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RESEARCH PAPER

Resilient Logistics: Ensuring Oil Industry Supply Chain Continuity in a Sanctioned Era

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Abstract

This research investigates the critical factors influencing supply chain logistics in environments burdened by sanctions. We identified key considerations for selecting reliable suppliers through a comprehensive literature review and in-depth qualitative interviews with logistics consultants, logistics service providers, business authorities, and economic development experts. Our analysis utilized the Fuzzy Best-Worst Method (FBWM) and Fuzzy Technique for Order Preference by Similarity to Ideal Solution (FTOPSIS) to evaluate supplier selection indicators. The research provides actionable insights for oil and gas companies operating in sanctioned environments. By prioritizing financial resilience, secure payment channels, and reliable service delivery, companies can enhance their supply chain resilience and mitigate the negative impacts of sanctions. Findings also reveal that financial flexibility and secure, untraceable financial channels are paramount for navigating sanctions. Companies that can maintain financial operations through intermediaries or their home country, and those able to flexibly manage costs by accepting alternative payment methods, are seen as reliable partners. Additionally, delivering services at the required standard remains a core expectation. Environmental sustainability factors, such as environmental competence and management systems, while important in non-sanctioned environments, are deemed less critical under sanctions. Ultimately, successful supply chain logistics in sanctioned environments necessitates a reliable and flexible approach that maintains multiple options for equipment, finances, and shipping through a network of semi-private domestic companies operating abroad.

Keywords:
Supply Chain Logistics, Oil Industry, Sanctions, Resilience, Supplier Selection.

Introduction

Sanctions were created to pressure governments to follow the interests of the imposing state. They aim to change the policies of the targeted nation by causing economic harm. They are seen as a nonviolent, kinder substitute for military involvement (Neuenkirch & Neumeier, 2016; O'Driscoll, 2017). To navigate the complex and dynamic challenges posed by sanctions, a deep understanding of the key factors influencing supply chain logistics and supplier selection is essential. While the impact of sanctions on businesses is widely recognized, specific research on resilient supplier selection in highly regulated sectors such as oil and gas remains limited. This research aims to fill this knowledge gap by identifying critical factors that can help

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businesses enhance their supply chain resilience and ensure operational continuity in sanctioned environments. By delving into these factors, companies can develop robust strategies to mitigate risks and optimize their supply chain performance. The new US sanctions against Iran are particularly significant as they target two key sectors of the Iranian economy: oil and finance (Dashti et al., 2020; Rafique & Nadeem, 2023). Iran's economy relies on its oil industry, vulnerable to global fluctuations. Strict sanctions have led many oil industry suppliers to hesitate. They are hesitating to continue their usual services and support. This has also created uncertainty and doubt in dealings with other companies. Some of these suppliers are now cooperating. But they have no history of working together. This makes their selection questionable. Thus, new strategies for obtaining equipment and support services need to be explored. The restrictions have greatly reduced the chance of foreign companies entering supply and equipment contracts. This is clear in the withdrawal of foreign oil companies from existing contracts and the halt in negotiations for pending contracts (Aslan et al., 2020; Brown, 2020). Conversely, domestic companies are viewing this situation differently. They see valuable opportunities. For example, the Ministry of Oil's initiatives aim to promote the use of Iranian goods and services in contracts. This shift could raise project costs in Rials. However, they also face challenges from international restrictions. These include higher costs for foreign equipment, potential delays in payments from the National Oil Company due to reduced oil exports, and trouble getting foreign financing and partnerships (Zhukov & Reznikova, 2020).

During sanctions, it seems vital to analyze the key factors in choosing and working with equipment and support service providers in the oil and gas sectors. Recognizing these elements will aid sanctioned economies in enhancing their resilience. This study aims to address the following research question: What attributes define reliable suppliers in the oil and gas industry during periods of sanctions, and what sets them apart from their counterparts?

The subsequent sections of this paper will explore the theoretical underpinnings of sanctions and their impact on the oil and gas industry, delve into the research methodology employed, and present the findings and conclusions derived from the analysis.

Literature Review

Economic sanctions are punitive measures aimed at reducing or eliminating economic, commercial, and financial ties with a specific country, typically implemented by a nation or a group of nations. Sanctions are an economic tool in civil conflict. They have overshadowed diplomacy. Managing sanction risks involves utilizing all economic resources and effective strategizing to reduce the costs associated with sanctions. To achieve this, officials and policymakers must understand the sanctions' impacts and costs. The first step in sanction risk management is to find the importance of the sanction type. For example, punishing certain people and groups by freezing their assets will have different results and costs. This is in comparison to financial and banking sanctions. Hence, it is crucial to recognize and assess the risks of each sanction based on the type of sanction and the parties involved in the sanction.

US Sanctions on Iran: A Historical Overview and Focus on the Oil and Gas Industry

The US has imposed sanctions on the Islamic Republic of Iran since 1979, with each period reflecting specific events and concerns. These periods include the hostage crisis, the Iran-Iraq war, the post-Cold War era, time after the September 11, 2001 period, and the current era focused on Iran's nuclear program and regional influence. The sanctions aim to pressure Iran on various issues, including its nuclear ambitions, support for terrorism, and human rights record. They can be divided into seven periods, each with unique features (Dashti et al., 2020; Rafique & Nadeem, 2023).

What makes the latest US sanctions against Iran significant is their focus on two key sectors

of the Iranian economy: oil and finance. The sanctions on Iran aim to cut its capacity to produce, sell, and profit from its main natural resources: oil and gas. The sanctions in the energy and oil sectors have two main goals. They focus on oil procurement, upstream, and downstream industries (Farzanegan & Batmanghelidj, 2024; Fattahi & Nafisi-Moghadam, 2023; Ghasseminejad & Jahan-Parvar, 2021). In essence, the sanctions targeting oil and energy can be observed in the accompanying image below.

Table 1. US sanctions against Iran

Period	Features
1(1979-1981)	The hostage period of the American embassy
2(1981-1988)	Iran-Iraq war period
3(1989-1992)	Reconstruction period
4(1993-2001)	Clinton presidency-bilateral restraint
5 (2001 to January 2012)	The period after September 11
6(From January 2012)	Nuclear period
7(From January 2019 until now)	

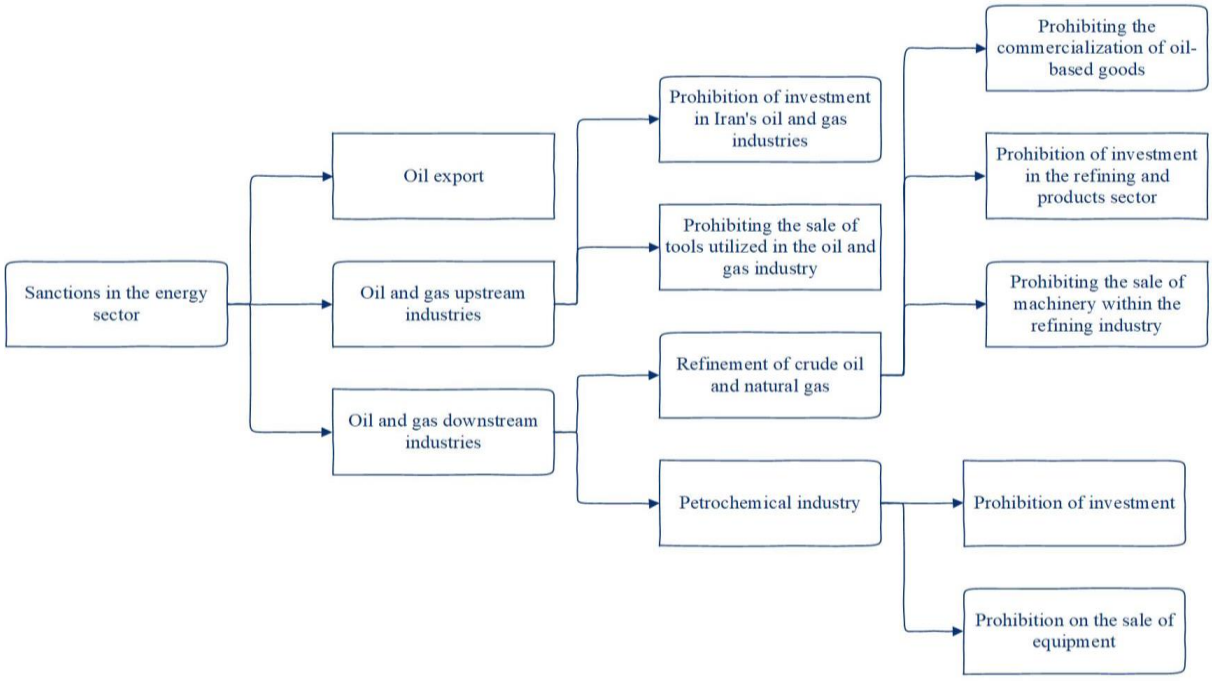

Figure 1. sanctions in oil and gas sector

The structure of oil sales is such that it makes complex and varied sanctions more effective and more trackable. Oil-producing countries, such as Iran, are greatly hurt by the economic processes of oil revenues. This industry has many key aspects. It relies on advanced tech from developing countries. It depends on global demand and consumption. It requires big investments in exploration and extraction. It relies on foreign firms for equipment. Uncontrollable factors affect oil prices. These factors make the industry a key target for sanctions.

Sanctions ban banking and gold trading with Iran. Getting funds for oil sales through official channels is impossible. The companies and nations purchasing the oil obstruct the revenue from these sales. Also, limits on transportation, like shipping, and insurance are key factors in oil transactions(Brown, 2020; Fattahi & Nafisi-Moghadam, 2023). Without solving these issues, the problems with oil sales will get worse.

Oil sanctions include several key components:

1. Ban on Investment: There is a prohibition on investments in Iran's oil and gas sectors. This

applies to all investments made by U.S. companies, as well as those made by foreign corporations and third-party nations.

2. Restrictions on Purchases: The rules limit the buying and selling of crude oil, gas liquids, and petroleum products. This includes the import of Iranian crude oil by American companies, foreign corporations, and third-party nations, as well as the import of refined products derived from Iranian crude.
3. Export Restrictions: The sanctions also prohibit the export of equipment and technology to Iran. This includes technology and equipment for Iran's petrochemical, oil, and gas sectors, and bars collaboration in the production of gasoline refining products. It encompasses the sale or provision of goods, services, information technology, or any other assistance in these areas.
4. Embargo on Refined Products: There is a ban on exporting refined products and gasoline to Iran, which includes all refined petroleum products.

A major goal of these oil sanctions is to reduce Iran's oil revenues. Although the sanctions have various components, they primarily target oil exports. The impact of these sanctions is felt both within the sanctioned nations and throughout the global market.

- Declining Income: Sanctions can severely restrict a nation's ability to sell oil, especially when access to major markets or essential financial institutions is blocked. This results in a decline in government revenue, affecting budgets and funding for vital services.
- Discounted Prices: Sanctioned nations may be forced to sell oil at lower prices in order to find alternative buyers, which can reduce their overall profit margins from oil exports.
- Disrupted Operations: Sanctions can limit access to essential technologies and expertise needed for oil production and refining. This can lead to decreased output or compel nations to adopt alternative, often less efficient, methods of production.

In terms of the global market, the effects can include:

- Price Volatility: Sanctions can disrupt established oil trade flows, leading to uncertainty and potential price spikes in the global market. While some may benefit from short-term price drops due to discounted, sanctioned oil, this instability can negatively affect consumers and businesses.
- Market Fragmentation: Sanctions can create a divided market, with sanctioned oil being sold to specific buyers at lower prices, while other countries continue to purchase oil at regular market rates. This fragmentation decreases overall market efficiency.

Finally, the effectiveness of sanctions is influenced by various factors, including the level of international cooperation and the availability of alternative markets for sanctioned oil (Timofeev et al., 2022; Torbat & Torbat, 2020; Zhukov & Reznikova, 2020).

The issue of Iran sanctions, particularly those related to Iranian oil, has been extensively analyzed in recent years. However, there remains a significant research gap regarding oil suppliers under embargo conditions.

The Impact of Sanctions on Oil and Gas Suppliers

Researchers recognize that sanctions are complex and acknowledge their impact on oil and gas suppliers. Sanctions on the oil and gas industry can create a cascading effect, influencing not only the targeted nation but also the companies that provide it with equipment, technology, and services. While there may be short-term disruptions and opportunities to explore alternative markets, these sanctions can also have a long-term detrimental impact on the energy sector of the sanctioned country.

Recent studies have yielded a mix of findings regarding the effects of sanctions on the suppliers to the oil and gas industry, particularly in relation to the recent sanctions on Iran and Russia. Here is a summary of some key observations (Åslund & Snegovaya, 2022; Azieva, 2021; Babina et al., 2023; Coote & States, 2018; Demertzis et al., 2022; Mitrova, 2022; Van

Bergeijk, 2022):

1. Disrupted Business and Investment: Sanctions disrupt business operations and investment opportunities. They complicate suppliers' ability to collaborate with sanctioned entities due to restrictions on financial transactions, technology transfers, and logistical arrangements. For instance, research from Columbia University indicates a decline in Russian oil production, attributed to sanctions blocking access to essential equipment and technology.
2. Reduced Demand and Investment: Sanctions often limit access to financing and technology, hindering exploration and production activities in the targeted nation. This subsequently leads to a decrease in demand for equipment and services from suppliers. Companies may be reluctant to invest in the sanctioned country due to reputational risks and uncertainty regarding the duration and implications of the sanctions.
3. Shifting Markets: Sanctions may compel sanctioned countries to seek new suppliers, potentially creating opportunities for non-sanctioned companies. However, this transition can be time-consuming and may not fully compensate for lost business. For example, while Russian oil exports have declined, countries like India and China have increased their purchases of Russian oil.
4. Supply Chain Disruptions: Sanctions introduce logistical challenges, making it difficult for suppliers to deliver goods and services to the sanctioned nation. This can result in delays, higher costs, and a search for alternative markets. The scope of the sanctions will dictate which technologies or expertise are restricted, further disrupting the supply chain for targeted oil and gas projects.
5. Long-Term Impact: The complete effects of sanctions may not be immediately visible. According to the Atlantic Council, sanctions can inhibit a country's energy development over the long term by restricting access to critical technologies and expertise.
6. Geopolitical Realignment: Traditional supply chains can be disrupted, leading to new partnerships between the sanctioned nation and countries that do not impose sanctions. While this may create opportunities for some suppliers, it can also pose challenges for those that previously dominated the market. The targeted nation might be forced to cultivate domestic capabilities in the oil and gas sector, thereby reducing reliance on foreign suppliers over time.
7. Uneven Applications: The effectiveness of sanctions on the oil and gas industry can vary based on the specific restrictions imposed and the dynamics of the global energy market. For example, sanctions targeting natural gas exports from Russia have been circumvented to avoid triggering an energy crisis in Europe.

Oilfield service companies and their suppliers have generally reduced their activities, which impacts oil and gas production. However, sanctioned countries such as Iran and Russia have demonstrated their ability to seek new markets for their exports. They can also source new suppliers to compensate for some of the gaps left by Western companies. While sanctions have many negative consequences—including reduced demand, limited investment, operational challenges, and market shifts—they also have a few positive effects (Babina et al., 2023; Corbeau & Mitrova, 2024). For example:

1. Increased Demand from Alternative Sources: Suppliers not restricted by sanctions may experience increased demand from countries that have taken over production previously handled by sanctioned nations.
2. Development of New Technologies: Sanctions can drive innovation, as companies are motivated to create alternative technologies and services that are not subject to these restrictions.

In a sanctions landscape, where uncertainty and ambiguity prevail, it is crucial to consider the entire supply chain when making strategic, tactical, and operational decisions. Suppliers play a pivotal role in mitigating the impact of sanctions on the oil and gas industry. However,

the selection of reliable suppliers in such environments poses significant challenges. Traditional cost-based approaches are often insufficient in situations characterized by high levels of uncertainty and risk.

To address these challenges, fuzzy logic-based MCDM methods such as Fuzzy Best-Worst Method (FBWM) and Fuzzy Technique for Order Preference by Similarity to Ideal Solution (FTOPSIS) offer a robust framework for supplier selection. These methods are particularly well-suited for handling imprecise and subjective information, which is common in sanctioned environments. By incorporating linguistic variables and fuzzy sets, these methods can effectively capture the inherent uncertainty and vagueness associated with decision-making under sanctions.

By leveraging these advanced techniques, oil and gas companies can make more informed and resilient supplier selection decisions, ultimately enhancing their supply chain resilience and mitigating the negative impacts of sanctions.

Methodology

This study aims to investigate the resilience approach for selecting oil and gas suppliers in the conditions of the embargo. The methodology used is based on Multi-Criteria Decision-Making (MCDM). The MCDM process involves defining multiple criteria and attributes, which are identified through literature review, interviews, surveys, brainstorming, or expert opinions. The MCDM process is designed in five stages. The first stage involves reviewing the previous literature to identify the most frequent criteria for selecting stable and resilient suppliers. In the second stage, 18 experts in the oil and gas industries were chosen for in-depth semi-structured interviews. A Likert scale and a fuzzy BWM questionnaire were used to identify the most important criteria. In the fourth stage, interviews were conducted, and the questionnaires were completed to determine the fuzzy weight assigned to each criterion. In the fifth stage, FBWM and the FTOPSIS technique were used to prioritize the criteria based on similarity to the ideal solution.

The snowball method was used to select experts who are familiar with oil and money sanctions, have experience in decision-making or supplying equipment during sanctions, and are in direct contact with oil and gas suppliers. In Snowball sampling, the existing subjects introduce future ones, and the sample group grows until the point of saturation is reached. At this point, no new or relevant information is obtained, and enough data is gathered for research (Audemard, 2020). Snowball sampling was the most suitable method for recruiting experts familiar with oil and money sanctions and experienced in decision-making or supplying equipment during such periods. This technique allowed us to access a hidden population by leveraging the social networks of initial participants. By recruiting experts with direct experience, we ensured the quality and relevance of the collected data. Saturation was determined by analyzing emerging themes and patterns in the interview data. Once no new themes emerged and redundancy was observed, we concluded that sufficient data had been gathered. This approach allowed us to conduct in-depth semi-structured interviews with 18 experts in the oil and gas industry, providing valuable insights into the challenges and opportunities of operating in sanctioned environments. To ensure the quality and relevance of the research, participants were selected based on their expertise in oil and money sanctions and their practical experience in decision-making and equipment supply within sanctioned environments. This included experienced oil and gas industry professionals, financial experts, government officials, policymakers, and consultants with a deep understanding of the complex challenges and opportunities associated with operating in sanctioned environments. By selecting experts from diverse backgrounds, the research aimed to capture a comprehensive understanding of the multifaceted issues at play.

During the interviews, the participants could freely talk about their experiences and the key points they remembered. The main questions asked were: What suppliers in the oil industry can we work with under the sanctions? What are the traits of such companies? What makes them better than others? Fuzzy questionnaires were given to the experts to prioritize the supplier selection indicators during the sanction condition. The questionnaire was prepared using the Likert scale for easy making and modification, number results, strong validity, and the need for less time and effort. The questionnaire's validity and reliability were ensured through content validity and reliability with Cronbach's alpha, which had a coefficient of 0.81, indicating acceptable validity and reliability.

Multi-Criteria Decision-Making (MCDM)

Selecting suppliers has become more complex due to diverse criteria, leading to a need for a multi-criteria decision-making approach. Multi-criteria decision-making (MCDM) methods are commonly used for supplier selection, allowing for the consideration of multiple decision factors simultaneously (Pamucar et al., 2020). The core function of MCDM is to systematically prioritize all involved parties and consider different criteria when selecting the best option from available choices based on decision-making information. A recent MCDM technique is the Best-worst Method (BWM), which uses the ratios of the significance of factors in comparisons. These ratios, based on two vectors – the best criteria compared to the others and the others compared to the worst – are provided by the decision maker using a 1-9 scale for pairwise comparisons. Criteria weights are derived by solving a linear or non-linear model. In comparison to the Analytic Hierarchy Process (AHP) method, the BWM method requires less data for comparisons but yields more consistent and dependable outcomes, contributing to its widespread application (Rezaei, 2022). However, BWM is reliant on human judgments, often leading to ambiguity due to the use of the 1-9 scale for pairwise comparisons. Recognizing this challenge, Guo and Zhao (2017) introduced FBWM, which combines the BWM method with fuzzy theory. The FBWM presents five qualitative terms (Equally important, Weakly important, Important, Fairly important, and Very important), providing more reliable weights and aligning better with real conditions, resulting in a more convincing ranking (Guo & Zhao, 2017). For ranking options based on multiple criteria, the FTOPSIS method can be utilized, aiming to select options closest to the best solution and farthest from the worst solution. Subsequent sections will outline the stages of the Fuzzy Best-Worst technique and cover Fuzzy TOPSIS.

Best-Worst Fuzzy Techniques Steps

First step: building the system of decision criteria

This system has a set of decision criteria. They are logically chosen to evaluate options (criteria). Assume that the number of n decision variables is (C1, C2, ..., Cn).

Second step: determining the best and worst criteria

Surveys and experts identify the most and least important factors in this stage. In this research, we set the best and not-so-good criteria. We did this by consulting with experts and collecting their viewpoints.

The third step involves fuzzy pairwise comparisons for the main criterion. It includes finding the preference values for the other criteria. These values are in relation to the least preferred criterion. This process includes comparing the main criterion with the others. It also involves contrasting the others with the least preferred one. Moreover, it means comparing the main view with the other views. It also means contrasting the other views with the worst one. We used the terms in Table 3. They show the fuzzy preferences of the main criterion over the other criteria. The vector represents the comparison between the main criterion and the others. Details are below:

$$\tilde{A}B= (\tilde{a}B1, \tilde{a}B2, \ldots, \tilde{a}Bn) \quad (1)$$

in the formula, $A\tilde{B}$ is the best fuzzy vector. It's better than the other criteria. $aB\tilde{j}$ is the fuzzy preference for the top CB criterion over the j criterion. It's evident that $aB\tilde{B}$= (1,1,1). To do this, we reassessed the fuzzy preferences of all criteria for the poorest one. We did this by using the linguistic variables from the corresponding table. The vector representing the other measures in relation to the worst (OW) is as follows:

$$\tilde{A}W= (\tilde{a}W1, \tilde{a}W2, \ldots, \tilde{a}W) \quad (2)$$

in the above relation, AW is the fuzzy vector of other criteria relative to the worst one. aWj is the fuzzy preference of criterion i relative to the worst criterion, CW. It is clear that aWW= (1,1,1).

The fourth step: determining the optimal fuzzy weights and creating the FBWM model.

It is possible to calculate the weight of the factors using the following nonlinear programming model.

$$\begin{cases} \left|\frac{(l_B^w, m_B^w, u_B^w)}{(l_j^w, m_j^w, u_j^w)} - (l_{Bj}, m_{Bj}, u_{Bj})\right| \le (k^*, k^*, k^*) \\ \left|\frac{(l_j^w, m_j^w, u_j^w)}{(l_{j\tilde{w}}^w, m_{j\tilde{w}}^w, u_{j\tilde{w}}^w)} - (l_{j\tilde{w}}, m_{j\tilde{w}}, u_{j\tilde{w}})\right| \le (k^*, k^*, k^*) \\ \sum_{j=1}^{n} R(\widetilde{w_j}) = 1 \\ l_j^w \le m_j^w \le u_j^w \\ l_j^w \ge 0 \\ j = 1,2,\ldots,n \end{cases} \quad (3)$$

Fifth step: Solving the model by optimization software such as Lingo

Executing the model acquires the weights of the criteria. We calculate all perspectives and criteria weights. We then use the diphase method to turn triangular numbers into precise ones for prioritization. The current study employs the center of gravity defuzzification formula method.

$$W_j^* = \frac{1}{6}(l_j + 4m_j + u_j) \quad (4)$$

FTOPSIS Techniques Steps

First Step: Identifying evaluation criteria and appropriate linguistic variables

Imagine a group has t evaluators. They are tasked with assessing m choices using n criteria. The criteria are divided into cost and benefit categories.

Second step: creating a decision matrix

The matrix shows the weights of the i-th option with respect to the j-th criterion in the fuzzy environment. It is:

$$D = \begin{matrix} A_1 \\ A_2 \\ A_M \end{matrix}\begin{bmatrix} x_{11} & \cdots & x_{1n} \\ \vdots & \ddots & \vdots \\ x_{m1} & \cdots & x_{mn} \end{bmatrix} \quad (5)$$

$$\widetilde{W} = (\widetilde{w_1}, \widetilde{w_2}, \ldots, \widetilde{w_n}) \quad (6)$$

Third, creating the fuzzy weighted normalization matrix using equation (7). Then, fuzzify the normalized matrix.

$$V^{-} = W^{-} \otimes R^{-} \quad (7)$$

The fourth step is to find the best negative and positive solution in the V matrix. It is based on profit. Then, select the Hurston maximum value. Finally, we get a fuzzy number for V+. It should be noted that the minimum value is chosen for cost criteria. For profit criteria, the lowest value in each column is chosen, yielding V-'s fuzzy number.

$$A^{*} = \left(\widetilde{v_1^{*}}, \widetilde{v_2^{*}}, \dots, \widetilde{v_n^{*}}\right) where \quad \widetilde{v_j^{*}} = max\left\{v_{ij3}\right\}, i = 1,2, \dots, m\,; j = 1,2, \dots, n \quad (8)$$

$$A^{-} = \left(\widetilde{v_1^{-}}, \widetilde{v_2^{-}}, \dots, \widetilde{v_n^{-}}\right) where \quad \widetilde{v_j^{-}} = min\left\{v_{ij1}\right\}, i = 1,2, \dots, m\,; j = 1,2, \dots, n \quad (9)$$

The fifth step is to calculate the proximity coefficient. This means finding the distance of each choice from the positive and negative ideal options. This is done by measuring the distance of each option from the best and worst options.

$$d_i^{*} = \sum_{j=1}^{n} d_v\left(\tilde{v}_{ij}, \tilde{v}_j^{-}\right), i = 1,2, \dots, m \quad (10)$$

Equation (11) yields the proximity coefficient of each option:

$$cc_i = \frac{d_i^{-}}{d_i^{-} + d_i^{*}}, i = 1,2, \dots, m \quad (11)$$

Sixth step: Ranking options

Finally, to calculate the score of each option, it's used:

$$cc_i = \frac{d_i^{-}}{d_i^{-} + d_i^{*}}, i = 1,2, \dots, m \quad (12)$$

$$Score_i = \frac{CC_i}{\sum_{i=1}^{m} CC_i} \quad (13)$$

Results

One of the first questions in this research was: "What are the criteria for selecting suppliers in oil and gas industries?" So, at first, we've formulated the review question. We then made a search strategy based on clear inclusion criteria. This strategy was to find eligible studies. Then, the research group searched for eligible studies using many databases and sources. They had no language restrictions. Finally, we selected studies, extracted data, and assessed risk of bias. We did this iteratively using two independent reviewers. This was to avoid random or systematic errors. In total, 21 criteria were identified in the first step, as shown in Table 2.

Table2. The most frequent evaluation criteria of stable and resilient suppliers.

	Criterion	Concept	References
1	Supplier ‘credit	Having a history and reputation among suppliers and customers	Alikhani et al., 2019; Durmić et al., 2020; Hosseini et al., 2019; Kannan et al., 2020; Kaur et al., 2020; Memari et al., 2019; Pamucar et al., 2020; Parkouhi et al., 2019; Sharma & Joshi, 2023; Stević et al., 2020; Xiong et al., 2020
2	Liability	The supplier's ability to respond in different situations	Abdel-Baset et al., 2019; Alikhani et al., 2019; Fallahpour et al., 2021; Ghadimi et

			al., 2019; Hosseini & Khaled, 2019; Kannan et al., 2020; Kaur et al., 2020; Liu et al., 2019; Memari et al., 2019; Pamucar et al., 2020; Parkouhi et al., 2019; Pramanik et al., 2017; Rabbani et al., 2019; Sharma & Joshi, 2023; Stević et al., 2020; Yu et al., 2019
3	Total cost of purchase	The final cost of the purchase is determined by the supplier.	Fallahpour et al., 2021; Hosseini et al., 2019; Kaur et al., 2020; Parkouhi et al., 2019
4	Restorative capacity	Supplier's ability to recover low-quality products from customers	Fallahpour et al., 2021; Hosseini et al., 2019; Parkouhi et al., 2019; Pramanik et al., 2017
5	Delivery time	The ability to deliver the product to the customer in the shortest possible time	Fallahpour et al., 2021; Hosseini et al., 2019; Parkouhi et al., 2019
6	Technology	Supplier's ability to adapt to innovations in technology	Kaur et al., 2020; Parkouhi et al., 2019; Rajesh & Ravi, 2015
7	Flexibility	Supplier's ability to manage disruptions and respond to fluctuating demands	Kaur et al., 2020; Parkouhi et al., 2019; Rajesh & Ravi, 2015; Sharma & Joshi, 2023
8	Reliability	The possibility of doing all the tasks by the company	Kaur et al., 2020; Parkouhi et al., 2019; Pramanik et al., 2017; Rajesh & Ravi, 2015
9	After-sales service	Responsibility and accountability of the supplier for the sold goods.	Hosseini & Khaled, 2019; Hosseini et al., 2019; Kaur et al., 2020; Parkouhi et al., 2019; Sharma & Joshi, 2023
10	Transportation	The ability to move products from one place to another begins at the beginning of the supply chain when the material enters the warehouse and continues until the customer receives the order.	Hosseini & Khaled, 2019; Parkouhi et al., 2019
11	Delivery on time	The supplier can deliver desired goods to customers.	Alikhani et al., 2019; Ghadimi et al., 2019; Kannan et al., 2020; Kaur et al., 2020; Liu et al., 2019; Memari et al., 2019; Parkouhi et al., 2019; Pramanik et al., 2017; Rabbani et al., 2019; Stević et al., 2020; Yu et al., 2019
12	Research &Development	The ability of suppliers in research and development to create innovations and keep pace with the current market turbulence	Kaur et al., 2020; Parkouhi et al., 2019; Sharma & Joshi, 2023
13	Quality	The ability to provide goods based on the quality expected by the customer.	Alikhani et al., 2019; Durmić et al., 2020; Ghadimi et al., 2019; Hosseini & Khaled, 2019; Kannan et al., 2020; Kaur et al., 2020; Liu et al., 2019; Rajesh & Ravi, 2015; Sharma & Joshi, 2023; Stević et al., 2020; Yu et al., 2019
14	Excess inventory	Extra inventory is available to get through critical situations.	Fallahpour et al., 2021; Hosseini et al., 2019
15	Risk reduction	The supplier must be aware of different levels of risks such as risks related to assets, processes, organizations, and the environment.	Fallahpour et al., 2021; Rajesh & Ravi, 2015
16	Visibility in the supply chain	Visibility is the supplier's ability to have a clear view of upstream and downstream inventory, demand, supply conditions, production, and purchase scheduling.	Rajesh & Ravi, 2015
17	Association	Supplier's ability to cooperate with other suppliers and customers to improve material quality	Fallahpour et al., 2021; Rajesh & Ravi, 2015

18	Desire of employees	Respecting all the rights and interests of the company's employees	Alikhani et al., 2019; Durmić et al., 2020; Memari et al., 2019; Yu et al., 2019
19	Instruction	Continuous training of employees	Durmić et al., 2020; Memari et al., 2019; Stević et al., 2020
20	Qualification of the environment	Compliance with environmental regulatory standards	Durmić et al., 2020; Ghadimi et al., 2019; Memari et al., 2019; Stević et al., 2020
21	Environmental system management	It is a set of systematic processes and methods that the supplier carries out to reduce its environmental effects, which includes organizational structure, planning, and implementation of policies such as ISO14001 for environmental protection.	Alikhani et al., 2019; Memari et al., 2019; Rabbani et al., 2019; Yu et al., 2019

Case Study

In the next step, we analyzed the criteria using quantitative and qualitative methods to obtain criteria related to the sanction's conditions. The experts discussed the criteria. They did this in a questionnaire with five experts in the oil and gas industry. Experts' viewpoints were combined to find ten key criteria. These criteria then moved to the next stages. Table 3 presents these criteria.

Table 3. The most important criteria for evaluating sustainable and resilient suppliers.

Row	Criterion	Row	Criterion
1	Total cost of purchase (c_1)	6	Flexibility(c_6)
2	Quality(c_2)	7	Technology (c_7)
3	Research &Development(c_3)	8	Delivery time (c_8)
4	Delivery on time (c_4)	9	Liability (c_9)
5	After-sales 'service(c_5)	10	Supplier Credit (c_{10})

In the third step, experts have been asked to identify the most valuable and optimal criteria based on the criteria listed in Table 3. The total cost of purchase was the best criterion. The supplier's credit was the worst. Then, we designed a fuzzy BWM questionnaire and gave it to the experts. They were asked to compare the best criteria with others and the worst criteria with others by filling out the questionnaire. It's worth mentioning that the comparisons rely on the fuzzy values in Table 4.

Table 4. Fuzzy research scale

Row	Definitive Likert scale	Importance	Persian Equivalent	Triangular fuzzy number
1	9	Absolutely Important (A)	Very very important	$\left(\frac{7}{2},4,\frac{9}{2}\right)$
2	7	Very Important (V)	Very important	$\left(\frac{5}{2},3,\frac{7}{2}\right)$
3	5	Fairly Important (F)	Relatively important	$\left(\frac{3}{2},2,\frac{5}{2}\right)$
4	3	Weakly Important (W)	A bit important	$\left(\frac{2}{3},1,\frac{3}{2}\right)$
5	1	Equally Important (E)	Neutral	$(1,1,1)$

The results are a mix of scores from experts and interviews with them. Expert answer sheets were analyzed with BWM fuzzy models solved by The Lingo 18.0. After consolidating the

experts' perspectives, the fuzzy weight and final ranking for each criterion were made, as shown in Table 5. Considering the sanctions factor, the ranking of the criteria was slightly different from the normal situation. Experts kept an eye on sanctions in ranking and scoring criterias. For example, in the interviews, most experts said that quality, technology, and research are most important. But, the sanction changes the ranking. Also, most of them said that standards are for normal conditions. They have no concern about environmental issues.

Most of their concern is to get foreign equipment and parts easily and cheaply. The Central Bank and Customs should make their orders easy to register. As shown in Table 5, total cost, flexibility, and after-sales service are the top concerns. They matter in picking suppliers for the oil and gas industry during sanction periods. As a result of sanction, cost of purchase and low-profit margins are so significant. Also, flexible suppliers can help the oil and gas industry find diverse cooperation solutions. This is especially true for financial transfer, shipping, marine insurance, and equipment supply. Elites are most concerned about the commitment to provide after-sales services. This is in an environment where technology is not up-to-date and outdated. The risk of failure is high, and system renewal is unlikely. Keeping the industry alive is the top priority. After-sales service has a great impact on establishing long-term cooperation and contracting with some suppliers.

Table 5. Fuzzy BWM results

Ranking	Definite Weight	Fuzzy Weight			Weight Criterion
		l	m	U	
4	0.046	0.046	0.046	0.046	**Research & development**
1	0.209	0.209	0.209	0.209	**Total cost of purchase**
1	0.209	0.209	0.209	0.209	**flexibility**
2	0.076	0.076	0.076	0.076	**quality**
4	0.046	0.046	0.046	0.046	**technology**
4	0.046	0.046	0.046	0.046	**Delivery on time**
1	0.209	0.209	0.209	0.209	**After sales service**
3	0.059	0.059	0.059	0.059	**Delivery time**
4	0.046	0.046	0.046	0.046	**Liability**
5	0.037	0.032	0.038	0.038	**Supplier credit**

In the next phase, experts got a fuzzy TOPSIS questionnaire. They used it to rate the four suppliers in the study according to the research criteria. We consolidated the experts' feedback. The resulting decision matrix for this stage is in Table 6.

Based on the decision matrix in Table 6, we used MATLAB software to solve the Fuzzy TOPSIS model. Its results are given in the following tables.

In Table 8, the third supplier has clinched the highest position with a score of 0.290982. Picking the best supplier in the oil and gas industry could boost the organization. It could make it more efficient, effective, and profitable. This matters because sanctions have caused economic instability. In this hard time, bolstering market share can make beneficiaries satisfied

Table 6. Final Expert Decision Matrix for Fuzzy TOPSIS

C10	C9	C8	C7	C6	C5	C4	C3	C2	C1	
$\left(\frac{7}{2},4,\frac{9}{2}\right)$	$\left(\frac{5}{2},3,\frac{7}{2}\right)$	(1,1,1)	$\left(\frac{5}{2},3,\frac{7}{2}\right)$	$\left(\frac{2}{3},1,\frac{3}{2}\right)$	$\left(\frac{7}{2},4,\frac{9}{2}\right)$	$\left(\frac{7}{2},4,\frac{9}{2}\right)$	(1,1,1)	$\left(\frac{5}{2},3,\frac{7}{2}\right)$	(1,1,1)	**S1**
$\left(\frac{5}{2},3,\frac{7}{2}\right)$	$\left(\frac{7}{2},4,\frac{9}{2}\right)$	$\left(\frac{7}{2},4,\frac{9}{2}\right)$	$\left(\frac{5}{2},3,\frac{7}{2}\right)$	$\left(\frac{7}{2},4,\frac{9}{2}\right)$	$\left(\frac{7}{2},4,\frac{9}{2}\right)$	$\left(\frac{7}{2},4,\frac{9}{2}\right)$	(1,1,1)	$\left(\frac{7}{2},4,\frac{9}{2}\right)$	$\left(\frac{7}{2},4,\frac{9}{2}\right)$	**S2**
$\left(\frac{5}{2},3,\frac{7}{2}\right)$	$\left(\frac{5}{2},3,\frac{7}{2}\right)$	$\left(\frac{5}{2},3,\frac{7}{2}\right)$	$\left(\frac{7}{2},4,\frac{9}{2}\right)$	$\left(\frac{7}{2},4,\frac{9}{2}\right)$	$\left(\frac{7}{2},4,\frac{9}{2}\right)$	$\left(\frac{5}{2},3,\frac{7}{2}\right)$	$\left(\frac{7}{2},4,\frac{9}{2}\right)$	$\left(\frac{7}{2},4,\frac{9}{2}\right)$	$\left(\frac{7}{2},4,\frac{9}{2}\right)$	**S3**
$\left(\frac{7}{2},4,\frac{9}{2}\right)$	$\left(\frac{7}{2},4,\frac{9}{2}\right)$	$\left(\frac{7}{2},4,\frac{9}{2}\right)$	$\left(\frac{7}{2},4,\frac{9}{2}\right)$	$\left(\frac{7}{2},4,\frac{9}{2}\right)$	$\left(\frac{7}{2},4,\frac{9}{2}\right)$	$\left(\frac{7}{2},4,\frac{9}{2}\right)$	$\left(\frac{3}{2},2,\frac{5}{2}\right)$	$\left(\frac{7}{2},4,\frac{9}{2}\right)$	$\left(\frac{2}{3},1,\frac{3}{2}\right)$	**S4**

Table 7. Weighted normalized matrix

C10	C9	C8	C7	C6	C5	C4	C3	C2	C1	
(0.04, 0.04, 0.05)	(0.12, 0.14, 0.16)	(0.05, 0.05, 0.05)	(0.025, 0.03,0.036)	(0.03, 0.05, 0.07)	(0.16, 0.19, 0.21)	(0.04, 0.04, 0.05)	(0.05, 0.05, 0.05)	(0.12, 0.14, 0.16)	(0.01, 0.01, 0.01)	**S1**
(0.03, 0.03,0.04)	(0.16, 0.19, 0.21)	(0.16, 0.19, 0.21)	(0.025, 0.03,0.036)	(0.16, 0.19, 0.21)	(0.16, 0.19, 0.21)	(0.04, 0.04, 0.05)	(0.05, 0.05, 0.05)	(0.16, 0.19, 0.21)	(0.04, 0.04, 0.05)	**S2**
(0.03, 0.03,0.04)	(0.12, 0.14, 0.16)	(0.12, 0.14, 0.16)	(0.04, 0.04, 0.05)	(0.16, 0.19, 0.21)	(0.16, 0.19, 0.21)	(0.03, 0.03, 0.04)	(0.16, 0.19, 0.21)	(0.16, 0.19, 0.21)	(0.04, 0.04, 0.05)	**S3**
(0.04, 0.04, 0.05)	(0.16, 0.19, 0.21)	(0.16, 0.19, 0.21)	(0.04, 0.04, 0.05)	(0.16, 0.19, 0.21)	(0.16, 0.19, 0.21)	(0.04, 0.04, 0.05)	(0.07, 0.09, 0.12)	(0.16, 0.19, 0.21)	(0.01,0.01, 0.02)	**S4**

Table 8. Calculation of the distance from the ideal solution, fuzzy positive, fuzzy negative, proximity coefficient, score, and rating of customers

Rank	Score	CC	DN	DP	
4	0.151	0.360	0.407	0.724	**S1**
3	0.272	0.648	0.657	0.357	**S2**
1	0.291	0.694	0.700	0.309	**S3**
2	0.287	0.683	0.695	0.322	**S4**

Discussion

Considering the outcomes from tables and thorough in-depth interviews with elites, the findings can be discussed. With the implementation of sanctions, the oil supply chain and distribution and sale were most affected. Procurement and sales in the oil industry have been disrupted. This requires fixing the resulting bottlenecks with a careful approach. The sanctions disrupted the purchase of: catalysts, chemicals, and additives. It also disrupted the purchase of equipment and parts from reliable American makers. These parts include pumps, turbines, and compressors, especially turbines. They also include olefinic compressors from Siemens. They also include parts with special materials, such as valves and titanium and tantalum sheets. During the buying process, issues arose mainly about the transfer of payment to the sellers' accounts. They had to use risky methods and pay upfront for orders without seller guarantees. Delays happened because it was hard to send money to sellers' foreign currency accounts, as deposits weren't accepted. Sellers demanded the full order amount when the purchase order was issued. They hesitated to confirm getting the payment after delivering the goods. During the discussions, it was mentioned that many supervisions need to be made interactive. They also need incentive strategies. These changes addressed the challenges and barriers in service and equipment provision. For instance, when elites were choosing among suppliers, they did not consider companies with a long history and all the required items and standards. Instead, they focused on companies and individuals able to set up an equipment supply network and to help with financial transactions during embargoes. The outcomes reveal that the chosen company lacks the needed items, qualifications, and technology. However, the Iranian Oil Company's incentive policies and its ability to set up a supply network for parts, shipping, and finance led to this score. Also, the chosen company could supply the materials and cover much of the costs after delivery. This allowed the National Iranian Oil Company to easily acquire foreign equipment and parts at a reduced cost. Also, this company had the ability to deliver essentials on time better than other companies. From the point of view of the elites, part of this ability was due to special support within the system. For example, ordering goods and getting currency from the central bank was much faster for this company. Customs has made it easier to clear this company's goods. Highly-rated companies typically have branch offices in neighboring countries to Iran. This helps streamline service, buy equipment, and set up a supply network

with foreign firms. It is crucial to involve a subsidiary in working with main suppliers. They will build a bridge between the main suppliers and new, low-cost, trustworthy suppliers.

So, the main factor in selecting suppliers was the cost of essential items. Also, it was their on-time delivery and consistent supply chain. Hiring retired staff from supplier firms for repairs, commissioning, and post-sales services, as well as equipment replacement, can boost a company's edge. Also, setting up reverse engineering units and using special engineering tools are preferential measures. The time of embargo is an opportunity to pay more attention to domestic producers. The National Iranian Oil Company should also try to support and work with local companies. They need to do this to make more of the equipment and chemicals the industry needs inside the country. This will turn the threat of sanctions into a chance to grow local technical knowledge in the oil industry and strengthen its resilience against sanctions. A supplier's flexibility in handling claims and invoices is an advantage that cannot be ignored. Accepting claims in different currencies, especially Iranian Rial are beneficial as it simplifies financial transactions.

The discussions of various elites regarding the embargo and its impact on supplier selection can be summarized as follows:

Sanctions disrupted direct sales. They caused purchases to be made mainly through intermediaries and agents. Consequently, their commissions are deducted from the sales revenue. Establishing various indirect offices was necessary to circumvent the sanctions during this period. The costs associated with these offices will pose a financial burden on the oil industry. The process of customers paying in foreign currency to the oil industry's accounts is hindered and time-consuming. Trading Iranian products is somewhat risky. The US may impose fines, leading buyers to seek discounts. Transporting and insuring products has been disrupted. Shipping companies (Forwarder) demand higher fees for changing the bill of lading (Swith BL) and changing the ship (Trans Shipment). Many countries and companies comply with sanctions. This limits global product markets to specific markets. It also prevents using the added value (NETBACK) of other markets. With shrinking oil export markets, we focused on China, Turkey, UAE, and India. We made maximum efforts to keep these markets and sourced equipment and suppliers from them. Also, they consider local suppliers that can work in the Iraqi market and deliver the necessary items to Iran at a lower cost. Such suppliers also offer solutions to facilitate financial transactions. Setting up cover and trust companies in these markets is an effective step. It creates a flexible supply chain and aids sales. In this way, we see that top suppliers have rented warehouses in the target markets. They did this with the help of intermediary companies. They do this to buy and sell equipment, services and products in the local currency and always available. In this setting, the best suppliers provide the needed equipment and services at a lower price. They also use the government system's support to make importing goods and allocating currency easier. The results of prioritizing indicators and choosing the best supplier can be understood from these debates. The supply companies facilitate these processes and are willing to cooperate in these areas. They also help with oil exchanges. They are considered resilient suppliers.

The findings align with previous studies highlighting the importance of financial resilience and flexibility in sanctioned environments. However, the research adds nuance by emphasizing the role of intermediaries, alternative payment methods, and the development of domestic capabilities. While traditional supplier selection criteria, such as quality, cost, and delivery time, remain relevant, the ability to navigate sanctions and secure reliable supply chains has become a paramount consideration.

The study emphasizes the significance of financial flexibility in mitigating the impact of sanctions. Suppliers capable of accepting alternative payment methods and maintaining financial operations through intermediaries or their home countries are considered highly reliable. Additionally, the ability to deliver services at the required standard, even under

challenging circumstances, is a crucial factor.

The research also highlights the role of government support in facilitating trade and investment in sanctioned environments. Government policies, such as preferential treatment for domestic suppliers and streamlined customs procedures, can significantly enhance the resilience of the oil and gas industry.

Overall, the findings underscore the need for a comprehensive approach to supplier selection in sanctioned environments. By considering factors such as financial resilience, operational flexibility, and government support, companies can mitigate the risks associated with sanctions and ensure the continuity of their supply chains.

Conclusion

The oil and gas industry faces significant disruptions due to sanctions, impacting market access, investment, production costs, and project development. To mitigate disruptions and ensure a stable supply chain, a comprehensive four-phase framework should be implemented. By considering political factors alongside commercial ones, the industry can proactively address geopolitical risks, diversify suppliers, and reduce reliance on vulnerable sources. This proactive approach will enhance the industry's resilience and safeguard its long-term sustainability. As a result, it's appears that a key component of enhancing resilience in the supply chain of oil industry lies in addressing political matters. This includes diplomatic efforts aimed at alleviating or mitigating the impact of embargoes. Additionally, fostering ties with strategic partners holds significant importance in increasing resilience of supply chain of oil industry. For instance, The elite view justifies cooperation with countries such as China, Turkey, UAE, Oman, Iraq and India when selecting suppliers. These strategic partners not only play a role in supplying the oil industry, but also in managing supply, export, sales and financial transactions.

It is necessary to adopt a series of incentive policies and easy monitoring and standards for supplier selection during the embargo period. This attracts a combination of domestic and foreign companies as well as individuals and legal entities to the procurement of equipment. A key condition is that most payments are deferred until after the delivery of supplies and equipment. By enacting such a policy, many potential companies can become actual suppliers. They can then earn credibility with the Iranian Oil Company based on their performance. A resillient database should be created with the aim of meeting the essential needs during the embargo. This system can enlist natural and legal persons and use their capabilities for this purpose. The National Iranian Oil Company should ease some requirements for picking suppliers. This is needed under sanction conditions. Even in relation to upstream suppliers, policies can be applied to encourage more natural and legal persons to supply goods. In addition to the incentives of the National Iranian Oil Company, governments should take measures during the sanctions. These measures should simplify the ordering of certain imported goods. The central bank and customs should help with this. This will facilitate the swift integration of these goods into the oil industry cycle at a reduced cost upon their arrival in the country. Such policies may not be wise in normal times. But they do help the short-term resilience of the oil industry supply chain. These measures may reduce transparency and possibly promote corruption through informal and non-transparent deals and transactions. This could benefit certain groups that would like the sanctions to continue for a longer period of time.

The key issue highlighted in a resilient long-term strategy amid sanctions is the significant rise in supply chain costs and the subsequent decline in profit margins. Therefore, enhancing local production and bolstering internal capabilities within the supply chain become crucial. The establishment of private knowledge-based firms enhances flexibility within the oil industry's supply chain and serves various functions. These entities contribute to research and development. They also build a broad global network. They do this by setting up branches and

offices worldwide to serve the industry's needs. They can also act as intermediaries in accessing other vital suppliers in the oil industry. Collaborating with domestic private knowledge-based firms raises the supply chain's efficiency and addresses some financial transfer challenges. Privatizing the oil industry's supply chain enhances its resilience and adaptability, enabling better resistance against sanctions. Furthermore, offering scholarships and grants through Iranian universities and the Ministry of Oil, along with reinforcing reverse engineering, fosters long-term knowledge transfer and boosts resilience.

This study encountered constraints, some of which were associated with the nature of sanctions. Indeed, numerous managers and suppliers within Iran's oil sector were hesitant to be engage in the study. A part of the supply chain functions under sanctioned circumstances covertly and unofficially, with suppliers being reluctant to discuss it.

Future research should prioritize examining the performance of successful supplier companies under sanction conditions. A key area of focus should be the development of a system that can rapidly identify reliable natural and legal persons capable of circumventing sanctions. This system should include an up-to-date database of approved domestic and foreign equipment and services, along with detailed information on costs, quality, and potential applications. A comprehensive evaluation of the resilience and effectiveness of such a system is essential.

Additionally, research should explore the impact of sanctions on smaller oil suppliers and investigate alternative mitigation strategies. The regulation of supply contracts during sanctions is another crucial area for further study. To promote self-sufficiency and reduce reliance on foreign suppliers, it is recommended to establish a mechanism that incentivizes contractors and suppliers to fulfill requirements and services internally whenever possible.

References

Abdel-Baset, M., Chang, V., Gamal, A., & Smarandache, F. (2019). An integrated neutrosophic ANP and VIKOR method for achieving sustainable supplier selection: A case study in importing field. *Computers in industry*, *106*, 94-110.

Alikhani, R., Torabi, S. A., & Altay, N. (2019). Strategic supplier selection under sustainability and risk criteria. *International Journal of Production Economics*, *208*, 69-82.

Aslan, M., Aslan, K., & Rashid, Y. (2020). Economic and socioeconomic consequences of us sanctions on Iran. *Center for Iranian Studies in Ankara*, *1*(1), 1-32.

Åslund, A., & Snegovaya, M. (2022). *Impact of Western Sanctions on Russia and how They Can be Made Even More Effective*. Atlantic Council.

Audemard, J. (2020). Objectifying contextual effects. The use of snowball sampling in political sociology. *Bulletin of Sociological Methodology/Bulletin de Méthodologie Sociologique*, *145*(1), 30-60.

Azieva, R. H. (2021). Sanctions War Against Russian Oil Industry. *European Proceedings of Social and Behavioural Sciences*.

Babina, T., Hilgenstock, B., Itskhoki, O., Mironov, M., & Ribakova, E. (2023). Assessing the impact of international sanctions on Russian oil exports. *Available at SSRN 4366337*.

Brown, P. (2020). *Oil market effects from US economic sanctions: Iran, Russia, Venezuela* (Vol. 3). Congressional Research Service Washington, DC, USA.

Coote, B., & States, A. C. o. t. U. (2018). *Impact of Sanctions on Russia's Energy Sector*. Atlantic Council. https://books.google.com/books?id=GeJ3swEACAAJ

Corbeau, A.-S., & Mitrova, T. (2024). Russia's Gas Export Strategy.

Dashti, F., Mirzaie, B., & Jahanmanesh, J. (2020). The United States Sanctions against the Islamic Republic of Iran; from Unilateralism to Violations of International Human Rights. *Journal of Contemporary Research on Islamic Revolution*, *2*(5), 117-142.

Demertzis, M., Hilgenstock, B., McWilliams, B., Ribakova, E., & Tagliapietra, S. (2022). *How have sanctions impacted Russia?*

Durmić, E., Stević, Ž., Chatterjee, P., Vasiljević, M., & Tomašević, M. (2020). Sustainable supplier selection using combined FUCOM–Rough SAW model. *Reports in mechanical engineering*, *1*(1), 34-43.

Fallahpour, A., Nayeri, S., Sheikhalishahi, M., Wong, K. Y., Tian, G., & Fathollahi-Fard, A. M. (2021). A hyper-hybrid fuzzy decision-making framework for the sustainable-resilient supplier selection problem: a case study

of Malaysian Palm oil industry. *Environmental science and pollution research*, 1-21.
Farzanegan, M. R., & Batmanghelidj, E. (2024). Understanding economic sanctions on Iran: A survey. *The Economists' Voice*, *20*(2), 197-226.
Fattahi, S., & Nafisi-Moghadam, M. (2023). Do oil sanctions affect the interdependence and integration of financial markets? *Heliyon*, *9*(2).
Ghadimi, P., Wang, C., Lim, M. K., & Heavey, C. (2019). Intelligent sustainable supplier selection using multi-agent technology: Theory and application for Industry 4.0 supply chains. *Computers & Industrial Engineering*, *127*, 588-600.
Ghasseminejad, S., & Jahan-Parvar, M. R. (2021). The impact of financial sanctions: The case of Iran. *Journal of Policy Modeling*, *43*(3), 601-621.
Guo, S., & Zhao, H. (2017). Fuzzy best-worst multi-criteria decision-making method and its applications. *Knowledge-Based Systems*, *121*, 23-31. https://doi.org/https://doi.org/10.1016/j.knosys.2017.01.010
Hosseini, S., & Khaled, A. A. (2019). A hybrid ensemble and AHP approach for resilient supplier selection. *Journal of Intelligent Manufacturing*, *30*, 207-228.
Hosseini, S., Morshedlou, N., Ivanov, D., Sarder, M., Barker, K., & Al Khaled, A. (2019). Resilient supplier selection and optimal order allocation under disruption risks. *International Journal of Production Economics*, *213*, 124-137.
Kannan, D., Mina, H., Nosrati-Abarghooee, S., & Khosrojerdi, G. (2020). Sustainable circular supplier selection: A novel hybrid approach. *Science of the Total Environment*, *722*, 137936.
Kaur, H., Singh, S. P., Garza-Reyes, J. A., & Mishra, N. (2020). Sustainable stochastic production and procurement problem for resilient supply chain. *Computers & Industrial Engineering*, *139*, 105560.
Khatami Firouzabadi, S. M. A., Galali, S. H., & Parvardeh, S. A. M. (2013). Prioritizing of Strategy Implementation Obstacles among Energy sector's Contractors Using Fuzzy TOPSIS Method. *Industrial Management Studies*, *11*(29), 113-137.
Liu, H.-C., Quan, M.-Y., Li, Z., & Wang, Z.-L. (2019). A new integrated MCDM model for sustainable supplier selection under interval-valued intuitionistic uncertain linguistic environment. *Information Sciences*, *486*, 254-270.
Memari, A., Dargi, A., Jokar, M. R. A., Ahmad, R., & Rahim, A. R. A. (2019). Sustainable supplier selection: A multi-criteria intuitionistic fuzzy TOPSIS method. *Journal of manufacturing systems*, *50*, 9-24.
Mitrova, T. (2022). Energy and the Economy in Russia. In *The Palgrave Handbook of International Energy Economics* (pp. 649-666). Springer International Publishing Cham.
Nejad, S. B., Kazemi, M., & Pouya, A. (2022). Performance Evaluation with a Combination of Balanced Scorecard Model and the Fuzzy Best-Worst Method (Case Study: Mashhad City Train Operation Company). *Industrial Management Perspective/Chashm/&āz-I Mudīriyyat-I Ṣanʿatī*, *12*(3).
Neuenkirch, M., & Neumeier, F. (2016). The impact of US sanctions on poverty. *Journal of Development Economics*, *121*, 110-119.
O'Driscoll, D. (2017). Impact of Economic sanctions on poverty and economic growth. *K4D Helpdesk Report (Institute of Development Studies, Brighton, UK, 2017)*.
Pamucar, D., Yazdani, M., Obradovic, R., Kumar, A., & Torres-Jiménez, M. (2020). A novel fuzzy hybrid neutrosophic decision-making approach for the resilient supplier selection problem. *International Journal of Intelligent Systems*, *35*(12), 1934-1986.
Parkouhi, S. V., Ghadikolaei, A. S., & Lajimi, H. F. (2019). Resilient supplier selection and segmentation in grey environment. *Journal of cleaner production*, *207*, 1123-1137.
Pramanik, D., Haldar, A., Mondal, S. C., Naskar, S. K., & Ray, A. (2017). Resilient supplier selection using AHP-TOPSIS-QFD under a fuzzy environment. *International Journal of Management Science and Engineering Management*, *12*(1), 45-54.
Rabbani, M., Foroozesh, N., Mousavi, S. M., & Farrokhi-Asl, H. (2019). Sustainable supplier selection by a new decision model based on interval-valued fuzzy sets and possibilistic statistical reference point systems under uncertainty. *International Journal of Systems Science: Operations & Logistics*, *6*(2), 162-178.
Rafique, S., & Nadeem, D. (2023). Politics of US Sanctions Against Iran: An Analysis Since 2000. *UCP Journal of Humanities & Social Sciences (HEC Recognized-Y Category)*, *1*(02), 35-53.
Rajesh, R., & Ravi, V. (2015). Supplier selection in resilient supply chains: a grey relational analysis approach. *Journal of cleaner production*, *86*, 343-359.
Rezaei, J. (2022). The balancing role of best and worst in best-worst method. Advances in Best-Worst Method: Proceedings of the Second International Workshop on Best-Worst Method (BWM2021),
Sharma, M., & Joshi, S. (2023). Digital supplier selection reinforcing supply chain quality management systems to enhance firm's performance. *The TQM Journal*, *35*(1), 102-130.
Stević, Ž., Pamučar, D., Puška, A., & Chatterjee, P. (2020). Sustainable supplier selection in healthcare industries using a new MCDM method: Measurement of alternatives and ranking according to COmpromise solution (MARCOS). *Computers & Industrial Engineering*, *140*, 106231.

Timofeev, I. N., Sokolshchik, Y. S., & Morozov, V. A. (2022). Sanctions against Iran: Lessons for Russia in the new international context.

Torbat, A. E., & Torbat, A. E. (2020). The economic sanctions against Iran. *Politics of Oil and Nuclear Technology in Iran*, 201-224.

Van Bergeijk, P. A. (2022). Sanctions against the Russian war on Ukraine: Lessons from history and current prospects. *Journal of World Trade*, *56*(4).

Xiong, L., Zhong, S., Liu, S., Zhang, X., & Li, Y. (2020). An approach for resilient-green supplier selection based on WASPAS, BWM, and TOPSIS under intuitionistic fuzzy sets. *Mathematical Problems in Engineering*, *2020*.

Yu, C., Shao, Y., Wang, K., & Zhang, L. (2019). A group decision making sustainable supplier selection approach using extended TOPSIS under interval-valued Pythagorean fuzzy environment. *Expert Systems with applications*, *121*, 1-17.

Zhukov, S., & Reznikova, O. (2020). Iran in the global oil market. *Herald of the Russian Academy of Sciences*, *90*, 708-717.