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Evaluation of Freight and Goods Transportation Systems in order to Manage and Control Export Costs (Case Study of Shazand Petrochemical)

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ABSTRACT

Organizations and companies need to continuously and purposefully evaluate the previous methods in their field to improve their performance, in order to strengthen their strengths to eliminate existing shortcomings and eliminate or reduce additional costs. Given that today a major part of the total cost is transportation costs, and companies and organizations are looking for ways to minimize these costs. For this purpose, the present study was conducted with the aim of evaluating and prioritizing methods of transporting goods and goods in order to manage and control export costs (studied by Arak Petrochemical(.The data collection tool in this research will be a self-made matrix questionnaire in the field of research variables. To check the validity of the questionnaire, content validity will be used using the opinion of experts. The present study is based on the purpose of an applied research. Based on the nature of the method, it is a descriptive-analytical research and in terms of data collection method, it is a survey (field) research. A sample of 28 experts was selected. According to the study and analysis of the data obtained based on the output of Topsis software, the most optimal method for transporting Arak Petrochemical products according to the criterion is the road transport method and respectively rail and air transport methods in The next categories are placed.

KEYWORDS: Goods Transportation Systems , Control Export , Shazand Petrochemical, Transportation Costs

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1. Introduction

Transportation systems are one of the factors affecting all the activities of society, especially the activities of companies, and as one of the very important tools of the country's development, it has a special role and place.The rapid development of industry has faced countries with energy crises and environmental pollution as serious problems.Therefore, the use of appropriate transportation systems is accepted as one of the most effective ways to reduce costs and environmental factors, as well as to increase the capacity of transportation of goods in developed countries.

The ever-increasing population of the world brings with it the need for more production, and in line with that, the amount of movement of cargo and goods at the international level will also expand Various activities in this industry. What is certain is that the development of effective transportation services that meet the needs of the industrial and commercial sectors will be realized in favorable political and economic conditions. On the one hand, governments emphasize the expansion of transportation services in order to encourage their exports. and on the other hand, organizations and companies should regularly try to find ways to reduce costs and energy consumption and control it. Changes in the business environment such as globalization, increased competition, focus on customers and social, political, and cultural conditions have caused management in the new changing environment to be different from the management practices in the previous static environment. Cost management is a solution to understanding the changes in production, sales, and transportation methods and their effects on the cost structure and providing information related to costs. Therefore, the application of cost management, especially in the cargo transportation sector, along with its continuous improvement, is considered one of the vital factors for the success of organizations today. The Durability of many companies depends on increasing the accuracy, quality, and strength of competition. This depends on managing costs and reducing unnecessary costs, including costs related to the transportation sector and increasing the value of goods along the production value chain. In this research, the researcher aims to reveal the ranking and the most optimal methods of transporting cargo and goods in the Arak Petrochemical Complex for the managers of this complex. By extracting priorities, the managers of this complex can make timely decisions, taking into account the available facilities, and choosing the best way to transport their products.

2. Literature and Research Background

Nowadays, export development is an accepted principle in the field of foreign trade of the country and as an effective factor in economic development in development and policy-making programs. In today's world, no country lives in complete isolation from other countries, and every country, starting international exchange, uses its production factors to produce products that are more productive and exchanges them with the products of other countries(Safdari et al., 2013). Petrochemical products are among the products that have been included in the country's export path in the last few years due to the government's considerable investment. The availability of many production factors and available imported technology and the interest of foreign investors in investing in this part of the economy have made the units producing such items highly profitable. Due to the existence of such facilities in the country, it is necessary to define a suitable strategy for the production and export of the desired products, especially in the transportation sector, and reduce related costs, so that based on that action strategies for the exporters and also those responsible for the business planning of the country to be presented(Fahimi Far et al. 2013).

Especially, the development of non-oil exports is one of the important strategies of the current economic development of the country. A policy that has been weakened in recent years and should grow by leaps and bounds in the current conditions and in accordance with the fifth economic development plan, which means that the export will increase to several times the current amount by using the empty capacity and new investment.

This will not be possible unless the current structure of the economy is out of balance, and secondly, potential export markets are identified in terms of import potential for each specific product, thirdly, advantageous items for export such as petrochemical products are identified, and finally, exports are supported comprehensively by the government (Sufi Majidpour, 2015). Without the existence of basic infrastructure such as energy and especially communication and transportation, there will be no opportunity for economic growth and development, of which non-oil exports are one of its objectives. Investing in infrastructure projects such as rail, road and sea transportation and evaluating and prioritizing methods of transporting goods and goods can be considered as a basis for the growth of future capacities and help in the sustainable development of the country, especially in the matter of petrochemical products exports (Mirzakhani et al., 2017).

So far, the export of these products has not been carried out within the framework of a formal and principled marketing and transportation strategy, and it has mainly been ad hoc and influenced by the political and diplomatic relations of the country with the buyer countries. This is despite the fact that in most countries of the Middle East, the production and export of petrochemical products through multinational companies and the prioritization of the transportation methods of these products have finally benefited from the advantages of monopoly and quasi-monopoly markets. Therefore, the countries whose markets have been suggested as ideal target markets for advantageous products such as petrochemical products, can be approved on the condition that, firstly, the export is carried out in the form of a long-term industrial production strategy, secondly, the manufactured products are of high quality, which It demands that production be done with modern and world-class technology, and finally, an export and marketing development strategy in which all aspects, including the evaluation and prioritization of the method of transporting the manufactured goods, and as a result, the reduction of costs and the finished price of petrochemical products will be followed. (Fahimi Far et al. 2013). An important issue that all the economic sectors of the country, including the petrochemical industry, should pay attention to in the time of sanctions and resistance economy, is the way of transporting manufactured goods and prioritizing them based on the existing conditions, so that they can, in addition to transporting their manufactured goods in safe conditions to manage and control transportation, fuel, and insurance costs. One of the prerequisites for economic prosperity in all countries is the transport industry. This problem in the field of transportation, on the one hand, refers to the existing rail, road, sea, and air infrastructures, and it is necessary to develop all of these transportation methods in an integrated manner within the framework of the regional and international transportation to be developed. On the other hand, one of the serious and influential issues on the safe and fast movement of goods is the issue of logistics management in the transportation chain (Tamanei, Rati Barezaki, 2018).

Shoukohi and colleagues (2018) in a study entitled "Investigation of the challenges of Iran's petrochemical industry in terms of the general policies of resistance economy" concluded that the most important challenges in this industry are: The absence of a trustee in the petrochemical industry, the weakness of laws and regulations to attract do mestic and foreign investors, and the lack of integration in the industry from upstream to downstream. On the other hand, the findings of the research show that appropriateness, accountability, financial independence, legal independence and political independence are the most important criteria that the regulatory body should have.

Varherami and colleagues (2018) in a study entitled "Comparison of the effect of foreign direct investment on the export of petrochemical products (urea, methanol, propane)" they concluded that the most influential variable on the export of petrochemical products is production. Therefore, adopting appropriate policies to increase the production of petrochemical products will increase the export of that product, policies such as the use of skilled labor, especially the use of new technologies, can accelerate the production process of petrochemical products.

Tamanaei and barzaki (2018) in a study titled "Game theory approach for modeling competition in the market of road and rail transport of goods" it was concluded that by applying the policy of increasing the price of fuel, the price of both modes of transportation as well as the demand and profit of the combined

transportation method will increase. and the travel time of the combined transportation method and the demand and profit of the road transportation method will decrease. Also, the policy of using modern trucks with low fuel consumption in road transportation reduces the equilibrium price of both road and combined transportation methods, reducing and increasing the equilibrium travel time of the combined transportation method. It will increase the demand and profit of the road transport method and will decrease the demand and profit of the combined transport method.

Abdi and colleagues (2016) in a study titled "Examination and criticism of the export of petrochemical products in the framework of the 13th paragraph of the general policies of the resistance economy" it was concluded that the solution to the problems and the development of the export of petrochemical products will be possible only by relying on the resistance economy. For this purpose, paragraph 13 of the notified policies, which directly refers to the export of the petrochemical industry and has divided its work methods into two parts. the first part generally examines the increase in exports in this industry, and the second part states three basic ways to export petrochemical products; which includes the diversity in sales methods, the use of the private sector in the export of petrochemical items, and the diversity in the export principle, has suggested that the implementation of all the orders of this paragraph will lead to the strengthening of the petrochemical industry.

Shakohi et al. (2018) in a research entitled "Investigation of the challenges of the Iranian petrochemical industry in terms of the general policies of the resistance economy" concluded that the most important challenges of this industry are: the lack of a trustee. In the petrochemical industry, there are weak laws and regulations to attract domestic and foreign investors and the lack of integration of this industry from upstream to downstream. On the other hand, the findings of the research show that appropriateness, accountability, financial independence, legal independence and political independence are the most important criteria that the regulatory body should have.

Varahrami et al. (2018) in a research entitled "Comparison of the impact of foreign direct investment on the export of petrochemical products (urea, methanol, propane)" concluded that the most influential factor on the export of petrochemical products is production. Therefore, adopting appropriate policies to increase the production of petrochemical products will increase the export of that product, policies such as the use of skilled labor, especially the use of new technologies, can accelerate the production process of petrochemical products.

Temanei and Barzeki (2017) in a research titled "Game theory approach for modeling competition in the market of road and rail transport of goods" concluded that by applying the policy of increasing the price of fuel, the price of both types of transport will also increase. As the demand and profit of the combined transport method increases and the travel time of the combined transport method and the demand and profit of the road transport method decrease. Also, the policy of using modern trucks with low fuel consumption in road transportation reduces the equilibrium price of both road and combined transportation methods, reducing and increasing the equilibrium travel time of the combined transportation method. It increases the demand and profit of the road transportation method and decreases the demand and profit of the combined transportation method.

Abdi et al. (2015) in a research entitled "Examination and criticism of the export of petrochemical products in the framework of the 13th paragraph of the general policies of the resistance economy" have come to the conclusion that solving the problems and developing the export of petrochemical products will be possible only by using it. Relying on the concept of resistance economy in paragraph 13 of the notified policies, which directly refers to the export of the petrochemical industry and divided its working methods into two parts, the first part generally examines the increase in the amount of exports in this industry, and the second part examines the three bases. he does. His working methods regarding the export of petrochemical products have been stated; which includes diversity in sales methods, the use of the private sector in the export of petrochemical items and diversity in export bases, the implementation of all the orders of this paragraph has led to the strengthening of the petrochemical industry.

Soltani (2015) in a research entitled "Overview of the position and strategic functions of petrochemical industries in Iran" concluded that the demand for petrochemical products has a direct relationship with the growth of the world economy and the growth of the applicant countries. .
Kazemi Versoli (2013) in a research entitled "Petrochemical industry in Iran" concluded that the problems of this industry are based on 2 main axes, the first axis refers to the structural weakness of this industry and industries in Iran in general. . The second axis is related to the existing policies in the field of the National Petrochemical Industry Company and the government.
Pak Maram et al (2008) in a research entitled "Effective factors on the application of cost management systems in the petrochemical industry of Iran" concluded that effective cost management is a necessary and key component in the petrochemical industry and in order to achieve this. Aim offers the following recommendations:

- Creating an integrated information system for the use of cost management and control systems.
- Choosing the right criteria to measure performance in this industry.
- Establishment and implementation of activity-based costing and management system.
- Expansion of cost management and control to the supply chain of raw materials.
- The need to make cost control and management a common belief for employees.

Rasekhi and Zabihi Laharmi (2007) in a study titled "Competitive advantage in the petrochemical industry of Iran during the period of 2011-2015" came to the conclusion that even though Iran has a clear relative advantage in most of the petrochemical export goods, but it has not been able to To have a stable competitive advantage in these goods. Fathi et al.(2008) in the study entitled "Future research of investment and financing in Iran's transportation industry (machinery and equipment sector)" came to the conclusion that considering the importance of transportation in the country's development and its relationship with Other economic sectors, planning and policy are very important in this industry. Whetstone et al. (2021) in a study titled "Transportation Cost: Mississippi River Freight Rates" concluded that accurate forecasting of commodity prices and transportation costs can be a great benefit for market participants. This is especially true for US agricultural exports such as corn and soybeans, which are characterized by low margins but high volumes. Tukayer et al (2018) carried out a study and its objective was to analyze and improve cargo transportation considering multi-purpose transportation with marine, road and rail transportation. In this study a dual-purpose mathematical model is developed that its objectives are total cost, the number of transportation operations and a factor for operation difficulty. This model decides on multi-purpose transportation program like decisions on voyage charter and transportation type. We make a Pareto border to have a choice on change in transportation complex. We test mathematical model as a sample of real activity of petrochemical ethylene manufacturer established in Turkey. This article considers a secondary aim and covers rail transportation as a third type in multi-mode transportation combination. For analyzing changes in decisions related to voyage charter and choosing mode, we introduce three different scenarios. Results indicate that small changes in transportation mode are possible without changing distribution network structure and bring about considerable cost savings. López et al (2016) in a research entitled "A cost optimization model of transportation existing or planned ports, this paper uses a Brazilian transportation network modeling and optimization model based on It is the basis of linear programming and transportation model. The objective of this model is to minimize the global cost of alternative routes for Brazilian soybean exports. Sekris (2016) in a study titled "Effects of domestic transportation on regional exports of Greece" has investigated the role of transportation on exports during the period of 2004-2012 using a dynamic panel. The results showed that transportation has a positive and significant effect on the specialization of production and export of products. There is also a relationship between the distance between trade areas and exports. Albaran, Carrasco and Hel (2013) in a study titled "Domestic transportation infrastructure and companies in the export market" investigated the effect of reducing the cost of domestic transportation on the export of companies according to the registration fee and other characteristics. companies have studied using the dynamic panel model and have come to the conclusion that the

improvement of domestic transportation infrastructure has a positive effect on the export of small and medium-sized companies.
routes for Brazilian soybean exports" concluded that Brazil is the world leader in soybean exports. However, it has high internal costs for transportation. Considering 7 origins in the main exporting countries of Brazil, 2 final destinations - the ports of Shanghai and Hamburg, and 9.

3. Methodology of Research

Information collection methods can be divided into library methods and field methods. In this research the field method will be used to collect information related to answering the research question, Also the library method such as reading books, articles, magazines, research projects, and internet databases will be used to compile and write the subject's literature and theoretical foundations. The data collection tool in this research will be a self-made matrix questionnaire in the field of research variables. To check the validity of the questionnaire, content validity will be used using experts' opinions. The current research is based on the purpose of an applied research. Based on the nature of the method, it is part of descriptive-analytical research, and in terms of the method of data collection, it is a survey (field) research. The statistical population of this research includes all experts and experts working in Arak Petrochemical Complex. Considering that the size of the statistical population is limited to the employees of Arak Petrochemical Complex. A sample of 28 people is selected to reach theoretical adequacy. The sampling method in this research will be snowball and selective (non-probability) sampling. Topsis software will be used for data analysis. The advice of the supervisor and some professors was also taken to increase the validity of the measurement tool and to design a questionnaire.

4. Research Findings

The scientific analyzes carried out in this section include quantitative analyzes in the Topsis software environment, which will be explained in order.

Data Analysis of Research

After describing the parameters and answers obtained from the statistical society, in this section, the study and analysis of the research data have been done.

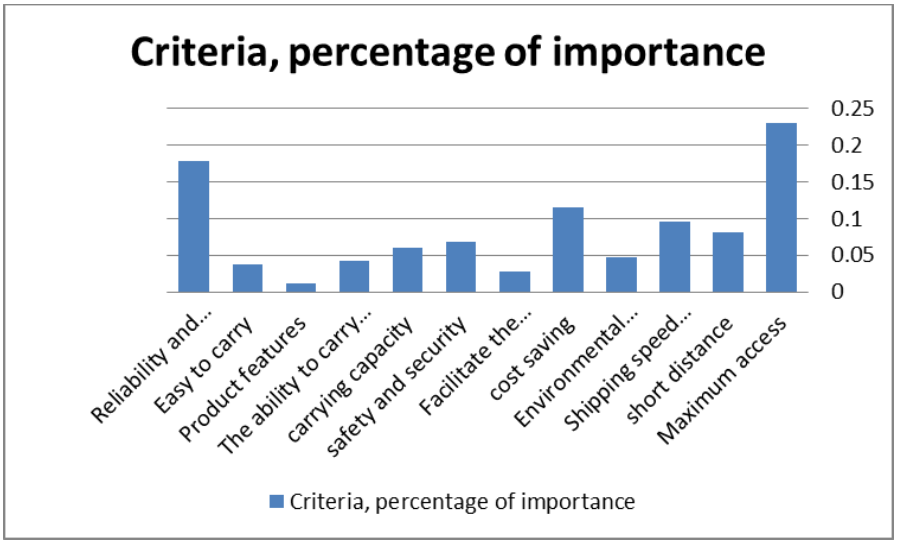

Chart 1- The final weight Wj of the criteria based on the opinion of the experts of Arak Petrochemical Complex

According to the study conducted and the analysis of the data obtained based on the opinion of Arak Petrochemical experts in this research, the highest level of access is the most important

criterion and in other words the most important criterion, then the reliability and regularity of the service and cost savings respectively The next effective indicators are in the ranking.
Topsis analysis process based on extracted data from the point of view of Arak Petrochemical Complex experts

1. The preliminary stage of designing the decision matrix
The data decision matrix includes 5 options and 12 criteria.

Table 1. Decision matrix based on the opinion of Arak Petrochemical experts

Indicators / **Shipping Methods**	Reliability and regularity of service	Easy to carry	Product features	The ability to carry all kinds of loads	carrying capacity	safety and security	Facilitate the unloading and loading process	cost saving	Environmental aspect	Shipping speed (reducing (time	short distance	Maximum access
Road												
Railroad												
Marine												
Air												
Hybrid												

2. The step of preparing the decision data matrix
The data decision matrix includes 15 options and 7 criteria, which are set based on the bipolar spectrum from 1 to 9. The numbers specified in the table indicate the status of the proposed transportation methods based on the desired index, which expresses the importance of the indicators according to the opinions. Of course, these numbers are recorded based on the importance of the options according to the criteria.

3. step of recording the decision matrix data in Topsis software
The data decision matrix includes 5 options and 12 criteria, which are set based on the bipolar spectrum as follows from 1 to 9 and recorded in Topsis software.

Table 2. Data decision matrix recorded in TOPSIS software

Indicators / Shipping Methods	Reliability and regularity of service	Easy to carry	Product features	The ability to carry all kinds of loads	carrying capacity	safety and security	Facilitate the unloading and loading process	cost saving	Environmental aspect	(Shipping speed (reducing time	short distance	Maximum access
Road	.4	.6	.1	.6	.9	.5	.3	.2	.4	.5	.9	.2
Railroad	.7	.5	.3	.4	.2	.4	.9	.5	.6	.6	.3	.3
Marine	.1	.1	.4	.2	.1	.3	.5	.1	.3	.7	.3	.6
Air	.8	.4	.2	.9	.7	.9	.7	.7	.6	.5	.3	.6
Hybrid												

First step: De-scaling of the decision matrix

Table3. De-scaling of the decision matrix

Indicators	Easy to carry	Reliability and regularity of service	.....	Maximum access
Indicators	(+)	(+)	.....	(+)
Shipping Methods			.....	
Road	0.675	0.528	.....	0.869
Railroad	0.46	0.433	.....	0.36
Marine	0.325	0.402	.....	0.18
Air	0.381	0.512	.....	0.18
Hybrid	0.286	0.331		0.223
Criteria, percentage of importance	0.18	0.04		0.23

Table 4. Balance the decision matrix

Indicators	Easy to carry	Reliability and regularity of service	.....	Maximum access
Indicators	(+)	(+)	.....	(+)
Shipping Methods			.....	
Road	0.121	0.021	.....	0.2
Railroad	0.083	0.017	.....	0.083
Marine	0.059	0.016	.....	0.041
Air	0.069	0.02	.....	0.041
Hybrid	0.051	0.013	.....	0.051
Positive ideals	0.121	0.021	.....	0.2
Ideal negatives	0.051	0.013	.....	0.041

The second step: balancing the decision matrix

The third step: calculating the size of the distance to the positive and negative ideals

Table 5. Calculating the size of the distance to positive and negative ideals

	The size of the distance to the positive ideal	The size of the distance to the negative ideal	CI
Road	0.021	0.177	0.896
Railroad	0.129	0.058	0.31
Marine	0.176	0.021	0.106
Air	0.168	0.049	0.227
Hybrid	0.17	0.013	0.073

The fourth step: calculating the size of the relative proximity to the ideals

Table 6. Calculation of the size of the relative proximity to the ideal

Prioritizing management strategies in cargo and goods transportation	CI
Road	0.896
Railroad	0.31
Marine	0.106
Air	0.227
Hybrid	0.073

Fifth step: software output: setting priorities based on calculating the size of the distance to positive and negative ideals

Table 7. Determining the priority of management strategies in transporting cargo and goods

	priority	Shipping strategies
S1	Priority 1	**Option 1 (road)**
S2	Priority 2	**Option 2 (Rail)**

S4	Priority 3	**Option 4 (Air)**
S3	Priority 4	**Option 3 (marine)**
S5	Priority 5	**Option 5 (combined)**

The sixth stage: final conclusion based on the opinion of Arak Petrochemical experts

When deciding to choose the best method for transporting and moving products among the available options and methods, the indicators and criteria known in this regard should be considered by the decision makers. According to the study and taking into account the known factors and indicators and factors such as the long distance from the active ports of the country, the lack of easy and continuous access to rail lines, the need to send the products of this complex to their destination quickly and safely. to the flammability of most of them, minimizing damages caused by accidents and unforeseen events (fire, flood, etc.) during transportation, reducing the costs of moving raw materials and the final product, and finally, the finished price The product, the price of products becoming more competitive and the growth and development of export markets with regard to saving and reducing costs, the most optimal method of transportation is road transportation, and rail and sea transportation methods are the most optimal strategies, respectively, in the next priorities. Among the strategies, they are introduced to transport cargo and goods in Arak Petrochemical Complex**.**

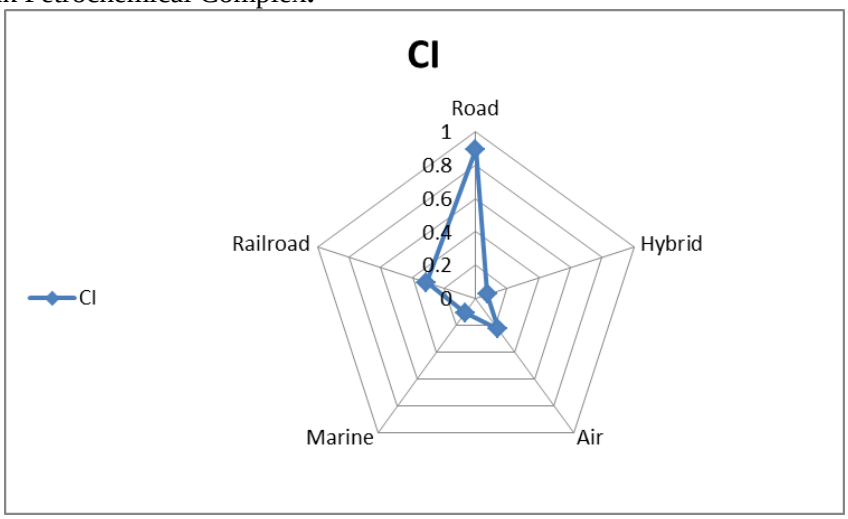

Chart 2. Ranking of strategies based on the opinion of Arak Petrochemical experts

5. Discussion and Conclusion

Discussion and summary based on the results of this research, the highest level of accessibility, reliability and regularity of service and cost savings are respectively the most important effective indicators in the ranking of cargo and goods transportation methods. Also, product features are introduced as the least important indicator in this regard. Also, based on the results obtained from the research and the output of the charts, the best method for transporting the products produced by the Arak Petrochemical Complex, due to the long distance from the active ports of the country, the lack of easy and continuous access to rail lines, the need to send the products produced by this complex quickly and safely to the destination Due to the flammability of most of them, minimizing the damages caused by accidents and unforeseen events (fire, flood, etc.) during transportation, reducing the costs of moving raw materials and the final product and finally the finished price. The product, the price of products becoming more competitive and the growth and development of export markets due to saving and reducing costs, is the road transportation method, and rail and sea transportation methods are placed in the next categories respectively. Research proposals when deciding to choose the best method for transporting and moving products from among the available options and methods, the indicators and criteria known in this regard should be considered by

the decision makers of Arak Petrochemical Complex. According to the findings of this research, among the methods of transportation, road transportation has effective indicators in this regard, such as the highest level of accessibility, reliability and regularity of service, saving costs related to the transportation of export products, ease of transportation of goods and Various products were recognized as the most optimal method of transporting export products in the said complex. After prioritizing the methods, the senior managers in Arak Petrochemical Complex should take into account the priorities of the methods of transporting the products and their effects by creating predetermined plans to fix the existing deficiencies, which can be done by holding briefing sessions. and training, creating suitable corrective operations, consulting with the senior managers of the main transportation networks in the country for more interaction in using points of view and experiences, in order to eliminate existing weaknesses and use the appropriate method to transport products with the priority of reducing costs take export steps.

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ETHICAL CONSIDERATION

Authenticity of the texts, honesty and fidelity has been observed.

CONFLICT OF INTEREST

Author/s confirmed no conflict of interest.