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Classification of application indicators of environmental logistics in the transportation of petrochemical petroleum products

Marjan Zolfaghar*
Master's student in Maritime Navigation with a specialization in Maritime Transportation
(marjan.zolfaghar@gmail.com)
Jafar Sayareh
Associate Prof., Chabahar Maritime University, Iran (J.Sayareh@gmail.com)

Abstract
The purpose of this work is to organize the indicators of the application of environmental logistics in the transportation of petrochemical petroleum products.
Based on this, this study can be considered a descriptive study, because we use a questionnaire to measure the variables, the study can be treated as a survey, and on the other hand, due to the applicability of the results of this study, they belong to the group of applied studies.
In this work, the most important indicators of the application of environmental logistics in the transport of petrochemical oil products and the library search method (articles, theses and books and expert opinions) are first identified using the Delphi technique.
Hierarchical analysis is then used to determine priorities. The statistical base population of this study is all Chabahar petrochemical experts, managers and environmental logistics experts.
The results of the present study show that environmental management criteria, laws and management and pollution control are the first and third most important criteria in the application of environmental logistics in the transport of petrochemical products. These results can be useful to advance the goals of ecological logistics management in the respective industries.
Keywords: implementation of environmental logistics, environmental logistics, transportation of Petrochemical products

Introduction

Considering that oil and its derivatives are considered reactive and toxic substances, hence the Environmental Protection Agency EPA has classified these substances as hazardous substances. Oil spills, which occur in different stages of the oil industry and especially its transportation, have adverse effects on the environment and various animals.
Therefore, identifying oil-contaminated areas and cleaning the environment are among the basic environmental priorities. (Shafiei, 2015)One of the most important risks in Transportation of hazardous materials is a road accident that can have destructive effects on the environment and road safety.
Using risk management techniques, route conditions and material transport methods can be determined and these accident-causing factors assessed, identified and controlled before an accident occurs. The growing use of transportation system in industry and service and its great impact on the efficiency and competitiveness of organizations have led researchers to pay attention to the optimization of transportation systems. (Hemati, 2016).
Considering the supply chain problem of various industries, especially the oil and gas industry, and the importance of developing an integrated supply chain logistics model that takes into account the reduction of greenhouse gas emissions, e.g. Carbon, taking into account environmental aspects and the costs to provide and solve an integrated logistics model, in the supply chain of the oil industry and gas is especially important when weighing several conflicting objectives together.

Undoubtedly, the increasing attention to organizational and environmental impacts requires attention to sustainable operations and fulfillment of social, economic and environmental needs .Over the past decade, researchers have devoted much attention to the challenge of developing sustainable human resource and supply chain systems to achieve corporate and accountability goals.

We have little knowledge about how sustainable human resource management can effectively lead to sustainable company performance goals. (Tahmasabi Roshan, 2022) If the design and implementation of sustainable human resource management procedures are not effective, the use of valuable resources such as humans will be complicated in organizations.

Focusing on the need to create a national logistics landscape from an economic perspective is a topic worth considering . Because it is through this lens and special vision that the government understands the need to transform the existing traditional vision into a global vision of logistics. (Fathi, 2014).

On the other hand, large economic enterprises and ministries can provide ground for infiltration and new ideas by focusing on this field and conducting research, knowing the national, regional and global coordinates of the commodity and logistics chain.

Thus, in addition to the role of a strong actor in the logistics, port and other transport sectors, the considered stage also has an advantage in the field of research and theoretical foundations.(Mahmoudi 2021).

One study set the objective. This study investigates the effectiveness of green logistics management practices on financial performance through environmental protection and social in Shiraz industrial city. Information is collected by library, field and internet methods. Also, the measurement tool is Manesh et al.'s (2020) questionnaire.

The number of products is 31, which measures variables of environmental performance, financial performance, green logistics management practices, market performance, and social performance.

All the results of the study showed that in this study, all the coefficients related to the paths between the variables are greater than the value of 1.96, which indicates the significance of all the paths and the adequacy of the structural model.

The research results showed that in order to achieve environmental goals, companies should allocate more resources to green logistics management practices such as sustainable energy, recycling, sustainable transportation and distribution, sustainable storage and environmentally friendly product packaging. Which leads to better financial and marketing performance of companies.

The findings of this research expand the literature by expanding the understanding of the application of green logistics management practices from a global perspective .Because this study provides insights from the production sector of a city where the food industry is not as advanced as Tehran, Karaj, Mashhad and Tabriz.

Despite the fact that this study was conducted in a nascent economy, this model can also be used in other cities' economies due to its complexity and connection with green supply chain management. (Hosseini, 2015)

Today, planning a proper reverse logistics network is of great interest in various industries for environmental and economic reasons .The reverse logistics network includes all logistics processes related to products/services after they are delivered to the customer. These processes include the main processes, such as collection, inspection, sorting, and sub-processes such as reproduction operations, recycling, reuse, and others.

In recent decades, the growth and development of industries such as petrochemicals has led to numerous environmental problems, including

global warming, ecosystem changes, air and sea pollution, and the destruction of the ozone layer. (Mohammadi, 2017)

Therefore, according to the emphasis of governments, organizations and bodies in charge of environmental protection and on the other hand, social pressures regarding environmental protection, industries are looking for solutions to create more productivity while protecting the environment.

In this regard, environmentally friendly supply chain management is a big step towards the implementation of these goals .The supply chain, or In other words, the logistics process, includes several elements. And in order to implement environmental programs and goals in the supply chain, green management and sustainable development must be done in each of the elements of the chain so that it can be called a green supply chain.

Therefore, it is necessary to identify and examine the factors influencing the implementation of green logistics in each of its elements separately. In order to be able to achieve useful and effective solutions in the implementation of green logistics in a more detailed and thorough manner.

For this purpose, the current research sought to rank the environmental logistics development indicators in the transportation of petroleum products in petrochemicals.

Research Methodology

In this research, we describe the status of each of the variables in the desired statistical population.

Therefore, this study can be considered a descriptive study because we use a questionnaire to measure the variables, so the study can be considered a survey. And on the other hand, due to the applicability of the results of this research, it can be placed in the applied research group.

In this research, in order to identify the most important indicators of the implementation of environmental logistics in the transportation of petrochemical petroleum products, the library search method, theses and books, as well as the opinions of experts were used with the help of the Delphi technique.

Then, hierarchical analysis is used to determine the priorities. The statistical population of this research is all experts, managers and knowledgeable employees in environmental logistics based in Chabahar Petrochemical.

In this research, non-random purposeful sampling was done.

And the initial questionnaire to determine the criteria and indicators using the Delphi technique is distributed among five experts and then the paired comparison questionnaire based on the criteria obtained from the first questionnaire is distributed among ten experts.

Among the factors extracted from the background, a number of sub-criteria were removed by Delphi experts. And three sub-criteria of recycling management, reduction of consumption of energy resources and input raw materials and management skills were recommended by Delphi experts for environmental management criteria.

In the current research, a library study was used to collect data and information.The main methods and tools of data collection are documents, interview observations and questionnaires.

In this research, in order to collect data, referring to the experts in the questionnaire and the opinions of Delphi experts were

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used.Questionnaire is one of the tools for obtaining information in survey research that collects data directly.

In the first round of the questionnaire, data was collected using the Delphi technique along with face-to-face interviews with experts. And in the next step, the questionnaire was distributed to implement the AHP method.

Findings

Descriptive Statistics

The statistical sample for this study includes ten petrochemical experts in Chabahar. Its descriptive statistics are presented in the following tables.

Table 1. Frequency and percentage of respondents to the paired comparisons questionnaire

Frequency percentage	Frequency	Organizational position
20%	2	Head of Refinement
10%	1	Head of Operation
10%	1	Director of staff affairs
40%	4	Manager of shift work
20%	2	Head of instrumentation
100%	10	Total

Chart 1. Frequency and percentage of respondents to the paired comparisons questionnaire

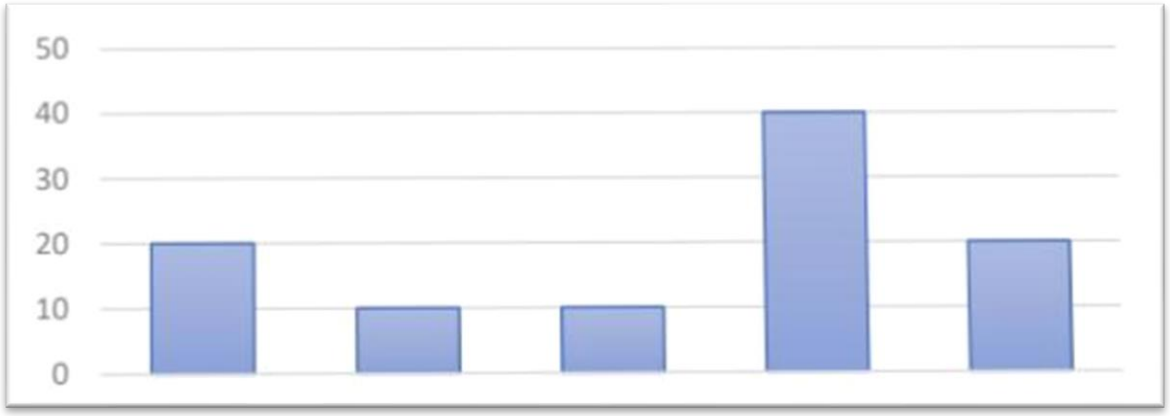

Table 2. The frequency of the average age of the Respondents

Frequency percentage	Frequency	Age of respondents
10%	1	Between 36 and 40 years
20%	2	Between 41 and 45 years old
0%	0	Between 46 and 50 years old
40%	4	Between 51 and 55 years old
30%	3	More than 55 years
100%	10	Total

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Chart 2. The frequency of the average age of the respondents

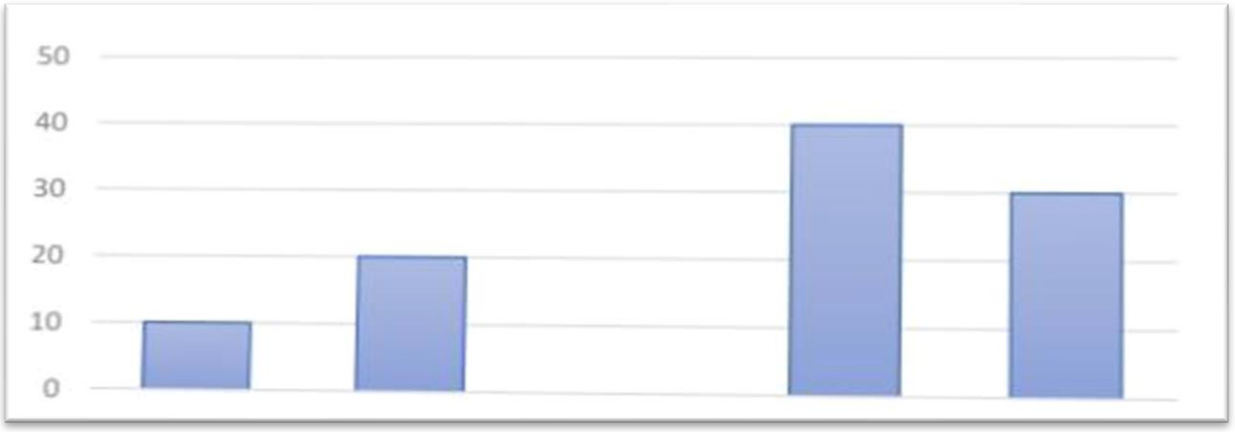
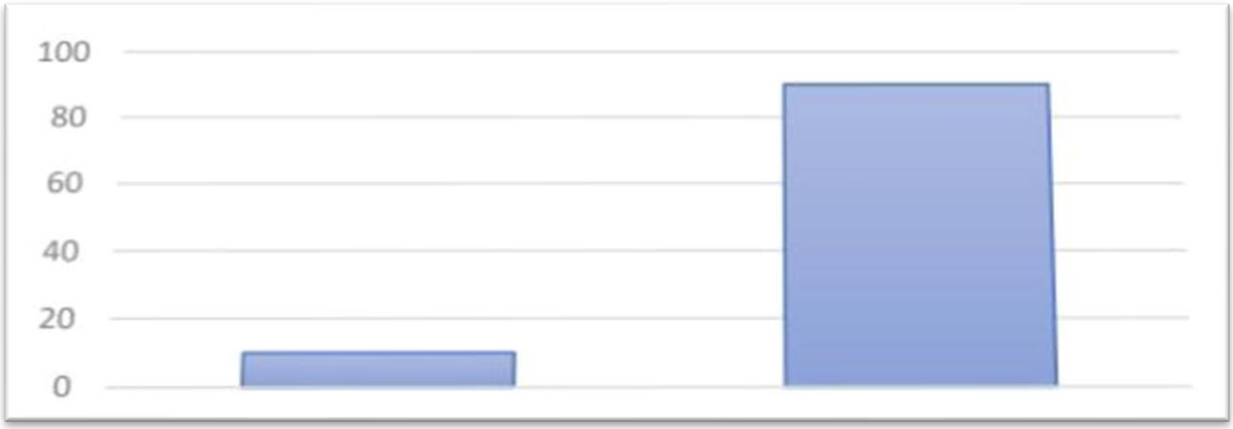


Table 3. Frequency of respondents' work experience

Frequency percentage	Frequency	Work experience
10%	1	Less than 25 years
90%	9	Between 25 and 30 years
100%	10	Total

Chart 3. Frequency of respondents' work experience

Table 4. Frequency statistics of respondents' education



Frequency percentage	Frequency	Education
40%	4	Bachelor
60%	6	Masters
100%	10	Total

Chart 4. Frequency statistics of respondents' education

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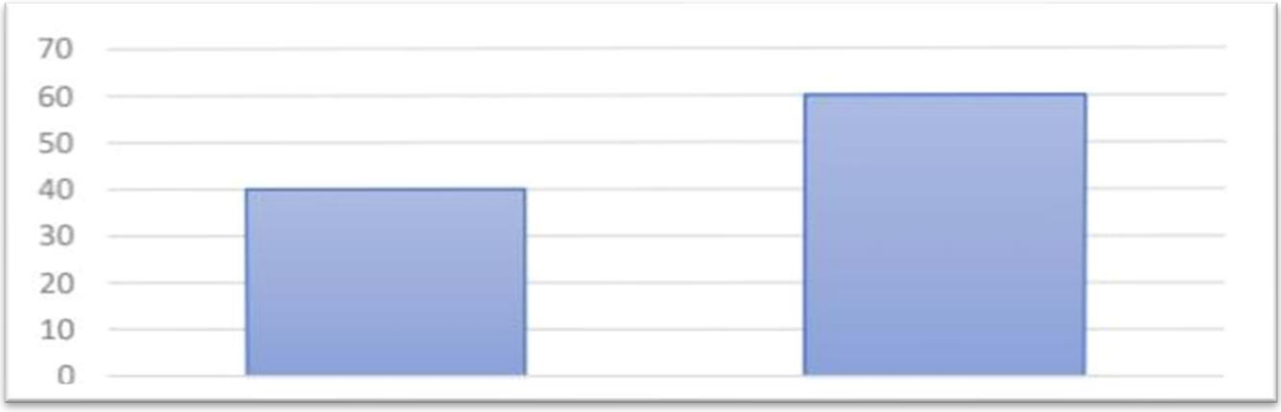

Identify criteria and sub-criteria

The number of six main criteria including green transportation, finance, rules and regulations, pollutant control, environmental and environmental management and 27 sub-criteria were obtained. Before any analysis, these criteria and indicators should be confirmed and screened by experts. To confirm and screen research indicators in this section, Delphi technique is used to identify indicators. For this purpose, the questionnaire is distributed among five experts in three stages, and in the last stage, if the standard deviation difference of each index is less than one, the repetitions can be stopped. The result of this test can be checked in the following tables.

The first stage of Delphi

In the first stage, the questionnaire was distributed among five experts in this field, which includes the hour spectrum that corresponds to the nine-point Likert spectrum.

It was arranged for the experts to answer and after collecting the answers, the average numbers chosen by the respondents for each of the factors and also their standard deviation were calculated, the results of which are shown in Table 5 as follows.

Table 5. Criteria and sub-criteria of the first Stage of Delphi

Standard deviation difference	Sub criterion	Criterion name
	Manpower training in optimal fuel consumption and engine maintenance	Transportation of products
	Manpower training in the arrangement of transportation and optimal use of spaces and reducing the frequency of distribution	
	Transportation infrastructure	
	Use of clean LNG fuel and multi-fuel vehicles	
	Use of new and Euro 5 certified vehicles	
	Reducing water consumption in washing vehicles	
	Use of diesel engine vehicles	
	Managing the washing and cleaning procedure of tankers carrying materials	

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	Shift medal	
	Investment	Financial
	Reduce costs through exploitation	
	Environmental laws	Terms and Conditions
	Taxes	
	The existence of modern policy and policies in the field of environment and social responsibilities in organization	
	Controlling the amount of dangerous and polluting substances in production	Control of pollutants
	Waste management	
	Reducing waste materials	
	Use of reverse logistics system	
	Green design	Environmental management
	Cooperation with customers	
	Environmental cooperation with stakeholders	
	Obtaining green standards and certificates	
	Management skills	
	Creating environmental protection for future generations	
	Customer pressures	
	Competition in the market	Environment
	Social pressures	

In this research, the number seven is considered as the average of the nine-degree spectrum. In this regard, according to Table 5, it is clear that the indicators whose average is less than seven are removed from the analysis. The indicators that should be removed are highlighted in the table.

In fact, the sub-indices of manpower training in arrangement and transportation and optimal use of spaces and reducing the frequency of distribution, reducing water consumption in vehicle washing,Using vehicles with diesel engines, managing the washing and cleaning procedure of tankers carrying materials, reducing waste materials, cooperating with customers,The creation of environmental protection for future generations and the pressures of customers obtained a lower average than other sub-indices. And as a result, they were excluded from the next round of the Delphi technique questionnaire.

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Table 6. The overall results of Delphi

Standard deviation difference	Standard deviation of the third round	Standard deviation of the second round	Sub criteria	Criterion name
0.20102	0.9545	0.89443	Manpower training in optimal fuel consumption and engine maintenance	
-0.28894	0.54772	0.83666	Transportation infrastructure	
-0.44722	0.44721	0.89443	Use of clean LNG fuel and multi-fuel vehicles	
0	-2.04939	-0.04939	Use of new and Euro 5 certified vehicles	
0.2284	1.64317	1.41241	Shift medal	
0.28894	0.83666	0.54772	Investment	Financial
0.10051	0.54772	0.44721	Reduce costs through exploitation	
0.28894	0.83666	0.54772	Environmental laws	Terms and Conditions
0.30352	0.14018	0.83666	Taxes	
-0.10051	0.44721	0.54772	Modern policies in the field of environment and social responsibilities in the organization	
-0.10051	0.54772	0.44721	Controlling the amount of dangerous and polluting substances in production	Control of pollutants
0.12929	0.22474	0.09545	Waste management	
0.12925	0.70711	0.83666	Use of reverse logistics system	
0.0888	0.73205	0.64317	Green design	Environmental management
0.21274	0.51658	0.30384	Environmental cooperation with stakeholders	
0.17342	0.81659	0.64317	Obtaining green standards and certificates	
0.12659	1.64317	0.51658	Management skills	
0	1.30384	0.30384	Competition in the market	Environment
0	1.30384	1.30384	Social pressures	

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According to the results of Table 6, considering that the difference of standard deviation of the second and third rounds is less than one. This result Is obtained that it is possible to finish repeating the distribution of questionnaires and reach a definite result and the indicators of this research are confirmed and accepted as the final indicators of the research.

Table7.Final criteria and sub-criteria table

Sub criteria	Criterion name
Manpower training in optimal fuel consumption and engine maintenance (c4)	Transportation of products
Transportation infrastructure(c2)	
Use of clean LNG fuel and multi-fuel vehicles (c1)	
Using new vehicles with Euro 5 (c5) certificate	
Medal shift (c3)	
investment (d1)	Finan cial
Reducing costs through exploitation (d2)	
Environmental laws (e1)	Terms and Conditions

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Taxes (e2)	
The existence of modern policies in the field of environment and social responsibilities in the organization (e3)	
Controlling the amount of dangerous and polluting substances in production (f1)	Control of pollutants
waste management (f3)	
Using reverse logistics system (f2)	
Green design (g2)	Environmental management
Environmental cooperation with stakeholders (g3)	
Obtaining green standards and certificates (g1)	
Management skills (g4)	
Competition in the market (h1)	Envir onme nt
social pressures (h2)	

Implementing the steps of the Analytical Hierarchy Process (AHP)

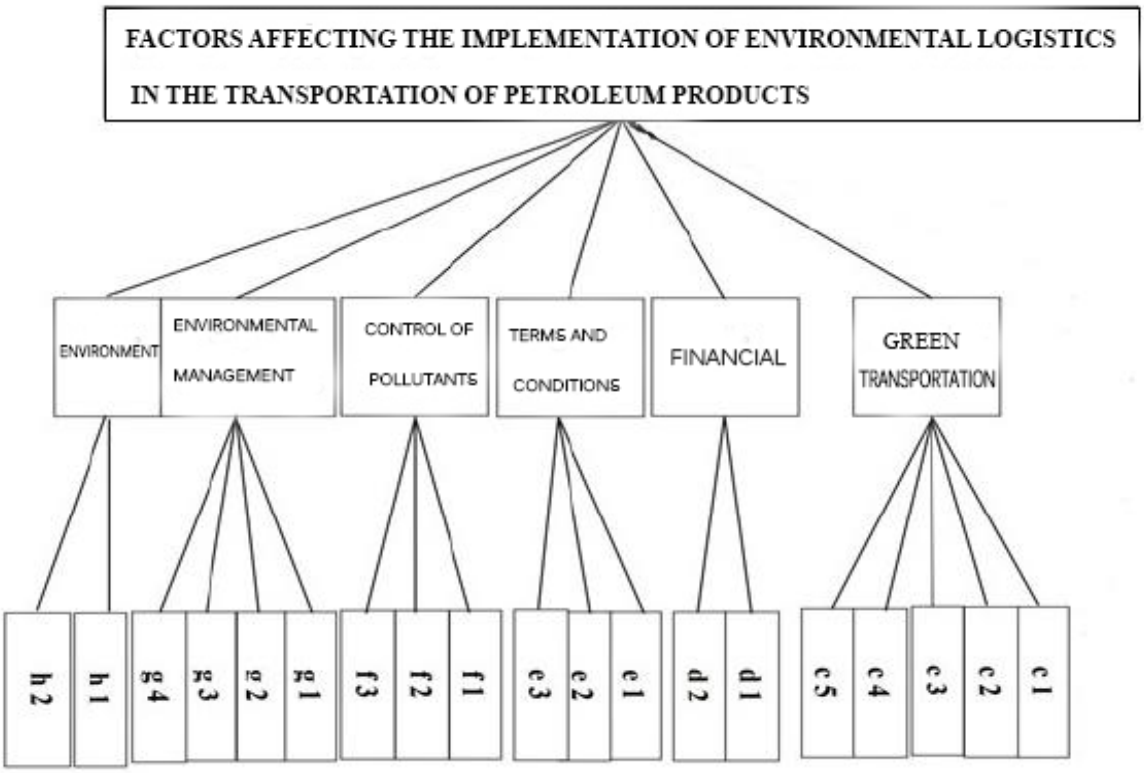

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Diagram 5. Factors affecting the implementation of environmental logistics in the transportation of petrochemical petroleum products

Formation of pairwise comparison matrices

In this step, both the main factors and the sub-criteria of each factor are compared in pairs or with each other and form the matrices of pairwise comparisons.

Table 8. Pairwise comparison matrix of the main criteria compared to the target

Transportation of products	Environment	Financial	Control of pollutants	Terms and Conditions	Environmental management	
7.20	4.92	4.79	3.77	2.71	1.00	Environmental management
5.38	3.62	2.24	2.29	1.00	0.37	Terms and conditions
3.53	2.29	1.35	1.00	0.44	0.27	Control of pollutants
2.67	2.22	1.00	0.74	0.45	0.21	Financial
2.22	1.00	0.45	0.44	2.28	2.20	Environment
1.00	0.45	0.37	0.28	0.19	0.14	Transportation of products

Table 9. Pairwise comparison of environmental management criteria

G4	G3	G2	G1	
5.55	3.80	3.96	1.00	G1
3.40	1.41	1.00	0.25	G2
3.38	1.00	0.71	0.26	G3
1.00	0.42	0.29	0.018	G4

Table 10. Pairwise comparison of the criteria of laws and regulations

e3	e2	e1	
4.56	3.77	1.00	e1
1.91	1.00	0.27	e2
1.00	0.52	0.22	e3

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Table 11. Pairwise comparison of pollutant control criteria

f3	f2	f1	
3.73	2.04	1.00	f1
2.22	1.00	0.49	f2
1.00	0.45	0.27	f3

Table. 12 pairwise comparison of financial criteria

d2	d1	
2.99	1.00	d1
1.00	0.33	d2

Table 13. Pairwise comparison of the environmental criteria

h2	h1	
3.39	1.00	h1
1.00	0.30	h2

Table 14. Pairwise comparison of the following criteria for transportation of products

c5	c4	c3	c2	c1	
5.28	6.46	3.66	2.09	1.00	c1
4.88	4.42	3.09	1.00	0.48	c2
3.36	2.93	1.00	0.32	0.27	c3
1.70	1.00	0.34	0.23	0.15	c4
1.00	0.59	0.30	0.21	0.19	c5

Table 15. Relative weight of the criteria

Criterion weight	Criterion name
0.372	Environmental management
0.201	Terms and Conditions
0.126	Control of pollutants
0.102	Financial
0.074	Environment
0.040	Transportation of products

Table 16. Final weight of sub-criteria

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Final weight of sub-criteria	The relative weight of the sub-criteria	Sub-criterion name	Criterion name and weight
0.018	0.445	C1	Transportation of products (0.04)
0.012	0.292	C2	
0.006	0.143	C3	
0.003	0.066	C4	
0.002	0.054	C5	
0.077	0.75	D1	(0.102) financial
0.026	0.25	D2	
0.1343	0.668	E1	Terms and Conditions(0.201)
0.0414	0.206	E2	
0.0253	0.126	E3	
0.0709	0.563	F1	Control of pollutants(0.126)
0.0372	0.295	F2	
0.0179	0.142	F3	
0.2143	0.576	G1	Environmental management(0.372)
0.0740	0.199	G2	
0.0565	0.152	G3	
0.0275	0.074	G4	
0.0571	0.772	H1	(0.074) environment
0.0169	0.228	H2	

The final weight of the sub-criteria is obtained by multiplying the relative weight of the sub-criteria by the weight of the criteria.

Table 17. Compatibility rate of factors

Compatibility rate	Criterion name
0.03	6 main factors
0.027	Sub-criteria of environmental management
0.022	Sub-criteria of rules and regulations
0.004	Pollutant control sub-criteria
0.0000	Financial sub-criteria
0.0000	Environment sub-criteria
0.034	Sub-criteria for transportation of products

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According to the results of Table 17, the compatibility rate of all cases is smaller than 1.0, which indicates compatibility in the comparisons. The final prioritization of the factors according to the calculations made and included in the tables of this priority clause of the main criteria is as follows.

The criterion of environmental management with a weight of 372.0 has won the first priority.

The criterion of rules and regulations with a weight of 201.0 has won the second priority.

The pollutant control criterion with a weight of 126.0 has won the third priority.

The financial criterion with a weight of 102.0 has won the fourth priority.

The environment criterion with a weight of 074.0 has won the fifth priority.

The criterion of green transportation with a weight of 040.0 has won the seventh priority.

Also, the description of the prioritization of all sub-criteria in its group is described as follows.

A) sub-criteria of environmental management criteria

The criterion for obtaining green standards and certificates (g1) with a weight of 576.0 has won the first priority among the sub-criteria of environmental management.

The green design criterion (g2) with a weight of 199.0 has won the second priority among the sub-criteria of environmental management.

The criterion of environmental cooperation with stakeholders (g3) with a weight of 152.0 has won the third priority among the sub-criteria of environmental management.

The criterion of management skills (g4) with a weight of 074.0 has won the fourth priority among the sub-criteria of environmental management.

B) The sub-criteria of rules and regulations

The criterion of environmental laws (e1) with a weight of 668.0 has won the first priority among the sub-criteria of laws and regulations.

The criteria of taxes (e2) with a weight of 206.0 has won the second priority among the sub-criteria of laws and regulations.

The criterion of the existence of modern policy in the field of environment and social responsibilities in the e3 organization with a weight of 126.0 has won the third priority among the sub-criteria of laws and regulations.

C) Sub-criteria for pollutant control

Controlling the amount of dangerous and polluting substances in production (f1) with a weight of 563.0 has won the first priority among the pollutant control sub-criteria.

The use of the reverse logistic system (f2) with a weight of 295.0 has gained the second priority among the pollutant control sub-criteria.

The waste management criterion (f3) with a weight of 142.0 has won the third priority among the pollutant control sub-criteria.

D) Financial sub-criteria

The investment criterion (d1) with a weight of 75.0 has won the first priority among the following financial criteria.

The criterion of reducing costs through productivity (d2) with a weight of 25.0 has gained the second priority among the financial sub-criteria.

E) Environment sub-criteria

The criterion of competition in the market (h1) with a weight of 772.0 has won the first priority among the sub-criteria of the environment.

The criterion of social pressures (h2) with a weight of 228.0 has won the second priority among the sub-criteria of the environment.

F) Sub-criteria for transportation of products

The criterion of using clean LNG fuel and multi-fuel vehicles (c1) with a weight of 445.0 has won the first priority among the sub-criteria of transportation of products.

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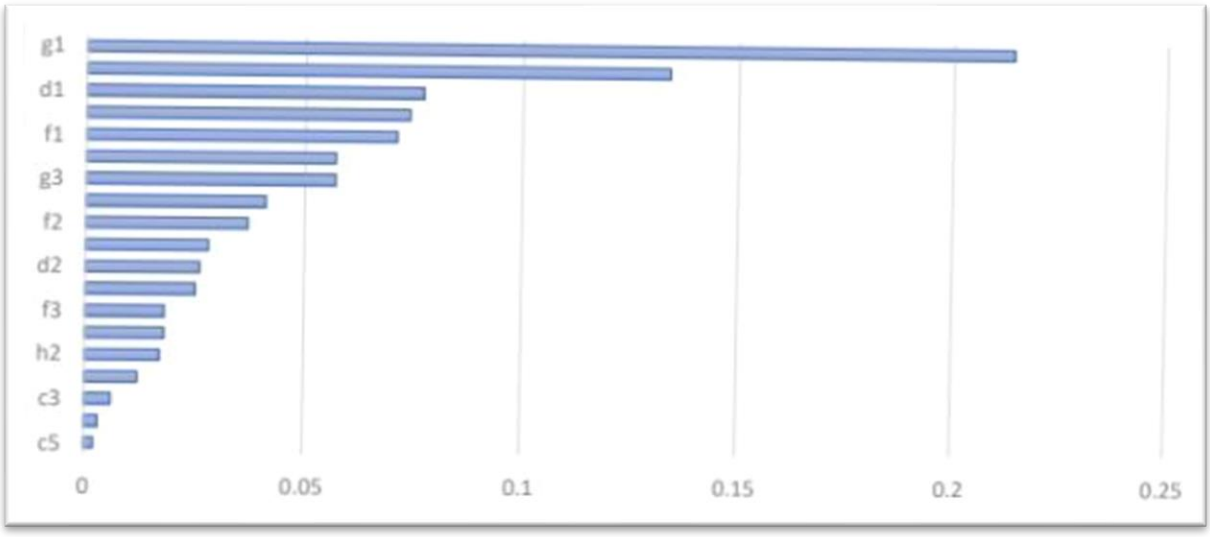
The transport infrastructure criterion (c2) with a weight of 0292 has gained the second priority among the sub-criteria of product transportation.
The medal shift criterion (c3) with a weight of 143.0 has won the third priority among the sub-criteria of product transportation.
The criterion of training human power in optimal fuel consumption and engine maintenance (c4) with a weight of 066.0 has won the fourth priority among the sub-criteria of transporting products.
The criterion of using new vehicles with Euro 5 certificate (c5) with a weight of 054.0 has won the fifth priority among the sub-criteria of transporting products. And finally, based on chart 6, the final prioritization of sub-criteria is as follows.

Chart 6. The final weights of the sub-criteria



According to the results of chart 6, sub-criterion g1 with a weight of 214.0 has won the first priority among all sub-criteria. And after that, sub-criteria e1 and d1 are in the second and third ranks, sub-criterion c5 with a weight of 002.0 has won the last priority among the sub-criteria.

Conclusion

Some of the main factors such as environmental management factors, laws and regulations and financial factors are among the effective factors in the implementation of environmental logistics. In this research, financial and environmental factors are among the main factors affecting the implementation of environmental logistics.
Supply chain management and environmental laws and regulations and cooperation with stakeholders and waste management are important factors in this research. The current research has examined the transportation of petrochemical products both in general criteria and sub-criteria and separately by obtaining the sub-criteria of each of these elements. And the relevant organization can refer to them separately by using each of the prioritized sub-criteria to implement the goals of the organization in

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transporting the products and make the necessary plans and decisions in this regard.
In the discussion of environmental management, which is listed as the most important indicator in this research,It can be concluded that organizations need environmental management based on management systems and skills in these systems to implement environmental logistics, especially in transportation, implementation of environmental laws, obtaining green standards and certificates, and green design.
Weakness in environmental management will lead to non-implementation of the organization's environmental programs .The Index of laws and regulations is in the second priority, which shows the importance of the existence of laws regarding the implementation of environmental programs in societies and organizations.
It Is bad that the existence of necessary laws in the implementation of environmental logistics in all its elements is considered an effective solution in this regard.Also, taxes, which are stated as sub-indexes of laws and regulations in this research, play a significant role in the implementation of environmental logistics.
Among them, we can mention the fuel tax, which will lead to saving fuel consumption and forcing to find ways to reduce fuel consumption.The existence of modern policies in the field of environment and social responsibilities in the organization has been identified as one of the important sub-indicators of laws and regulations.
The third priority of the main indicators is the pollution control index, which, from the point of view of the organization's experts, should adopt the method. By controlling the amount of dangerous and polluting substances in production and with the help of reverse logistics and waste management, which are the most important sub-indicators here, a big step can be taken towards the implementation of environmental logistics.
The fourth priority is related to the financial index, which is considered as the most important influencing factor in all discussions.In this regard, the investment sub-index is considered as the main sub-index. It reveals the importance of investment in various aspects of the implementation of environmental logistics, including investment in terms of facilities and equipment, investment in new management methods, intelligent systems, etc.
Also, by improving production performance and raising productivity through equipment and management systems, the costs of the organization can be reduced.
The fifth priority Is the environmental indicator, which means that the pressure on the organization caused by the environment is considered an important indicator for the organization. Which includes market competition and social pressure sub-indices in order of importance.
Today, customers and even suppliers who cooperate with an organization consider the level of environmental protection of the organization as one of the factors when they choose an organization to cooperate with.
Therefore, their pressure on organizations is considered as a very important and driving factor for maintaining the organization's position in domestic and foreign markets.
On the other hand, organizations are under pressure from society's growing awareness of social responsibility towards the environment. And this is one of the most important factors in the implementation of environmental logistics.
The sixth priority Is the environmental transport index. This index, like other indicators, is important in the transportation of petrochemical products, especially in the present study and in general in the process of

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implementing environmental logistics .Many consider environmental logistics to be equivalent to green transport, which is of course an incomplete interpretation of environmental logistics.
Because according to the description of the logistics chain, it is a continuous supply of raw materials, storage, packaging, transportation and distribution, as well as maintenance services. Product transport is naturally one of the most important links in the environmental logistics chain.
And knowing the factors that affect the implementation of environmental transport will have a significant impact on the greenness of the entire logistics chain .The important sub-indices of transportation of products, according to the priority index of the use of clean LNG fuel and multi-fuel vehicles, Transportation infrastructure, medal shift (alternative transportation methods), training of manpower in optimal fuel consumption and engine maintenance, use of new vehicles with Euro 5 certification.
In this research, the number seven is considered as the average of the nine-degree spectrum. In this regard, according to Table 5, it is clear that indicators with an average value of less than seven are excluded from the analysis.
The removable indicators are highlighted in the table. In fact, the following indicators are the preparation of the workforce in terms of organization and transport, as well as the optimal use of facilities and the reduction of distribution frequency, the reduction of water consumption for washing vehicles, the use of diesel vehicles. Management of the washing and cleaning of tankers carrying material, reduction of waste materials.
Cooperation with customers, creating environmental protection for future generations and pressure from customers received a lower average score than the other sub-indices. And as a result, they were excluded from the next round of the Delphi technology survey.
According to the results in Table 6, considering that the standard deviation difference between the second and third round is less than one. As a result, we were able to stop distributing repetitive questions and get clear results. And the results of this study are verified and accepted as the final results of the study. According to the results in Table 17, the efficiency ratio for all cases is less than 1.0, which indicates that the efficiency is comparable.
According to the results of graph 6, sub-criterion g1 with a weight of 214.0 has won the first priority among all sub-criteria. After that, sub-criteria e1 and d1 are in the second and third ranks. Sub-criteria c5 with a weight of 002.0 has won the last priority among the sub-criteria.

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