Journal of Petroleum Research and Studies

Open Access
Vol. 15, No. 2, June 2025, pp. 148-164

P- ISSN: 2220-5381
E- ISSN: 2710-1096

DOI: http://doi.org/10.52716/jprs.v15i2.813

Risk Analysis in the Oil and Gas Industry by using SPSS (Study Field in the Project of Increasing Liquid Gas Storage in Iraq)

Kadhim J. Obayes

Ministry of Oil, General Company for Gas Filling and Services, Baghdad, Iraq.

*Corresponding Author E-mail: kadhimjawad2015@gmail.com

Received 15/10/2023, Revised 03/04/2024, Accepted 07/04/2024, Published 22/03/2025

Abstract

The oil and gas industry of Iraq is one of the largest industries in the country and provides a lot of income for the country. Because this industry is associated with many risks, risk analysis in this industry is very vital. Therefore, the present research was carried out in order to manage risk in the oil and gas industry in the project of increasing liquefied gas storage in Iraq, by a survey-type descriptive method and an applied purpose in 2023. The statistical population of the research consisted of all the senior managers, middle managers and officials of 15 oil and gas companies in Iraq 255 people, from which 154 people were selected to participate in the research using the Cochran formula and based on the stratified sampling method proportional to the volume. The data collection method is the library and field method. The tool for collecting data is a researcher-made questionnaire with 9 components (exploration stage risk, evaluation stage risk, development stage risk, gas condensate storage tank risk, ground surface facility risk, economic risk, technological risk, operational risk, legal and contractual risk) and 60 indicators, which were designed based on a 5-point Likert scale (very much, much, to some extent, little, very little). The validity was confirmed based on face, content and construct validity in Smart PLS software. The reliability coefficient was estimated using Cronbach's alpha as 0.9. Further, SPSS software was used in two descriptive and inferential levels in order to analyze the data. The findings indicated that risk management in the oil and gas industry of Iraq is above average in order to increase liquefied gas storage in Iraq. In addition, exploration stage risk with a mean rank of (6.07) ranked 1st among the components of risk management, evaluation stage risk with a mean rank of (5.55) ranked 2nd, development stage risk with a mean rank of (5.09) ranked 3rd, ground level facility risk with a mean rank of (5.03) ranked 4th, operational risk with a mean rank of (4.93) ranked 5th, economic risk with a mean rank of (4.81) ranked 6th, the risk of gas condensate storage tanks with a mean rank of (4.66) ranked 7th, legal and contractual risk with a mean rank of (4.48) ranked 8th, technological risk with a mean rank of (4.37) ranked 9th.

Keywords: Liquid gas storage, Oil and gas industry of Iraq, Risk analysis.

Journal of Petroleum Research and Studies

Open Access
Vol. 15, No. 2, June 2025, pp. 148-164

P- ISSN: 2220-5381
E- ISSN: 2710-1096

تحليل المخاطر في صناعة النفط والغاز باستخدام برنامج SPSS (دراسة ميدانية في مشروع زيادة تخزين الغاز المسال في العراق)

الخلاصة:
تعد صناعة النفط والغاز في العراق من أكبر الصناعات في البلاد وتوفر الكثير من الدخل للبلاد. ونظرًا لارتباط هذه الصناعة بالعديد من المخاطر، فإن تحليل المخاطر في هذه الصناعة أمر حيوي للغاية. لذلك أجري البحث الحالي بهدف إدارة المخاطر في صناعة النفط والغاز في مشروع زيادة تخزين الغاز السائل في العراق، وذلك بطريقة وصفية مسحية وهدف تطبيقي في عام 2023 . المجتمع الإحصائي للبحث تكون من جميع المديرين الكبار والمديرين المتوسطين والمسؤولين في (15) شركة نفط وغاز في العراق بواقع (255) شخصا، تم اختيار 154 شخصا منهم للمشاركة في البحث باستخدام صيغة كوكران وعلى أساس طريقة أخذ العينات الطبقية المتناسبة مع الحجم. طريقة جمع البيانات هي الطريقة المكتبية والميدانية. وأداة جمع البيانات عبارة عن استبيان أعده الباحث مكون من 9 مكونات (مخاطر مرحلة الاستكشاف، مخاطر مرحلة التقييم، مخاطر مرحلة التطوير، مخاطر صهاريج تخزين مكثفات الغاز، مخاطر منشأة سطح الأرض، المخاطر الاقتصادية، المخاطر التكنولوجية، المخاطر التشغيلية، المخاطر القانونية والتعاقدية المخاطر) و60 مؤشرًا، تم تصميمها بناءاً على مقياس ليكرت المكون من 5 نقاط (كثير جدًا، كثيرًا، إلى حد ما، قليل، قليل جدًا). تم التأكد من الصلاحية على أساس الوجه والمحتوى وصلاحية البناء في برنامج SmartPLS. والمحتوى حيث تم تقدير معامل الثبات باستخدام ألفا كرونباخ بقيمة 0,9. علاوة على ذلك، تم استخدام برنامج التحليل الاحصائي في المستويين الوصفي والاستدلالي من أجل تحليل البيانات. أشارت النتائج إلى أن إدارة المخاطر في صناعة النفط والغاز في العراق أعلى من المتوسط وذلك لزيادة مخزون الغاز السائل في العراق. بالإضافة إلى ذلك، احتلت مخاطر مرحلة الاستكشاف بمتوسط رتبة (6,07) المرتبة الأولى بين مكونات إدارة المخاطر، ومخاطر مرحلة التقييم بمتوسط رتبة (5,55) في المرتبة الثانية، ومخاطر مرحلة التطوير بمتوسط رتبة (5,09) في المرتبة الثالثة. ، مخاطر المنشأة على مستوى الأرض بمتوسط رتبة (5,03) في المرتبة الرابعة، والمخاطر التشغيلية بمتوسط رتبة (4,93) في المرتبة الخامسة، والمخاطر الاقتصادية بمتوسط رتبة (4,81) في المرتبة السادسة، ومخاطر صهاريج تخزين مكثفات الغاز بمتوسط (4,66) في المرتبة السابعة، والمخاطر القانونية والتعاقدية بمتوسط (4,48) في المرتبة الثامنة، والمخاطر التكنولوجية بمتوسط (4,37) في المرتبة التاسعة.

1. Introduction

The oil, gas and petrochemical industry in the Republic of Iraq is one of the largest industries, and risk management is very important in this industry due to the existence of numerous risks. Risk management includes the process of planning risk management, identifying, classifying, assessing risk, reacting to risk and controlling and implementing the risk management plan. This field creates requirements in the organization body as well as the project management body, which will lead to better management and monitoring of the risks to which the project is exposed [1].

In the field of oil and gas projects, especially gas storage projects, there are many internal and external risks that can lead to serious accidents and irreparable damages. In addition, many companies in the field of preventing serious accidents and reducing the effects of risks try to improve performance and reduce risks in their work area by providing various trainings to employees and providing advanced equipment and technologies [2].

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Vol. 15, No. 2, June 2025, pp. 148-164

P- ISSN: 2220-5381
E- ISSN: 2710-1096

Oil and gas projects are complex and risky due to their dynamic nature and involve a significant number of stakeholders [3], therefore, companies should take advantage of past experiences and apply effective risk management methods to prioritize improving performance and reducing risks in their work area [4].

Since gas condensate and liquefied gas storage projects in Iraq are nascent and domestic contractors have little ability to emerge and self-examine in this field, and also the scientific approach of project management in private sector contractors is in the initial stages of growth and maturity, the implementation and performing of risk management in these projects have not much history and it has been paid much less attention than other areas of project management such as time and cost management, while considering the major risks and dangers inherent in such projects, risk management in these types of projects is very important. Therefore, it is influential and vital in this research, the researcher intends to investigate risk management in the oil and gas industry with the aim of increasing the storage of liquefied gas in projects in Iraq. According to the purpose of the research, this study answers the following questions:

1. In order to increase liquefied gas storage in Iraq, what indicators and components of risk management should be considered in the oil and gas industry?
2. What is the status of risk management in the oil and gas industry of Iraq in order to increase liquefied gas storage in Iraq?
3. What is the ranking of risk management indicators and components in the oil and gas industry in order to increase the storage of liquefied gas in Iraq?

1.1 Research background

In a research titled risk assessment of overhaul projects in upstream oil process industries using a multi-factor fuzzy combination decision-making method concluded, to the conclusion that the technical risk, external risk, business risk, management risk was some of the most important risks identified [1]. In a study that included designing a model for risk management Iranian oil industry ,it consisted of risk variables, energy insurances include leveling of organization issues, macro budgeting of the industry, rate of return on investment, shaping of the environment, economic polarization, gross domestic product, risk orientation, influence and leadership of risk manager, risk management strategy, political-economic and legal environment, bargaining power of insurance industry, neighboring units, subsidiaries and contractors, risk identification, risk intensity, risk frequency, risk conceptual map, grouping risk, risk management budgeting, risk

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P- ISSN: 2220-5381
E- ISSN: 2710-1096

management scenarios, risk leveling, risk acceptance and maintenance, risk avoidance, risk reduction, risk transfer, risk management mixed strategy, macro insurance premium, oil industry bargaining power, rate and the conditions are the reward of low loss ratio, credit of foreign reinsurance, safety requirements, payment of damages, risk assessment[5]. The despite the laws, regulations or risk management tools are designed to prevent harmful events, a hydrocarbon spill on an offshore oil and gas platform are major hazardous events that represent a failure in risk control. On the other hand, the review of various studies indicates that the majority of accidents occurred due to human errors that occurred when the sea crew was working with unsafe systems that had improper design. To reduce these errors, it is necessary to strengthen the safety culture and combine regulatory requirements and enforcement activities that are parts of the safety field, this issue can affect better risk management [6]. The successful implementation of any project depends on designing an efficient contract that leads to distribution by transferring the responsibility of management and bearing risks to the party that is in the best position to manage them that leads to optimized and fair distribution of project risks [7]. The environmental risks of Bangistan and Asmari gas pressure boosting stations using the Hazan method in the Maroon 3 oil and gas exploitation complex and concluded that after evaluating the environmental risks in both stations, the most severe risks related to the pollution risk of burning gas in burners and the noise pollution risk related to the noise of turbines and compressors after start-up [8]. Tthe greatest amount of environmental and health safety risks in the tanks are, respectively, fire caused by terrorist and intentional factors because of Iran's country sensitive position in the region and the inhalation of steam during repairs is due to non-observance of safety precautions and non-use of personal protective equipment [9]. The risk of the urban gas distribution network was evaluated in Baharan town located in Sanandaj city and came to the conclusion that the indicator of involvement of natural persons from the subgroup of causality indicator and the indicator of substance risk from the subgroup of consequence indicator, respectively, have the highest weight and indicator of pipeline pressure has the least weight [3]. The need to provide guarantees with large sums, non-agreement of operating companies with internal product testing and changes in macroeconomics indicators were some of the most important risks identified [2].

2. Method

In order to manage risk in the oil and gas industry in the project of increasing the storage of liquid gas in Iraq, the present research was carried out in a descriptive survey type and with a practical

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P- ISSN: 2220-5381
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purpose in 2023. The statistical population was made up of all senior managers, middle managers and officials of 15 oil and gas companies in Iraq, Oil Projects Company (SCOP), Oil Pipeline Company (OPC), State Organization for Marketing of Oil (SOMO), Oil Products Distribution Company (OPDC), Iraqi Drilling Company (IDC), North Oil Company (NOC), Midland Oil Company (MDOC), South Oil Company (SOC), Maysan Oil Company (MOC), North Gas Company (NGC), South Gas Company (SGC), Gas Filling Company in (GFC), North Refineries Company (NRC), Mead Refinery Company (MRC), South Refinery Company (SRC)] as 255 people, 154 people were selected to participate in the research. The data collection method in this study is the library and field method. The data collection tool, as specified in Table (1), is a researcher-made questionnaire with 9 components (exploration stage risk, assessment stage risk, development stage risk, risk of gas condensate storage tanks, risk of terrestrial facilities, economic risk, technology risk, operational risk, legal and contractual risk) and 60 indicators that were designed based on a 5-point Likert scale. The face validity of the questionnaire was used using the opinions of a number of several respondents, the content validity was used using the opinions of a number of experts and the construct validity of the questionnaire was used using confirmatory factor analysis in SmartPLS software. Figure (1) shows the factor loading of all questions. In addition, the fit indicators in SmartPLS are reported in Table (2). The reliability coefficient of the whole questionnaire was estimated using Cronbach's alpha as 0.9. In order to analyze the data, SPSS software was used in two descriptive and inferential levels.

Table (1): Risk management questionnaire of oil and gas industry projects

Row	Dimension	Identified risk	Reference
1	**Exploration stage risk**	Geological unknowns and risks that affect the process of oil and gas extraction.	[10,11,12]
2		Type and dimensions of oil or gas trap.	[12,13]
3		The height of the oil and gas column.	[12,13]
4		Depth of access to hydrocarbons.	[12,13]
5	**Assessment stage risk**	The amount of available information.	[12,13]
6		The volume of oil or gas in situ.	[12,13]
7		The number of wells needed to be drilled.	[12,13]
8		The degree of porosity of the rock/the degree of oil saturation in the rock.	[12,13]
9		Tank pressure	[12,13]
10		Water saturation.	[12,13]
11		Permeability, viscosity, heat, gravity.	[12,13]

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12	Development stage risk	The volume of oil or gas that can be extracted.	[12,13]
13		Arrangement of required wells.	[12,13]
14		Drilling time of each well.	[12,13]
15		Repository model update.	[12,13]
16		Field production chart.	[12,13]
17		Maintain of tank pressure.	[12,14]
18	Risk of gas condensate storage tanks	Liquid overflow due to earthquake.	[9]
19		Oil or gas leakage from the pipeline.	[15]
20		Liquid overflow due to human error.	[9]
21		Leakage from tank connections.	[9]
22		Fire caused by lightning.	[9]
23		Explosion and fire due to terrorist attacks.	[9]
24		Corrosion in the tank.	[9]
25		Contact with materials in tanks.	[9]
26		Spilling oily liquids in the surrounding area.	[9]
27		Excessive increase in product temperature.	[9]
28		Holes in the bottom of the tank and leakage cases.	[9]
29		Use of water from nearby sources.	[9]
30		Contact with materials in tanks.	[9]
31		Going up and down the stairs of the tanks.	[9]
32		Slippery work environment.	[9]
33	Risk of terrestrial facilities	The possibility of environmental pollution caused by the penetration of production fluids into the surface layers of the earth.	[10,16,17,18]
34		Environmental effects caused by the leakage of sulfur gas and other polluting fluids.	[18]
35		Human errors in the design, construction and installation phase of facilities or during work.	[18]
36	Economic risk	Lack of tax system and variable tax rate.	[19]
37		Exchange rate (the conversion rate of the currency units of different countries to each other).	[19,20,21]
38		The world price of oil.	[19]
39		Oil supply and demand fluctuations.	[21,22]
40		Repayment of international loans.	[19]
41		Downturn.	[20,21]
42		Inflation.	19,20,21]
43	Technology risk	Lack of proper mechanism for technology transfer and accelerated planning.	[21,23,24]
44		The dependence of technology transfer in the new oil contract on the conclusion of another contract.	[24,25]
45		The impossibility of obtaining manufacturing and production technologies, or equipment and machinery, or delays in it.	[2]

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46		Not matching the drill with the manufacturer and geological layers in different fields.	[2]
47		The insignificant role of the new contract in reducing the country's technology dependence is due to the transfer of old and obsolete technologies.	[24,25]
48	**Operational risk**	Long project approval procedures.	[26]
49		Lack of skilled and specialized manpower.	[17]
50		Poor internal organization for project management.	[21]
51		The manager's ignorance of the possible risks of the project.	[23]
52		Lack of operational experience in similar projects.	[27]
53		Lack of complementary and suitable infrastructures (old pipes and drilling rigs).	[2]
54		Inefficiency of the project team.	[26]
55	**Legal and contractual risk**	Inadequate bidding methods.	[26]
56		The possibility of inappropriate and insufficient insurance coverage.	[28]
57		Avoiding conflict of interest.	[29]
58		Immunity and commercial considerations in contracts.	[29]
59		Injuries and income losses.	[29]
60		Dispute resolution mechanisms.	[29]

Table (2): Criteria for fitting the research questionnaire

Dimension	Cronbach's alpha	Composite reliability	AVE	R^2	Communality	Q^2	F^2	GOF
Assessment stage risk	0.875	0.904	0.574	0.733	0.329	0.386	2.749	0.709
Development stage risk	0.888	0.915	0.642	0.604	0.412	0.351	1.524	
Economic risk	0.897	0.919	0.618	0.758	0.382	0.429	3.129	
Exploration stage risk	0.893	0.925	0.756	0.665	0.572	0.462	1.984	
Legal and contractual risk	0.896	0.92	0.657	0.81	0.432	0.485	4.263	
Operational risk	0.934	0.947	0.72	0.795	0.518	0.526	3.884	
Risk of gas condensate storage tanks	0.958	0.963	0.635	0.835	0.403	0.483	5.064	
Risk of terrestrial facilities	0.913	0.946	0.853	0.62	0.728	0.487	1.629	
Technology risk	0.919	0.939	0.756	0.752	0.572	0.522	3.039	

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P- ISSN: 2220-5381
E- ISSN: 2710-1096

One of the reliability confirmation methods is Cronbach's alpha, if its value is more than 0.7, reliability is confirmed. Another method to determine reliability is to use composite reliability with an acceptable level of 0.7 or more. Also, to confirm the convergent validity, the Average Variance Extracted indicator (AVE) was used, with an acceptable value of 0.5 or more [30]. Of course, some researchers consider a value more than 0.4 as confirmed, which means that the structure in question is appropriate if it explains 40% to 50% of the variance of its indicators [31]. The value in Table (2) indicates that Cronbach's alpha, composite reliability and convergent validity of the dimensions of the questionnaire have appropriate values. Also, the coefficient of determination, R^2, shows the size of changes of dependent variables by independent variables. The values of R^2, i.e. 0.19, 0.33, 0.67 are known as weak, mean and strong values [32]. Q^2 indicator shows the predictive power of endogenous variables in the model. A positive Q^2 value shows the optimal fit of the model and the optimal predictive power of the model [33]. F^2 indicator for an independent variable shows the amount of changes in the estimate of the dependent variable when the effect of that variable is removed. The values of F^2 indicator are 0.02 (weak), 0.15 (mean) and 0.35 (strong), respectively [34]. The GOF indicator is used in order to fit the structural part and measure. A GOF value of 0.1 to 0.25 is weak, 0.25 to 0.36 is considered mean, more than 0.36 is considered strong [35]. The value of GOF is reported as 0.709 in this study, which is a desirable value. In addition, as shown in Table (2), R^2, Q^2 and F^2 indices of the model also have favorable values.

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E- ISSN: 2710-1096

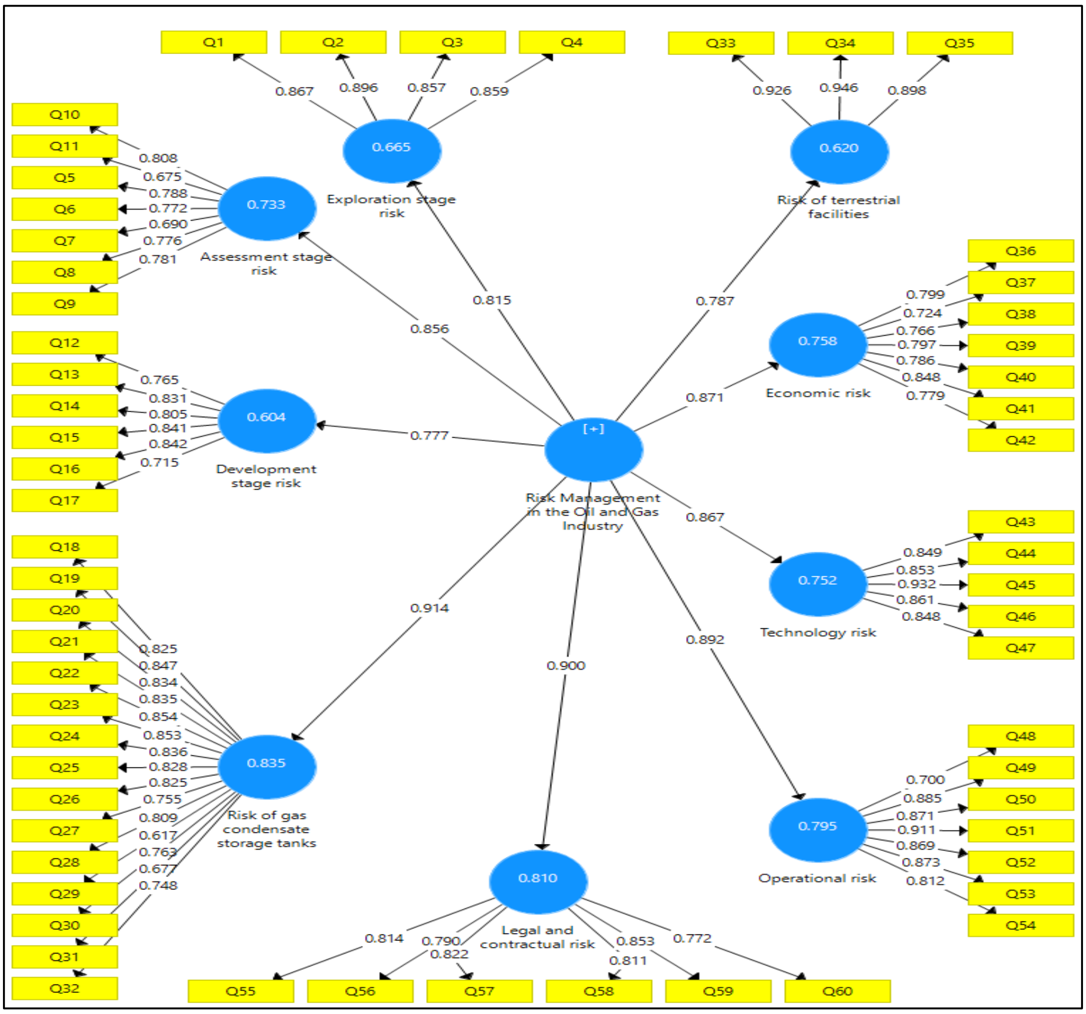

Fig. (1): Factor loading coefficients of the research questionnaire

3. Results and Discussion

3.1 Indicators and components of risk Analysis should be considered in the oil and gas industry.

The findings of Table (1) showed that 9 components (exploration stage risk, assessment stage risk, development stage risk, risk of gas condensate storage tanks, risk of terrestrial facilities, economic risk, technology risk, operational risk, legal and contractual risk) and 60 indicators in risk management in the oil and gas industry should be considered.

3.2 The status of risk management in the oil and gas industry.

The results reached are as shown in Table (3), risk of the exploration stage is (4.168), the assessment stage risk is (4.093), the risk of the development stage is (3.982), the risk of gas condensate storage tanks is (3.877), the risk of terrestrial facilities is (3.937), economic risk is

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(3.957), technological risk is (3.880), operational risk is (3.932), legal and contractual risk is (3.921) and, in general, it is (3.956) in the research questionnaire. Since the P-Value in all the identified risks is less than (0.05), it has a significant difference with the test value, i.e. 3, and is in an above-average state. On the other hand, considering that the upper and lower limits of the positive confidence interval have been obtained, it can be concluded that the risk management situation in the oil and gas industry of Iraq for increasing the storage of liquid gas in Iraq is above the accepted mean level.

Table (3): Results of one-sample t-test for the research questionnaire

Identified risks	N	Mean	SD	Test Value = 3			Lower limit	Upper limit
				t	df	P-value		
Exploration stage risk	154	4.168	0.763	19.006	153	0.000	1.047	1.290
Assessment stage risk	154	4.093	0.654	20.746	153	0.000	0.989	1.197
Development stage risk	154	3.982	0.739	16.501	153	0.000	0.865	1. 100
Risk of gas condensate storage tanks	154	3.877	0.885	12.298	153	0.000	0.736	1.019
Risk of terrestrial facilities	154	3.937	0.949	12.249	153	0.000	0.786	1.088
Economic risk	154	3.957	0.768	15.468	153	0.000	0.835	1.079
Technology risk	154	3.880	0.845	12.927	153	0.000	0.746	1.015
Operational risk	154	3.932	0.860	13.439	153	0.000	0.795	1.069
Legal and contractual risk	154	3.921	0.801	14.260	153	0.000	0.793	1.048
Total of questionnaire	154	3.956	0.703	16.872	153	0.000	0.844	1.068

3.3 The ranking of risk management indicators and components in the oil and gas industry.

In order to prioritize risk management indicators and components in the oil and gas industry, Friedman's test was used. The results of Table (4) show that the significance level of risk management indicators and components in the oil and gas industry for increasing liquefied gas storage in Iraq is less than the threshold (0.05) ($P<0.05$). Therefore, it can be concluded that there is a significant difference between indicators and components of risk management; in the following in Table (5), the ranks are reported.

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Table (4): Friedman test results (Significant result of dimensions and components of risk management)

H0 & H1	K^2	df	Significance level	Test result
H0: The mean rank of the dimensions is equal. **H1: The mean rank of the dimensions is not equal.**	59.758	8	0.000	H0 was rejected
H0: The mean rank of the components is equal. **H1: The mean rank of the components is not equal.**	222.389	59	0.000	H0 was rejected

Table (5): Ranking of risk management components and indicators in order to increase liquefied gas storage

Row	Dimension	Rank mean	Mean	Identified risk	Rank mean	Mean
1	Exploration stage risk	6.07	1	Geological unknowns and risks that affect the process of oil and gas extraction.	36.53	1
2				Type and dimensions of oil or gas trap.	34.11	5
3				The height of the oil and gas column.	34.49	4
4				Depth of access to hydrocarbons.	32.47	9
5	Assessment stage risk	5.55	2	The amount of available information.	32.46	10
6				The volume of oil or gas in situ.	34.75	3
7				The number of wells needed to be drilled.	32.14	14
8				The degree of porosity of the rock/the degree of oil saturation in the rock.	31.10	22
9				tank pressure	35.66	2
10				Water saturation.	30.79	23
11				Permeability, viscosity, heat, gravity.	31.70	17
12	Development stage risk	5.09	3	The volume of oil or gas that can be extracted.	33.88	6
13				Arrangement of required wells.	28.30	53
14				Drilling time of each well.	29.31	45
15				Repository model update.	29.56	35
16				Field production chart.	32.16	13
17				Maintain tank pressure.	32.86	8
18	Risk of gas condensate storage tanks	4.66	7	Liquid overflow due to earthquake.	30.19	25
19				Oil or gas leakage from the pipeline.	29.67	34
20				Liquid overflow due to human error.	30.42	24
21				Leakage from tank connections.	29.18	48
22				Fire caused by lightning.	29.22	47
23				Explosion and fire due to terrorist attacks.	31.67	18
24				Corrosion in the tank.	29.94	31
25				Contact with materials in tanks.	28.85	50
26				Spilling oily liquids in the surrounding area.	29.46	41
27				Excessive increase in product temperature.	32.21	11

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28				Holes in the bottom of the tank and leakage cases.	27.23	58
29				Use of water from nearby sources.	29.50	39
30				Contact with materials in tanks.	28.28	54
31				Going up and down the stairs of the tanks.	26.93	60
32				Slippery work environment.	29.72	33
33	Risk of terrestrial facilities	5.03	4	The possibility of environmental pollution caused by the penetration of production fluids into the surface layers of the earth.	30.18	26
34				Environmental effects caused by the leakage of sulfur gas and other polluting fluids.	31.91	15
35				Human errors in the design, construction and installation phase of facilities or during work.	29.23	46
36	Economic risk	4.81	6	Lack of tax system and variable tax rate.	27.77	55
37				Exchange rate (the conversion rate of the currency units of different countries to each other).	32.17	12
38				The world price of oil.	31.26	20
39				Oil supply and demand fluctuations.	33.56	7
40				Repayment of international loans.	31.43	19
41				Downturn.	27.17	59
42				Inflation.	30.13	27
43	Technology risk	4.37	9	Lack of proper mechanism for technology transfer and accelerated planning.	29.96	29
44				The dependence of technology transfer in the new oil contract on the conclusion of another contract.	29.53	37
45				The impossibility of obtaining manufacturing and production technologies, or equipment and machinery, or delays in it.	27.72	56
46				Not matching the drill with the manufacturer and geological layers in different fields.	27.46	57
47				The insignificant role of the new contract in reducing the country's technology dependence is due to the transfer of old and obsolete technologies.	29.45	42
48	Operational risk	4.93	5	Long project approval procedures.	31.79	16
49				Lack of skilled and specialized manpower.	28.73	51
50				Poor internal organization for project management.	29.32	44
51				The manager's ignorance of the possible risks of the project.	31.12	21
52				Lack of operational experience in similar projects.	29.81	32

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53				Lack of complementary and suitable infrastructures (old pipes and drilling rigs).	29.95	30
54				Inefficiency of the project team.	29.06	49
55	Legal and contractual risk	4.48	8	Inadequate bidding methods.	29.51	38
56				The possibility of inappropriate and insufficient insurance coverage.	29.48	40
57				Avoiding conflict of interest.	30.12	28
58				Immunity and commercial considerations in contracts.	29.55	36
59				Injuries and income losses.	28.46	52
60				Dispute resolution mechanisms.	29.43	43

In this study, there are 9 components and 60 indicators for the risk management were identified. The findings and factors identified in this study is somewhat similar and close with the indicators identified in the studies of [1], [2], [3], [5], [8]and [9]. On the other hand, the results of the second research question indicated that the state of risk management in oil and gas industry of Iraq for increasing liquefied gas storage in Iraq is above average. The findings obtained in this research question are somewhat consistent with the results of the studies of [6], [7]. In addition, among the components of risk management, the risk of the exploration stage is ranked 1st, the risk of the evaluation stage is ranked 2nd, the risk of the development stage is ranked 3rd, the risk of terrestrial facilities is ranked 4th, the operational risk is ranked 5th, the economic risk is ranked 6th, the risk of condensate gas storage tanks is ranked 7th, legal and contractual risk is ranked 8th, technological risk is ranked 9th.

In explaining the obtained findings, it can be acknowledged that the companies active in the field of oil and gas in Iraq also become aware that not focused all their attention on time and cost as in the past, and on various factors that can overshadow the risk of the project; Therefore, in this situation, it is possible to minimize the threats and unpleasant situations which the project tried to face. That may occur by the ability and knowledge and awareness of risk management and decision analysis, using risk management tools, planning to develop a structured and integrated approach.

4. Conclusion

Liquefied gas storage is very important in oil-rich countries, including Iraq. Iraq will be successful in this field when it reduces and manages the risk of this industry along with the developments in the oil industry. For example, it is difficult to predict the occurrence of force majeure (war or fire)

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E- ISSN: 2710-1096

in an oil project because these events are beyond the will of the project managers. Also, the occurrence of disputes between the host government and the foreign oil company, expropriation, change of law, environmental issues and other components that were discussed in this study are some of the issues that an oil project will face. If they are not managed, they can reduce the motivation of foreign investors and make the project face many risks. Therefore, it can be concluded that preparing a risk management plan is one of the requirements of the project to avoid risks. For the risk management of oil and gas industry projects or liquid gas storage, different methods and approaches such as SWOT analysis, PEST analysis can be used and in this way, planning can be done to manage the risks related to these projects. On the other hand, it is necessary to consider critical plans for the risks that can affect the project, so that if a problem occurs, the project managers can deal with it quickly and efficiently and reduce its effects. In order to increase the storage of liquefied gas in Iraq and manage related risks, the following solutions can be used:

- The use of new and up-to-date technologies, continuous planning and accurate assessment of risks, appropriate policies for risk management and training and education of human resources with strong technical knowledge can help manage the risks related to these stages.
- Cooperation with international companies can help Iraq in increasing liquid gas storage. These companies usually have strong experience and technical knowledge in this field and can help Iraq in the optimal exploitation of oil and gas resources.
- It is suggested to identify and evaluate the risks of liquefied gas projects. In the next step, to increase safety and reduce risks, employees and workers related to gas condensate storage tanks should receive proper training in the field of safety, use of safety equipment and safety behaviors against various risks.
- To manage the economic risk in oil and gas projects, proper financial planning should be done according to the forecast of project revenues and costs.
- In order to manage legal and contractual risk in oil and gas projects, appropriate contracts should be concluded by contractors and suppliers and financial and legal responsibilities should be clearly defined.

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