Environmental Energy and Economic Research 2023 7(3): S063
DOI 10.22097/eeer.2023.368678.1271

Research Article

Assessment of Green Logistics Practices in Downstream Petroleum Industries for the Transition to Circular Economy

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Received: 11 January 2023 /Accepted: 25 April 2023

Abstract
Environmental damage such as global warming, climate change, reduction of natural resources, emission of greenhouse gases, etc. have caused the transition of production systems towards sustainable development and circular economy. One of the main drivers of these systems is green logistics, the implementation of which can reduce the destruction of the environment. green logistics is the main trend of the transition towards modern logistics and as a basic system of circular economy development. It links resources and products, products and consumers and is very useful for closing the circle of circular economy. The main purpose of this study is to identify green logistics practices and analyze their importance. This research, in terms of purpose, is in the field of applied research and in terms of method, in the form of quantitative research. In first, a number of the green logistics practices are extracted from related reviews of the studies. Data collection tool was a researcher-made questionnaire. The green logistics practices were validated using experts' opinions in academic and industry. Then, the Best-Worst Method (BWM) was used to determine the importance of practices. In first, the mathematical model was programmed in Lingo 18.0 software. Then, based on the opinions of each expert, the weight of practices and the inconsistency rate were calculated. By averaging, the final weight of the practices was obtained. The inconsistency rate was calculated 0.035, which is acceptable. The findings show that green purchasing and end-of-life practices have weights of 0.213 and 0.189, respectively. it can be said that they are very important. Therefore, it is suggested to pay more attention to these two factors for the transition to circular economy. Finally, discussion and conclusions are presented.
Keywords: Circular Economy, Green Logistics, Downstream Petroleum Industries, Best-Worst Method.

Introduction

Environmental pollution has been one of the biggest challenges of the 21st century. As the world's population increases, resources are scarce and waste production increases. To address these issues, there has been an urgent need to address concerns related to environmental protection against the industry. Companies face a lot of pressure to solve environmental problems (Liu et al., 2021). Green and low-carbon development has become the focus of attention of the global community in developed and emerging economies (He et al., 2017).

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Manufacturers use various approaches such as circular economy in order to improve their productivity by using sustainable and efficient resources to eliminate environmental damage.

Circular economy seeks economic growth while respecting the limits of natural resources and social impacts (Morli, 2017). It seeks to reduce the use of raw materials, protect material resources and also reduce carbon impact. In a 2014 study, the European Commission showed that the manufacturing sector could generate about 600 billion euros in annual profits using the circular economy. Arponen et al. (2015) stated in a study that the global economy will benefit from 1000 billion dollars annually as a result of implementing the circular economy concept. However, despite all these potential gains, the implementation and operation of the circular economy is always slow.

One of the main factor in context of the circular paradigm is green supply chain Management (GSCM). Therefore, to achieve a CE model that emphasizes environmental protection and resource conservation, it is necessary to implement GSCM (Seroka and Kubicka, 2019). The GSCM can increase competitive advantages and market share while meeting societal concerns and complying with regulations (Abdel-Baset et al., 2019). It was introduced in the field of manufacturing almost five decades ago, and there are still many opportunities and obstacles in the way of manufacturing excellence through this concept. Green supply chain management includes traditional supply chain management practices that integrate environmental criteria or concerns into organizational purchasing decisions and long-term relationships with suppliers. It is responsible for applying the idea of ecology in each stage of the life cycle of products and services in a supply chain (Sirvstra, 2007). Not considering the concepts of this new paradigm of supply chain management will bring many organizational costs and environmental pollution (Tsang et al, 2019).

In the past decade, with the increase in the speed and volume of communication in the whole world and the expansion of the competition environment of organizations, the design of the optimal and economic supply chain has gained double importance. In traditional approaches, the performance of the supply chain was measured only from the economic aspect, and in the design of the network of this chain, the attention of researchers and industrialists was only focused on minimizing costs or maximizing revenues. But, logistics plays a vital role in the economic growth of a country and significantly increases air pollution including greenhouse gases such as CO2 (Khan and Qianli, 2017). In 2017, the World Bank announced that 23% of the world's CO2 emissions are related to transportation, which is one of the most recognized and valuable activities in logistics.

The linear flow of production has caused many problems, especially in the field of environmental sustainability. In logistics, a circular and greener production system is associated with the implementation of Green Logistics (GL), which aims to reduce greenhouse gas emissions, use fossil energy resources and return materials after their end of life.

It includes all activities related to the efficient management compatible with the environment on both sides of the direct and reverse flow of products and information at the origin and point of consumption, and its goal is to achieve the level of consumer satisfaction. It is the main trend of modern logistics and a cornerstone system of CE development because reverse logistics (RL) is the basis of closing the cycle and reducing emissions. Green logistics is an important tool for the development of circular economy (Seroka and Kubica, 2019).

Although based on previous studies, it can be stated that green and low-carbon models are accepted and implemented in logistics operations (He et al., 2017). However, they on green logistics is very scarce. So, the main question of this research is: What are the practices in green logistics as the main trend of CE development and how important are they?

The rest of the present research is organized in four sections: The second part reviews the theoretical and experimental foundations of circular economics and green logistics. In the following, the practices will be identified. In the third section, the research methodology is introduced and will be performed. In the fourth section, the research findings are presented. Finally, results and suggestions for managers and future studies are presented.

Literature review

In the surrounding world, various sources such as materials, water and energy are used to produce products and provide services. In this process, waste materials will be produced. Generating waste beyond the capacity of the system disrupts the environment's ability to supply resources, which leads to resource depletion. One of the approaches that prevent the system in the production of waste and waste is the circular economy. This system sees waste and waste born in the process as new resources for reproducing goods and products (McDonough and Braungart, 2013). For the first time, the concept of circular economy was introduced in 1966 in an article titled "Earth Economy in the Future" by Boulding. Then, in 1989, Pierce and Turn developed a concept called environmental economics in the economics of natural resources and the environment. Its practical applications in economic systems have been formed with the concepts of industrial ecology, clean production and the cradle-to-cradle idea, all of which agree on a closed loop. A circular economy promotes competitive advantage, sustainable economic growth and job creation (European Union, 2015). This economy is considered a resource recovery system (Grafstrom and Aasma, 2021). It focuses on the efficient use of materials, waste reduction and material recycling, improving the earth's ecosystem through profitable business models and creating hidden job opportunities (Kirchherr, 2017). It emphasizes the use of healthy raw materials and the elimination of harmful substances, reducing waste production, reusable and recycling materials, renewable energy, water management (treating wastewater and increasing its quality for reuse and reducing water consumption), and social awareness.

In 2018, the European Union introduced industry performance indicators in the four areas of production and consumption, waste management, second-hand raw materials, and competitiveness and innovation to the circular economy. Massi et al. (2018) state that the circular economy is a type of economic system that represents a paradigm shift in the way human society relates to nature, and its purpose is to prevent resource depletion, use renewable energy and materials, and facilitate sustainable development. Achieving the circular model requires environmental innovation and revision of laws, production and consumption in society. Green logistic is one of the steps to achieve CE and sustainability in logistics operations, as shown in figure 1.

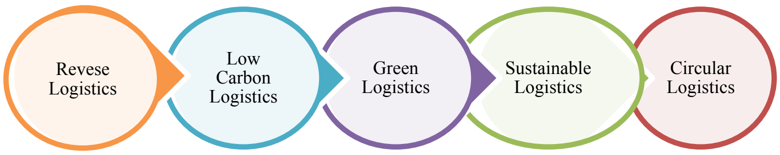

Figure 1. Reverse logistics to circular logistics (De Souza et al, 2022)

Green procurement is a new paradigm to achieve circular economy. it is created to reduce environmental impacts caused by logistics, to protect the environment (Ćirović et al., 2014). And beyond traditional logistics, it provides green products and services to customers (Zhang et al., 2015). Zaman and Shamsuddin define green logistics as product acquisition, production, distribution, consumption, collection after use and recycling. Therefore, it can be said that green logistics focuses on the implementation of measures to reduce CO_2 emissions and energy consumption (He et al., 2017). Its main goal is to reduce environmental impacts by minimizing production costs and improving product value, as well as reducing logistics costs and increasing profits to maintain sustainable development.

One of the ways to implement green logistic is to solve transportation problems regarding alternative energy sources through electric vehicles, intelligent transportation systems, green transportation, and other environmentally friendly infrastructures (Lin et al., 2014). GL's practices include measuring impacts from transportation with ISO 14001 and reducing energy and material consumption. GL is one of the critical components of green supply chain management (Zaman and Shamsuddin, 2017).

In recent years, various studies have contributed to the circular economy literature (Barros et al., 2020; Keulen et al, 2020; Singh et al, 2020; Rivera et al, 2020; Feng and Gang, 2020), some of which are listed below: Sharma et al (2023) in a study examines the relationships between green logistics practices, I4.0 technologies, and CE adoption. The results showed firms can enhance CE adoption driven by I4.0 technologies with green logistics practices as a mediator. Shiyuan et al. (2023) in a study investigate the relationship between circular economy practices and sustainable performance. The key finding supports that CE practice has benefited both firms' commercial and ecological sustainability. De Souza et al (2022) presented a study on Performance evaluation of green logistics: Paving the way towards circular economy. Results show that some areas of green logistics are being overlooked when companies approach environmental sustainability, thus compromising the progress towards GL. In contrast, the green transportation category presents the worst results, followed by green stocking, green packaging and reverse logistics. Seroka and Kubica (2019) presented green logistics is the main trend of the transition towards modern logistics and as a basic system of circular economy development. It links resources and products, products and consumers and is very useful for closing the circle of circular economy. Green logistics is an important tool for the development of circular economy. Bjornbet et al. (2021), by conducting a study entitled The role of circular economy in manufacturing industries, tried to understand and establish the relationship between circular economy and sustainable development. The results showed that the improvement of sustainable performance of organizations would be achieved through the implementation of a circular economy with emphasis on environmental, social, and economic dimensions. Grafstrom and Aasma (2021) conducted a study to identify barriers to circular economics. The results showed that technological, organizational, market and cultural barriers are key barriers to implementing the circular economy. In a study, Kumar et al. (2021) identified barriers to the circular economy and fourth generation industry in India's multinational corporate supply chain. The results showed that the lack of government support and incentives for sustainability and the lack of specific policies and protocols for the circular economy are the most important obstacles. Moreno et al. (2021), in a study, identified the performance indicators of the circular economy in Spanish companies. The results showed that the indicators of green purchasing management and waste management, recycling and recycling, and use of green energy are the most important performance indicators. Prada et al. (2021) presented a study on driving the circular economy through public environmental and energy research and development from SMEs in the European Union. the study showed that public environmental and energy research and development negatively affects the level of SMEs' investment in CE activities. In a study, Abokersh et al. (2021) identified a framework for sustainable evaluation of thermal energy storage in circular economy. The study concludes that the integration of reusing and recycling at the initial design should be sought in order to achieve a more environmentally sustainable and circular outcome. Karayılan et al. (2021) conducted a study prospective evaluation of circular economy practices within plastic packaging value chain through optimization of life cycle impacts and circularity. The results show that if better upcycling options including industrial symbiosis can be identified and established in the future, in addition to the composting as a viable End of Life option, plastic packaging value chain can create higher environmental benefits.

A careful study of the existing literature shows that there is very little knowledge of green logistics and its implementation practices in the industry. While, green logistics is the main process of transition to sustainable logistics and finally circular economy. It should be noted that those few studies are correlational in nature and emphasize the existence of a positive relationship between green logistics and circular economy. Identifying and measuring the importance of the main practices of green logistics can be very important and accelerate the movement of industries in the transition towards a circular economy. Also, this study is innovative by applying this idea in downstream petrochemical industries.

Methodology

The main purpose of this study is to identify green logistics practices and analyze their importance. This research is applied in terms of purpose and descriptive-survey in terms of data collection. Its statistical population was formed by faculty member's familiar with the subject of the Persian Gulf University. The members of the research sample were selected in a purposeful and non-random way. The data collection was done using a researcher-made questionnaire. The content validity method used for determining the validity of questionnaires. In this research, for this purpose, the questionnaire was provided to 8 experts who were selected based on the criteria of theoretical mastery and practical experience. Table 1 shows the information of the demographic characteristics of experts.

Table 1. The information of the demographic characteristics of experts

Number of expert	Gender	Education	Position	Work Experience
1	man	PhD	University	20 years
2	woman	Master's Degree	Industry	8 years
3	man	PhD	University	15 years
4	man	PhD	University	17 years
5	woman	PhD	University	11 years
6	man	Master's Degree	Industry	8 years
7	man	PhD	University	10 years
8	woman	Master's Degree	Industry	9 years

To determine the validity of the questionnaire in the Best-Worst Method (BWM), pairwise comparisons are measured by the inconsistency rate method. Values less than 0.1 are acceptable. Briefly, the steps of the research are given in figure 2.

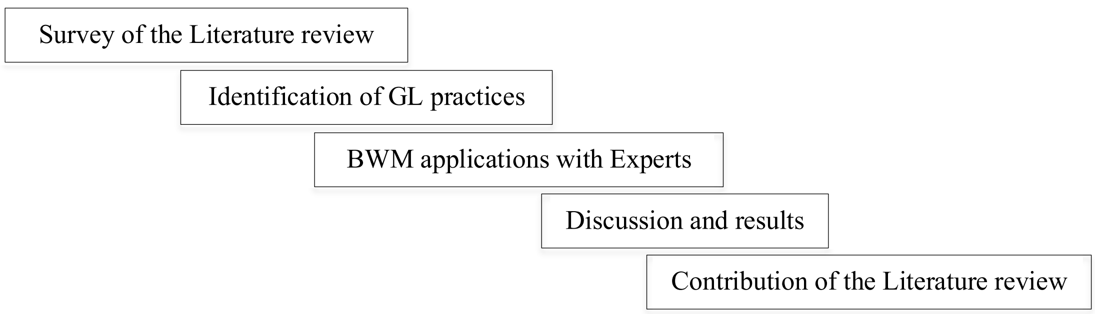

Figure 2. The research method

In this paper, the practices of the green logistics were exploited through the study of thematic literature. They are shown in table 2.

Table 2. The green logistics practices

Practices	Definition	Reference
Green Purchase	Green procurement is related to the purchase of goods and services with the least harmful environmental effects. In other words, it refers to the demand for recyclable products, efficient energy systems, technology and clean fuels.	Graham et al. (2018); Islam et al. (2018); Yang (2018); Tseng et al. (2019); Santos et al. (2019); Santos et al. (2019); Govindan et al. (2020)
End-of-life Practices	It refers to products that can be used as second-hand, reusing and recycling material at the end of their life and leave the least amount of waste in the environment	Kusi-Sarpong et al. (2016); Nascimento et al. (2019)
Green Transportation	It emphasizes the use of environmentally friendly fuels and the use of cleaner and more efficient means of transportation	Yang (2018); Govindan et al. (2020); Agyabeng-Mensah et al. (2020); Khan and Yu (2020)
Green Packaging	It emphasizes the use of reversible, reusable and recycled packages, as well as the process of using renewable energy and reducing fossil energy consumption during the packaging process.	Khan and Qianli (2017); Alonso et al. (2017); Tseng et al. (2019); Govindan et al. (2020)
Green Stocking	It refers to energy consumption during storage and the use of renewable energy during storage	Nascimento et al. (2019); Govindan et al. (2020); de Souza et al. (2022)
Sectional	It refers to the adoption of environmental certification (ISO 14001), environmental monitoring and auditing, as well as reducing greenhouse gas emissions and using clean technologies.	Khan and Yu (2020); Govindan et al. (2020); de Souza et al. (2022)
Reverse Logistics	It refers to the collection of post-consumer products and customer cooperation	Geng et al. (2017), Nascimento et al. (2019); Tseng et al. (2019); Abdel-Baset et al. (2019); Agyabeng-Mensah et al. (2020)

In next step, the BWM was used to determine the importance of practices. BWM is a multi-criteria decision-making (MCDM) method developed by Rezaei in 2015. The steps involved in this method are described below:

Step 1: Identifying a set of decision criteria: In this step, based on the literature review and the experts' opinions, a set of n criteria $\{c1, c2, ..., cn\}$ are identified to evaluate alternatives.

Step 2: Determining the best (e.g., most desirable, most important) and the worst criteria.

Step 3: Determine the preferences of the best criterion over the other criteria, using a number between 1 and 9. The best-to-others (BO) vector can be represented as:$A_B = (a_{B1}.a_{B2}.\cdots.a_{Bn})$ where a_{Bj}indicates the preference of the best criterion B over the other criteria. The final value can be achieved by the consensus of all the experts involved in making a decision.

Step 4: Using a number between 1 and 9 and determining the preference of all the criteria over the worst criterion. The others-to-worst (OW) vector can be represented as: $A_w = (a_{1w}.a_{2w}.\cdots.a_{nw})^T$,where a_{jW} indicates the preference of criteria j over the worst criterion W.

Step 5: Finding the optimal weights: to determine the optimal weights of each of the criteria, for each of the pairs $^{w_B}/_{w_j}$ and $^{w_j}/_{w_w}$, $\frac{w_B}{w_j} = a_{Bj}$ and $\frac{w_j}{w_w} = a_{jw}$ must be equal for all j; Therefore, one should look for a solution that minimizes the maximum absolute value of the differences $\left|\frac{w_B}{w_j} - a_{Bj}\right|$ and $\left|\frac{w_j}{w_w} - a_{jw}\right|$ to considering $\sum_{j=1}^{n} w_j \geq 0$ and $\sum_{j=1}^{n} w_j = 1$. Optimization modeling is formulated as the following :

$$\min \ \xi$$
$$st$$
$$\left|\frac{w_B}{w_j} - a_{Bj}\right| \leq \xi \ \ . \ \ j = 1.\cdots.n \qquad (1)$$
$$\left|\frac{w_j}{w_w} - a_{jw}\right| \leq \xi \ \ . \ \ j = 1.\cdots.n \qquad (2)$$
$$\textstyle\sum_{j=1}^{n} w_j = 1 \qquad w_j \geq 0 \ . \ j = 1.\cdots.n \qquad (3)$$

By solving this model, the optimal weights of each criterion $(w_1^*.w_2^*.\cdots.w_n^*)$ and value ξ^* are obtained. As can be seen, the model presented in the above relation is a non-linear model that may not provide a unique answer. To solve this problem, Rezaei (2015) multiplied the limits in the denominator and introduced the linear model presented in the following relationship to achieve a unique solution.

$$\min \ \xi^l$$
$$st$$
$$\left|\frac{w_B}{w_j} - a_{Bj}\right| \leq \xi^l \ \ . \ \ j = 1.\cdots.n \qquad (4)$$
$$\left|\frac{w_j}{w_w} - a_{jw}\right| \leq \xi^l \ \ . \ \ j = 1.\cdots.n \qquad (5)$$
$$\textstyle\sum_{j=1}^{n} w_j = 1 \qquad w_j \geq 0 \ . \ j = 1.\cdots.n \qquad (6)$$

This problem is a linear model, which has a unique solution. By solving this problem, the optimal weights are obtaining. To calculate the inconsistency rate (RI), the value obtained in the previous step and the consistency index (CI) reported for different values (Table 3) and the equation $\mathrm{IR} = \frac{\xi^{L*}}{\mathrm{CI}}$ are used. Values less than 0.1 are acceptable for this index.

Table 3. The inconsistency rate

a_{Bw}	1	2	3	4	5	6	7	8	9
CI	0.00	0.44	1.00	1.63	2.30	3.00	3.73	4.47	5.23

Finding

The initial stage of this study was to identify the green logistics practices downstream petroleum industries. Seven practices were identified by examining theoretical foundations and experimental background. Data collection tool was a researcher-made questionnaire. The green logistics practices were validated using experts' opinions in academic and industry. In this research, for this purpose, the questionnaire was provided to 8 experts who were selected based on the criteria of theoretical mastery and practical experience. Table 4 shows green logistic practices.

Table 4. The code of green logistic practice

Practice	Code
Green Purchase	C_1
End-of-life Practices	C_2
Green Transportation	C_3
Green Packaging	C_4
Green Stocking	C_5
Sectional	C_6
Reverse Logistics	C_7

Next, each expert has determined the best (✶) and worst (✓) green logistic practices as shown in table 5.

Table 5. The best and worst green logistic practices

Practices		Experts							
		1	2	3	4	5	6	7	8
Green Purchase	C_1		✶						✶
End-of-life Practices	C_2	✶					✶	✶	
Green Transportation	C_3		✓	✓		✓			
Green Packaging	C_4				✶				
Green Stocking	C_5			✶					✓
Sectional	C_6					✶			
Reverse Logistics	C_7	✓			✓		✓	✓	

Next, the preference of the best dimension of green logistics compared to other dimensions was determined in the form of table 6.

Table 6. Preference of the best practices compared to other practices

Experts	Best dimension	C_1	C_2	C_3	C_4	C_5	C_6	C_7
1	C_2	4	1	9	5	3	2	8
2	C_1	1	3	6	5	4	5	9
3	C_5	5	3	7	4	1	3	6
4	C_4	3	5	8	1	4	4	7
5	C_6	4	3	5	2	6	1	7
6	C_2	3	1	6	2	4	2	6
7	C_2	4	1	7	3	4	5	8
8	C_1	1	4	6	3	5	4	7

The continue, the preference of the degree of preference of the practices compared to the bad practice dimensions was determined in the form of table 7.

Table 7. The degree of preference of the practices compared to the bad practice

	The bad practices							
	1	2	3	4	5	6	7	8
	C_7	C_3	C_3	C_7	C_3	C_7	C_7	C_6
C_1	7	6	7	4	5	5	6	7
C_2	5	5	4	7	4	6	7	3
C_3	2	1	1	2	1	2	3	2
C_4	5	4	6	6	4	8	4	5
C_5	6	5	4	4	6	7	6	6
C_6	4	4	5	6	5	4	5	1
C_7	1	3	3	1	2	1	1	2

In the following, the weight and the amount of inconsistency of the dimensions were obtained for each expert.

Then, by geometric averaging of the obtained weights, the average weight of the dimensions was calculated as shown in table 8. Then, the weight of each index is given by each expert in the format of figure 3.

Next, the radar diagram of green logistics practices was drawn in figure 4.

Table 8. Weight and dimension inconsistency rate per expert and average weight

Practices	Expert 1		Expert 2		Expert 3		Expert 4		Expert 5		Expert 6		Expert 7		Expert 8		W_j	IR
	W_j	IR	W_j	IR	W_j	IR	W_j	IR	W_j	IR	W_j	IR	W_j	IR	W_j	IR		
C_1	0.115		0.396		0.099		0.171		0.115		0.131		0.123		0.363		**0.189**	
C_2	0.321		0.169		0.165		0.103		0.153		0.284		0.382		0.134		**0.213**	
C_3	0.052		0.047		0.038		0.064		0.036		0.065		0.071		0.089		**0.051**	
C_4	0.092	0.037	0.101	0.032	0.123	0.036	0.366	0.037	0.231	0.039	0.193	0.028	0.164	0.029	0.179	0.045	**0.181**	**0.035**
C_5	0.153		0.126		0.324		0.128		0.076		0.098		0.123		0.107		**0.142**	
C_6	0.231		0.102		0.165		0.129		0.321		0.196		0.098		0.047		**0.161**	
C_7	0.036		0.056		0.082		0.036		0.065		0.294		0.039		0.076		**0.085**	

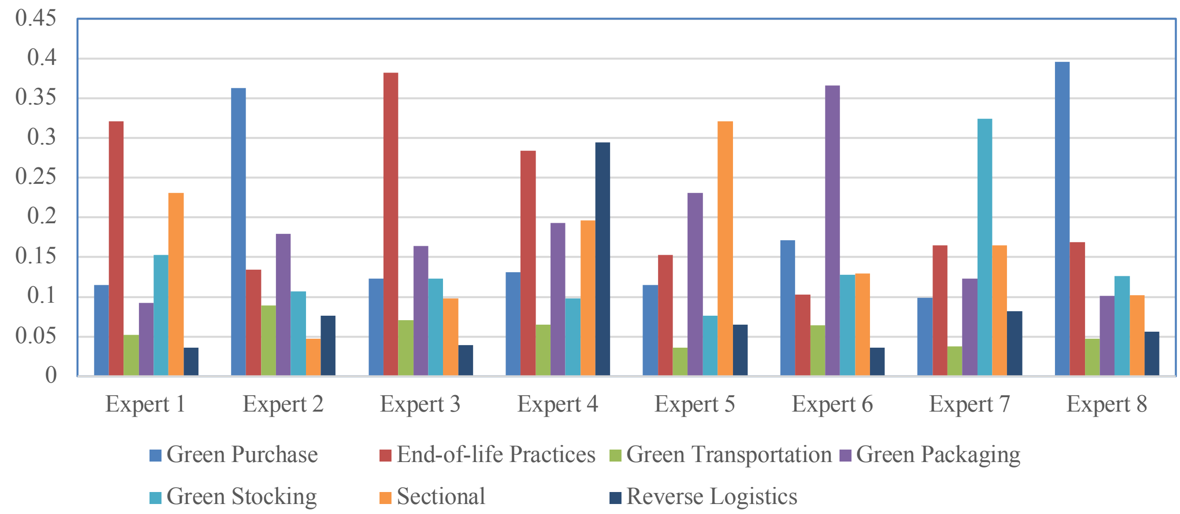

Figure 3. The weight of each index is given by each expert

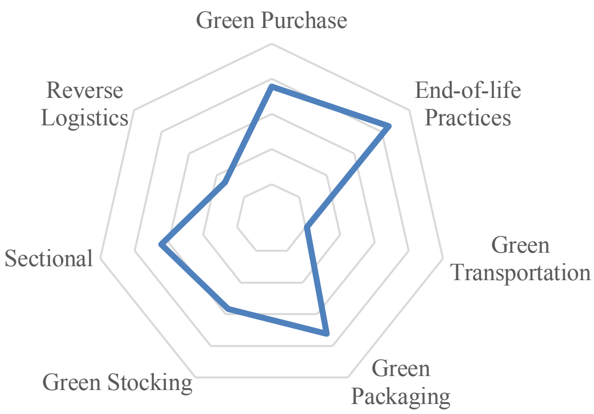

Figure 4. The radar diagram of green logistics practices

This diagram shows that the further a practice is from the center of the diagram, the more important it is. The categories with high scores are End of life Practice, Green Purchase and Green Packaging.

Conclusion

The increase in environmental pollution has caused global warming and has affected the health of humans and animals. Therefore, the issue of being green is one of the important issues. One of the main drivers of these systems is green logistics, the implementation of which can reduce the destruction of the environment. The main purpose of this study is to identify green logistics practices and analyze their importance. This research, in terms of purpose, is in the field of applied research and in terms of method, in the form of quantitative research. In first, a number of the green logistics practices are extracted from related reviews of the studies. Data collection tool was a researcher-made questionnaire. The green logistics practices were validated using experts' opinions in academic and industry. In this research, for this purpose, the questionnaire was provided to 8 experts who were selected based on the criteria of theoretical mastery and practical experience. Since in the BWM method, the value of the inconsistency index was calculated to be less than 0.1 based on the opinions of different experts, the reliability of the questionnaire was confirmed. Then, the Best-Worst method was used to determine the importance of practices.

The results showed that end-of-life and green purchase practices are very important. Of course, these findings were also true in other studies. De Souza et al (2020) also concluded in their research that end-of-life practices and green purchase have a great impact on green logistics. In the study of Cao et al (2022), the reuse of secondary goods is emphasized in order to promote circular economy.

In the discussion of the end of product life, it can be said that the majority of consumers throw away end-of-life products (EOL products), which will cause a lot of environmental damage. It is also necessary to pay attention to the fact that the production of a new product will involve the use of resources and energy consumption. Today, repairing and reusing materials and products is a fundamental step in the circular economy and can reduce the consumption of resources and energy in addition to preventing environmental challenges. In the study of Cao et al (2022), the reuse of secondary goods is emphasized in order to promote circular economy. Green procurement pays special attention to the purchase of goods that seek to help close the energy and material loops in the supply chain to reduce negative and destructive environmental effects. In October 2017, the European Commission published the brochure "Green Procurement for a Circular Economy" in support of the transition to a circular economy. The main point is to what extent the purchased product can be reused at the end of its life. In order to improve the recycling and reuse of purchased goods or green packaging, investment, especially in advertising and education, can be effective.

It is necessary for industries to pay attention to these two main factors in the transition to the circular economy. However, it should be noted that the implementation of each of the implementation practices of green logistics is likely to have many obstacles and contradictions; Therefore, researchers can analyze these problems in their future studies. In order to implement the results, it is suggested to specify operational measures for each. Since there are internal relationships between factors, it is suggested to identify internal relationships with approaches such as ISM and DEMTEL. Other methods such as AHP and SWARA can be used to measure the importance of criteria.

One of the limitations of this research can be called the equality of experts in terms of knowledge. Indeed, there may be a knowledge gap between experts. Since green logistics and circular economy are new concepts. Therefore, there is a weakness of accurate and complete acquaintance of experts with the concepts and definitions of some of its actions unconsciously, which may create a knowledge gap between research experts and distort the results. Therefore, it is hoped that this limitation will be resolved in other researches by taking necessary measures.

It should be mentioned that the necessary measures have been taken in the field of ensuring validity and reliability of the research in different stages of the research. However, scientific courtesy requires more thought in generalizing the results.

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