screened by the experts. The research tool in this step is a researcher-made questionnaire in the form of a Likert scale. In the second part, TOPSIS and DEA techniques were used to rank operational indicators by effectiveness in increasing the performance efficiency of Khorramshahr port.

The paper provided numerous justifications for using the mixed-method research design. First and foremost, the paper pointed out that the mixed-method research design addressed the need to understand and examine complex social phenomena. Second, the mixed-method research design, especially in collaborative and applied research, facilitates addressing confirmatory and explanatory questions simultaneously (Dawadi S. et al, 2021).

In explanatory sequential design quantitative and qualitative data are collected and analysed sequentially, with the aim of building upon and explaining the findings of the initial phase of data collection. (Sharma L R. et al, 2023).

The researcher used the Data Envelopment Analysis technique (DEA), i.e. a mathematical model and one of the best non-parametric methods, to measure organizational efficiency based on input and output variables. Another research tool, fuzzy TOPSIS, was one of the decision-making methods used.

The qualitative approach takes a lot of time, its reliability is questionable, the procedure is not standard, the design is not structured, cannot be used for large-scale research and research results can be influenced by the subjectivity of the researcher. The quantitative approach struggles to control other variables that can influence the research process either directly or indirectly. High validity also requires accuracy in sample selection, data retrieval and analytical tool selection (Sarwono J, 2022).

In this research, the effective operational indicators relevant for increasing the productivity of Khorramshahr port were explored using the data envelopment analysis method, the multiple CCR model and the fuzzy TOPSIS technique.

## 5. RESULTS & FINDINGS

As indicated above, operational indicators that potentially have the capacity to effectively increase the performance efficiency of Khorramshahr port docks have been examined using the data envelopment analysis model and TOPSIS. In this research, the indicators were identified by first studying the operational indicators that effectively increase the productivity of wharfs in Khorramshahr port through contact with port contractors, customers, managers and experts, as well as by reviewing the relevant literature and research background. The most important indicators of productivity are efficiency and effectiveness. The most important operational indicators effective in increasing productivity are given in the tables below.

| No | Index name | Ranking | Quantity |
|---|---|---|---|
| 1 | Time to towing completion | 2 | 0.739 |
| 2 | The time of providing services to ships delivering waste materials | 9 | 0.085 |
| 3 | Human resource or workforce providing ship inspection services (PSC) | 5 | 0.544 |
| 4 | Duration of pilotage | 6 | 0.498 |
| 5 | Duration of ship registration certificate issuance | 12 | 0.000 |
| 6 | Loading and unloading cargo at wharf | 1 | 0.758 |
| 7 | Warf length | 3 | 0.643 |
| 8 | Container cranes | 7 | 0.208 |
| 9 | Duration of ship berthing | 8 | 0.161 |
| 10 | Service provision to ships | 11 | 0.015 |
| 11 | Time to truck arrival to the port | 10 | 0.019 |
| 12 | Time spent at the wharf | 4 | 0.552 |

Table 2. Studying the status of operating indicators effective in increasing wharf productivity (Source: Research findings 2023)

Table 2 shows that loading and unloading at the wharf with the weight of 0.758 is the highest ranking operational indicator of wharf productivity, followed by time to towing completion with the weight of 0.739, wharf length with the weight of 0.643, while time spent at the wharf with the weight of 0.552 ranked fourth, human resource or workforce providing ship inspection services (PSC) with the weight of 0.544 ranked fifth, duration of pilotage with the weight of 0.498 ranked sixth, container cranes with the weight 0.208 ranked seventh, duration of ship berthing with the weight of 0.161 ranked eighth, time of providing services to ships delivering waste materials with the weight of 0.085 ranked ninth, time to truck arrival to the port with the weight of 0.019 ranked

tenth, service provision to ships with the weight of 0.015 ranked eleventh and duration of ship registration certificate issuance with the weight of 0 ranked twelfth.

## 5.1. TOPSIS TECHNIQUE

The TOPSIS method is one of the famous classical MCDM techniques, first introduced by Huang and Yong in 1981. The basic logic of TOPSIS is to identify positive ideal and negative ideal solutions. An ideal solution is a solution that maximizes the profit criteria and minimizes the cost criteria.

This technique is based on the concept that each selected factor should have the smallest distance from the positive ideal factor (the most important factor) and the largest distance from the negative ideal factor (the least important factor). In other words, in this method, the distance between a factor and positive and negative ideal factors is measured and serves as factor rating and prioritizing criterion. The method consists of the following steps:

First step: decision-making matrix creation

| | Performance | Effectiveness |
|---|---|---|
| Factors | Negative | Positive |
| s1 | 13 | 15 |
| s2 | 2 | 12 |
| s3 | 11 | 10 |
| s4 | 11 | 11 |
| s5 | 12 | 9 |
| s6 | 2 | 6 |
| s7 | 13 | 5 |
| s8 | 15 | 1 |
| s9 | 3 | 3 |
| s10 | 6 | 2 |
| s11 | 4 | 2 |
| s12 | 6 | 3 |

Table 3. Decision-making matrix (N) (Source: Research findings 2023)

Second step: decision matrix normalization (normalizing)

Third step: obtaining the weighted dimensionless matrix using the following formula:

$$V = N_1 \times w_{n\times n}$$

| | Performance | Effectiveness |
|---|---|---|
| s1 | 0.032368768 | 0.046760976 |
| s2 | 0.00497981 | 0.037408781 |
| s3 | 0.027388957 | 0.031173984 |
| s4 | 0.027388957 | 0.034291383 |
| s5 | 0.029878863 | 0.028056586 |
| s6 | 0.00497981 | 0.018704391 |
| s7 | 0.032368768 | 0.015586992 |
| s8 | 0.037348578 | 0.003117398 |
| s9 | 0.007469716 | 0.009352195 |
| s10 | 0.014939431 | 0.006234797 |
| s11 | 0.009959621 | 0.006234797 |
| s12 | 0.014939431 | 0.009352195 |

Table 4. Weighted dimensionless matrix (V) (Source: Research findings 2023)

Fourth step: Calculating the distance between the positive and negative ideals

Fifth step: Calculating the degree of proximity of each of the factors to the positive ideal and negative ideal factors by using the following formula:

$$d_i^+ = \sqrt{\sum_{j=1}^{n} \left(V_{ij} - V_j^+\right)^2}$$

$$d_i^- = \sqrt{\sum_{j=1}^{n} \left(V_{ij} - V_j^-\right)^2}$$

$$CL_i^* = \frac{d_i^-}{d_i^- + d_i^+}$$

Sixth step: Index and CL (Coefficient Length or the distance of the desired option from positive and negative ideals shown in Table 3) ranking or grading. It should be noted that the value of CL is between zero and one, and can be calculated by using the above formula.

| No | Indices | Distance to the positive ideal | Distance to the negative ideal | CL | Rank |
|---|---|---|---|---|---|
| 1 | Time to towing completion | 0.252502 | 0.240767 | 20.51744 | 2 |
| 2 | Time to provide services to ships delivering waste materials | 0.268203 | 0.203136 | 3.121962 | 9 |
| 3 | Human resource or workforce providing ship inspection services (PSC) | 0.268486 | 0.245376 | 10.61776 | 5 |
| 4 | Duration of pilotage | 0.260197 | 0.236526 | 9.992225 | 6 |
| 5 | Duration of ship registration certificate issuance | 0.239749 | 0.240249 | 1.002086 | 12 |
| 6 | Loading and unloading cargo at wharf | 0.296936 | 0.172258 | 30.315719 | 1 |
| 7 | Warf length | 0.223944 | 0.239458 | 15.4358 | 3 |
| 8 | Container cranes | 0.266602 | 0.240206 | 9.100158 | 7 |
| 9 | Duration of ship berthing | 0.273452 | 0.219844 | 4.100994 | 8 |
| 10 | Service provision to ships | 0.25194 | 1.008587 | 1.008587 | 11 |
| 11 | Time to truck arrival to the port | 0.251696 | 1.325763 | 1.325763 | 10 |
| 12 | Time spent at the wharf | 0.300619 | 13.07036 | 13.07036 | 4 |

Table 5. Index ranking (Source: Research findings 2023)

## 6. CONCLUSION

The results of this research based on the data envelopment analysis model are as follows:

- The most important operational indicators that effectively increase the productivity of Khorramshahr port wharf are: time to towing operation completion, time to provide services to ships applying to deliver waste materials, labor to provide services, PSC ship inspection, duration of pilotage, duration of ship registration certificate issuance, loading and unloading at the wharf, wharf length, container cranes, mooring duration, providing services to the vessels, time to truck arrival to the port, time spent at the wharf.
- The results of the evaluation and ranking of operational indicators that effectively increase the efficiency of wharfs show that time spent at the wharf with the weight of 0.371 is the highest ranking indicator, followed by wharf length with the weight of 0.364 ranked second, time to towing completion with the weight of 0.359 ranked third, PSC ship inspection service workforce with the weight of 0.348 ranked fourth, time to provide services to ships applying for delivery of waste materials with the weight of 0.284 ranked fifth, duration of pilotage with the weight of 0.279 ranked sixth, loading and unloading at the wharf with the weight of 0.254 ranked seventh, ship mooring time with the weight of 0.250 ranked eighth, container crane with the weight of 0.213 ranked ninth, time to truck arrival to the port with the weight of 0.159 ranked tenth, providing services to the vessel with the weight of 0.017 ranked eleventh and finally duration of pilotage with the weight of 0.013 ranked twelfth.
- The results of the evaluation and ranking of operational indicators that effectively increase the efficiency of wharves show that loading and unloading at the wharf with the weight of 0.711 was the highest ranking indicator, time to provide services to ships applying for delivery of waste materials with the weight of 0.672 ranked second, time to provide services to ships applying for delivery of waste materials with the weight of 0.646 ranked third, duration of pilotage with the weight of 0.550 ranked fourth, ship mooring time with the weight of 0.525 ranked fifth, PSC ship inspection services with the weight of 0.482 ranked sixth , wharf length with the weight of 0.336 seventh, service provision to vessels with the weight of 0.315 ranked eighth, container crane with the weight of 0.310 ranked ninth, time spent at the wharf with the weight of 0.214 ranked tenth, time to truck arrival to the port

with the weight of 0.166 ranked eleventh, and finally, duration of ship registration certificate issuance with the weight of 0 ranked twelfth.

- The results of the evaluation and ranking of the final status of operational indicators affecting the productivity of Khorramshahr port wharfs showed that unloading and loading at the wharf with the weight of 0.758 had the highest ranking, with time to towing completion with the weight of 0.739 ranked second, the wharf length with the weight of 0.643 ranked third, berthing time with the weight of 0.552 ranked fourth, PSC ship inspection service workforce with the weight of 0.544 ranked fifth, duration of pilotage with the weight of 0.498 ranked sixth, container crane with the weight of 0.208 ranked seventh, the duration of berthing with the weight of 0.161 ranked eighth, the time to provide services to ships applying for the delivery of waste materials with the weight of 0.085 ranked ninth, time to truck arrival to the port with the weight of 0.019 ranked tenth, service provision to vessels with the weight of 0.015 ranked eleventh and duration of ship registration certificate issuance with the weight of 0 ranked twelfth. The results of the evaluation and ranking of operational indicators that effectively improve the performance of Khorramshahr port wharfs using the TOPSIS method are as follows:
    1. Loading and unloading cargo at the wharf
    2. Time to towing completion
    3. Wharf length
    4. Time spent at the wharf
    5. Human resources or work force that provides PSC ship inspection services
    6. Duration of pilotage
    7. Container cranes
    8. Duration of ship berthing
    9. Time to provide services to ships delivering waste materials
    10. Service provision to ships
    11. Service provision to ships
    12. Duration of ship registration certificate issuance

Based on the above results obtained by using DEA (data envelopment analysis) and TOPSIS, it was established that none of the operational indicators studied were suitable for improving the performance of Khorramshahr port wharfs. In fact, different operating indicators must be improved at the port, such as hiring skilled and trained workforce, purchasing advanced equipment, dredging the river, increasing water depth at the wharf, and monitoring the duration and status of operations at each wharf, to increase the productivity of Khorramshahr port wharfs. Therefore, the efficiency and productivity of port wharfs will rapidly increase if Khorramshahr port improves the following operational indicators:

1. Reduces time spent at the wharfs
2. Increases wharf length
3. Reduces the duration of towing operation
4. Cuts ship inspection duration (PSC)
5. Reduces the time of service provision to ships delivering waste materials
6. Reduces ship pilotage and assistance duration
7. Reduces ship turnaround time
8. Reduces berthing and un-berthing times of ships at the wharf
9. Improves the ability of crane operators, especially container crane operators
10. Plans for quick truck arrival to the wharf

## CONFLICT OF INTEREST

The authors declared no potential conflicts of interest with respect to the research, authorship and publication of this article.

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