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Analyzing the Potential Risks Associated with Buyback Petroleum Contracts from the Contractor's Perspective

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Highlights

- Empirical insights: This study draws on the qualitative data from interviews with oil industry experts, offering in-depth insights into the challenges and complexities of upstream buyback petroleum contracts.
- Comprehensive risk analysis of buyback contracts: The research critically examines the potential risks in upstream buyback contracts from the contractor's perspective, highlighting significant legal and operational vulnerabilities.
- Identification of legal and economic risk factors: Key risks include contractual ambiguities, financial uncertainties, and regulatory challenges that could impact Iran's oil and gas sector and diminish its appeal to international investors.
- Strategic recommendations for contractual stability: The study proposes strategic recommendations to enhance the stability of buyback frameworks and effectively mitigate associated risks.
- Advancement in oil and gas law scholarship: This work offers a valuable contribution to the understanding of petroleum contract frameworks in complex geopolitical settings, providing essential insights for scholars and practitioners in oil and gas law, contract negotiation, and international arbitration.

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Abstract

It is imperative to acknowledge the ongoing significance of oil and gas in the global economy despite the global initiative to transition to renewable energy sources such as wind, solar, and geothermal power, which are more environmentally friendly and cost-effective. Nowadays, Iran is actively seeking to attract investment, modern technologies, and specialized expertise from both domestic and international sources to enhance the extraction of its natural resources. This paper examines the legal framework of buyback contracts. After reviewing the legal and financial requirements of existing contracts, the paper analyzes the risks faced by the parties involved, with a particular focus on the risks affecting the contractor. Analyzing the primary risky events associated with buyback contracts is the primary objective of this study as it has rendered this contract unappealing to contractors. In order to identify and monitor all contractual and non-contractual risks associated with buyback contracts, we implement a combination of qualitative and quantitative methodologies. The main objective of the study is to offer investors valuable insights into the potential risks associated with upstream oil and gas buyback contracts and to aid the National Iranian Oil Company (NIOC) in effectively responding to and monitoring these risks. It also discusses strategies to mitigate these risks. As a result, solutions for managing these risks within the framework of contractual provisions are proposed. Fifty experts from the Iranian oil and gas industry and contractors engaged in buyback contracts, who possess extensive knowledge of buyback risk events, were interviewed. The research methodology was based on the Delphi technique. A detailed study was conducted to identify the risky events associated with Iran's oil buyback contracts.

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1. Introduction

As of the end of 2019, the primary holders of gas reserves were Russia (38 trillion cubic meters (TCM)), Iran (32 TCM), and Qatar (24.7 TCM) (Cozy et al., 2020; British Petroleum, 2019). The total proven gas reserves of the planet were 198.8 trillion cubic meters. Iran ranked third in the world by 2020, contributing 6.1% of global gas production per billion cubic meters (Cozy et al., 2020; British Petroleum, 2019). Venezuela (17.5% of global reserves), Saudi Arabia (17.2% of global reserves), Canada (9.8% of global reserves), and Iran (9% of global reserves) are the top four countries in terms of confirmed oil reserves (Cozy et al., 2020; British Petroleum, 2019). Iran was the eighth largest producer of crude oil globally by 2020, accounting for 3.6% of the total global oil production per million tons (Cozy et al., 2020; British Petroleum, 2019). Nevertheless, the dangers associated with international oil companies contemplating investments in Iran have been exacerbated by the sanctions imposed on Iran's energy sector. A type of upstream oil risk service contract has been introduced, which includes the Iranian buyback contract, concession contracts, production sharing contracts (PSC), and joint venture contracts (Al-Attar and Alomar, 2005; Boyett et al., 2012). Buyback contracts are so named because they enable the contractor to recoup their expenses and compensation by utilizing revenues generated in the same operational oil field. The petroleum law of 1974 in Iran was the first to propose the conclusion of risk service contracts in the energy industry (Shirai and Ebrahimi, 2006).

The National Iranian Oil Company (NIOC) is permitted to enter contracts with reputable foreign companies for the development of the Pars and South Pars fields, with a maximum value of 3.5 billion USD, under the condition that the recovery of investments in a field is to be done using the revenues generated from that field. This is a risk service contract, as authorized by various laws, such as Section 1 Paragraph P Note 29 of the budget act dated 1994 (Shirai and Ebrahimi, 2006; Farimani, Mu, Sahebhonar, and Taherifard, 2020). NIOC is also permitted to enter exploration and development buyback contracts with other companies under the budget laws of 2003–2005, the Second and Third (Five-Year) Economic Development Plans, and the 1995–1999 and 2000–2004 Economic Development Plans (Shirai and Ebrahimi, 2006; Asgharian, 2017). The capital expenditure (capex) ceiling is established on the contract's effective date, and these contracts, referred to as second-generation buyback contracts, are employed for the exploration and development of the field. Furthermore, the third generation of buyback contracts, referred to as "buyback contracts", are referenced in the budget law from 2007 to 2019 and Paragraph A Article 14 of the fourth development plan from 2005 to 2009 (Shirai and Ebrahimi, 2006; Asgharian, 2017). The capital costs ceiling in third-generation contracts is established through a tender process following an agreement between the parties, typically 18 months from the effective date of the contract (Farimani, Mu, Sahebhonar, and Taherifard, 2020; Behdadnia and Ziyaee, 2022). The primary attributes of these buyback contracts are as follows:

1. In order to develop petroleum resources, the international oil company (IOC) is required to enter a joint operating agreement (JOA) with an Iranian company that has been approved by the National Iranian Oil Company (Ebrahimi, Shahmoradi, Gas, and Law, 2017; Shirai and Vafaei, 2020).
2. The contractor shall assume complete responsibility and consider all costs and risks associated with the exploration of unexplored fields. In the event that the field is determined to be non-commercial, the contractor is not reimbursed for any costs or expenses. For development contracts (explored oil

fields), foreign oil companies are obligated to provide the required finance or capital to develop the field (Shirai and Ebrahimi, 2006; Farimani, Mu, Sahebhonar, and Taherifard, 2020; Soleimani and Tavakolian, 2017).

3. The principle of "ring fencing" is a critical component of the buyback, ensuring that the finances of each specific project are kept separate from others and that the incurred approved costs and remuneration of the contractor will be recovered and paid from the gross revenues of the same field (Soleimani and Tavakolian, 2017; Ghadas, Muslim, and Hamid, 2014; Shahri, 2015).
4. The contractor is prohibited from revising its master development plan (MDP) or submitting a new MDP during the contract period unless it obtains the approval of NIOC (Shirai and Ebrahimi, Nikbakht Fini, Bagheri, and Ghorbani).
5. The contractor is required to transfer the field to NIOC upon the conclusion of the development phase. NIOC or a company approved by NIOC will conduct the production phase (Ghandi and Lawell, 2017). Only during the production phase is the contractor permitted to provide production support, assistance, and supervision to NIOC.
6. The cost recovery period is typically brief, typically falling within the range of 7–9 years (Sahebhonar, TaheriFard, and Farimani, 2016; Shahri, 2010).
7. The costs depicted in Figure 1 are divided into the following categories (Farimani, Mu, Sahebhonar, and Taherifard, 2020; Ebrahimi and Shahmoradi, 2017; Nikbakht Fini, Bagheri, and Ghorbani, 2018; Ghandi and Lawell, 2017; Shahri, 2010):
    a. Capital costs (excluding non-capital costs, bank charges, and production support and assistance costs) are all costs incurred and paid by the contractor under the contract from the effective date until the conclusion date of the development phase, directly related to the carrying out of the development operations. This includes direct costs and project management costs.
    b. Non-capex costs refer to all expenses the contractor incurs and pays in an indirect manner in connection with the development operation, including VAT, corporate income tax, customs duties, and other Iranian statutory charges the contractor pays to Iranian governmental bodies or public entities, such as municipalities, in relation to petroleum operations.
    c. Production support and assistance costs during the production phase.
    d. Operating costs mean all costs and expenses directly and exclusively incurred and paid by contractor, with the prior written approval of NIOC in relation to the operating activities, procurement of the spare parts, applicable insurance premium, except capex, bank charges and non-capex.
    e. Bank charges (interest payments linked to cost recovery, typically a fixed margin of 3 quarters of one percent (0.75) + LIBOR) which is allocated only to capex and non-capex and any carried forward due amount of operational expenditure (opex), fee, assistant cost, and bank charges.
8. The contractor is required to pay taxes and royalties, which are reimbursed to the contractor on a quarterly basis as indirect costs.
9. Capital costs in buyback contracts are restricted (Shirai and Ebrahimi, 2006; Shahri, 2010; Kakhaki, 2008).
10. The cost stop for the recovery of the contractor's incurred costs and remuneration is 50–60% of the aggregate revenue from the field (Shirai and Ebrahimi, 2006).
11. The oil in the well, the oil produced, and the oil at the export point are not the property of the contractor. The handling agreement detailed in the contract authorizes NIOC to sell oil to the contractor at market price (Shirai and Ebrahimi, 2006).

12. The contractor's remuneration fee in a buyback contract, as illustrated in Equation 1, is determined by a fixed percentage of capital costs, while adhering to the contract cost stop and the agreed-upon rate of return (ROR) specified in the contract (Shirai and Ebrahimi, 2006; Nikbakht Fini, Bagheri, and Ghorbani, 2018; Kakhaki, 2008).

$$\text{Remuneration}(R) = A \text{ (a fixed percentage agreed in the contract)} \times \text{Capex} \quad (1)$$

Figure 2 illustrates the legal framework of the buyback contract for oil and gas contracts.

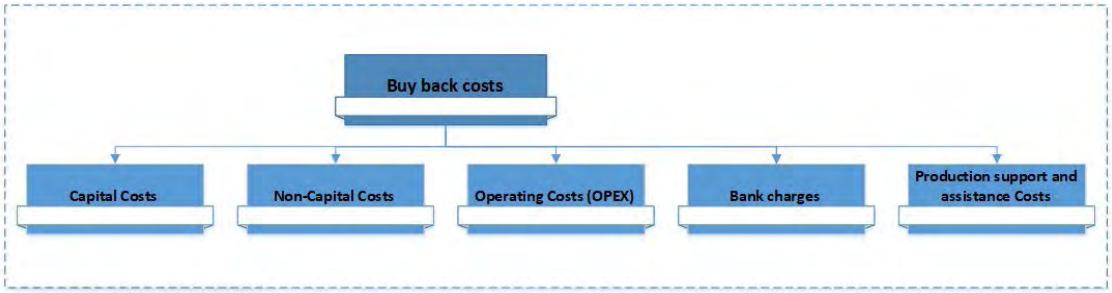

Figure 1

The buyback costs (Farimani, Mu, Sahebhonar, and Taherifard, 2020; Ebrahimi and Shahmoradi, 2017; Nikbakht Fini, Bagheri, and Ghorbani, 2018; Ghandi and Lawell, 2017; Shahri, 2010)

The initial phase in evaluating potential project risks is the identification of risks (Johnston, 2003). The assessment of the probability and impact of these risks on the project, on the other hand, is the essence of risk analysis (Johnston, 2003). The development of a management strategy, the determination of risk distribution, and the formulation of a plan to address risks in scenarios involving multiple parties are all part of the risk response process (Johnston, 2003). Risks can be classified qualitatively, quantitatively, or through a combination of both methods, employing specialized risk analysis software.

A contract is a formal commitment and agreement between two or more parties that delineates their responsibilities, liabilities, and obligations to one another (Johnston, 2003). In the event of a breach or failure to fulfill contractual obligations, parties are typically obligated by the terms of the contract under contract law and frequently reach an agreement on remedies for the innocent party (Johnston, 2003). Contractors who are involved in upstream petroleum contracts are exposed to significant risks that could potentially deter investments in certain countries or impact their assets by virtue of their high-risk nature. Nevertheless, it is imperative to identify and assess these risks as part of risk management when investing in countries that lack modern technologies, expertise, and resources.

The objective of this investigation is to identify the high-risk incidents that rendered Iran's oil buyback contract unappealing to investors, resulting in the implementation of the Iranian New Petroleum Contract (IPCs)[*]. It is crucial to emphasize that, despite the introduction of IPCs, buyback contracts remain valid in the Iranian legal system for exploration and development purposes, but not for operation periods. Numerous qualitative studies have been conducted and published on the contractual and legal aspects, as well as the similarities and differences, of petroleum buyback contracts with other types of contracts, including joint venture contracts, license contracts, production sharing contracts, and various service contracts worldwide. These studies have been conducted using library and document research. Nevertheless, no comprehensive

[*] The Iranian New Petroleum Contract, which is the fourth generation of petroleum buyback contracts, was implemented by the Iranian Cabinet of Ministers in 2016. This risk service contract was developed to promote foreign investment in Iran's oil industry. It provides greater flexibility in terms and conditions than previous buyback contracts, particularly in financial provisions such as the calculation of contractors' remuneration fees, the calculation and recovery of costs, and the manner of contractors' engagement in oil activities (including exploration, development, and exploitation).

and practical approach to the hazardous aspects of buyback contracts was adopted in any of these studies, which were conducted qualitatively. Several researchers have contributed to this topic, including Shirai and Ebrahimi (2006), Shahiri (2015), Ebrahimi and Shahmoradi (2017), Ghandi (2017), Soleimani and Tavakolian (2017), Asgharian (2017), Ghandi (2017), Nikbakht Fini, Bagheri, and Gorbani (2019), Farimani (2020), and Behdadnia and Ziyaee (2022). Nevertheless, none of these studies exhaustively and realistically address the high-risk events associated with buyback contracts.

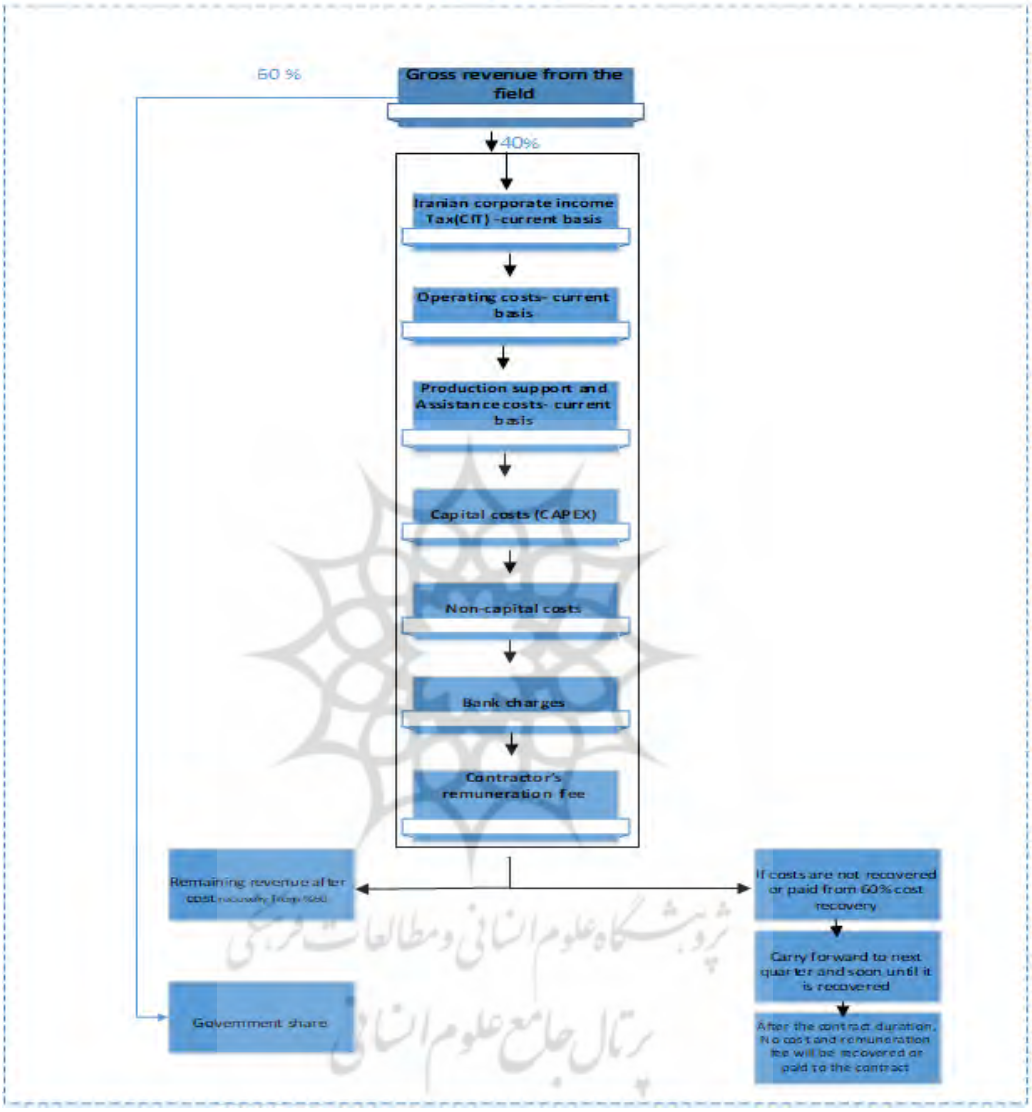

Figure 2

The legal framework of the buyback oil contract

Thus, the purpose of the current work is to address the current research gap by offering a comprehensive overview of upstream petroleum contracts and examining both contractual and non-contractual risky events of buyback from the contractor's perspective. The research employs a combination of quantitative methods and qualitative techniques, including library and documentary research. The study offers a practical comprehension of the risks associated with oil buyback contracts from the perspective of the contractors, thereby assisting them in understanding the potential risks associated with such agreements. This work undoubtedly serves as a catalyst for additional research on buyback contracts and provides valuable insights for both national and international contractors who are interested in collaborating with NIOC in buyback contracts.

2. Oil buyback risky events

Fifty experts from the Iranian oil and gas industry and contractors engaged in the buyback contract, who possess extensive knowledge of buyback risk events, were interviewed, and a detailed study was conducted to identify the risky events of Iran's oil buyback contract. Table 1 and Figure 3 provide a description of this statistical sample, which assisted in the identification of the primary risks associated with the non-completion of these contracts. Table 2 presents these risks. The data were maintained until the categories reached theoretical saturation, where it was impossible to acquire additional data.

Table 1

The demographic characteristics of the sample members

		Frequency	Percentage
Gender	Man	34	68%
	Woman	16	32%
Experience	10–15 years	18	36%
	16–20 years	19	38%
	More than 20 years	13	26%
Education	Master	31	62%
	Ph.D.	19	38%

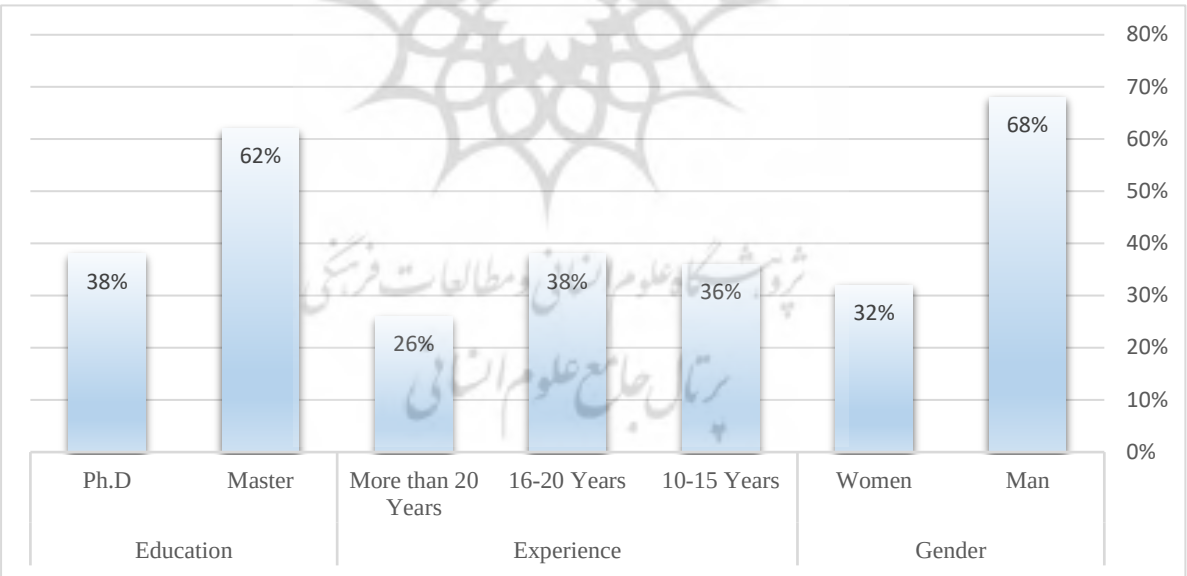

Figure 3

The frequency percentages of the demographic characteristics of the sample members

Table 2

Buyback risky events from the contractor's perspective

Criteria	Sub-criteria	Code
Political risky events	The interference of several governmental authorities in the signed contracts: The interference of some governmental agencies in signed contracts between the National Iranian Oil Company and contractors is a point of concern for some contractors due to the agencies' mission to protect national interests. These agencies play a key role in project implementation by carefully reviewing contract terms and suggesting improvements for the country's benefit. However, since oil industry investments require efficient time and financial resource management, some contractors may worry about project delays caused by detailed reviews and proposed changes. Therefore, balancing oversight processes and speeding up project execution can make investments more.	A1
	The contractor's fear of political violence (war, revolution, and rebellion) in Iran: Even though Iran is one of the safest countries in the world for investment, instability in some neighboring countries has made foreign investors worried about investing in the oil and gas industry in the region, including Iran. This has caused concerns about the possibility of insecurity spreading and threatening investors' assets, which is a major concern for investors.	A2
	The contractor's concern of nationalization, confiscation, and expropriation of their assets in Iran: The history of nationalization in Iran still makes some foreign companies worried even though those claims were resolved at that time. This history has made some contractors still concerned about the safety of their long-term investments in Iran despite the support and incentives offered after the Islamic Revolution to attract investment in the oil and gas industry. This is one of the factors that affects contractors' decisions to enter Iran's upstream oil and gas markets.	A3
	Non-conversion of currency due to political interests: the non-conversion of the required currency of the contractor by the host government agencies or prolonging the currency conversion path and creating restrictions on the transfer of profits from the project to abroad are contractor's concern.	A4
	Sanction: The negative consequences associated with this situation discourage foreign investors from investing their money in the sanctioned country. These consequences include the following: • The contractor may face restrictions in accessing the world markets for carrying out oil-related activities; • Obstacles arise in transferring funds to and from Iran, along with freezing the contractor's accounts and financial channels; • Challenges arise in transporting equipment to carry out the project under the conditions of the embargo.	A5
	Geopolitical tensions: Iran, as a key player in global energy security, has always emphasized cooperation with countries in the region and the international community, and has worked to maintain stability and security in the region. However, some geopolitical developments and imposed policies of international powers have affected economic interactions and foreign investment in Iran's oil industry without Iran having a major role in them. These conditions have caused concerns for foreign investors and have affected the process of attracting capital in this area.	A6
	Contract Termination/Cancellation: Despite the absence of such incidents in upstream oil contracts post-revolution, the cumulative experiences of contract terminations in the midstream and downstream sectors within Iran have engendered anxieties among some foreign contractors. This apprehension primarily revolves around the potential for alterations in contractual terms and their consequential impact on contractors' capital and concessions. Notwithstanding, Iran has consistently underscored its commitment to upholding contractual obligations and fostering a stable investment environment.	A7
	Public pressure on investors: The principle of a nation's sovereign right over its natural resources is a well-established tenet of international law. Consequently, it is natural for societies to exhibit heightened	A8

Criteria	Sub-criteria	Code
	sensitivity regarding the exploitation of these resources and the concessions granted to foreign investors. In numerous instances, a lack of comprehensive understanding concerning the intricacies of contractual agreements can lead to the perception of undue privileges being extended to foreign entities, potentially inciting social and media pressures. This phenomenon is particularly pronounced in African and Middle Eastern nations, including Iran, and poses a significant challenge for contractors. Therefore, the implementation of contractual transparency and the dissemination of accurate information are paramount in mitigating these concerns.	
	Joint oil and gas reserves with neighboring nations: The shared oil reserves between Iran and other countries present a challenge for contractors, as the possibility of border disputes with neighboring countries and a lack of detailed information regarding the properties of these reserves. The uncertainties surrounding these issues may create apprehension among contractors, leading them to hesitate in investing in Iran's collaborative oil reserves.	A9
	Joint Management Committee: The contractor is apprehensive about the possibility that some expenses accrued throughout the duration of the contract may not receive approval from the Joint Management Committee overseeing the contract.	B1
	Bank charges: The contractor is dissatisfied with the bank charges rate in buyback. The calculation of bank charges in a buyback scenario includes a fixed margin (usually 75%) in addition to a LIBOR rate, but the contractor deems the fixed margin to be insufficient and unfavorable.	B2
	Non-bankability of buyback: Buyback contracts are considered non-bankable which means that the contractor is incapable of securing loans or guarantees from domestic or global financial institutions or banks.	B3
	Cost recovery period: The buyback contract allows for a limited timeframe for the contractor to recover costs and receive payment for their services. In the initial generation, this period spans approximately seven years, while in subsequent generations, it is even shorter. It is important to note that there is a potential risk of not fully recovering the approved costs and remuneration of the contractor within the duration of the contract.	B4
Contractual risky events	Force majeure: If the contract is terminated due to force majeure before reaching the agreed final production point, NIOC has the obligation to exert all possible efforts to achieve the final agreed production point, either by itself or through another contractor. The contractor will be reimbursed for all oil costs incurred prior to the termination of the contract within a specified period from the termination date in the agreed event that the final production point is attained. However, even if the National Oil Company or its contractor fails to reach the agreed final production point within the specified period from the termination date, the reimbursement of oil costs will be postponed until the agreed final production point is reached. It is crucial to highlight that once the final production point is achieved, the National Oil Company's opex costs will be amortized first, followed by the contractor's costs.	B5
	Capability of capital costs: Because capital costs are capped in buyback contracts, this issue is not attractive for the contractor.	B6
	Fall in oil and gas prices: A decrease in oil and gas prices could result in a reduction in the project's earnings, potentially causing delays in the contractor's ability to recoup expenses and receive remuneration for their services rendered.	B7
	Non-commerciality of the field and insufficient production from the field: In numerous contracts involving both exploration and development, the contractor is obligated to undertake the exploration of the field at their own expense and assume the associated risks. This continues until the Joint Management Committee of the contract approves the commercial viability of the field. However, if the JMC does not grant approval for the field's commerciality, the contractor will not be entitled to any form of cost recovery or fee payment. The reimbursement of the contractor's approved costs and remuneration fee from the gross production of	B8

Criteria	Sub-criteria	Code
	the field (based on the ring-fencing principle) poses a potential risk in situations where there is inadequate production. This implies that there is a possibility that the fee and costs may not be fully recovered until the contract duration is completed.	
	Risk of production delays or production stoppages for various reasons: In the event that the production of a field is stopped or delayed due to various factors such as local community problems, negligence of subcontractors, ineffective management, or disputes, it can lead to a delay in the contractor receiving compensation and recovering approved expenses. Consequently, this may result in the contractor's funds (fees and recoverable costs) being blocked/immobilized and lead to the contractor's interests being jeopardized.	B9
	Payment: Buyback contracts stipulate that NIOC has the option to deliver oil or gas to the contractor as opposed to making cash payments for the compensation remuneration and recoverable costs. This arrangement may not be appealing to the contractor and could pose challenges in terms of selling and monetizing the oil or gas supplied by NIOC.	B10
	Weaknesses in the contractor's design or study of the field: Investing in a petroleum project can be a risky endeavor for contractors, as uncertainties in reservoir characteristics, field conditions, or design deficiencies can hinder the achievement of expected production levels. Additionally, failure to conduct comprehensive reservoir studies can further exacerbate these challenges. Consequently, such circumstances may result in a decline in petroleum production, causing a subsequent delay in the contractor's payments and potentially leading to a loss of their interest in the project. To illustrate, consider a scenario where the permeability of an oil field was initially measured at 20 milli-Darcy when the contract was signed. However, as the contract period progresses, the permeability drops to 10 milli-Darcy, significantly impacting production. Another example involves the unexpected discovery of sulfur crystals in a field, which not only increases investment costs but also leads to delays in the contractor's payments. These examples highlight the potential consequences that contractors may face when uncertainties and unforeseen challenges arise in petroleum projects.	B11
	Cost stop: The contractor's approved expenses and fee are recovered from a percentage of the excess oil production from the field, ranging from a minimum of 50% to 60%, as stipulated in the contractual agreement between the parties. In the event that the contractor's expenses and compensation are not paid during the initial quarter or period, they will be carried forward to the subsequent quarter or period, along with the bank charges. However, upon the conclusion or termination of the contract, the contractor will not receive any further fee, and no costs will be reimbursed to the contractor. Consequently, the contractor's capital will remain inactive, leading to a decrease in the contractor's profit and a decline in the rate of return of his investment. Furthermore, the contractor may find the third generation of buyback contract unappealing due to the requirement of obtaining approval from the contract JMC for all tender documents and results. This poses the risk of rejection of costs, and the uncertainty of unforeseen expenses throughout the contract duration is the contractor's concern.	B12
	The non-application of interest to the actual costs of subcontractors: The contractor reimburses the subcontractor for their actual costs without any additional profit or surplus. Reimbursement is done at cost, meaning the contractor directly pays the subcontractor according to the payment status settlement, without any profit margin included. Furthermore, NIOC does not allow for overtime or changes to the contractor's proposed price during the bidding process as it views these as outcomes of the contractor's risk management strategy.	B13
	Remuneration fee: The contractor's remuneration and expenses are determined based on the rate of return, which is subject to a cap in contracts. These contracts include Durood field at 16%, Bilal field at 17.8%, Soroush and Nowruz fields at 16.6%, Phases 4 and 5 of South Pars at 19%, and Yadavaran Square at 19.6%. If the ROR exceeds these percentages, the contractor will not receive any additional payment.	B14
	Huge capital and funding for upstream oil projects: Oil and gas upstream operations are known for their substantial capital demands and inherent risks. These activities necessitate significant financial investments	B15

Criteria	Sub-criteria	Code
	for the exploration and development of oil and gas projects, and only a few companies possess the capability to participate in this specific industry. The capital costs are fixed at the time of contract signing; however, any additional capital costs required for development operations must be covered by the foreign company. Non-capital and operating costs are not predetermined at contract signing and may surpass the contractor's initial estimate throughout the contract duration, thereby putting the contractor's interest at risk. Additionally, numerous contracts stipulate that the NIOC retains the authority to terminate the agreement if the contractor fails to furnish the necessary financial resources for the project.	
	Master development plan: In buyback contracts, the contractor is only allowed to revise its MDP or submit a new MDP during the contract period with written approval from NIOC. The MDP is typically based on data and information available at the time of preparation. If the contractor wishes to modify the MDP based on new information obtained during oil operations, approval from NIOC is necessary and any costs exceeding the capital costs must be borne by the contractor, potentially putting the contractor's interests at risk. Further, changes to the MDP or submitting new MDP during the contract term could result in project implementation delays and a decrease in the contractor's rate of return.	B16
	The agreed final production point: The contractor's costs must be repaid starting from the first day of the first month after reaching the agreed production point. Failing to repay the contractor before reaching the agreed production point is not the contractor's desired outcome. Some signed contracts may include a final production rate that is deemed unfavorable for the contractor. This is particularly problematic as contractors often lack sufficient information about the field conditions at the beginning of the contract. Consequently, this poses a significant risk for the contractor, further complicating their decision-making process. If the contractor fails to achieve the final production point agreed in the contract, no fee payment or cost recovery will be made. Also, a delay in achieving the first target production may result in a delay in fee payment or cost recovery and pose a threat to the contractor's financial interests as it will result in a blockage of its funds (fees and recoverable costs).	B17
	Decline in production: If there is a decline in production, the contractor's remuneration may be delayed, and the approved costs may be carried forward to the next quarter(s). This delay in payment and carry forward of costs can lead to a decrease in the ROR over time, impacting the contractor's overall earnings.	B18
	Lack of transparency of some laws in Iran: Similar to numerous countries globally, Iran also encounters legal challenges and a lack of transparency in certain laws and regulations, which can be a source of concern for investors. Although extensive efforts have been made to enhance and clarify laws, particularly in the realm of attracting and protecting foreign investment, certain implementation issues persist.	C1
Legal risky events	Local oppositions/adversaries: Local oppositions is a common issue in project implementation worldwide. Local communities, depending on the environmental, cultural, social, and economic conditions of the region, may have demands and expectations from the government and contractors. In some cases, oil projects are implemented on lands belonging to these communities, which can lead to challenges in the project's execution. Inadequate management of these issues can result in delays, increased costs, legal disputes, and even, in some instances, the complete cessation of the project. Therefore, effective engagement with local communities, consideration of their concerns, and implementation of corporate social responsibility policies can mitigate these challenges and facilitate smoother project execution.	C2
	Dispute resolution: In case of a dispute, both parties have agreed to utilize the arbitration procedure outlined in the contract, as stated in the IPC. The contractor faced difficulties due to the Iranian government's strict adherence to principle 139 of the Iranian constitution, which mandates approval of major international contracts by the Iranian parliament.	C3
	Changes in laws and regulations during the contract period and ratification of disruptive and contradictory laws and regulations in Iran: The change in numerous laws, regulations, and policies of the Iranian government, particularly in the domains of taxation, customs, and banking, has raised concerns for the foreign investor during the contract duration because it can affect the project execution by the contractor such as leading to project delays and ultimately reducing the contractor's rate of return. Moreover, during	C4

Criteria	Sub-criteria	Code
	the contract period, the contractor is concerned about the ratification of conflicting laws and regulations. For instance, the Central Bank of Iran may approve multiple implementing regulations that contradict the current Iranian laws and regulations.	
	The law of local content: The contractor is obligated to comply with Iran's local content law as required by NIOC, which raises concerns for the contractor.	C5
	Tax authorities: Dealing with Iranian tax authorities can be challenging due to the complexity of their system and bureaucratic procedures.	C6
	Lack of commitment to the laws and regulations: Laws and regulations are usually properly drafted and promulgated by the legislative branch, but their implementation is not fully and correctly executed due to certain inconsistencies or managerial weaknesses. This issue can create challenges for contractors and hinder project implementation. This challenge is observed in many countries worldwide and can affect the investment climate. Therefore, improving oversight of law enforcement and enhancing the efficiency of executive agencies can build greater confidence for investors and contractors, and facilitate project execution.	C7
Economic risky events	Changes in the market of oil and gas equipment and material: Alterations in various factors within the oil and gas markets can impact prices of oil equipment and finally the project costs.	D1
	Inability of NIOC to pay the contractor's fee or approved reimbursable costs: The inability of NIOC to fulfill the contractor's fee or approved reimbursable costs was a concern for contractors in buyback contracts due to sanctions. To address this and protect investors, the Iranian government introduced IPC contracts, where the contractor's remuneration is tied to oil production, and instead of direct payment, oil is sold to them. However, this issue can exist in most countries and is easily manageable, as will be addressed in the recommendations section. This may arise due to various factors; for example, Iranian government or NIOC might encounter limitations in selling oil and gas to offset the contractor's fee and recover the approved costs throughout the contract period. As a result, the only feasible option left is to offer the contractor oil or gas instead of cash payments. However, this presents a predicament for the contractor as the sale of oil and gas from Iran has proved to be challenging due to sanctions or other obstacles.	D2
	Exchange rate fluctuations: Contractors in Iran face the risk of exchange rate fluctuations, which indirectly impact their operations. Due to fluctuating exchange rates, construction companies often have to pay significantly higher prices when purchasing goods domestically. The calculation of these costs in Iranian Rial is based on the exchange rate set by the Iranian central banking system. However, when it comes to payment, the contractor receives the amount in the local currency, resulting in a loss due to currency exchange. Additionally, the contractor has to bear the burden of the exchange rate wage, further increasing their risk.	D3
	Fluctuation in the interest rate: Due to the substantial capital required for oil and gas upstream projects, contractors often seek loans from international agencies. However, the fluctuation of interest rates poses a significant concern for contractors.	D4
	Fluctuations in global oil and gas prices: Fluctuations in global oil and gas prices can have adverse effects on project revenues, potentially causing a decrease and delaying the payment of the contractor's remuneration and approved costs. This situation can significantly impact the contractor's interests. Further, it should be noted that the underperformance and inefficiency of oil equipment combined with the volatility of the oil and gas services and equipment market in Iran pose significant challenges for the contractor.	D5
	Persistent and unpredictable inflation in Iran and the world: The contractor's expenses are subject to persistent and unpredictable inflation in Iran and the world, resulting in a delay in cost coverage and immobilization of the contractor's interests.	D6

Criteria	Sub-criteria	Code
Management risky events	The risk of OPEC member countries' quota system: OPEC member countries face a significant risk through the quota system. This system poses challenges and uncertainties, potentially impacting the contractor's interests. This system leads to a decline in oil sales, which ultimately leads to a decrease in oil revenues and a delay in the payment of the contractor's remuneration and approved costs, thereby blocking the contractor's interests.	D7
	Clean energy: As a result of the lower costs and environmental advantages, countries are increasingly shifting toward renewable energy sources instead of relying on fossil fuels. This transition has also attracted investors displaying a greater willingness to invest in clean energy rather than conventional fossil fuels like oil and gas.	D8
	The instability of the project management team: One of the fundamental principles of the PMBOK is the stability of the employer team, which fluctuates with changes in the government. The instability of the project management team can lead to the cancellation of several contracts or the postponement of their implementation. Such cancellations/terminations not only directly impact the involved contractors, but also cast a negative perception on other contractors.	E1
	Contract approval by various entities such as the Economic Council: The approval of upstream contracts is a responsibility shared among various entities, one of which is the Economic Council. Nevertheless, there have been instances where contracts have been signed but are still awaiting approval from the Economic Council.	E2
	The number of government agencies involved: In numerous countries globally, the execution of large-scale national projects necessitates coordination with diverse governmental entities, which can amplify the complexity of implementation processes and escalate costs for contractors. This challenge is also prevalent in Iran's oil and gas industry, where the multiplicity of decision-making authorities and bureaucratic procedures can protract project timelines and augment expenditures. While recent endeavors have aimed to streamline these processes and alleviate administrative hurdles, the complete resolution of this issue could significantly enhance the investment climate and augment the attractiveness of Iranian oil and gas projects to contractors.	E3
	The inflexibility of NIOC managers toward contractors: Managers are expected to be adaptable and resolve any issues amicably during the contract period. However, there have been instances where NIOC managers have displayed inflexibility, resulting in numerous problems for the contractor.	E4
	The Iranian government's bureaucratic system: The Iranian governmental bureaucratic system, akin to many other nations with state-controlled oil industries, is characterized by a tendency among officials to defer decisions to obtain requisite approvals, driven by a desire to mitigate personal risks. This inherently time-consuming process may not be satisfactory to all contractors. Iran is no exception to this paradigm, thereby mandating innovative management approaches for the effective and efficient administration of this process.	E5
	Corruption/Rent: Corruption and rent-seeking, phenomena ubiquitous to varying degrees across the globe, are not absent in Iran. While these practices can accrue substantial benefits to individuals, they concurrently pose concerns that impede operational efficacy and efficiency. Such practices include illicit payments to expedite processes or the appointment of unqualified personnel through patronage. These issues can inflict financial detriment upon contractors. However, it must be acknowledged that these challenges are pervasive globally, with variations primarily in the degree of oversight and control.	E6
	Lack of commitment to the work: The contractor might face obstacles in obtaining permits and dealing with other matters due to the lack of commitment from the senior executives of the employer toward their responsibilities.	E7
	Lack of expertise: A dearth of expertise was particularly pronounced in pre- and early post-revolutionary Iran. While the last two decades have witnessed improvements with the induction of expert and elite	E8

Criteria	Sub-criteria	Code
Insignificant contractual risky events	managers into the Iranian oil industry, this issue is not fully resolved. The training of young, specialized personnel with contemporary knowledge will effectively address this concern in the near future. The contractor could encounter numerous challenges as a result of the inadequate expertise of the technical staff of the employer and the consultants from NIOC.	
	Penalty: The contract does not include any provisions for imposing monetary penalties on NIOC if the contractor's remuneration and expenses are not paid or if there is a delay in payment by NIOC to the contractor.	F1
	Approval of project execution standards: It is the responsibility of the National Oil Company to approve the standards for the contract obligations. Failure to obtain approval from the National Oil Company in a timely manner may lead to significant costs and expenses and may decrease the contractor's rate of return. In such cases, any changes to the contract specification must be submitted to the Joint Management Committee for approval. Failure to obtain approval can create difficulties for the contractor. Additionally, this process can result in excessive bureaucracy and be detrimental to the contractor's interests. It is important to highlight those certain technical decisions, requiring prompt action to prevent the contractor from incurring unnecessary costs.	F2
	Contract cancellation: In the event that NIOC cancels the contract due to the contractor's negligence, the contractor will not receive any remuneration fee, and their expenses will not be deducted. However, the oil activity will then be carried out by either the National Oil Company or another contractor. Once the development phase is completed and the agreed final production point is reached, the contractor will receive payment for oil costs and its remuneration fee until the cancellation date. This payment will be made from the income generated from the field, while adhering to the capital cost ceiling and the ceiling for reimbursement of the contractor's expenses and remunerations fee (typically 50%–60% of the field's gross revenue). It is important to note that there is a risk of the contractor or the employer not completing the development operation for several years, resulting in dormant capital.	F3
	Auditing: The contractor is responsible for the financial management of the project and must maintain accurate project accounts in accordance with international accounting principles. This is necessary to obtain audit approval from NIOC. If the contractor fails to meet these requirements, it is possible that the auditor from the NIOC may not accept a portion of the project costs during the audit.	F4
	Delivery of the contract area: Delays in delivering the contract area to the contractor due to various reasons can lead to delays in starting field operations, ultimately reducing the contractor's rate of return. Additionally, there is a risk that the contractor could not recover or receive any costs and remuneration after the end of contract period.	F5
	Foreign personnel: According to the IPC guidelines, the contractor must hire foreign personnel for positions where an Iranian contractor is not available. Furthermore, if the contractor plans to use foreign personnel for contract-related tasks, prior approval of the National Iranian Oil Company is necessary. If non-Iranian personnel are employed in an organizational role, they must be replaced by qualified Iranian personnel as soon as a suitable candidate is identified for the position in question.	F6
	Performance guarantee: Some contractors may encounter difficulties in preparing and submitting the required guarantee, such as a performance guarantee, parent company guarantee, or other approved guarantees, as mandated by the National Iranian Oil Company. Consequently, the execution of the contract may be suspended or postponed until the guarantee is submitted to NIOC.	F7
	Oil operations: In the development phase, IOC is required to form a joint operating agreement with an Iranian company approved by the National Oil Company. Both companies hold individual and joint responsibilities to the NIOC as partners in this JOA. The actual field exploitation is conducted by an Iranian company approved by the Iranian oil company, with the contractor bearing the responsibility. However, partnering with an Iranian company lacking financial resources, skilled personnel, and equipment poses a	F8

Criteria	Sub-criteria	Code
	significant risk to the contractor, potentially jeopardizing their interests due to obligations of the NIOC, making it an undesirable situation for the contractor.	
Environmental risky events	Local protests: Environmental-related local protests have the potential to temporarily halt operations, causing delays in oil production implementation. Such delays result in postponing cost recovery and bonus payments to the contractor.	G1
	Insufficient knowledge of the contract area: Lack of knowledge about the contract area and failure to comply with environmental regulations can lead to environmental hazards, prompting legal and administrative authorities to suspend work, thereby ultimately putting the contractor's interests at risk.	G2
	Weather: Some of Iran's oil and gas fields are situated in regions with harsh weather conditions, posing a threat to the contractor's interests and making the field less appealing.	G3
	Wildlife regulations: Ensuring compliance with wildlife regulations is a significant concern for the contractor.	G4

The results of the third round of the Delphi process are presented in Table 3.

Table 3

The third round of the Delphi process of the buyback risky events

Symbol	First Delphi average	Secondary Delphi average	Third Delphi average	Standard deviation	Completely disagree	Disagree	Neither agree nor disagree	Agree	Completely agree
A1	3.88	4.16	4.24	0.591	0%	0%	8%	60%	32%
A2	3.76	4.08	4.16	0.548	0%	0%	8%	68%	24%
A3	3.56	3.86	3.92	0.634	0%	0%	24%	60%	16%
A4	3.88	4	4.08	0.488	0%	0%	8%	76%	16%
A5	4.16	4.36	4.44	0.644	0%	0%	8%	40%	52%
A6	2.76	2.56	2.44	0.760	16%	24%	60%	0%	0%
A7	2.76	2.56	2.44	0.760	16%	24%	60%	0%	0%
A8	2.82	2.66	2.72	0.730	8%	20%	64%	8%	0%
A9	2.40	2.32	2.32	0.741	16%	36%	48%	0%	0%
B1	4.08	4.20	4.20	0.700	0%	0%	16%	48%	36%
B2	3.54	3.68	3.68	0.621	0%	0%	40%	52%	8%
B3	3.84	4	4.04	0.832	0%	0%	32%	32%	36%
B4	3.68	3.76	3.84	0.548	0%	0%	24%	68%	8%
B5	3.90	4	4.08	0.488	0%	0%	8%	76%	16%
B6	3.82	3.86	3.92	0.488	0%	0%	16%	76%	8%
B7	4.16	4.30	4.40	0.495	0%	0%	0%	60%	40%
B8	4.04	4.22	4.28	0.454	0%	0%	0%	%72	28%
B9	4.14	4.30	4.40	0.639	0%	0%	8%	44%	48%
B10	3.82	3.98	4	0.571	0%	0%	16%	68%	16%

Symbol	First Delphi average	Secondary Delphi average	Third Delphi average	Standard deviation	Completely disagree	Disagree	Neither agree nor disagree	Agree	Completely agree
B11	3.60	3.54	3.60	0.639	0%	0%	48%	44%	8%
B12	3.76	3.76	3.84	0.548	0%	0%	24%	68%	8%
B13	3.82	4	4.04	0.669	0%	0%	20%	56%	24%
B14	4.02	3.90	4.08	0.488	0%	0%	8%	76%	16%
B15	3.46	3.44	3.52	0.505	0%	0%	48%	52%	40%
B16	3.70	3.82	3.92	0.752	0%	0%	32%	44%	24%
B17	3.98	4.06	4.16	0.681	0%	0%	16%	52%	32%
B18	4.12	4.20	4.28	0.536	0%	0%	4%	64%	32%
C1	3.36	3.60	3.64	0.802	0%	0%	56%	24%	20%
C2	3.80	3.94	3.92	0.488	0%	0%	16%	76%	8%
C3	4.04	4.04	4.12	0.773	0%	0%	24%	40%	36%
C4	4.16	4.24	4.44	0.501	0%	0%	0%	56%	44%
C5	3.76	4	4.08	0.488	0%	0%	8%	76%	16%
C6	4	4.14	4.20	0.404	0%	0%	0%	80%	20%
C7	3.04	2.88	2.76	0.916	16%	8%	60%	16%	0%
D1	4.08	4.32	4.32	0.471	0%	0%	0%	68%	32%
D2	3.84	4.08	4.08	0.488	0%	0%	8%	76%	16%
D3	3.64	3.72	3.72	0.607	0%	0%	36%	56%	8%
D4	4.04	4.10	4.20	0.495	0%	0%	4%	72%	24%
D5	3.76	3.92	3.92	0.634	0%	0%	24%	60%	16%
D6	4.20	4.44	4.44	0.644	0%	0%	8%	40%	52%
D7	2.60	2.46	2.44	0.644	8%	40%	52%	0%	0%
D8	2.38	2.38	2.40	0.756	16%	28%	56%	0%	0%
E1	3.58	3.80	3.80	0.808	0%	0%	44%	32%	24%
E2	3.32	3.56	3.60	0.495	0%	0%	40%	60%	32%
E3	4.30	4.34	4.40	0.639	0%	0%	8%	44%	48%
E4	3.80	4.28	4.28	0.671	0%	0%	12%	48%	40%
E5	3.70	4.06	4.08	0.752	0%	0%	24%	44%	32%
E6	3.10	2.86	2.80	0.756	8%	16%	64%	12%	0%
E7	2.46	2.26	2.28	0.730	16%	40%	44%	0%	0%
E8	2.36	2.30	2.28	0.730	16%	40%	44%	0%	0%
F1	3.26	3.66	3.64	0.693	0%	8%	24%	64%	4%
F2	3.90	4.08	4.08	0.634	0%	0%	16%	60%	24%
F3	3.94	4.30	4.32	0.471	0%	0%	0%	68%	32%
F4	4.08	4.12	4.24	0.591	0%	0%	8%	60%	32%

Symbol	First Delphi average	Secondary Delphi average	Third Delphi average	Standard deviation	Completely disagree	Disagree	Neither agree nor disagree	Agree	Completely agree
F5	3.60	3.92	3.92	0.488	0%	0%	16%	76%	8%
F6	3.74	3.96	4	0.404	0%	0%	8%	84%	8%
F7	3.52	3.84	3.84	0.548	0%	0%	24%	68%	8%
G1	3.54	3.72	3.84	0.548	0%	0%	24%	68%	8%
G2	3.72	4.24	4.24	0.431	0%	0%	0%	76%	24%
G3	3.04	3.58	3.64	0.631	0%	0%	44%	48%	8%
G4	3.2	2.82	2.76	0.591	8%	8%	84%	0%	0%

The contractor's perspective on the risks associated with buyback contracts is supported by the results of the third round of the Delphi process, which reveal the existence of numerous significant sub-criteria. The anticipated threshold of 70%, which is equivalent to 3.5 on a 5-point Likert scale utilized in this investigation, was not met by the following sub-criteria: A6, A7, A8, A9, C7, D7, D8, E6, E7, E8, and G4. This led to their exclusion, and they will be removed from our statistical analysis; alternative subcriteria were subsequently approved. The results of the Kendall coefficient in the third round of the Delphi method for the sub-criteria associated with the risks of buyback contracts are illustrated in Table 4. The Kendall coefficient is currently 0.820, surpassing the threshold of 0.5, indicating a favorable level of agreement. Furthermore, the Kendall coefficient's statistical significance is verified by the significance test.

Table 4

The Kendal coefficient of the third Delphi

N	50
Kendall's Wa	0.820
Chi-square	81.989
Df	49
P-value	0.000

Source: Research finding

Suppose $\tilde{P}_{ij}$ be a collection of decision makers' preferences regarding a particular index in comparison to other indices. The matrix of pairwise comparisons is formed as given in Equation 2:

$$\tilde{\boldsymbol{A}} = \begin{bmatrix} \mathbf{1} & \tilde{P}_{12} & \tilde{P}_{1n} \\ \tilde{P}_{21} & \mathbf{1} & \tilde{P}_{2n} \\ \tilde{P}_{n1} & \tilde{P}_{n2} & \mathbf{1} \end{bmatrix} \quad (2)$$

The number of contiguous elements in each row is represented by symbol *n*. Equation 3 is employed to determine the geometric mean of the fuzzy comparisons between index I and each index (Hsieh, Lu, and Tzeng, 2004). The fuzzy weight of index I is subsequently expressed as a triangular fuzzy number, as determined by Equation 4. Upon completion of the fuzzy weighting factors computation, the weights are dephased and subsequently normalized using Equation 5. It is necessary to divide the total sum of non-phase weights by each non-phase weight to achieve normalization. The subsequent results were obtained

through the application of the fuzzy AHP method in this study. The primary research factors were identified and validated during the Delphi phase. In this stage, criteria were evaluated pairwise and presented to 50 experts from the Essay Statistical Society. The weight in pairwise comparisons was determined using AHP fuzzy numbers and verbal expressions from Table 5.

Table 5

Verbal expressions and corresponding AHP fuzzy numbers to score criteria (Patil and Kant, 2014)

Code	Criteria	Fuzzy equivalent of priorities		
		Lower level	**Medium**	**Upper level**
1	Equal important	1	1	1
2	Equal-to-relatively-more important	1	2	3
3	Relatively more important	2	3	4
4	Relatively-more-important than very important	3	4	5
5	Highly important	4	5	6
6	Highly-to-extremely important	5	6	7
7	Extremely important	6	7	8
8	Extremely important to absolutely more important	7	8	9
9	Absolutely more important	8	9	10

After the pairwise comparisons were completed, the inconsistency ratios of the matrices were calculated and they were all less than 0.1. This indicated that the pairwise comparisons were consistent and reliable. Subsequently, the geometric mean technique was implemented to consolidate and amalgamate the responses. Additionally, the geometric mean method was employed to determine the weights of the pairwise comparisons. Utilizing a fuzzy spectrum spanning from 1 to 9, the pairwise comparisons of buyback indicators were conducted, as illustrated in Table 6.

Table 6

Pairwise comparisons of the buyback indices at a discordance rate of 0.06

	A	**B**	**C**	**D**	**E**	**F**	**G**
A	(1,1,1)	(1.289,1.789,2.378)	(1.023,1.373,1.856)	(1.528,2.088,2.861)	(1.014,1.412,1.97)	(1.933,2.651,3.575)	(1.493,1.96,2.449)
B	(0.421, 0.559, 0.776)	(1,1,1)	(1.272,1.701,2.273)	(1.2,1.654,2.229)	(1.12,1.492,1.989)	(1.338,1.748,2.225)	(1.73,2.248,2.851)
C	(0.539, 0.728, 0.978)	(0.440,0.588,0.786)	(1,1,1)	(1.444,2.04,2.797)	(1.187,1.552,2,003)	(1.368,1.868,2.545)	(1.166,1.662,2.326)
D	(0.35, 0.479, 0.654)	(0.449,0.605,0.833)	(0.358,0.490,0.629)	(1,1,1)	(1.344,1.755,2.309)	(1.399,1.835,2.455)	(1.013,1.381,1.898)
E	(0.508,0.708,0.987)	(0.503,0.670,0.893)	(0.499,0.644,0.842)	(0.433,0.57,0.744)	(1,1,1)	(1.347,1.845,2.467)	(1.158,1.544,2.014)
F	(0.28,0.377,0.517)	(0.449,0.572,0.747)	(0.393,0.535,0.731)	(0.407,0.545,0.715)	(0.405,0.542,0.742)	(1,1,1)	(1.411,1.959,2.586)
G	0.408,0.510,0.67)	(0.351,0.445,0.578)	(0.43,0.602,0.858)	(0.527,0.724,0.987)	(0.497,0.647,0.864)	(0.387,0.51,0.709)	(1,1,1)

Equations 3 and 4 are employed to calculate the geometric mean of the fuzzy numbers for each row in Table 8 during the fuzzy weights and normalization calculation procedure.

$$\tilde{r}_i = \left(\prod_{j=1}^{n} \tilde{P}_{ij}\right)^{1/n} \quad i = 1,2,3,\dots,n \tag{3}$$

$$w_i = r_i \otimes (r_1 \oplus r_2 \oplus \dots \oplus r_m)^{-1} \tag{4}$$

The fuzzy weight is derived by dividing each geometric mean obtained by the total sum of all geometric means in accordance with Equation 5.

$$w_{crisp} = \frac{l + 2m + u}{4} \tag{5}$$

In order to remove the fuzziness from each fuzzy weight and achieve normalization, the defuzzified weight is divided by the total sum of all defuzzified weights. The second column of Table 7 displays the results of the similar calculations performed on the remaining rows. The geometric mean values of these results are then added, obtaining 3.123, 4.021, and 5.167. The fuzzy weighting for each criterion is determined by dividing the geometric mean of the row corresponding to the criterion by the sum of all geometric means. Equation 6 is employed to perform this calculation for criterion A.

$$Fuzzy\ Weight\ for\ A = \frac{(1.303,1.686,2.151)}{(5.711,7.404,9.575)} = (0.136,0.228,0.377) \tag{6}$$

The same procedures as those depicted in the third column of Table 7 are used to determine the weights for each criterion. Subsequently, Equation 7 is employed to defuzzify each weight.

$$Fuzzy\ Weight\ for\ A = (0.136,0.228,0.377) => Defuzzified\ Weight\ for\ A$$
$$= \frac{0.136 + 2 \times 0.228 + 0.377}{4} = 0.242 \tag{7}$$

The defuzzified weights for all criteria are obtained by repeating the procedure. The fourth column of Table 7 lists these weights. Equation 8 is employed to divide each defuzzified weight by the sum of all defuzzified weights in order to normalize the weights.

$$Defuzzified\ Weight\ for\ A = 0.242 ==> normal\ weight\ of\ A$$
$$= \frac{0.242}{0.242 + 0.192 + 0.177 + 0.142 + 0.128 + 0.097 + 0.09} = 0.227 \tag{8}$$

Table 7

Fuzzy and non-fuzzy weight of the buyback indices

Criteria	Geometric mean ($\left(\prod_{j=1}^{n} \tilde{P}_{ij}\right)^{1/n}$)	Fuzzy weight ($\widetilde{W}$)	De-fuzzy weight	Normal weight
A	(1.288,1.679,2.158)	(0.135,0.226,0.375)	0.241	0.226
B	(1.075,1.373,1.747)	(0.113,0.185,0.304)	0.197	0.185
C	(0.94,1.228,1.588)	(0.099,0.166,0.276)	0.177	0.166
D	(0.726,0.936,1.222)	(0.076,0.126,0.213)	0.135	0.127
E	(0.704,0.905,1.155)	(0.074,0.122,0.201)	0.130	0.122
F	(0.528,0.679,0.873)	(0.55,0.092,0.152)	0.098	0.092
G	(0.484,0.613,0.795)	(0.051,0.083,0.138)	0.089	0.083

$$\sum\left(\prod_{j=1}^{n}\tilde{P}_{ij}\right)^{1/n} \qquad (5.747,7.415,9.538)$$

Figure 4 illustrates that the criterion labeled "political risky events" holds the greatest position in the ranking, with a weight of 0.226. "Significant contractual risky events" is the second-place criterion, with a weight of 0.185, following closely behind. The criterion "legal risky events" is ranked third and has a weight of 0.166. The criterion "economic risky events" is ranked fourth with a weight of 0.127, while "management risky events" is ranked fifth.

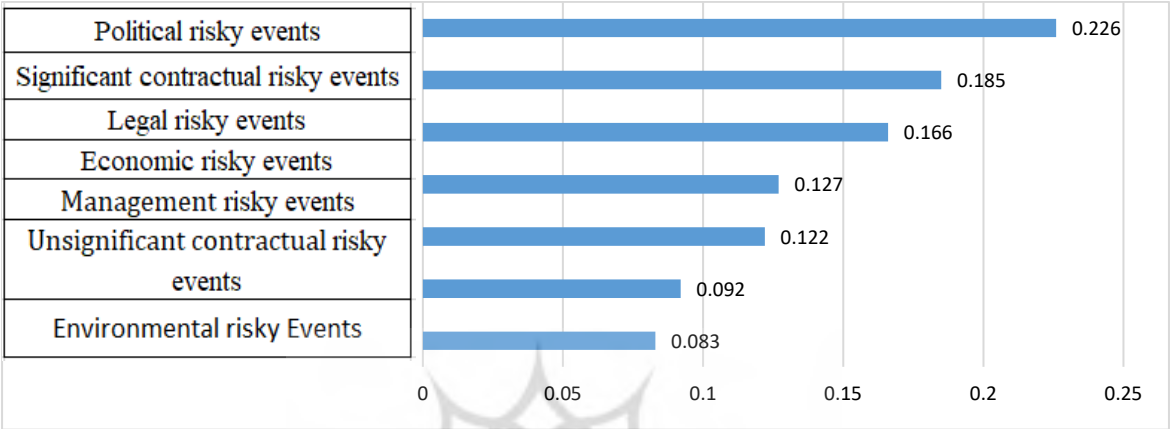

Figure 4

Weights of the buyback indices

The TOPSIS method is implemented to ascertain the final score and ranking of the criteria. Huang and Yun introduced this method in 1981 (Patil and Kant 2014). The fuzzy TOPSIS method commences with the development of a decision matrix predicated by Equation 9.

$$\tilde{D} = \begin{bmatrix} \tilde{x}_{11} & \tilde{x}_{12} & \cdots & \tilde{x}_{1n} \\ \tilde{x}_{21} & \tilde{x}_{22} & \cdots & \tilde{x}_{2n} \\ \vdots & \vdots & \ddots & \vdots \\ \tilde{x}_{m1} & \tilde{x}_{m2} & \cdots & \tilde{x}_{mn} \end{bmatrix} \quad i = 1,2,\dots,m;\ j = 1,2,\dots,n \qquad (9)$$

The matrix consists of a single row containing 50 buyback indices and a column containing 50 experts who evaluate each criterion using Table 8.

Table 8

Verbal expressions and corresponding TOPSIS fuzzy numbers to score criteria (Patil and Kant, 2014)

Code	Criteria	Fuzzy equivalent of priorities		
		Upper limit (U)	Medium (M)	Low limit (L)
1	Very low	3	1	1
2	Low	5	3	1
3	Average	7	5	3
4	Much	9	7	5
5	Very much	11	9	7

The evaluations are subsequently transformed into fuzzy numbers, which leads to the construction of a fuzzy decision matrix, as illustrated in Table 9.

Table 9

Fuzzy TOPSIS decision matrix

	Expert 1	**Expert 2**	**Expert 3**	**…**	**Expert 48**	**Expert 49**	**Expert 50**
A1	(3,5,7)	(5,7,9)	(3,5,7)	…	(3,5,7)	(7,9,11)	(5,7,9)
A2	(5,7,9)	(7,9,11)	(5,7,9)	…	(1,3,5)	(5,7,9)	(3,5,7)
A3	(5,7,9)	(1,3,5)	(5,7,9)	…	(5,7,9)	(1,1,3)	(1,3,5)
A4	(5,7,9)	(5,7,9)	(5,7,9)	…	(3,5,7)	(1,3,5)	(1,3,5)
A5	(1,1,3)	(5,7,9)	(1,1,3)	…	(7,9,11)	(5,7,9)	(3,5,7)
…	…	…	…	…	…	…	…
G1	(5,7,9)	(7,9,11)	(7,9,11)	…	(5,7,9)	(5,7,9)	(5,7,9)
G2	(5,7,9)	(1,3,5)	(3,5,7)	…	(1,3,5)	(5,7,9)	(1,1,3)
G3	(7,8,11)	(5,7,9)	(5,7,9)	…	(1,3,5)	(5,7,9)	(3,5,7)

The decision matrix in Table 9 is normalized using Equations 10 and 11:

$$\tilde{R} = \left[\tilde{r}_{ij}\right]_{m\times n} \tag{10}$$

$$\tilde{r}_{ij} = \left(\frac{a_{ij}}{c_j^*}, \frac{b_{ij}}{c_j^*}, \frac{c_{ij}}{c_j^*}\right) \; and \;\; c_j^* = \max_i c_{ij} \tag{11}$$

We will analyze the normalization of element A11, which represents the intersection of criterion A1 and expert 1. At the outset, we ascertain the maximum value (upper limit) of the fuzzy numbers in the column of expert 1, which is 11 in this instance. Consequently, Equation 12 is implemented to divide each fuzzy number in the column of expert 1 by 11.

$$A_{11}^{Normal} = \frac{(3,5,7)}{11} = (0.273,0.455,0.636) \tag{12}$$

The normalized decision matrix is presented in Table 10.

Table 10

The fuzzy TOPSIS normal matrix

	Expert 1	**Expert 2**	**Expert 3**	**….**	**Expert 48**	**Expert 49**	**Expert 50**
A1	(0.273,0.455,0.636)	(0.455,0.636,0.818)	(0.273,0.455,0.636)	....	(0.273,0.455,0.636)	(0.636,0.818,1)	(0.455,0.636,0.818)
A2	(0.455,0.636,0.818)	(0.636,0.818,1)	(0.455,0.636,0.818)	....	(0.091,0.273,0.455)	(0.455,0.636,0.818)	(0.273,0.455,0.636)
A3	(0.455,0.636,0.818)	(0.091,0.273,0.455)	(0.455,0.636,0.818)	....	(0.455,0.636,0.818)	(0.091,0.091,0.273)	(0.091,0.273,0.455)
A4	(0.455,0.636,0.818)	(0.455,0.636,0.818)	(0.455,0.636,0.818)	....	(0.273,0.455,0.636)	(0.091,0.273,0.455)	(0.091,0.273,0.455)
A5	(0.091,0.091,0.273)	(0.455,0.636,0.818)	(0.091,0.091,0.273)	....	(0.636,0.818,1)	(0.455,0.636,0.818)	(0.273,0.455,0.636)

	Expert 1	Expert 2	Expert 3	….	Expert 48	Expert 49	Expert 50
….	….	….	….	….	….	….	….
G1	(0.455,0.636,0.818)	(0.636,0.818,1)	(0.636,0.818,1)	....	(0.455,0.636,0.818)	(0.455,0.636,0.818)	(0.455,0.636,0.818)
G2	(0.455,0.636,0.818)	(0.091,0.273,0.455)	(0.273,0.455,0.636)	....	(0.091,0.273,0.455)	(0.455,0.636,0.818)	(0.091,0.091,0.273)
G3	(0.636,0.727,1)	(0.455,0.636,0.818)	(0.455,0.636,0.818)	....	(0.091,0.273,0.455)	(0.455,0.636,0.818)	(0.273,0.455,0.636)

In this stage, we obtain the weighted normalized matrix values using Equations 13 and 14:

$$\widetilde{V} = \left[\tilde{v}_{ij}\right]_{m\times n} \quad i = 1,2,\dots,m \;\; j = 1,2,\dots,n \tag{13}$$

$$\tilde{v}_{ij} = \tilde{r}_{ij}.\widetilde{w}_j \tag{14}$$

where $\widetilde{w}_j$ represents the importance of the experts, equaling 0.033; it is then multiplied by the corresponding column of each expert in the normalized matrix. Table 11 lists the results.

Table 11

The result of the weighted normalized matrix

	Expert 1	Expert 2	Expert 3	….	Expert 48	Expert 49	Expert 50
A1	(0.009,0.015,0.021)	(0.015,0.021,0.027)	(0.009,0.015,0.021)	....	(0.009,0.015,0.021)	(0.021,0.027,0.033)	(0.015,0.021,0.027)
A2	(0.015,0.021,0.027)	(0.021,0.027,0.033)	(0.015,0.021,0.027)	....	(0.003,0.009,0.015)	(0.015,0.021,0.027)	(0.009,0.015,0.021)
A3	(0.015,0.021,0.027)	(0.003,0.009,0.015)	(0.015,0.021,0.027)	....	(0.015,0.021,0.027)	(0.003,0.003,0.009)	(0.003,0.009,0.015)
A4	(0.015,0.021,0.027)	(0.015,0.021,0.027)	(0.015,0.021,0.027)	....	(0.009,0.015,0.021)	(0.003,0.009,0.015)	(0.003,0.009,0.015)
A5	(0.003,0.003,0.009)	(0.015,0.021,0.027)	(0.003,0.003,0.009)	....	(0.021,0.027,0.033)	(0.015,0.021,0.027)	(0.009,0.015,0.021)
….	….	….	….	….	….	….	….
G1	(0.015,0.021,0.027)	(0.021,0.027,0.033)	(0.021,0.027,0.033)	....	(0.015,0.021,0.027)	(0.015,0.021,0.027)	(0.015,0.021,0.027)
G2	(0.015,0.021,0.027)	(0.003,0.009,0.015)	(0.009,0.015,0.021)	....	(0.003,0.009,0.015)	(0.015,0.021,0.027)	(0.003,0.003,0.009)
G3	(0.021,0.024,0.033)	(0.015,0.021,0.027)	(0.015,0.021,0.027)	....	(0.003,0.009,0.015)	(0.015,0.021,0.027)	(0.009,0.015,0.021)

We proceed to identify the positive and negative ideals by employing Equations 15–17 after acquiring the weighted normalized matrix.

$$A^{+} = (\tilde{v}_1^*, \tilde{v}_2^*, \dots, \tilde{v}_n^*) \; where \; \tilde{v}_j^* = \left(\tilde{c}_j^*, \tilde{c}_j^*, \tilde{c}_j^*\right) \; and \; \tilde{c}_j^* = \max_i\left\{\tilde{c}_{ij}\right\} \tag{15}$$

$$A^{+} = (\tilde{v}_1^*, \tilde{v}_2^*, \dots, \tilde{v}_n^*) \; where \; \tilde{v}_j^* = \left(\tilde{c}_j^*, \tilde{c}_j^*, \tilde{c}_j^*\right) \; and \; \tilde{c}_j^* = \max_i\left\{\tilde{c}_{ij}\right\} \tag{16}$$

$$\forall i = 1,2,\dots,m; \quad j = 1,2,\dots,n \tag{17}$$

The negative ideal is represented by the lowest value in the first element of every criterion's column in the weighted normalized matrix, while the positive ideal is represented by the highest value in the third element of every criterion's column (Table 12).

Table 12

The ideals of fuzzy TOPSIS

Criteria	Expert 1	Expert 1	Expert 1	...	Expert 1	Expert 1	Expert 1
Positive ideal	(0.033,0.033,0.033)	(0.033,0.033,0.033)	(0.033,0.033,0.033)	....	(0.033,0.033,0.033)	(0.033,0.033,0.033)	(0.033,0.033,0.033)
Negative ideal	(0.003,0.003,0.003)	(0.003,0.003,0.003)	(0.003,0.003,0.003)	....	(0.003,0.003,0.003)	(0.003,0.003,0.003)	(0.003,0.003,0.003)

The conformity coefficient index (CCI) and ranking of options are determined through the calculation procedure. The distance of each option from the positive ideal (*d*+) and the negative ideal (*d*–) is determined using Equations 18.

$$D(A,B) = \sqrt{\frac{1}{3}[(a_2 - a_1)^2 + (b_2 - b_1)^2 + (c_2 - c_1)^2]} \qquad (18)$$

$$\tilde{A} = (a_1, b_1, c_1) \qquad \tilde{B} = (a_2, b_2, c_2)$$

Equations 19 and 20 are employed to determine the distance between each component and the ideal and anti-ideal:

$$d_i^* = \sum_{j=1}^{n} d(\tilde{v}_{ij} - \tilde{v}_j^*) \quad i = 1,2,\dots,m \qquad (19)$$

$$d_i^- = \sum_{j=1}^{n} d(\tilde{v}_{ij} - \tilde{v}_j^-) \quad i = 1,2,\dots,m \qquad (20)$$

In the subsequent phase, the conformity coefficient index of each option is determined using Equation 21:

$$Cl = \frac{d_i^-}{d_i^* + d_i^-} \quad i = 1,2,\dots,m \qquad (21)$$

The results are presented in Table 13, and the alternatives are subsequently ordered based on these computations.

Table 13

The final ranking of the buyback indices

Criteria	Code	Final score	Rank
Political risky events	A1	0.4600	2
	A2	0.4285	3
	A3	0.4252	5
	A4	0.4267	4
	A5	0.4953	1
Significant contractual risky events	B1	0.4224	15
	B2	0.4379	13
	B3	0.4461	10
	B4	0.4426	12
	B5	0.4084	16
	B6	0.4775	5

Criteria	Code	Final score	Rank
	B7	0.4501	8
	B8	0.4876	2
	B9	0.4370	14
	B10	0.4455	11
	B11	0.4520	7
	B12	0.4562	6
	B13	0.4064	17
	B14	0.4813	4
	B15	0.4998	1
	B16	0.3816	18
	B17	0.4836	3
	B18	0.4482	9
Legal risky events	C1	0.4335	1
	C2	0.3740	6
	C3	0.4050	4
	C4	0.4305	2
	C5	0.3917	5
	C6	0.4301	3
Economic risky events	D1	0.4993	3
	D2	0.3874	5
	D3	0.5485	1
	D4	0.4852	4
	D5	0.3807	6
	D6	0.5011	2
Management risky events	E1	0.4679	1
	E2	0.4379	2
	E3	0.4324	3
	E4	0.4249	4
	E5	0.3871	5
Insignificant contractual risky events	F1	0.4282	3
	F2	0.3926	6
	F3	0.4148	4
	F4	0.4063	5
	F5	0.3912	7
	F6	0.4480	1
	F7	0.4284	2
Environmental risky Events	G1	0.5255	1
	G2	0.4267	3
	G3	0.4749	2

3. Conclusions

The oil and gas industry is a critical, risky, and capital-intensive sector and plays a crucial role in the economic progress of a nation. Powerful nations have initiated numerous conflicts worldwide by assaulting countries with substantial oil and gas reserves in order to secure the energy resources they require. Iran possesses significant oil and gas reserves; however, it lacks the requisite capital, technical expertise, and contemporary technology to extract them efficiently. Therefore, it is essential to attract foreign investors. The establishment of appropriate contract models that protect the capital of the foreign investor while assuring a reasonable profit is an effective approach to attracting foreign investment. However, Iran's buyback oil contracts have not been particularly successful in attracting foreign investment. The objective of this investigation was to pinpoint the deficiencies in this domain and resolve them through qualitative and qualitative methodologies. The study emphasized the significance of mitigating extractive risks to facilitate successful cooperation and maximize profits for both the foreign investor and the National Iranian Oil Company. This is achieved by thoroughly examining all contractual and non-contractual risks associated with these contracts in order to maximize economic gain while minimizing risk. The study concludes that the top five reasons why this form of contract is unattractive to foreign investors are political risk events, contractual risk events, legal risk events, economic risk events, and management risk events in order of importance. Although risk identification is an essential component of risk management, the approach to risk response and monitoring may differ based on the agreement between parties in a contract or the overarching policies of the host government that are designed to attract foreign investment. In light of this, the present study focuses on the identification of all potential risks associated with a buyback contract and subsequently addresses the five primary identified risks of this contract as presented in Table 14.

Table 14

Suggestions to attract foreign investment

Criteria	Risks	Suggestions
Political risky events	Sanction	Iran must adopt strategies aimed at diminishing its dependence on the financial systems and technologies of countries that impose sanctions. This objective can be realized by enhancing domestic capabilities, developing regional supply chains with neighboring nations and non-Western trading partners, and exploring alternative financial mechanisms, including bilateral and multilateral currency agreements with them or using state-controlled digital currencies. Furthermore, engaging in proactive economic diplomacy and strengthening relationships with neutral or aligned countries can contribute to a more stable environment for the advancement of economic projects.
	Interference of several governmental authorities in the signed contracts	The Ministry of Petroleum should design a system wherein all oversight of contracts by regulatory bodies occurs on the finalized contract template prior to signing, with no subsequent pronouncements after the contract has been executed. This system has been progressively improving in recent years.
	The contractor's fear of political violence (war, revolution and rebellion) in Iran	The Ministry of Petroleum negotiating team must convince foreign contractors during negotiations that Iran's security conditions differ from those of its neighboring countries and that it possesses sufficient domestic potential to safeguard investments.

Criteria	Risks	Suggestions
	Non-conversion of currency due to political interests	Non-discriminatory and good-faith treatment of contractors, as has been the practice in recent years and has led to the enactment of the Foreign Investment Promotion and Protection Act, must be expanded across all dimensions to eliminate any concerns for foreign contractors.
	The contractor's concern of nationalization, confiscation, and expropriation of their assets in Iran	Although this issue has not occurred post-revolution and contractor concerns stem from revolutionary and pre-revolutionary events, providing adequate guarantees and enacting necessary laws and regulations, such as the Foreign Investment Promotion and Protection Act, can further enhance contractor confidence. Currently /government in many cases guarantees.
	Huge capital and funding for upstream oil projects	Oil and gas projects require substantial capital and funding, limiting the participation of only a few companies in upstream ventures. To encourage investment, all capital costs, non-capital costs, and operating costs shall be fully recoverable by the contractor, without any limitations, after approval from the Joint Management Committee. The National Iranian Oil Company's inspection organization shall play a more active role to prevent corruption.
	Non-commerciality of the field and insufficient production from the field	While the risk of non-commerciality or insufficient production is common in most upstream oil and gas contracts, Iran, in its efforts to attract foreign investment, can propose that a percentage (e.g., 25%) of the incurred costs, as approved by the JMC, be reimbursed to the contractor in case of non-commerciality of the field or insufficient production from the field.
Significant contractual risky events	The agreed final production point	The repayment of the contractor's costs shall commence from the initial day of the first month following the agreed production point. It is not in the contractor's best interest to fail to repay them before reaching the agreed production point. Some contracts may stipulate a final production rate that is disadvantageous to the contractor; thus, to attract foreign investment, NIOC can propose the contractor a fair and favorable production point.
	Remuneration fee	In a buyback contract, the contractor's fee and expenses are determined by the rate of return, which is subject to a contractual cap. If the ROR surpasses these limits, the contractor will not receive any additional payment. NIOC can consider increasing the ROR or implementing mechanisms similar to those used in Iraq or in the Iranian new Petroleum Contract to attract foreign investment.
	Capability of capital costs	Since capital costs are capped in buyback contracts, which may not be appealing to the contractor. To attract contractors, the ceiling shall be open although NIOC can enhance its inspection and monitoring procedures.
Legal risky events	Lack of transparency of some laws in Iran	Over the past few years, the approach of the government has been to establish clear laws and regulations, and all laws and regulations are now published through pre-designated web

Criteria	Risks	Suggestions
		sites. Furthermore legislative branch continuously strives to eliminate ambiguities, draft specified codes, and refine them.
	Changes in laws and regulations during the contract period and ratification of disruptive and contradictory laws and regulations in Iran	Historical precedents demonstrate the Iranian government's commitment to compensating contractors for incurred costs. However, a lack of awareness among contractors regarding this practice fosters significant apprehension. Two viable strategies exist: either codifying the legal framework at contract inception or ensuring appropriate compensation for incurred damages, a practice consistently upheld to date. Contractors should be thoroughly informed of this policy
	Dealing with tax authorities	Dealing with Iranian tax authorities poses challenges for contractors, as taxes in buyback contracts are eventually passed on to them. Contractors are averse to the bureaucratic procedures of Iranian tax authorities and shall be exempt from tax payments.
	Dispute resolution procedure	Limitation related to referring to arbitration under Article 139 of the constitution primarily applies to governmental bodies and state-owned companies and does not impose any limitation on foreign companies' ability to refer disputes to arbitration.
	The law of local content	While the legislation's primary objective is to facilitate knowledge transfer and bolster Iran's domestic capabilities in alignment with national interests, recent endeavors have focused on incorporating its provisions into contractual frameworks and extending support to contractors. Further augmentation of these support mechanisms is imperative.
	Exchange rate fluctuations	Exchange rate calculations can be based on the free exchange rate, rather than the central bank of Iran.
	Persistent and unpredictable inflation in Iran and the world	Unforeseeable inflation across the globe cannot be regulated, but the Iranian government has the ability to manage the unpredictable inflation within Iran or compensate for the difference to the contractor.
Economic risky events	Changes in the market of oil and gas equipment and material	This risk is a worldwide concern, and the contractor must factor it into their profit calculations.
	Fluctuation in the interest rate	This issue is not limited to Iran but has a global impact, and contractors must anticipate it when determining their profits.
	Inability of NIOC to pay the contractor's fee or recovery of approved costs	There may be instances where the National Iranian Oil Company is unable to fulfill the contractor's fee or approved reimbursable costs due to various factors. In such cases, it is the responsibility of the Iranian government or NIOC to assure the contractor that their fee will be paid or their costs will be recovered without any complications.
Management risky events	Instability of the project management team	Changing the project management team at NIOC shall not hinder the execution of the project or the contractual obligations. The Iranian government will oversee and control this process.

Criteria	Risks	Suggestions
	Contract approval by various entities such as the Economic Council	The contract shall come into effect upon signing and after obtaining approval from the relevant entities. Each entity's duties and responsibilities shall be clearly defined to avoid any interference or conflicts.
	The number of government agencies involved	In recent years, this issue has been rigorously addressed and controlled, minimizing disruptions. However, continued refinement of governmental management strategies is essential.
	The inflexibility of NIOC managers toward contractors	NIOC shall adopt a more flexible approach toward contractors when dealing with different problems and disputes.
	The Ministry of Petroleum 's bureaucratic system	This challenge is ubiquitous across numerous nations and institutions. However, effective management coupled with the implementation of artificial intelligence and automation can expedite processes. This approach has been actively pursued in the Ministry of Petroleum and other governmental sectors over the past year.

Nomenclature

AHP	Analytic hierarchy process
CAPEX	Capital cost/expenditure
IOC	International oil company
IPC	Iranian Petroleum Contract
JMC	Joint Management Committee
JOA	Joint operating agreement
JVC	Joint venture contract
LIBOR	The London interbank offered rate
MDP	Master development plan
N	Number
NIOC	National Iranian Oil Company
OPEC	Organization of the petroleum exporting countries
OPEX	Operational cost
PSC	Production sharing contract
ROR	Rate of return
TCM	Trillion cubic meters
TMC	Trillion cubic meters
TOPSIS	Technique for order of preference by similarity to ideal solution
VAT	Value added tax

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