Role of scientific research in solving the problems of Syrian oil and gas sector from the point of view of its employees

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Abstract:

The aim of this research was to identify the obstacles facing scientific research in oil and gas sector in Syria, and indicate the role and importance of scientific research in solving the problems facing this sector (infrastructure obsolescence, environmental pollution associated with extraction and processing operations, high extraction and processing costs, ensuring HSE conditions at work sites and reducing work risks for workers and equipment) from the point of view of its employees. The descriptive analytical method was used by designing a questionnaire and making sure of its truthfulness and consistency, and then applied to (214) workers at Hayan Petroleum company (HPC). The results showed that there was a role and importance of scientific research in solving the problems that arise during the exploration, drilling, production, processing, transportation and maintenance operations carried out by this sector in Syria from the point of view of the sample members, and that there were no differences between the opinions of the sample members on the role of scientific research in solving the problems of oil and gas sector according to the variables (gender, nature of work), while there were differences between the opinions of the sample members on the role of scientific research in solving the problems of oil and gas sector according to the variables (scientific qualification and years of experience), and the results also showed some of the obstacles facing scientific research in the oil and gas sector in Syria from the point of view of the sample members. The research recommended to establish mechanisms to link the local, Arab and international research centers specialized in oil and gas with the oil and gas companies in Syria, increase spending on scientific research in oil and gas sector in Syria, qualify researchers in oil and gas sector in Syria, provide the database in the research centers specialized in oil and gas with the latest relevant local, Arab and international researches, and finally to work to provide the necessary tools for scientific research in oil and gas sector in Syria.

Keywords: scientific research, problem solving, oil and gas sector, employees.

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دور البحث العلمي في حل مشكلات قطاع النفط والغاز السوري من وجهة نظر العاملين فيه

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الملخص:

هدف هذا البحث إلى تعرّف المعوقات التي تواجه البحث العلمي في قطاع النفط والغاز في سورية، وبيان دور وأهمية البحث العلمي في حل المشكلات التي تواجه هذ القطاع (تقادم البنى التحتية، التلوث البيئي المرافق لعمليات الاستخراج والمعالجة، ارتفاع تكاليف الاستخراج والمعالجة، تأمين شروط الأمن والسلامة في مواقع العمل والحد من مخاطر العمل على العاملين والمعدات) وذلك من وجهة نظر العاملين فيه. وتم استخدام المنهج الوصفي التحليلي عن طريق تصميم استبانة والتأكد من صدقها وثباتها، حيث ثم تطبيقها على (214) عاملاً في شركة حيان للنفط. وقد أظهرت النتائج وجود دور وأهمية للبحث العلمي في حل المشكلات التي تظهر خلال عمليات التنقيب والحفر والإنتاج والمعالجة والنقل والصيانة التي يقوم بها هذا القطاع في سورية من وجهة أفراد العينة، وأنه لا توجد فروق بين آراء أفراد العينة حول دور البحث العلمي في حل مشكلات قطاع النفط والغاز تبعاً لمتغيري (النوع الاجتماعي، وطبيعة العمل)، بينما توجد فروق بين آراء أفراد العينة حول دور البحث العلمي في حل مشكلات قطاع النفط والغاز تبعاً لمتغيري (المؤهل العلمي وسنوات الخبرة)، كما بينت النتائج بعض المعوقات التي تواجه البحث العلمي في قطاع النفط والغاز في سورية من وجهة نظر أفراد العينة. وقد أوصى البحث بوضع آليات للربط بين المراكز البحثية المحلية والعربية والعالمية المتخصصة بالنفط والغاز من جهة وبين الشركات النفطية والغازية في سورية من جهة أخرى، وزيادة الإنفاق على البحث العلمي في قطاع النفط والغاز في سورية، وتأهيل الباحثين في قطاع النفط والغاز في سورية، وتزويد قاعدة البيانات في المراكز البحثية المتخصصة بالنفط والغاز بأحدث الأبحاث المحلية والعربية والعالمية ذات الصلة، والعمل على توفير الأدوات اللازمة للبحث العلمي في قطاع النفط والغاز في سورية.

الكلمات المفتاحية: البحث العلمي، حل المشكلات، قطاع النفط والغاز، العاملون.

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1-Research introduction:

Oil and gas sector is one of the most important industrial sectors that plays major role in the growth and development of societies and providing well-being for their members as a result of the large and influential role of oil in achieving industrial, social and technical development. Syrian oil and gas sector is considered a strategic sector and represents an important resource in achieving any additional growth rate through its direct and indirect contribution to the GDP. It also helps to meet Syria's needs of raw materials and contributes to the formation of GDP for the rest of the economy sectors including agriculture, transportation and services.

However, during recent years, Syrian oil and gas sector has been suffering from many problems that have led to a decline in its strategic role, as a result of several factors, the most important of which is the decline in oil and gas production and the worsening deficit of oil derivatives balance. After the rise in world oil prices had a positive effect of the large surplus phase, it turned into a negative impact at the stage of the growing deficit and the shift to the import of oil derivatives. This challenge comes at a time when the Syrian economy is suffering from a structural crisis associated mainly with the effects of oil and its revenues on the economy as a whole (Suleiman and Al-Aridi, 2013, 95).

Research and development in the oil and gas sector plays a role in developing the technical processes underlying this sector, and finding various solutions for the problems and challenges related to oil and gas exploration, extraction, processing and transportation, which contributes to increasing production and filling the deficit in them. Hence, this research has focused on identifying the role of scientific research in solving the problems of the oil and gas sector in Syria from the point of view of its employees.

2-The problem of the research:

Despite the enormous efforts being made by the Syrian authorities to improve the status of oil and gas sector, after the unfair war that Syria was subjected to, it still suffers from many problems that led to negative results on both production rates and the quality of oil products. The most prominent of these problems is the destruction of part of the infrastructure and the unfair sanctions imposed on Syria and the obsolescence of the remaining infrastructures, including equipment for drilling, processing, transportation and storage, which negatively reflected on production rates, in addition to the high costs of extraction and processing, which reduces the profitable returns of the oil and gas sector, and the necessary rehabilitation of the remaining environmental protection and prevention systems that led to high pollution rates in the environments surrounding the extraction and processing sites, both through carbon emissions and produced water and processing

operations, in addition to the need to rehabilitate HSSE systems at work sites due to the destruction imposed by terrorism in order to avoid the possibility of injuries during work and its high risk to workers and equipment.

These problems have forced us to the need to search for serious and radical solutions for them in order to increase production to the maximum possible rates and improve production efficiency in the oil and gas sector in Syria, which contributes to balancing demand and production as much as possible, and promoting economic growth in all other sectors, hence the importance of scientific research carried out in engineering colleges and research centers specialized in the subject of energy in innovative methods, mechanisms and technologies that try to solve the previous problems and limit their negative impacts on oil and gas production. Therefore, the problem of research can be identified in answering the following questions:

- What is the importance of scientific research in oil and gas sector?
- What is the role of scientific research in solving the problems of the oil and gas sector?
- What are the obstacles to scientific research in the oil and gas sector?

3-The importance of the research:

The importance of the research comes from the following points:

- The importance of scientific research in solving the problems and challenges facing society and forcing to the need to keep up with global developments, in addition to achieving development and prosperity of peoples through high technologies it innovates.

-The importance of oil and gas sector to support the economy, in addition to its great role in achieving economic, social and technical development.

- Highlighting the most major problems of the oil and gas sector in Syria and the importance of research and development in order to solve its problems, increase production rates, reduce costs and improve the efficiency of its products.

-The lack of local research that dealt with the role of scientific research and its importance in solving the problems of the oil and gas sector in Syria.

4- Research objectives:

The research seeks to achieve the following objectives:

- To identify the importance of scientific research in Syrian oil and gas sector from the point of view of its employees.

-To determine the role of scientific research in solving the problems of the oil and gas sector in Syria from the point of view of its employees.

- To identify the obstacles to scientific research in the oil and gas sector in Syria from the point of view of its employees.

- To identify the differences between the opinions of HPC employees on the role of scientific research in solving the problems of oil and gas sector in Syria, depending on variables (gender, educational qualification, years of experience, nature of work).

5-Research hypotheses:

The research seeks to test the validity of the following hypotheses:

-There is an importance of scientific research in the oil and gas sector in Syria from the point of view of its employees.

- There is a role for scientific research in solving the problems of the oil and gas sector in Syria from the point of view of its employees.

-There are obstacles to scientific research in the oil and gas sector in Syria from the point of view of its employees.

-There are statistically significant differences between the opinions of HPC about the role of scientific research in solving the problems of the oil and gas sector in Syria due to variables (gender, educational qualification, years of experience, nature of work).

6-Previous Studies:

The aim of Al-Majidel and Shammas' research(2010) entitled "**The obstacles of scientific research in the faculties of education from the point of view of faculty members (field study- Faculty of Salalah)**",the two researchers used the descriptive analytical method, where a questionnaire was sent to the faculty members at the Faculty of education in Salalah, and the research reached the approval of the majority of the faculty members by 60% on all the items of the questionnaire, and they confirmed that administrative obstacles were more severe on the faculty members in the field of scientific research, and the research showed that there are no significant differences between the faculty members attributed to variables(gender and specialization) in relation to their suffering from scientific research obstacles, while there were significant differences related to the variable of years of experience in favor of the less experienced in terms of the severity of their suffering from these disabilities.

The study of Suleiman and al-Aridi (2013) on "**The status of the oil industry in Syria and its future prospects, current challenges and alternative strategies**" aimed to track the development of the oil industry in Syria and the impact of the oil deficit on the role of this industry in energy supply on the one hand, and in supporting the balance of the Syrian economy on the other hand, by analyzing the possibilities the Syrian economy has and the potential energy sources in Syria, and putting achievable strategies though a package of integrated policies and procedures. The research concluded that the end of the Syrian oil may be the beginning of thinking and working to create a more developed and sustainable

energy industry in the economy if the available resources are well-managed, invested and used with the required efficiency.

In AlBajouri study(2015) entitled: "**The impact of scientific research on economic growth in the Arab countries**", the study aimed to measure the impact of scientific research on economic growth in (6) Arab countries (Algeria, Egypt, Kuwait, Morocco, Saudi Arabia, Tunisia) during the period from 2000 to 2012, and to achieve the goal of the study, the method of cross-sectional time series data was used, and the results were summarized in the presence of a positive and non-significant impact of scientific research on economic growth in the Arab countries under study.

Abadi's Study (2018) in Iraq, entitled "**The role of research and development in economic growth selected international experiments with reference to Iraq**" aimed to identify the role of research and development in economic growth according to the Finnish, Korean and Iraqi experience, the researcher used the descriptive analytical method and deductive method, and he concluded a set of conclusions, the most important of which are: Most of the countries that have adopted the research and development strategy are developed countries with a high degree of competitiveness, low unemployment rates, and sustainable growth rates, and the large financial spending on research and development in the sample countries, as the percentage exceeds the world average of (2.5%) of GDP, and this percentage decreases in Iraq, and in some years it drops to zero.

In Kuwait, a study was conducted for Al-Shamri (2020) on "**The impact of research and development on financial performance indicators in Kuwaiti oil companies**". The study aimed to identify the role of research and development on financial performance indicators in Kuwaiti oil companies. The descriptive analytical approach was used. A measurement tool, a questionnaire, was designed and distributed to a random stratified sample of employees of those companies, numbering (367) workers. the study found a positive impact of research and development on financial performance indicators. The study recommended the need to increase attention to research and development because of its positive impact on financial performance indicators.

Dunn and Forman (2014) discussed research and development practices in major global organizations, where the study aimed to identify the status of research and development practices in major global organizations, explored ways for giant organizations to adopt R & D concepts and practices, and highlighted on the various trends of research and development in increasing achievement at work. The study found that there are some special insights on the extent of giant organizations ' preoccupation with R & D practices, and the study showed that organizations are making great efforts in the field of research and development, in

addition to there is a positive change in the development of global organizations in terms of introducing and integrating R & D standards research and development in their strategies and practices.

Sekeroglu(2018) studied the subject of research and development and its impact on the excellence of organizations in order to identify the role that research and development plays in institutional excellence, determine the role of research and development dimensions on the development of institutional performance, as well as determine their role in achieving standards of excellence. The study found a moral correlation between research and development and achieving institutional excellence, and the presence of a moral impact of the dimensions of research and development represented by (leadership excellence, excellence in service provision, human resources excellence, financial excellence). The study showed that the attention of management leaders to the concept of research and development has a positive impact on achieving organizational excellence.

Beheshti (2019) identified the relationship between strategic leadership and technology management through the centralization of the role of research and development. The study aimed to determine the role of strategic leadership on research and development, through the introduction of research and development in the field of Technology Management as an intermediate variable, as well as to know the role of research and development on technology management. The results of the study showed that there was an important role for strategic leadership on research and development in the field of Technology Management, and also showed thar R&D contributes in achieving better advantages to improve technology management for the industrial organizations, and there is an impact for strategic leadership variables on technology management development methods through using research and development and achieving new advantages for the organizations.

Alagoz (2023) also studied sustainable development in the oil and gas sector by taking into account economic, environmental and social aspects, and the study aimed to show the importance of achieving a balance between economic, environmental and social factors in order to achieve sustainable development in the oil and gas sector, highlighting ways in which the industry can be more sustainable, in addition to clarifying the importance of reporting on sustainability efforts and providing examples of sustainable business strategies under implementation. The research also addressed the future of sustainability in the oil and gas sector, new trends and problems in this sector, opportunities for innovation and teamwork in order to achieve sustainability in it.

Previous studies have outlined the strategic role of scientific research in various aspects such as economic growth, improving management efficiency, achieving institutional

excellence and increasing the profits of economic organizations and institutions. Thus the current study meets with previous studies in highlighting the importance of scientific research in development and modernization, but what distinguishes the current study from previous studies is that it outlined the role of scientific research in solving the problems of the oil and gas sector specifically.

7–Research variables:

- Independent variables: scientific research, taxonomic variables (gender, scientific qualification, years of experience, nature of work).
- Dependent variables: solving the problems of the oil and gas sector.

8–The limits of research:

- Locative limits: the research was applied in Hayan Petroleum Company (HPC).
- Time limits: the research was applied during the period between 03/01/2024 and 02/03/2024.
- Objective limits: the research was limited to know the role of scientific research in solving the problems of the oil and gas sector from the point of view of its employees.

9–Theoretical Framework of the research:

First: The importance of scientific research:

Scientific research is one of the most important tools of technological and knowledge progress required by the countries of the world, as it helps to discover new knowledge and invent modern technologies that contribute positively to the prosperity and growth of societies.

Scientific research is defined as a regular intellectual process carried out by a person called a researcher in order to investigate the facts related to a particular issue or problem called the subject of research, following an organized practical method called the research method in order to reach appropriate solutions to the problem or to results valid for generalization to similar problems called research results (Thigil and Jawarin, 2012, 9).

It is also the main mean by which a solution to a specific problem can be reached through a comprehensive and accurate investigation of all the evidence that relates to it, and thus it is a new addition to the field of knowledge through the discovery of new facts using systematic and objective methods, and therefore it is the basis for launching towards the axes of economic development (Al–khaikani, 2010, 99).

The important objective of scientific research is to find solutions to the problems facing society in various aspects of life and to invent methods and tools that address these problems through scientific and technological progress and apply its outputs as a measure of its economic progress and the prosperity of its society, so that interest in scientific

research and means of knowledge has become characteristic of developed countries, as technological development is one of the most important factors responsible for economic growth and a high standard of living(Abadi, 2018, 31).

Scientific research includes basic, applied and experimental research, such as academic scientific research that aims to add knowledge and importance, industrial scientific research that generates a stock of knowledge and information to fuel engineering development and support design and creativity in order to increase profitability. Scientific research has many functions, including education, training and knowledge exploration, as well as it is a package of methods and steps organized and integrated used in the analysis and examination of old information to reach new results that differ according to different characteristics of scientific research, it helps to add new information and helps to make new adjustments to previous information in order to continue its development. Research and development include systematically based creative work in order to increase the knowledge reserve, which includes the knowledge of humans, culture and society, and use this knowledge reserve in order to invent new applications (Dodgson and Jean, 2014, 55).

Second: The status of the oil sector in Syria and its problems:

The oil sector in the Syrian Arab Republic is a strategic sector, it is the most important factor in achieving the required growth rate for the output of all sectors of the economy. Despite the existence of an economic reserve of oil and gas and the presence of two oil refineries that provide an important part of the country's need for oil derivatives, however, this sector is currently considered one of the most affected sectors as a result of the crisis experienced by Syria starting in 2011, where it suffered massive destruction of infrastructure and most of the production, processing and transportation facilities of oil and gas , and suffered huge losses as a result of unilateral coercive economic measures imposed on the Syrian Arab Republic. According to the numbers the Ministry of oil and Mineral Resources and its accurate statistics, direct and indirect losses in the sector of extraction, supply, distribution and investment of oil, gas and Mineral Resources since 2011 until mid-2022 have amounted to (107.1) billion dollars(Ministry of Foreign Affairs and expatriates in Syria, 2022).

The oil sector is facing several challenges, the most important of which are improving the level of crude oil production, rehabilitating transportation and distribution networks, providing the necessary financing for the implementation of existing refinery development projects, establishing new refineries to produce oil derivatives with international specifications and reducing fuel combustion emissions (gasoline, diesel fuel…) (Ministry of local administration and environment of Syria, 2018, 8).

The report of the planning and International Cooperation Commission (2020, 7) also states that Syria has not been able to reach the stage of energy saturation and optimum efficiency of using energy sources despite the efforts made to increase oil and gas production, and the war has led to negative results on production and transportation processes, but this has not prevented partial compensation for the sharp decrease in the supply of crude oil to refineries through its import and refining, the problem of obtaining spare parts for machinery and equipment from abroad has worsened, the difficulty of having tankers for oil derivatives, and the migration of some technically experienced staff.

Third: Scientific research and development in oil and gas sector in Syria:

The status of scientific research in the field of energy in Syria is no different from the general status of technical research and development, which can be summarized as it is still fragile, weak and closed to itself, and its interactions with other parties are almost not existed in the national system of science, technology and innovation such as companies, production and service institutions, intermediaries and the rest of the parties of supply and demand in the scientific research market, as well as with actors within the regional and international environment. However, the availability of an acceptable infrastructure for research in the field of energy in addition to the presence of the National Center for energy research is a strong point that can be built on and developed in the process of scientific research in the energy sector, and that the Masters and PhDs theses related to energy completed in the faculties of chemical & petroleum, mechanical, electrical and electronic engineering at Syrian universities are several. When analyzing the applied aspects that have been used from the previous mentioned theses in the Syrian industry in its various forms, it turned out that a very small part has been invested in the industry. Table (1) shows the most important research bodies and their field of work related to the oil and gas sector:

Table(1): the most important research bodies and their field of work related to the oil and gas sector:

Enterprise	Oil-related business areas
Faculty of chemical and petroleum engineering	- Improving the productivity of oil-producing wells. - The use of geophysical methods in the exploration of oil and gas reservoirs. - Oil refining researches. - Drilling engineering of oil & gas wells researches.
National Center for Energy Research	- Energy Management and efficiency in various sectors. - Training and qualification of staff, preparation of competent human resources, preparation of studies and research in the field of energy.

(Higher commission for scientific research, 2012,75-78)

For the development of the oil sector in Syria, scientific research can include the following research axes:

* Research on ways to raise the efficiency of natural gas use.

* Developing and innovating technologies to increase the efficiency of supplies for the transportation, storage and distribution of oil, gas and derivatives and researching the automation of the processes of transportation and distribution of derivatives.

* Research and development of modern methods and techniques in the evaluation and investment of mining wealth and areas of optimal use of unconventional resources, especially: oil shale, zeolites, phosphates, very heavy oil, volcanic tuff, asphalt, quartz sand, and others.

* Research and development in solving the problems of production pumps used in oil industry of all kinds.

* Research on the impact of energy sources price liberalization on the rationalization of energy consumption and the national economy.

* Research and development in the use of modern technologies and methods in both oil investment operations and drilling engineering of oil & gas wells(higher commission for scientific research, 2012, 79).

Fourth: the obstacles of scientific research in Syria:

The national system of Science, Technology and innovation in Syria consists of higher institutions for the management and planning of scientific research and technical development, scientific research and technical development centers, technical production institutions, intermediate and supporting institutions. This system suffers from weak

relationships, interdependence, cooperation and coordination between its components for various reasons, including weak structures and legislation that strengthen this relationship, weak initiatives and the absence of an evaluation mechanism, and also suffers from weakness in the relationship between them and different economic sectors, and weakness in technology transfer whether the inter-related within the same institution or between different institutions, and finally weakness in external technology transfer, employment and localization(United Nations, 2019,5).

The low percentage of spending on scientific research is also one of the most important obstacles limiting its prosperity in Syria, as according to the UNESCO Science Report (towards 2030), Syria was spending the equivalent of (0.1) of GDP on scientific research, and this percentage declined after (2011) to (0.04) of GDP (United Nations, 2019, 31).

10- Field Study:

First: Research Approach: the descriptive analytical approach was used to identify the role of scientific research in solving the problems of the oil and gas sector from the point of view of its employees.

Second: Research community and its sample:

The research community consists of the 256 employees of HPC. The research was applied to the entire community because of its small size. The questionnaire was applied to a survey sample of (30) workers to ensure its truthfulness and consistency. the questionnaire was then distributed to (226) workers. the number of returned questionnaires valid for statistical analysis was (214). Table(2) shows the characteristics of the sample members:

Table (2): characteristics of the sample members:

Variable	levels	total number	survey sample	discarded questionnaires	basic sample	Percentage%
Gender	Male	230	28	12	190	88.79%
	Female	26	2	0	24	11.21%
	Total	**256**	**30**	**12**	**214**	**100%**
educational qualification	High School	16	3	3	10	4.67%
	Institute	123	15	4	**104**	48.6%
	Engineers	82	6	4	**72**	33.64%
	Other university degrees	30	6	1	**23**	10.75%
	Masters and PhDs	5	0	0	**5**	2.34%
	Total	**256**	**30**	**12**	**214**	**100%**
Years of experience	less than (5) years	68	12	3	**53**	24.77%
	5–10 years	106	8	5	**93**	43.46%
	More than (10) years	82	10	4	**68**	31.77%
	Total	**256**	**30**	**12**	**214**	**100%**
Nature of work	Fields	207	27	12	**168**	78.50%
	Head office	49	3	0	**46**	21.5%
	Total	**256**	**30**	**12**	**214**	**100%**

Third: Research tool and statistical methods used in analyzing the results:

To achieve the research objectives, a questionnaire consisting of (3) axes was designed, under which (31) phrases fall, and each phrase has five options (strongly agree, agree, neutral, disagree, strongly disagree) according to the five-point Likert scale, and the authenticity of the questionnaire has been confirmed and fixed according to the following:

Truthfulness of the tool: The truthfulness of the questionnaire was confirmed by the truthfulness of the content by presenting it to a group of qualified arbitrators and polling their opinions if the phrases were appropriate, and the correlation of the phrases with the axes listed under, and finally the linguistic correctness of the words of the phrases. The required

adjustments were made by the arbitrators on the questionnaire phrases. The method of internal consistency truthfulness was also used by calculating the coefficients of the phrases related to the total degree of the questionnaire. The values of the Pearson correlation coefficient ranged between $(0.641-0.782)$ which is a function of (0.01). The coefficient of the phrases related to the total degree for the axis listed below were calculated, and the values of the Pearson correlation coefficient ranged between $(0.598-0.763)$, which is a function of (0.01), which Indicates the truthfulness of the questionnaire.

Stability of the questionnaire: the stability of the questionnaire was confirmed by using the cronbach's Alpha stability and the stability of the half-hash. The stability of the questionnaire as a whole by the cronbach's Alpha method reached (0.875) and the value of the coefficient of stability of the half-hash reached (0.869), which were acceptable values.

To test the validity of the research hypotheses, the following statistical methods were used: the t-test for One sample (One Sample t Test) , T-Test for two independent groups, and analysis of variance (One Way ANOVA).

Fourth: Testing Research hypotheses:

The first hypothesis: There is an importance of scientific research in oil and gas sector in Syria from the point of view of its employees.

To verify the validity of the hypothesis, the researcher used the t test for One sample (one Sample t Test) to analyze the paragraphs of the axis of the importance of scientific research in oil and gas sector in Syria, and in comparison between the arithmetic mean and the standard average (hypothesis), the results were as shown in Table(3).

Table (3): statistical indicators of the opinions of the study sample according to the variables of the first hypothesis

Ser.	Phrases	No.	Arithmetic Mean	standard deviation	Relative weight	Degree of Freedom	T value	Sig. value
1	scientific research helps in the development of oil and gas exploration technologies.	214	3.49	0.72	69.8%	213	10.204	0.00
2	scientific research helps to discover new reserves of oil and gas.	214	3.54	0.79	70.8%	213	10.210	0.00
3	scientific research helps in the development of oil and gas well drilling technologies.	214	3.45	0.71	69%	213	9.360	0.00
4	scientific research helps to introduce modern methods of extracting oil and gas from wells and increasing recovery factor.	214	3.47	0.73	69.4%	213	9.565	0.00
5	scientific research assists in the development of equipment and processes for geophysical measurements of oil and gas wells.	214	3.50	0.67	70%	213	11.014	0.00
6	scientific research contributes to the innovation of more efficient technologies for oil separation, processing and storage in gas treatment plants (GTPs) and stations.	214	3.46	0.70	69.2%	213	9.913	0.00
7	scientific research contributes to the innovation of more efficient technologies for gas processing in GTPs and stations, and the export of sales gas on specifications.	214	3.47	0.71	69.4%	213	9.823	0.00
8	scientific research contributes to the innovation of new technologies to raise the efficiency of condensate and LPG recovery from raw gas in gas processing plants.	214	3.48	0.69	69.6%	213	10.298	0.00
9	scientific research contributes to increasing oil and gas production rates.	214	3.52	0.67	70.4%	213	11.532	0.00
10	scientific research improves the quality of local oil and gas products.	214	3.51	0.68	70.2%	213	11.208	0.00
11	scientific research improves operational efficiency in oil and gas sector.	214	3.42	0.74	68.4%	213	8.433	0.00
12	scientific research contributes to the development and automation of management systems in the oil sector.	214	3.48	0.71	69.6%	213	10.104	0.00
The axis of the importance of scientific research in oil and gas sector in Syria		**214**	**3.48**	**0.58**	**69.6%**	**213**	**12.327**	**0.00**

It is clear from Table (3) that the importance of scientific research in oil and gas sector from the point of view of the employees of HPC came to a high degree, as their average responses on the axis of the importance of scientific research in the oil sector reached (3.48), which is greater than (3) with a standard deviation (0.58) is small, and the value of the function t= (12.327) and the value of the function sig= (0.00), which is smaller than the standard significance level (0.05). Therefore, the difference between the averages of the respondents ' answers on the axis of the importance of scientific research therefore, we reject the hypothesis of nothingness and accept the alternative hypothesis, that is, there is an importance of scientific research in oil and gas sector in Syria.

The second hypothesis: There is a role for scientific research in solving the problems of oil and gas sector in Syria from the point of view of its employees.

To verify the validity of the hypothesis, the researcher used the t test for One sample (One Sample t Test) to analyze the paragraphs of the axis of the role of scientific research in solving the problems of the oil and gas sector, and in comparison between the arithmetic mean and the standard average (hypothesis), the results were according to Table (4):

Table (4) statistical indicators of the opinions of the study sample according to the variables of the second hypothesis

Ser.	phrases	No.	Arithmetic Mean	standard deviation	Relative weight	Degree of Freedom	T value	Sig. value
13	scientific research improves the efficiency of maintenance of oil and gas wellhead equipment.	214	3.52	0.74	70.4%	213	10.320	0.00
14	scientific research improves the efficiency of maintenance of downhole equipment for oil and gas wells.	214	3.48	0.72	69.9%	213	9.927	0.00
15	scientific research develops new technologies for workover of oil and gas wells.	214	3.55	0.78	71%	213	10.392	0.00
16	scientific research improves the efficiency of surface equipment maintenance in oil and gas GTPs and stations.	214	3.50	0.80	70%	213	9.360	0.00
17	scientific research improves the efficiency of maintenance of oil and gas transmission pipelines.	214	3.51	0.72	70.2%	213	10.395	0.00
Infrastructure obsolescence problem		214	3.51	0.63	70.2%	213	11.970	0.00
18	scientific research contributes to the innovation of effective ways to reduce the gases emitted by gas and oil processing plants and stations to a minimum limit.	214	3.56	0.77	71.2%	213	10.919	0.00

19	scientific research helps to find a solution to the problem of produced water.	214	3.53	0.77	70.6%	213	10.173	0.00
20	scientific research reduces the risks of oil and gas activities on the surrounding environment.	214	3.54	0.69	70.8%	213	11.500	0.00
The problem of environmental pollution associated with extraction and processing operations:		214	3.54	0.61	70.8%	213	13.144	0.00
21	scientific research contributes to suggestion of solutions to reduce the downtime of equipment in oil and gas field to a minimum, which also reduces the costs resulting from downtime.	214	3.51	0.69	70.2%	213	10.996	0.00
22	scientific research contributes to suggestion of solutions to reduce the time of RIH and POOH operations to the minimum during oil and gas well drilling operations, which contributes to reducing well drilling costs to the minimum.	214	3.49	0.70	69.8%	213	10.490	0.00
23	scientific research contributes to reaching optimal consumption rates of chemicals needed during oil and gas processing, and as a result reducing the cost of chemicals to the minimum.	214	3.41	0.74	68.2%	213	8.347	0.00
24	scientific research contributes to suggestion of solutions to reduce the energy consumption rates necessary to operate oil and gas extraction and processing equipment to the minimum limits.	214	3.50	0.68	70%	213	10.903	0.00
The problem of high extraction and processing costs:		214	3.48	0.61	69.6%	213	11.573	0.00
25	scientific research helps to ensure maximum protection for workers in the oil sector from pollution and work hazards.	214	3.59	0.79	71.8%	213	11.055	0.00
26	scientific research helps to strengthen the provision of the necessary means of protection for surface and downhole equipment within the oil sector in order to sustain its operation as long as possible.	214	3.60	0.80	72%	213	11.080	0.00
The problem of securing HSE conditions at work sites and reducing the risks of work on workers and equipment:		214	3.60	0.77	72%	213	11.409	0.00

The role of scientific research in solving the problems of the oil and gas sector in Syria	**214**	**3.60**	**0.77**	**72%**	**213**	**11.409**	**0.00**

It is clear from Table (4) that the role of scientific research in solving the problems of the oil and gas sector in Syria was high, as the average answers of HPC employees on the axis of the role of scientific research in solving the problems of the oil and gas sector in Syria as a whole reached (3.53), which is greater than (3) with a small standard deviation (0.61), and the value of the function t= (12.806) and the value of the function sig= (0.00), which is smaller than the standard significance level (0.05), and therefore the difference between the averages of the answers of the respondents on the axis of the role of scientific research in solving the problems of the oil and gas sector in Syria and the average hypothesis is statistically significant, and therefore we reject the hypothesis of nothingness and accept the alternative hypothesis, that is, there is a role for scientific research in solving problems of oil and gas sector in Syria.

The third hypothesis: There are obstacles to scientific research in the oil and gas sector in Syria from the point of view of its employees:

To verify the validity of the hypothesis, the researcher used the t test for One sample (one Sample t Test) to analyze the paragraphs of the axis of scientific research obstacles in the oil and gas sector in Syria, and in comparison between the arithmetic mean and the standard average (hypothesis), the results were as follows:

Table (5): statistical indicators of the opinions of the study sample according to the variables of the third hypothesis

Ser.	Phrases	No.	Arithmetic Mean	standard deviation	Relative weight	Degree of Freedom	T value	Sig. value
27	weak linkage between local, Arab and international research centers specialized in oil and gas on the one hand and oil and gas companies in Syria on the other.	214	3.19	0.99	63%	213	2.958	0.00
28	Weakness of funding of scientific research in the oil sector.	214	3.24	1.05	65.4%	213	3.504	0.00
29	poor preparation and qualification of researchers in the oil sector.	214	3.43	0.72	63.6%	213	8.833	0.00
30	the database in research centers specialized in oil and gas is poor.	214	3.46	0.74	62.8%	213	9.392	0.00
31	weakness of the availability of the necessary tools for scientific research in the oil sector.	214	3.48	0.69	62.6%	213	10.395	0.00
The axis of scientific research obstacles in the oil and gas sector in Syria		**214**	**3.36**	**0.64**	**63.4%**	**213**	**8.454**	**0.00**

It is clear from Table (5) that there are obstacles to scientific research in the oil and gas sector in Syria, as the average answers of employees of HPC on the axis of scientific research obstacles in the oil sector amounted to (3.36), which is greater than (3), with a small standard deviation (0.64), and the value of the function t= (8.454), and the value of the sig=(0.000) which is smaller than the standard significance level(0.05). Therefore, we reject the hypothesis of nothingness and accept the alternative hypothesis, so there are obstacles to scientific research in oil and gas sector in Syria.

Fourth hypothesis: There are significant differences between the opinions of HPC employees about the role of scientific research in solving the problems of the oil and gas sector due to the gender variable.

To verify the validity of this hypothesis, the averages of the scores of the sample members of the male employees of HPC and the averages of the scores of the sample members of the female employees of HPC were calculated to identify the role of scientific research in solving the problems of the oil sector as a whole, then for each of its axes, and calculate the T-Test value for two independent groups, to know the significance of the differences between the scores of the two groups (female/ male), and the following table shows the results:

Table (6): the differences between the average scores of the sample members of the HPC employees according to the gender variable:

axis	variable	number	Arithmetic Mean	standard deviation	Degree of Freedom	T value	Sig. value	Decision
The importance of scientific research in the oil and gas sector in Syria	male	190	42.14	6.58	212	1.24	0.215	Statistically Insignificant
	female	24	40.25	9.93				
The role of scientific research in solving the problems of the oil and gas sector in Syria	male	190	49.54	8.06	212	0.54	0.590	Statistically Insignificant
	female	24	48.54	12.15				
Scientific research obstacles in the oil and gas sector in Syria	male	190	16.88	3.11	212	0.25	0.802	Statistically Insignificant
	female	24	16.70	4.10				
Overall questionnaire	**male**	**190**	**108.57**	**16.85**	**212**	**0.78**	**0.433**	**Statistically Insignificant**
	female	**24**	**105.50**	**25.94**				

It is clear from Table (6) that the value of the sig function in the questionnaire as a whole =(0.433) and is greater than the significance level (0.05), which means that there are no differences between the averages of the scores of the sample members of the male HPC employees and the averages of the scores of the sample members of the female HPC employees on the questionnaire as a whole, and the values of the Sig function in all sub-axes are greater than the significance level (0.05), which means that there are no differences between the averages of the scores of the sample members of HPC male and female employees averaged the scores of the respondents on all the axes of the questionnaire, and therefore we accept the zero assumption, i.e. there are no statistically significant differences when the level of significance (0.05) between the averages of the answers of HPC employees on identifying the role of scientific research in solving the problems of the oil and gas sector according to the gender variable.

Fifth hypothesis: There are significant differences between the opinions of HPC employees about the role of scientific research in solving the problems of the oil and gas sector due to the variable of scientific qualification.

To test the validity of this hypothesis, the researcher used a variance analysis (One Way ANOVA) in order to verify the significance of the differences between the averages of the workers ' answers to the questionnaire depending on the scientific qualification variable, and the results were as follows:

Table (7): arithmetic averages and standard deviations of employees ' answers depending on the scientific qualification variable:

Scientific qualification	number	arithmetic mean	standard deviation
High School	10	70.10	4.81
Institutes	104	107.14	16.70
Engineers	72	109.83	12.97
Other university degrees	23	115.82	13.38
Masters and PHD`s	5	149	1.41
Total	**214**	**108.22**	**18.04**

Table (8): results of One Way ANOVA test of employees' answers according to the scientific qualification variable:

Variance	sum of squares	degree of freedom	squares average value	F value	Sig value	Decision
between groups	24484.739	4	6121.185	28.520	0.000	**Statistically Significant**
Within groups	44857.041	2.9	214.627			
Total	**69341.780**	**312**				

It is clear from Table(8) that the value of the Sig statistical function in the questionnaire = (0.000), which is smaller than the significance level (0.05), which means that there are statistically significant differences between the averages of the answers of HPC employees depending on the educational qualification variable, and to find out the trends of these differences, the researcher used the Scheve test and the results were as follows:

Table (9): results of the Chevet test for the grades of workers on the questionnaire as a whole according to the scientific qualification variable:

Scientific qualification (I)	scientific qualification (J)	average differences(I-J)	standard error	(Sig) value	decision
High School	Institutes	-37.04423	4.85040	0.000	Statistically Significant
	Other university degrees	-45.72609	5.54926	0.000	Statistically Significant
	Engineers	-39.73333	4.94405	0.000	Statistically Significant
	Masters and PHD`s	-78.90000	8.02422	0.000	Statistically Significant
Institutes	High school	37.04423	4.85040	0.000	Statistically Significant
	Other university degrees	-8.68186	3.37570	0.162	Statistically insignificant
	Engineers	-2.68910	2.24603	0.835	Statistically insignificant
	Masters and PHD`s	-41.85577	6.70739	0.000	Statistically Significant
Engineers	High school	39.73333	4.94405	0.000	Statistically Significant
	Institutes	2.68910	2.24603	0.838	Statistically insignificant
	Other university degrees	-5.99275	3.50892	0.573	Statistically insignificant
	Masters and PHD`s	-39.16667	6.77542	0.000	Statistically Significant
Other university degrees	High school	45.72609	5.54926	0.000	Statistically Significant
	Institutes	8.68186	3.375570	0.162	Statistically insignificant
	Engineers	5.99275	3.50892	0.573	Statistically insignificant
	Masters and PHD`s	33.17391	7.22890	0.000	Statistically Significant
Masters and PHD`s	High School	78.90000	8.02422	0.000	Statistically Significant
	Institutes	41.85577	6.70739	0.000	Statistically Significant
	Other university degrees	33.17391	7.22890	0.000	Statistically Significant
	Engineers	39.16667	6.77542	0.000	Statistically Significant

It is clear from Table (9) the following:

- There are statistically significant differences between the average grades of workers with a high school certificate and workers with other certificates in favor of workers with higher certificates.

- There are no statistically significant differences between the average grades of employees with an institute or engineers or another university degrees.

- There are differences between employees with Institute degrees and those with higher degrees in favor of employees with higher degrees.

- There are no significant differences between the average grades of engineers and those with another university degrees.

- There are differences between workers with another university degrees and workers with higher degrees in favor of workers with higher degrees.

- There are differences between engineers and workers with higher degrees in favor of workers with higher degrees.

Sixth hypothesis: there are significant differences between the opinions of HPC employees about the role of scientific research in solving the problems of oil and gas sector due to the variable of years of experience.

To test the validity of this hypothesis, the researcher used a variance analysis (One Way ANOVA) in order to verify the significance of the differences between the averages of the workers ' answers to the questionnaire depending on the variable of years of experience, the results were as follows:

Table (10): arithmetic averages and standard deviations of employees ' answers according to the years of experience variable:

Years of experience	number	arithmetic mean	standard deviation
Less than (5) years	53	94.79	20.73
Between (5-10) years	93	108.77	13.77
More than (10) years	68	117.95	14.19
Total	**214**	**108.22**	**18.04**

Table (11): Results of One Way ANOVA test for employees ' answers according to the variable of years of experience:

Variance	sum of squares	degree of freedom	squares average	F value	Sig value	Decision
Between groups	16029.93	2	8014.96	31.72	0.000	Statistically Significant
Within groups	53311.84	211	252.66			
Total	**69341.780**	**213**				

It is clear from Table(11) that the value of the Sig statistical function in the questionnaire = (0.00), which is smaller than the significance level (0.05), which means that there are statistically significant differences between the averages of the answers of employees at HPC according to the variable of years of experience, and to find out the trends of these differences, the researcher used the Scheve test and the results were as follows:

Table (12): results of the Chevet test for the scores of workers on the questionnaire as a whole according to the variable of years of experience

Years of experience (I)	Years of experience (J)	average variances(I–J)	standard error	(Sig) value	Decision
Less than (5) years	between (5–10) years	13.98174	2.73	0.000	**Statistically Significant**
	More than (10) years	23.16343	2.91	0.000	**Statistically Significant**
between (5–10) years	Less than (5) years	13.98174	2.73	0.000	**Statistically Significant**
	More than (10) years	9.18169	2.53	0.002	**Statistically Significant**
More than (10) years	Less than (5) years	23.16343	2.91	0.000	**Statistically Significant**
	between (5–10) years	9.18169	2.53	0.002	**Statistically Significant**

Table(12) shows the following:

– There are significant differences between workers with less than (5) years of experience and workers with experience between (5–10) years in favor of and workers with experience between (5–10) years.

– There are statistically significant differences between workers with less than (5) years of experience and workers with more than (10) years of experience in favor of and workers with more than (10) years of experience.

– There are statistically significant differences between workers with experience between (5–10) years and workers with experience more than (10) years in favor of and workers with experience more than (10) years.

Seventh hypothesis: There are significant differences between the opinions of HPC employees about the role of scientific research in solving the problems of oil and gas sector due to the variable nature of work.

To verify the validity of this hypothesis, the averages of the scores of the sample members working in HPC in the head office and the averages of the scores of the sample members working in HPC fields were calculated to identify the role of scientific research in solving the problems of oil and gas sector as a whole, then for each of its axes, and calculate the T–Test value for two independent groups, to know the significance of the differences between the scores of the two groups (in the head office / in the fields), and the following table shows the results:

Table (13): the differences between the average scores of the sample members of HPC employees according to the variable nature of the work:

axis	variable	number	arithmetic mean	standard deviation	Degree of Freedom	T value	Sig. value	Decision
The importance of scientific research in the oil and gas sector in Syria.	Head office	46	42.91	5.67	212	1.07	0.286	Statistically Insignificant
	Fields	168	41.66	7.35				
The role of scientific research in solving the problems of the oil and gas sector in Syria.	Head office	46	51.43	6.71	212	1.79	0.074	Statistically Insignificant
	Fields	168	48.88	8.96				
The axis of scientific research obstacles in the oil and gas sector in Syria.	Head office	46	17.39	2.92	212	1.25	0.212	Statistically Insignificant
	Fields	168	16.72	3.29				
Overall questionnaire	**Head office**	**46**	**111.73**	**14.61**	**212**	**1.49**	**0.137**	**Statistically Insignificant**
	Fields	**168**	**107.26**	**18.79**				

It is clear from Table (13) that the value of the sig function in the questionnaire as a whole =(0.137), which is greater than the significance level (0.05), which means that there are no differences between the averages of the scores of the sample members working in HPC fields and the averages of the scores of the sample members working in HPC head office on the questionnaire as a whole, and the values of the Sig function in all sub-axes are greater than the significance level (0.05), which means that there are no differences between the averages of the scores of the sample members working in HPC head office and the average scores of the sample members working in HPC fields on all axes of the questionnaire, and therefore we accept the zero assumption, i.e. there are no statistically significant differences at the indicative level (0.05) between the averages of the answers of HPC employees to identify the role of scientific research in solving the problems of the oil and gas sector according to the nature of the work variable.

11. Conclusions:

* There is an importance of scientific research in oil and gas sector in Syria from the point of view of its employees.

* There is a role for scientific research in solving the problems of oil and gas sector in Syria from the point of view of its employees.

* There are obstacles to scientific research in oil and gas sector from the point of view of its employees.

* There are no differences between the opinions of HPC employees on the role of scientific research in solving the problems of the oil sector depending on two variables(gender, nature of work).

* There are differences between the opinions of HPC employees on the role of scientific research in solving the problems of the oil sector depending on two variables (scientific qualification in favor of holders of higher degrees, and years of experience in favor of those with more than 10 years of experience).

12.Recommendatios:

* Developing mechanisms to link local, Arab and international research centers specialized in oil and gas with oil and gas companies in Syria.

* Increasing spending on scientific research in Syrian oil and gas sector.

* Preparing and qualifying researchers in Syrian oil and gas sector.

* Providing the database in specialized oil and gas research centers with the latest local, Arab and international specialized researches.

* Working to provide the necessary tools for scientific research in the oil and gas sector in Syria.

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