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RESEARCH ARTICLE

THE EFFECT OF INTANGIBLE DRILLING COSTS ON OIL EXTRACTION UNDER STRATEGIC RESERVES.THE CASE OF SUDAN NATIONAL PETROLEUM CORPORATION- SUDAPET

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Abstract

This research aimed to identify the extent to which the costs of intangible drilling affect oil extraction under strategic reserves. To achieve this objective, the research used the descriptive analytical approach. The research also used the questionnaire method, as a research instrument, where, (41) questionnaire forms were distributed to a random sample of employees working at the Sudapet Company-Sudan in 2021. Using the Statistical Package for the Social Sciences program (SPSS). The research has reached, the fact that the end of service indemnity is expensive, which causes the company to incur a huge amount of money. The research has also reached the fact that roads need pavement, and modern machineries are very expensive. Needless to say, that machineries and equipment consume much fuel. The research, on the other hand, recommended the guarding of oil fields by the national army to prevent theft. The research also recommended the preparation of maps and geological survey, and the building of residences for experts and employees in the area of oil fields. This is in addition to remove the natural obstacles such as trees, and rocks that hinder the performance of machineries and equipment.

Introduction:-

As an extractive industry, oil industry is unique in having such characteristics as to distinct it from other manufacturing industries. The operations of oil exploration and extraction are basically relating to the search for natural resources (crude oil), which is a depleting and exhausting resource. Taking into account, that search operations are lasting for a relatively long time. This is in circumstances that characterized by a high degree of financial risk, with uncertainty of achieving the best results, where, sometimes, any effort to spend huge amounts of money may have gone without finding oil.

Drilling and development are the most significant stages of oil industry. This is because the activities of drilling are those which determine exclusively, the existence or nonexistence of crude oil in a specific area. The function of the operations of geological and geophysical exploration that precedes the stage of drilling is exclusively limited to determine the most appropriate place of drilling or to specify rock composition (depth), which may contain oil. After this stage, one well or more, will be drilled, and the drilling into the depth of the land layers, will increase until it

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reaches the layer and composition required. It is just, at this point, the existence or nonexistence of oil could be verified.

When drilling operations result in the discovery of oil in commercial quantities, then such exploration should be developed and the well should be prepared for production. Expenses incur by the companies for drilling of the wells, by preparing them for production, are divided into the two main following types: intangible drilling and development costs, which are our research in question, and intangible preparations and equipment. Most of the items of expenses of this stage consist of expenditures of the selection and specification of drilling areas, as well as the expenses of cleaning the areas and preparing them for drilling. This is followed by the stage of drilling and inspection of oil samples. Expenditures on oil exploration in areas that promising the existence of oil in economic quantities, and the preparation of maps, and housing the employees, in addition to the fetching of heavy machineries to the site, have made the company spent huge amount of money on oil dirilling and exploration.

The process of oil exploration in the Sudan actually began following the conclusion of an agreement with the American companey Chevron in 1975. Based on the good results of the exploration works in the middle of the Sudan, a second bilateral agreement was concluded in 1979, with Chevron its self. Sudan government began to conclude agreements with other companies, for instance, two Canadian companies, in 1991 and 1993 respectively, the Gulf company in 1995, Oil Consortium in 1997, and the Greater Nile Petroleum Company in 1997. The Khartoum Oil Refinery, located 70 kilometer north of Khartoum city was established to help in exporting refined oil. The Refinery is a public shareholding company between the Sudan government, represented in the Ministry of Energy and Mining and Sudapet and China National Petroleum Corporation (GNPC). Meaning that, it is equally shared between the Sudan government and China.

Research problem

The researches which have been conducted in the fields of oil production in the Sudan on petroleum accounting, did not investigate intangible drilling costs of oil extraction, or relate the same to the strategic reserves. To put the research problem statement into effect, the following main research question has been raised:

What is the extent of the effect of intangible drilling costs on oil extraction under strategic reserve? Based on said main research question, the following sub-questions have been developed:

1. What is the effect of high costs of search and exploration in the conditions of intangible drilling on oil extraction under strategic reserves?
2. What is the effect of high costs of experts and employees' wages in the conditions of intangible drilling on oil extraction under strategic reserves?
3. What is the effect of high costs of purchase of machineries in the conditions of intangible drilling on oil extraction under strategic reserves?

Research hypotheses

1. **First hypothesis:** high costs of search and exploration in the conditions of intangible drilling affect oil extraction under strategic reserves.
2. **Second hypothesis:** high costs of wages and expenses of experts and employees in the conditions of intangible drilling affect oil extraction under strategic reserves.
3. **Third hypothesis:** high costs of purchase and operation of machineries in the conditions of intangible drilling affect oil extraction under strategic reserves.

Research Objectives:-

1. The research aimed to identify the reasons behind the lack of acquiring oil areas of economic feasibility in an easy manner.
2. The research aimed to identify the extent of actual compliance with the application of the laws and regulations and systems that govern the process of oil extraction in the Sudapet Petroleum company.
3. The research aimed as well, to identify integrated information system about oil fields in order to provide a clear idea for the bodies responsible for oil extraction in the Sudapet Petroleum company.

Research Significance

The scientific research significance is represented in the following

The research acquires its significance through its substantial role in the limitation and identification of the problems encountering the extraction of oil and how to solve the same. This is in addition to identify the effect of intangible drilling costs on oil extraction.

This research findings may attract the attention of the decision-makers in the Sudapet Petroleum company, in order to know more about this research subject and work to apply its findings.

Lack of the attention of other researchers at the national level- this is to the best of the researchers' knowledge- to the subject of intangible drilling costs on oil extraction under strategic reserves.

Research limitation
Spatial limitation
the research is limited to the Sudapet Petroleum company.

Temporal limitation
the field survey of the research conducted in 2021.

Research terminology
1. Intangible drilling: are expenses related to land settlement and cleanliness, as well as the costs of road construction and the transfer of machineries to the drilling site. These costs are deemed to be bad expenses.
2. Strategic reserves: these are reserves that relating to economic and national security, which are not calculated and are not referred to upon estimating their oil reserves.

Conceptual framework and prior literature
Firstly: Conceptual framework
Concept of oil drilling costs
Cost accounting concept
it is that system, which consist of a set of principles and concepts as well as methods and procedures, by which costs are identified, analyzed, and disclosed in different manners. There are, of course, various types of costs for various purposes. The objective of cost accounting is to achieve the following:
1. To measure activity unit cost.
2. To help management in making planning.
3. To help management in control and performance evaluation.
4. To help management in making decisions.

The researchers see that the position of cost accountant, in the map of the organizational structure of the institution is an advisory position, and he is not considered as an accountant within the employees of the accounts section. Therefore, he is directly affiliated to the general manager to help him in making decisions that concerned with the cost of each particular elements or items of the institution activity.

Drilling and development
Drilling and development, is the one of the most significant stages of the oil industry, since it exclusively determines the existence or nonexistence of oil. However, this stage begins immediately after the process of survey and exploration, and includes the operations of search and exploration to specify the potential areas, in which oil may exist. Afterwards, the drilling process of the wells will be initiated and developed to produce oil.

Drilling expenses and well development for production
To identify the types of drilling and development expenses it is necessary to distinguish between exploratory wells and development wells, where, there are three basic types of wells as per the following:
1. exploratory wells.
2. development wells.
3. Stratigraphic test well.

In pursuance to the rules of Financial Accounting Standards Board (FASB), and the Securities and Exchange Commission, (SEC) the following definitions have been set for these types of wells:

Exploratory well
that means, drilling a well to find oil in an undeveloped area or to find new project in an already existed field, in order to render it an oil producing field, or the expansion of an already existed project.

Development well
it is a well that was drilled within a developed area with a horizontal depth that is well known as productive.

Stratigraphic test well
this type of wells represents the efforts made in drilling in order to obtain information on status of geographical layers and is often drilled without the intention of having complete production. This type also includes subsoil tests.

Types of drilling expenses and well development for production
When oil has been discovered in commercial quantities, the company immediately works to develop the well and prepare it for production. The expenses that incurred by the company for drilling and development of wells and preparing them for production can be divided into two main following types (Mukhtar, 2012: 15)

1. Intangible drilling and development costs, which is called dead drilling expenses, which is our research in question.
2. Tangible costs of preparation and equipment in relation to the well or contract.

Firstly: Intangible drilling and development costs:
This type of costs includes the following expenses

1. Geological and geophysical expenses to specify the drilling area.
2. Expenses of the preparation of drilling area, which include the following:
3. Cleaning and leveling of land and treatment of water, if any.
4. Costs of roads building and laying foundations of drilling.
5. Costs of transporting and erecting drilling rigs.
6. Expenses of drilling rigs and the process of drilling:
7. These include, the wages of drilling workers, material and supplies necessary for drilling, maintenance and repair of machineries and equipment, fuel and motive power, depreciation of drilling machineries and equipment and indirect other costs.
8. Completion process expenses, which include the following;
9. Fees of necessary tests, casing the well and making cementation around it, cost of acids and solvents chemical material, well drilling, installation of valves and other fittings of the well.
10. Other expenses necessary for dismantling of drilling equipment and cleaning up the site after the completion of drilling process and filling up of dry well.

Secondly: cost of tangible equipment and machineries of the well or contract
These include all that which is spent on the acquisition of tangible machinery and equipment indispensable for the preparation of the well for production, which will have sufficient value at the end of its production life. In general, these equipment are installed for either to serve a specific well or a number of wells, which are stated in one concession contract. One of the characteristics of these equipment is that they can be easily dismantled and removed to other sites. By all means, they are quite different from those fixed machineries and equipment, owned by the company, and are not related to specific contract or well, such as drilling machineries and equipment and transportation vehicles.

Accounting treatment for intangible drilling expenses:
The accounting treatment of these expenses is performed by compiling drilling and development expense in a general account called under drilling wells account or account under operation. The researchers will adopt the last nomination for this account, which is a total control account in the general ledger. This account will have auxiliary accounts for the different wells, each of which will include the expenses of each well. However, these expenses will be charged to this account until the results of the drilling appear, (Khalid, 2001: 6)

The researchers hold that the account of wells drilling will be under the name of accounts under operation, and other numerous accounts branch out of it, such as drilling equipment and machineries account, drilling tools account, and drilling materials and supplies accounts. This method is clear in compiling the total drilling and development

expenses into one account, which will help in treating these expenses in accordance with the policy of the company in charging the expenses.

Intangible drilling costs distribution between different wells

The most part of oil companies referred the drilling operations to an external contractor. Therefore, it is not difficult to allocate costs for each well in accordance with the contract, which determines the obligation of both the contractor and the company. Accordingly, the cost of each well will be clear and determined in the light of invoices, (Ali,2018;34). In the event that, the company undertook the process of drilling the wells by itself, the problem of allocating the shared costs to the different wells will arise, taking into account, that the company uses its own workers, as well as its own equipment and tools, indispensable for the drilling of these wells.

The researchers maintain that referring the drilling process to a contractor is beneficial for the producing company, where, it does not concern itself with the details of drilling, but rather the value of the whole contract and its terms. However, this method may render the company involved in the whirl of implementation and its tedious details, such as the workers, and the equipment and energy devices, and hence it is so difficult to separate the shared expenses.

Most important methods used in costs distribution between well

Actual costs method

this method requires that each well will directly incur the actual expenses that are spent during the process of drilling, such as, materials and wages and other supplies that related to the well (Ali, 2018:32).

The researchers see that this method has some defects that do not achieve justice in the distribution of some expenses, which may be of great importance with regard to their sums of money if they are wholly drawn from the well, while it is being drilled, when they realized, such as insurance premiums, which changed from time to time.

Distribution on a quantitative basis method

To avoid the defects of the said method, some companies may adopt another method in the distribution of the expenses shared between wells. This is could be done by establishing one total account for overall wells within a specific period and after the drilling operations are completed, this account will be aggregated and distributed between the wells, on the basis of the volume of drilling and its measurement in feet or in cubic meter, drilled for each well.

The researchers are in the opinion that one of the defects of this method is that the land in which the wells are drilled, varies from one area to another. For instance, there is a solid rocky land, or a sandy land or a clay land, therefor, the drilling costs vary from one nature to another.

Proportional distribution method

that means to make benefit from the advantages of the previous methods by charging expenses that are easily attributed to a specific well directly to the account of that well. As to other expenses, which are difficult to be directly attributed are aggregated in intermediate account and then redistributed between different wells. In this respect, the company may establish two total accounts, the first of which is the account under operation to which auxiliary sub-accounts of the different wells are related. In this account, expenses, which are difficult to be directly charged to private wells as regard to the drilling rigs, used in the drilling operation of these well. Finally, there are many risks encountered by the producing company, which represented in fire and explosion risk, redrilling risk to replace the well with another, loss or damage of drilling tools and the cost of replacing or repairing the machineries, (Khalid;157) ibid, that are damaged by reason of fire or explosion, (Farhad,1999; 2).

The researchers hold that oil producing companies incur great losses in money and lives. Consequently, weak oil companies cannot continue to produce oil. However, giant companies are capable of oil production, at all costs, because they will compensate for the losses.

Strategic oil reserves

Classification of oil reserves

oil reserves are defined as the quantities of oil existed in oil deposits "project" or wells which can be extracted in commercial quantities, by available technical and technological potentials, under the existing circumstances, (Farhad,1999; 29) ibid.

Classification of oil reserves is as follows

1. Proved reserves (confirmed).
2. Unproved reserves.
3. Strategic reserves, (these are our research in question).
4. Sources of underground wealth.

Firstly

Proved reserves (confirmed):

These are reserves that the existence of which, is ascertained in an appropriate degree, where the degree of confidence is not less than 90%. Meaning that, specific quantities of reserves can be extracted under the existing economic and political conditions and by the available technical means.

Secondly: unproved reserves

The estimation of unproved reserves is based on geological and engineering data, which is similar to that on the basis of which, proved reserves were estimated. However, the lack of certainty of some technical and contractual data prevents the classification of these reserves as proved reserves.

The researchers see that proved reserves can be extracted for other purposes, such as planning and administrative purposes.

Thirdly: potential reserves

Potential reserves are in fact a sub-classification of unproved reserves, which are intended to refer to well-known oil accumulations in a specific date, and the degree of the certainty of their utilization is about 50%, (Abdelaziz,2005: 16)

Fourthly: **strategic oil reserves**

Oil reserve or strategic reserves, are the quantities of oil and oil derivatives stored by the states to use them in cases of emergency and supply interruption. However, there are many countries that own strategic reserves, most of them are members in the International Energy Agency. This is in addition to other countries like Saudi Arabia and China. India has recently started building its strategic oil reserve, (Omar,2012: 73). Despite the existence of oil reserves in all member states of the International Energy Agency, however, most of oil reserves are in the form of oil derivatives, and in the form of crude oil as in the case of the United State. China, on the other hand, has started building a huge strategic reserve, in the periods of low prices. The U.S. government considered establishing oil reserve in 1944, but it did not finish its oil reserve until 1977 following the oil boycotting imposed by some Arab states against the United State in 1973. After this incident, the U.S. government has imported oil and stored it in local caves in Texas and Louisiana. The U.S. government withdrew from these reserves many times, specially, at the begging of the second Gulf War in 1991. The U.S. government continued to withdraw several times from this reserve during the era of President Clinton, Bush, Obama, and Trump, with a view to reducing the deficit in the budget. The volume of the U.S. strategic reserve in 2008 has reached about **689** million barrels, 40% of which, is sweet oil and the rest is sour oil. But the continuous withdrawal to cover its costs has reduced this quantity to about 630 barrels, which is currently sufficient to cover the imports for more than 105 days. However, it may be reduced to 84 days, when demand returns to normal after the effect of Corona virus disappear. (Turkish Anatolia Agency,2021).

It has been said that, there is a considerable disagreement between specialists on the feasibility of filling oil reserves, and the feasibility of using it. While, some see it is necessary to fill it, others say there are many benefits of using it. The researchers hold that the sale of oil stock when it was stored for long periods, its composition could change and becomes of less quality. For long-term storage is detrimental to fuel, which can be stored for short periods and sold, then new fuel may be purchased, that withstand storage. The impact of Corona virus on oil extraction is enormous, as demand for purchase has decreased, since most people remain at homes, and there is no movement of vehicles, no factories revolve. The result was that the demand for purchase is decreased and world oil prices decreased as well.

These quantities of oil reserves are not calculated or referred to in the financial reporting, since they are used only in critical times such as war or when there is a severe deficit in the state's budget.

Secondly: previous literatures

Study of: Samir Ereshani, 2002

this research aimed to analyze the extent of the concurrence of accounting rules used in the oil and gas production industry in Syria with the similar rules used by United States companies. This is by comparing the accounting rules used by the Syrian company (SPC) as a government company, and the accounting rules and polices used by production-sharing companies in Syria, which represented by Euphrates Oil Company, with the generally accepted accounting principles, applied by the Oil and Gas Production Company of the United States of America, which is represented in the successful efforts and full cost methods.

Based on the results of the pilot testing, it has been found that expenses based on the accounting rules of the Syrian production-sharing companies were higher than the expenses based on the accounting rules of the full cost method by about 63 **%**, and more than the expenses that based on the accounting rules in accordance with the successful efforts method by about 40%. When the existed differences in the measurement of expenses were analyzed, the fact was that they have been basically related to the following four categories of expenses: amortization, exploration, operation and management.

Based on the referred to above findings, the research recommended the adoption of the generally accepted accounting principles, in the oil and gas industry, or the international financial reporting standards, particularly, the (IFRS6), which relates to extractive industries, in the industry of oil and gas production in Syria.

Study of: Khalaf, 2009

the research problem is represented in the quality of Arab oil distribution between the Arab countries and its geostrategic significance as well as its financial returns and the position of oil consuming countries. The research aimed to identify the Arab oil and the study of geopolitics, which highlight the image of the oil sites structure in the Arab region in terms of reserve, production and consumption. The research also aimed to study oil industry and its financial returns. The research, on the other hand, aimed to provide a vision on the geostrategic diagrams in the giant industrial countries, with a focus on the strategies of the United States of America, European Union and China.

The research findings have shown that Arab oil contributes to the era of geostrategies and military plans, in which the reserve production and consumption are distributed in the Arab world. This has been disclosed by the study of Arab oil distribution. The research recommended adopting the geographic map, which represents the first performance of geography in exploring oil reserve and production and consumption and relying on the systems of statistical programs, such as the Statistical Package for the Social Sciences program, (SPSS), in reporting on the image of oil structure.

Study of PWC, 2011

this research aimed to investigate the effects of the prospected international accounting standard, with respect to which, the International Accounting Standards Board has issued a draft in June 2010, regarding the accounting treatments currently used in the oil and gas production companies. The research has dealt with the concept of client provided for by the said international standard under the production sharing contracts, in which the relationship between the investing company and the local government was determined as a correlation between the provider of the services or goods and the client who receives the services or goods.

This research findings have shown that the concept of client according to the Standard, is not clear enough, therefore, it demanded the managements of the production of oil and gas companies to investigate the provisions of each production sharing contract, separately and with due care. This is because of the great differences in the provisions of production sharing contracts. Taking into account that, the selection of accounting treatment for the production sharing contracts depends largely on the nature of the relationship, imposed by the contract between the local government and the investing company, where, the relationship between the investing company and the local government is likewise that which between the provider of the services and goods, and the client who receives the services and goods. In this respect, the investing company must consider its all costs as receivables in the financial liability of the client, who receives the production (local government). The investing company, must as well, recognize the revenues when the agreed upon provisions in the contract have been met, such as the termination of

the seismological study, or the approval of the exploratory work program, and the termination of the development program or the starting up of production.

Commentary on previous studies

The previous studies have shown that they adequality address the concept of client in the International Accounting Standard under the share production, therefore, the Standard demanded the production of oil and gas companies to investigate the provisions of each production sharing contract, separately and with due care.

The current research in question is distinguished as having dealt with intangibles drilling costs on oil extraction within the framework of strategic reserves, which has not been addressed by previous researches.

Research Methodology and its Procedures:-

Research Methodology:-

The research used the descriptive analytical approach, which includes the method of the field study to collect information and data by a questionnaire from. The information and data were then statistically analyzed in order to test the validity of the hypotheses.

Research community

The research sample community comprises all the employees of the Sudapet Petroleum Company. As to the research sample it has been randomly chosen from among the research community. To effect the field study, the researchers distributed (45) questionnaire forms to the research community respondents, where, (41) employees are responded to the required information, that is to say, 91% of the respondents, which is deemed appropriate.

Description of Research sample characteristics:

Table (1):- frequencies for research sample individuals according to academic qualification.

Academic qualification.	Frequency.	Percentage.
Bachelor.	13	39,9
Higher Diploma.	10	24.4
Master degree.	10	24.4
PhD degree.	3	7.3
Others.	5	12.2
Total.	41	100

It is clear that from table (1), that 31.7% of the research sample are bachelor holders, and 24.4% their academic qualification is a higher diploma, while those who obtained a master degree are 24.4% and those who hold PhD are 7.3% and those hold other qualifications are 12.2%.

Table (2):- Frequencies for research sample individuals according to years of experience.

Years of experience.	Frequency.	Percentage.
Five years or less.	1	2.4.
From 6 to 10 years.	8	19.5
From 11 to 15 years.	23	56.1
More than 15 years.	9	22
Total.	41	100

Table (2) shows that 2.4% of the sample individuals, have five years of experience or less, and **19,5**% have experience from 6 to 10 years, while **56,1**% have experience from 11 to 15 years, and **22**% have more than 15 years of experience.

Research Instrument

The research depended on the questionnaire technique, which is the primary instrument in the data collection. Regard had been paid upon its formation, to its ability to diagnose and measure the research variables. In the determination of the questionnaire variables, the researchers relied upon numerous research and studies. This is besides, benefitting from the viewpoints of academic peers in the same scientific specialization, where, their substantive remarks have taken into consideration. According to which, indispensable amendments have been made.

Description of the questionnaire

In the preparation of the questionnaire, the researchers depended mainly on the five-point Likert scale. The questionnaire comprised two axes, the first of which contained the data of the academic qualification and the years of experience. The second axis contained "30" statements represent the three research hypotheses. To ascertain the apparent validity of the questionnaire and the reliability of its statements, in terms of wording and clarity, the same was presented to a number of arbitrators and some necessary amendments were made.

Measurement of validity and reliability of questionnaire statements

Apparent validity

the validity and reliability of the measurement instrument have been tested following numerous stages and steps. Starting from the process of the verification of the validity of the instrument, meaning that, to ensure its validity for measurement. In this regard, the researchers depended on the face validity, where, they presented their views to arbitrators of the same experience and specialization, and provided them with the research objectives and hypotheses. The arbitrators then expressed their views and suggestions, on the basis of which, the questionnaire validity took its final form, which has been distributed to the researched sample.

Measuring Inter-item reliability

the intrinsic validity of the questionnaire has been statistically tested, using the intrinsic validity equation

That is to say, validity = reliability. The reliability coefficient of the scale used in the questionnaire was calculated based on the split have method, in accordance with the Spearman Brown formula, and the results were as in the following table

Table (3):- Statistical reliability and validity of the answers of the sample survey individuals to the questionnaire.

Hypothesis.	Reliability coefficient.	Intrinsic validity coefficient.
First	68%	82%
Second	76%	87%
Third	73%	79%
Complete questionnaire.	91%	92%

It is evident from table (3) that all reliability and validity coefficients of the answers of the sample survey individuals to the statements of research hypotheses, and to the complete questionnaire, were greater than 65%, which indicates that the questionnaire is statistically acceptable.

Statistical methods used

The Statistical Package for the Social Sciences program (SPSS), was used in the data analysis. Other statistical methods were also used, the most significant of which, are graphs, frequency distribution of answers, percentages, Pearson correlation coefficient, Spearman formula to calculate the reliability coefficient, arithmetic mean and chi-square test for the significance of the differences between the answers.

Presentation of research findings and hypotheses testing

First hypothesis

high costs of search and exploration in the conditions of intangible drilling affect oil extraction under strategic reserves.

Table (4):- Shows the frequency and percentage of the answers of the research sample individuals about the statements of the first hypothesis.

I strongly disagree.	I disagree.	Neutral.	I agree	I strongly agree.	Statement.	Number.
		1 2.4%	2 4.9%	38 92.7%	Search for remote new drilling areas	1

					affects the increase of costs of fuel and movement.	
	1 2.4%	1 2.4%	4 9.8%	35 85.4%	Removal of natural obstacles, affects the increase of drilling costs.	2
	3 7.3%		1 2.4%	37 90.3%	Search in wilderness area needs powerful engines, which affect the increase of drilling cost.	3
		1 2,42.4%	1 2.4%	39 95.2%	Search for new areas needs preparation of maps, which increases drilling costs.	4
			1 2,4%	40 97.6%	Search and exploration need security protection from thieves and bandits, which increases drilling costs.	5
		1 2.4%	2 4.9%	38 92.7%	Search and exploration need a long time to find oil fields, which increases drilling costs.	6
	1 2.4%		4 9.8%	36 87.8%	Search and exploration need the provision of food stuff and waters, which increases drilling costs.	7
		1 2.4%	3 7.3	37 09.3%	Search and exploration need qualified	8

					experts, which increases drilling costs.	
	1 2.4%	1 2.4%	3 7.4%	36 87.8%	Search and exploration need health units for the experts and employees, which increases drilling costs.	9
		2 4.8%	4 9.8%	35 85.4%	Search and exploration need fuel for the engines, which increases drilling costs.	10

Table (4) reflects the following facts

1. That 92.7% of the respondents strongly agree that remote oil areas have a significant effect on the increase of costs, while 2% say they agree, and 1% are neutral.
2. That 85.4% of the respondents strongly agree that removal of natural obstacles, increases the costs, while 4% say they agree, and 1% are neutral, whereas 1% disagree.
3. That 90.3% of the respondents strongly agree that search in the wilderness areas needs powerful engines, which increases the costs, while 2.94% say they agree, and 7.3% disagree.
4. That 95.2% of the respondents strongly agree that looking for new areas needs preparation of maps, which increases the drilling costs, while 2.4% say they agree, and 2.4% are neutral.
5. That 97.6% of the respondents strongly agree that search and exploration need security measures from the national army to protect the machineries and souls, while 4% say they agree.
6. That 92.7% of the respondents strongly agree that search and exploration take a long time, while 4.9% say they agree, and 2.4% are neutral.
7. That 87.8% of the respondents strongly agree that search and exploration need the provision of food stuff and waters, which increases the drilling costs, while 9.8% say they agree, and 2.4% strongly disagree.
8. That 87.8% of the respondents strongly agree that search and exploration need qualified experts, which is leading to higher drilling costs, while 7.3% say they agree, and 2.4% are neutral.
9. That 87.8% of the respondents strongly agree that search and exploration need health units for the employees, while 7.4% say they agree, and 2.4% disagree, whereas 2,4% are neutral.
10. That 85.4% of the respondents strongly agree that search and exploration need more fuel for machineries, which increases the drilling costs, while 9,8% say they agree, and 4.8% are neutral.

Table (5):- Arithmetic mean and standard deviation, in addition to degrees of freedom, and the probability value of the chi-square test for the answers of the research sample individuals about the first hypothesis.

Probability value.	Degree s of freedom.	Chi-square value.	Standard deviation.	Arithmetic mean.	Statements.	Number.
0,01	1	41	0,1	4	Search for new areas affect the increase of drilling costs.	1
0,01	1	33,8	0,3	4,1	Removal of natural obstacles	2

					affects the increase of drilling costs.	
0,02	2	62,8	0,3	4,1	Search in the wilderness areas needs powerful engines, which increases drilling costs.	3
0,01	2	28	0,5	4,3	Search for new areas needs preparation of maps, which increases drilling costs.	4
0,03	3	34	0,7	4,4	Search and exploration need security protection, which increases drilling costs.	5
0,02	1	33	0,03	4	Search and exploration need a long period of time, which increases drilling costs.	6
0,01	2	50	0,02	4,3	Search and exploration need the provision of food and waters, which increases drilling costs.	7
0,03	2	44	0,01	4,1	Search and exploration need qualified experts, which increases	8

					drilling costs.	
0,02	3	50	0,03	4	Search and exploration need health units for experts, which increases drilling costs.	9
0,01	2	36	0,02	4,2	Search and exploration require fuel for the engines, which increases drilling costs.	10

It is obvious that the Arithmetic mean in table (5) for all statements is greater than the hypothetical Arithmetic mean. This, however, indicates that the answers of the respondents are heading towards the positive direction, meaning that, they agree to these statements. As to the standard deviation of these statements, it is ranging from 1-0.3, and this indicates the homogeneity of the answers of the respondents. In respect of the probability value for all statements, it is less than 0.05 level of significance. This, however, indicates the existence of differences of statistical significance, that is to say, the answers of the respondents are biased towards one answer and not the others.

Based on these facts, the validity of the hypothesis provides for: high costs of search and exploration in the conditions of intangible drilling affect oil extraction under strategic reserves of the Sudapet Petroleum company, has been proved.

This result is attributed to the fact that most of the operations of search and exploration need huge amount of money for the preparation of maps, security guard, building residences for experts, and expenditure on fuel, in addition to the establishment of health units for the employees of the producing company.

Second hypothesis:
high costs of wages and expenses of experts and employees in the conditions of intangible drilling affect oil extraction under strategic reserves.

Table 6:- Shows the frequency and percentage of the answers of the research sample individuals about the statements of the second hypothesis.

I strongly disagree.	I disagree.	Neutral.	I agree.	I strongly agree.	Statement.	Number.
			1 2.4%	41 97.6%	Wages and expenses of experts and employees are very high, which affect the increase of drilling costs.	1

		1 2.4%	1 2.4%	39 35.2%	Experts end of service indemnity affects the increase of drilling costs.	2
	1 2.4%		2 4.9%	38 92.7%	Transfers of experts need flight for remote distances, which increases drilling costs.	3
	1 2.4%	1 2.4%	4 9.8%	35 85.4%	Experts need protection by the army, which increases drilling costs.	4
		1 2.4%	3 7.3%	37 90.3%	Experts need high health care, which increases drilling costs.	5
	1 2.4%	2 4.7%	3 7.3%	35 85.3%	Experts need to be provided with food, which increases drilling costs.	6
		2 4.8%	3 7.3%	36 87.9%	Some employees need additional expertise, which increases drilling costs.	7
		1 2.4%	2 4.8%	38 92.7%	Experts need housing near oil fields, which increases drilling costs.	8
	1 2,42.4%	2 4.8%	3 7.3%	35 85.5%	Most of experts are	9

					foreigner who need airline tickets to and from their countries, which increases drilling costs.	
		2 4.8%	4 9.7%	35 85.5%	Experts and employees are paid in foreign currency, which costs the company huge money.	10

Table (6) reflects the following facts:

1. That 97.6% of the respondents strongly agree that the wages of experts are very high, which increases the drilling costs, while 2.4% say they agree.
2. That 35.2% of the respondents strongly agree that experts end of service indemnity affects the increase of drilling costs, while 2.4% say they agree, and 2.4% are neutral.
3. That 92.7% of the respondents strongly agree that experts need flight for remote distances, which increase the drilling costs, while 4.9% say they agree, and 2.4% disagree.
4. That 85.4% of the respondents strongly agree that experts need protection by the army, which increase the drilling costs, while 9.8% say they agree, and 2.4% are neutral, where 2.4 disagree.
5. That 90.3% of the respondents strongly agree that experts need high health care, which increase the drilling costs, while 7.3% say they agree, and 2.4% disagree.
6. That 85.4% of the respondents strongly agree that experts need to be provided with food by the company, which increase the drilling costs, while 7.4% say they agree, and 4.8% are neutral, whereas 2.4% disagree.
7. That 87.9% of the respondents strongly agree that employees need additional expertise and training, which increase the drilling costs, while 7.83% say they agree, and 4.8% are neutral.
8. That 92.7% of the respondents strongly agree that experts need housing near oil fields, which increase the drilling costs, while 4.9% say they agree, and 2.4% are neutral.
9. That 85.5% of the respondents strongly agree that most of experts are foreigner who need airline tickets, which increase the drilling costs, while 7.3% say they agree, and 4.8% are neutral, whereas 2.4 disagree.
10. That 85.5% of the respondents strongly agree that spending on experts in foreign currency, increases the drilling costs, while 9.7% say they agree, and 4.8% are neutral.

Table (7):- Arithmetic mean and standard deviation, in addition to degrees of freedom, and the probability value of the chi-square test for the answers of the research sample individuals about the second hypothesis.

Probability value.	**Degrees of freedom.**	**Chi-square.**	**Standard deviation.**	**Arithmetic mean.**	**Statement.**	**Number.**
0,02	2	62,8	0,5	4	Wages and expenses of experts and employees are very high, which affect the increase of drilling	1

					costs.	
0,02	2	62,8	0,4	4	Experts end of service indemnity affects the increase of drilling costs.	2
0,02	2	48,9	0,4	4,1	Transfers of experts need flight for remote distances, which increase drilling costs.	3
0,03	3	32,8	0,7	4,3	Experts need protection by the army, which increases drilling costs.	4
0,01	4	37,6	0,9	4,2	Experts need high health care, which increases drilling costs.	5
0,03	3	33,5	0,4	4,1	Experts need to be provided with food, which increases the costs.	6
0,02	2	60,4	0,8	4	Some employees need additional expertise, which increases drilling costs.	7
0,01	1	55,4	0,7	4,2	Experts need housing near oil fields, which	8

					increases drilling costs.	
0,02	2	40,3	0,5	4,1	Most of experts are foreigner who need airline tickets to and from their countries, which increases drilling costs.	9
0,03	3	35,4	0,4	4,3	Experts and employees are paid in foreign currency, which costs the company huge money.	10

It is clear from table (7) that the Arithmetic mean for all statements is greater than the hypothetical Arithmetic mean. This, however, indicates that the answers of the respondents are heading towards the positive direction, meaning that, they agree to these statements. As to the standard deviation of these statements, it is ranging from (0.4 - 0.9), and this indicates the homogeneity of the answers of the respondents. In respect of the probability value for all statements, it is less than 0.05 level of significance. This, however, indicates the existence of differences of statistical significance, that is to say, the answers of the respondents are biased towards one answer and not the others.

Based on these facts, the validity of the hypothesis provides for: high costs of wages and expenses of experts and employees in the conditions of intangible drilling affect oil extraction under strategic reserves, has been proved.

The researchers agree with this finding, because the wages and expenses of the experts are very high, and that the experts need housing in the field sites. They also need food and security protection by the army. This is in addition to the fact that experts and employees end of service indemnity costs the company more amount of money to pay for them.

Third hypothesis:
high costs of purchase and operation of machineries in the conditions of intangible drilling affect oil extraction under strategic reserves.

Table (8):- shows the frequency and percentage of the answers of the research sample individuals about the statements of the third hypothesis.

I strongly disagree.	I disagree.	Neutral.	I agree.	I strongly agree.	Statement.	Number.
		1 2.4%	2 4.8%	38 92.7%	Machineries are brought from abroad, which	1

					increases drilling costs.	
			1 2.4%	40 97.6%	High quality machineries are expensive, which increases drilling costs.	2
	1 2.4%	1 2.4%	3 7.3%	36 87.8%	Maintenance of machineries needs spare parts, which increases drilling costs.	3
		2 4.8%	2 4.8%	37 90.3%	Modern machineries need operation experts, which increases drilling costs.	4
		2 4.8%	4 9.8%	35 85.4%	Transfer of machineries from abroad to the fields' sites, increases drilling costs.	5
		1 2.4%	2 4.8%	38 92.7%	Heavy machineries need paved roads, which increases drilling costs.	6
	1 2.4%		2 4.8%	38 92.7%	Machineries need to be heavily guarded by the army to protect them from theft, which increases drilling costs.	7
		1 2.4%	4 9.8%	36 87.8%	Some characteristics of land need certain drilling machineries to be brought from abroad, which increases drilling costs.	8
	1 2.4%	1 2.4%	5 12.2%	34 83%	When machineries operated, they need to remove any obstacles that impede their operations,	9

					which increase drilling costs.	
		2 %4,8	4 %9,8	35 %85,4	Machineries need more fuel, which increases drilling costs.	10

Table (6) reflects the following facts:

1. That 92.7% of the respondents strongly agree that bringing machineries from abroad, increases the drilling costs, while 4.9% say they agree, and 2.4% are neutral.
2. That 97.6% of the respondents strongly agree that high quality machineries, are expensive, which increases the drilling costs, while 2.4% say they agree.
3. That 87.7% of the respondents strongly agree that maintenance of machineries needs spare parts, which increases the drilling costs, while 7.4% say they agree, and 2.4% are neutral.
4. That 87.8% of the respondents strongly agree that modern machineries need operation experts, which increases the drilling costs, while 4.9% say they agree, and 4.8% are neutral.
5. That 85.4% of the respondents strongly agree that transfer of machineries from abroad to the fields' sites, increases the drilling costs, while 9.8% say they agree, and 4.8% are neutral.
6. That 92.7% of the respondents strongly agree that heavy machineries need paved roads, which increases the drilling costs, while 4.9% say they agree, and 2.4% are neutral.
7. That 92.7% of the respondents strongly agree that machineries need to be heavily guarded by the army to protect them from theft., which increases the drilling costs, while 4.9% say they agree, and 2.4% are neutral.
8. That 87.8% of the respondents strongly agree that some characteristics of land need certain drilling machineries to be brought from abroad, which increases the drilling costs, while 9.8% say they agree, and 2.4% are neutral.
9. That 83% of the respondents strongly agree that when machineries operated, they need to remove any obstacles that impede their operations, which increases the drilling costs, while 12.2% say they agree, and 2.4% are neutral, whereas 2.4% disagree.
10. That 85.4% of the respondents strongly agree that machineries need more stored fuel, which increases the drilling costs, while 9.8% say they agree, and 4.8% are neutral.

Table (9):- Arithmetic mean and standard deviation, in addition to degrees of freedom, and the probability value of the chi-square test for the answers of the research sample individuals about the third hypothesis.

Probability value.	Degrees of freedom.	Chi-square value.	Standard deviation.	Arithmetic mean.	Statement.	Number.
0,02	2	62,2	0,4	4	Machineries are brought from abroad, which increases drilling costs.	1
0,02	2	59,4	0,4	4,1	High quality machineries are expensive, which increases drilling costs.	2
0,02	2	35,2	0,4	4,1	Maintenance of machineries needs spare parts, which increases drilling costs.	3

0,03	3	36,5	0,3	4,3	Modern machineries need operation experts, which increases drilling costs.	4
0,01	1	37,6	0,8	4,2	Transfer of machineries from abroad to the fields' sites, increases drilling costs.	5
0,02	2	40,3	0,4	4	Heavy machineries need paved roads, which increases drilling costs.	6
0,02	1	55,4	0,9	4,3	Machineries need to be heavily guarded by the army to protect them from theft.	7
0,01	3	60,5	0,3	4	Some characteristics of land need certain drilling machineries to be brought from abroad, which increases drilling costs.	8
0,02	2	63,4	0,4	4,2	When machineries operated, they need to remove any obstacles that impede their operations, which increase drilling costs.	9
0,03	2	30,3	0,2	4,3	Machineries need more fuel, which increases drilling costs.	10

It is clear from table (9) that the Arithmetic mean for all statements is greater than the hypothetical Arithmetic mean. This, however, indicates that the answers of the respondents are heading towards the positive direction, meaning that, they agree to these statements. As to the standard deviation of these statements, it is ranging from (0.2-0.9), and this indicates the homogeneity of the answers of the respondents. In respect of the probability value for all statements, it is less than 0.05 level of significance. This, however, indicates the existence of differences of statistical significance, that is to say, the answers of the respondents are biased towards one answer and not the others.

Based on these facts, the validity of the hypothesis provides for**: high costs of purchase and operation of machineries in the conditions of intangible drilling affect oil extraction under strategic reserves.**

This result, is due to the fact that machineries brought from abroad cost the company a lot of money. High quality machineries, on the other hand, cost the company a great deal of money. Theses machineries were also guarded by the army in fear of bandits and thieves. Heavy machineries also require paved roads. Expenditure on fuel, since there are many machineries, causes the company to incur more money, which increases the drilling costs.

Thesis and Dissertation

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2. Muthanna Saman Khalaf Al Mazrouei, Arab Oi, A Research in Geopolitics, Unpublished PhD Dissertation, Mustansiriyah University, Iraq.

Conclusion and Findings:-

The research investigated the effect of intangible drilling costs on oil extraction under strategic reserves, from the viewpoint of the (41) employees in Sudapet Petroleum Company Sudan. Based on the information of the questionnaire, the following findings have been reached:

1. Search and exploration in remote areas cause the company to incur huge money.
2. Search and exploration require security guard by the army.
3. The end of service indemnity affects the increase of drilling costs.
4. Experts and employees need residences, which increases the drilling costs.
5. Heavy machineries require paved roads.
6. High quality machineries are very expensive.

Recommendations and proposals:-

1. The research recommended paving the roads leading to oil fields.
2. The research recommended that machineries should be guarded by the army in order to prevent theft.
3. The research recommended the building of residences for experts and employees.
4. The research recommended purchasing of high-quality modern machineries to accomplish tasks quickly.
5. The research recommended removing natural obstacles that impede the work of the machineries.
6. The research recommended the provision of sufficient fuel to operate the machineries.

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