Exploiting the potential role of artificial intelligence in identifying the critical success factors for information centers in Alexandria Petroleum Company

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Abstract

In the face of an increasingly complex world, the need has become necessary to access information to success of any company / project. The development of electronic information has resulted in enhanced access to information and timely delivery it. In the development of the information system, it must be identify and digitize all assets, establish a database, and set criteria for the success of the company / project. One of the important ways to achieve this is the critical success factors. Critical Success Factors affect the company / project in developing its strategy and objectives. No company can afford any development strategy does not provide sufficient attention to the key factors behind the success of its activity. Therefore, these factors can be used to manage the different situations and problems in the company or project and give the projects the ability to identify the wrong and to reschedule the project plan (s) in a timely manner.It has also been shown that byintegrating critical success factors with technology of the artificial intelligence and machine learning (AI/ML) in oil companies, this will lead to better outcomes for mitigating and adapting to devastating risks and surviving. The aim of this paper is paper is to exploiting the potential role of artificial intelligence in identifying the critical success factors for information centers in Alexandria Petroleum Company.

Keywords: *Critical success factors, Artificial intelligence, machine learning, Information centers in petroleum companies, Intelligent information systems, Knowledge Management.*

1. Introduction

Knowledge is a combination of data, information, experience, and expert insight that help to evaluate and incorporate new experience and information. The knowledge sharing is critical to a firm's success [1] as it leads to faster knowledge deployment to company's portions to benefit from it, [1] and improvement of the organizational performance, and competitive of the company.There are many of differences in disparate subsystems [2,3], which lead to fragmentation and duplication of resources and services which caused confusion, especially, when users' needs were for integrated information services [4]. So it require the need for, obtaining, maintaining, and distributing information, and transferred it to users of the company's information and knowledge workers [5,6], through the establishment of an integrated information unit to simplify the management and implementation of technology more efficient and effective [7], and to satisfy the increasing

needs of company's information usersand to harness information technologies for controlling access to data, for the preservation of corporate information integrity and compatibility, and for mediation between the departments[8,9].The petroleum industry is one of the biggest sectors and the driving force behind many other sectors such as transportation.[10] Undertaking such large projects in different parts of the world promote the need for tackling challenges, as multinationals are exposed to working with people from different cultures, backgrounds and environments [11]. This highlights the need for the identification of critical success factors for information centers in petroleum companies / projects,and also the application of artificial intelligence and machine learning (AI/ML). The aim of this paper is identify the critical success factors for information centers in Petroleum Companies, and the importance of integrating these factors with applied of the technology of artificial intelligence and machine learning in oil companies to achieve better results to mitigate the devastating risks and adapt to them and survive. And also its importance in the success and continuation of the company and to enable it the exchange of knowledge in tackling current and future challenges. The rest of the paper is organized as follows: Section 2 provides general background on some of the definitions, and a brief overview of the Alexandria petroleum company. Section 3 presents the challenges. Section4 presents examples of some international oil companies that have used artificial intelligence and machine learning (AI/ML). Section 5 discusses the Critical success factors for information centers in oil Companies with the suggestion of combining them with industrial intelligence and machine learning. The last section conclusions and future work.

2. Profile of the company

Alexandria Petroleum Company is one of the oil companies in the Arab Republic of Egypt, this company is aiming to produce 1.3 million tons of mazut, 1.3 million tons of naphtha, 1.2 million tons of diesel, 485,000 of jet fuel, 99,100 tons of butane, 37,000 metric tons of solvents, and 6,600 tons of neutral lubricant prepared from 10,000 tons of used lubricants, the refining capacity of the company is up to 5mt per year. The company refined around 4.3 million tons of crude oil during the year.

(a) Defining Success:[12] shows that the world success means: The achievement of something that you planned to do or attempt to do. And [12] says that it means: The achieving of the results wanted or hoped for, something that achieves positive results [13, 14].

(b) Project management success and product success: Successful project means that successful project management delivers the project on time with a good product that meets the specifications [15,16].

(c) Critical Success Factors: Critical success factors are the few factors that ensure the company's success and it is a magical key to the success of any company/ project, and achieve its objectives, and it has a strong impact on the outcome of the project and to achieve satisfactory results, and ensure the successful competitive performance for the company and its continuation in the market, because without them the project can't be successful [17,18].

(d) The importance of Critical Success Factors: The value of the critical success factors process is to clarify all areas in the company and to improve performance in each area without spend many time in thinking about ways to improve performance, and they can

also be used to assist the company's planning process, to help development information systems, enhance communication between the company's managements, and ensure to continually the company [19].

(e) What is AI/ML? : According to John McCarthy, AI is "The science and engineering of making intelligent machines, especially intelligent computer programs". Also, AI is a set of technologies that include ML, which has the ability to understand and apply knowledge and interpret data to help decision – making [20].

3. The Main Challenges of the oil Companies

Critical success factors will influence all the project management processes, from formulation, planning, and execution, and controlling process. In order to know critical success factors needed in the projects, it must know the challenges that are facing these projects / companies. There are many challenges that are facing the Petroleum Companies, for example:

(a) Producing crude oil and refined products at a lower cost to stay competitive on the market: One of the main challenges facing the oil and gas industry is producing crude oil and refined products at a lower cost in order to stay competitive on the market. So, improving production systems and environmental facilities on operating sites is a priority for the oil industry. This will help in increasing productivity in production and, reduces the costs of extraction and refining [21].

(b) Improving performance to ensure the valorization of assetsOil companies are looking for new sources of oil and gas for which extraction, transport, and refining are much more complex and costly; to sustain their supply of crude oil or gas, and to achieve the highest reliability for their plants. So, the oil and gas industry is faced with the challenge to guarantee that their plants are dependable, and they not have any unanticipated shutdowns [22].

(c) Role of speculators, and Price volatility: One of the factors affecting oil and gas prices is the role of speculators, which involves a huge debate among leading energy agencies, as well as investment institutions and governments; and also the abundance of supply in the market leads to lower prices [23].

(d) The lack of the information: One of the most important problems is the lack of operational insight resulting from abandoned data from disparate sources, old software systems, lack of the information timely access, for example, it is difficult to know any fires must be extinguished first and how? [24].

(e) Attracting skilled human resources: One of the major challenges facing the industry is continue to attract skilled human resources, technical and administrative areas, the implementation of these big projects successfully. To attract these talented professionals, the industry will need to improve its public image. Thereforeit must work with the higher standards of safety and care with the environment, and conduct business in a manner consistent with standards of ethical and organizational[25].

(f) Compliance with environmental regulations: The oil and gas industry is subject to harsh environmental standards because this industry is the main consumer of energy and water resources. Which makes these factories are working on the re-formulate of methods of production, extraction, and distribution in order to maintain or obtain a license to operate [26].

(g) Inspections: In the oil and gas industry, there is a need to inspect equipment and facilities on a daily, weekly, monthly and annual basis. These inspections often require temporary structures, mobile equipment, emergency response equipment, operational readings, and stairs and so forth [27].

(h) Turnarounds, shutdowns: Turnarounds, shutdowns, equipment isolation and lockout events are activities that require long time of planning and can last for weeks or months. Because shut down and starting events are the most common occurrence of accidents, companies of oil and gas are looking for ways to help save time and to help maintain staff safety [28].

(i) Spill Control: Spills and leaks are the most devastating events that oil and gas companies may face. So, it is very important to have the supplies needed for rapid and effective response in the event of such an event [29].

4. Examples of the international oil companies that have usedAI/ML

(a) In Europe,Royal Dutch Shell RDS has tested the AI program that monitors equipment sensors in the Rotterdam refinery to help better identify where to direct maintenance staff [30].

(b) North America, Canada: As a result of the challenges facing the Canadian oil and gas sector from falling commodity prices, expectations of peak demand for oil, and the increasing pressure towards sustainable energy sources, to notice the entire sector that change is must happening, so petroleum companies have resorted to the application of artificial intelligence and machine learning to meet these challenges [31].

(c) In Africa: French company Total has tested an artificial intelligence program in the Gulf of Guinea that will help translate data from underground 3D imagery. AI will help organize this data and identify images such as fault lines. And it may lead to oil and gas discoveries, and faster and more reliable production forecasts [32].

(d) South America, Texas: Exxon Company uses a machine learning algorithm to extract its data for problems and solutions as the best way to blend hydrocarbons to obtain different types of petroleum products. Exxon also installs AI to gain insights from data from millions of sensors that monitor its global refineries [33].

5. Discussion

5.1 The Critical success factors for information centers

Nowadays, all organizations have to face some challenges in their business environment such as: the economic crisis, globalization, and competition in their market. Moreover, the increase in information technology (IT) requires new procedures. So organizations that do not meet the "quality" of products or services do not have their chance to stay on the market. Therefore, companies seek to know the critical factors that influence competitive advantage in global markets and the company's survival and sustainability.

Critical success factors for information centers provide support to customer, eliminating unnecessary and redundant processes and systems, allowing the company/ project better control of information, and allowing it to focus on key processesbusiness. Therefore, companies seek to implement these factors that seeking to reduce costs, better

information management, more efficient processes, and better service quality for customers and balance all of them. The success of any project/company depends on determining the critical factors to continue of project and these factors shown in figure 1 are:

5.2 Business Policy

(a) Quality and replacement of reserves: A life-long Evaluation of the reserve and its quality is one of the key factors used to determine a company's growth strategy, capital expenditure and future business performance, where strategy of replacement will be more important for those with mature reserves.

(b) Diversification: Diversification is critical to reduce risks including anticipating oil price volatility. The location of the spread of oil and gas reserves may help to reduce the risk of disruption of work.

5.3 Financial Policy

(a) Financial Obligations: Leverage, debt structure, profit distribution policy and hedging in an attempt to reduce the overall financial risk of the company. The company's record is also verified to meet its previous financial obligations to determine the degree of obligations, readiness and consistency to pay the core obligations in the timely manner.

(b) Cost Position: Find the costs and lifting the cost of the company is very important to any company, where these costs vary depending on the location of the project and the availability of the infrastructure of the project.

(c) Capital Structure: Total debt and net debt in relation to shares and depreciation and amortization EBITDA (Earnings before deducting financing costs, taxes, depreciation and amortization), debt structures and composition, and foreign currencies is very important to the success of any project.

(d) Cash Flow Protection and Liquidity: It is important for any company, the Generating cash flow for the company and the ability to meet its short-term and long-term financial obligations. The level of debt service capacity is measured by interest rate and debt coverage of the company. And assess the degree of its liquidity for meet its obligations.

(e) Budget: Before starting the project, you must have an adequate budget to complete the work. There are funds required purchasing licenses or tools and others, and there may be new requirements for this must be available funds.

5.4 Administrative Policy

(a) Operating Management: There are important factors to achieve the degree of efficiency of the company such as qualified human resources, equipment status and use, infrastructure, productivity, integration of technological improvements, success rate of the drilling, cost structure, and etc.

(b) Attention to people: People will be affected, to more or less degree, by their technical and behavioral competencies, and will be required for their roles, dependency relationships, and new customer orientation and excellence practices, consistent with the amount of information provided in the timely manner. There is therefore a need for information centers to manage this change and to support people as they absorb these changes.

(c) Teamwork: Teamwork can be change anything and therefore may be one of the reasons for a successful project.Teamwork always wins and ensures great success in the success of the project.

(d) Skills and knowledge: Oil companies need to highly-skilled engineers. Without the skills required in the team, nothing can work, and updating current trends is crucial. Skills personnel are the main reason for the project's success and its quality assurance. Therefore, resources must be employed that have great technical skills, good knowledge of the field of the project and good exposure to the market. The efficiency of people is an important issue to balance in the project.

(e) Desire to give something extra : Every individual of working in the company wants something extra to prevent some critical flaws or to provide something really useful; this can earn the customer's respect.

(f) Communication: Communication is a fundamental point of any project. Whether communicating with the client, contacting the internal team, communicating with the management or communicating with an outside party, it plays an important role in the success of the project. So there must be clear communication in the project between all parties which helps in the smooth running of the project, and to keep everyone aware of the activities being implemented in the project so that everyone can contribute efficiently to successful releases.

5.5 Processes and Project (management) policy

(a) Planning: To clarify the final destination of any project, all things in the project must be planned with effective, with a good plan that includes scheduling and consideration of real-time issues, availability of tools, requirements, constraints, approaches and obstacles, team capabilities and strengths and weaknesses of the team and others.

(b) Process: Any project will not succeed without following the proper processes; there must be something to measure and planning efforts and follow-up to these processes.

(c) Tools: Specific tools can make the project schedule achievable on time, and the efficiency of tools and the ability to identify the appropriate tool for each level of the project according to the expected requirements at each level is very important.

(d) Risk analysis and Management: Project management is a very difficult task. There are daily challenges that make it difficult focus on the objectives required. The resource requirements and the lack of required skills and pressure from the client and coordination also with the team and the client at the same time are keeping up with schedules and this is not an easy task. In order to avoid any problems or surprises that may occur suddenly there must be an alternative plan already so that if things do not go as planned, the alternative plan can be used immediately. Moreover, effective management is the one that can coordinate with the client and the team, and deal efficiently with the lack of resources required. This helps greatly in the success of the project.

(e) Time: Time is one of the most important things for the project succeeds, so there should be a good estimate of time. If the time is not in your favor, must select ways to improve your business coverage within the specified time and budget to complete the project without any losses.

(f) Bugs: Knowing the causes of the defect and recording the defect is very important. You should know the errors well enough with supporting screen shots, other possible

workflow and actual/expected results. Much time is wasted in just discussing and understanding errors. To reduce this time, and should be identified and the previous errors recorded and resolved, this will reduce the time lost in correcting the unwanted errors. Errors should also be reported in a timely fashion so that no delay in the delivery date can affect the cost of the project.

(g) Improving safety standards: In Oil and gas companies must maintain the highest possible safety standards. Because, oil platforms are the dangerous work places in the project, there must be clear contingency plans in the event of an accident. A new regulatory framework must be developed to protect marine life and coastal environments from pollution, and to achieve behavioral development in human management.

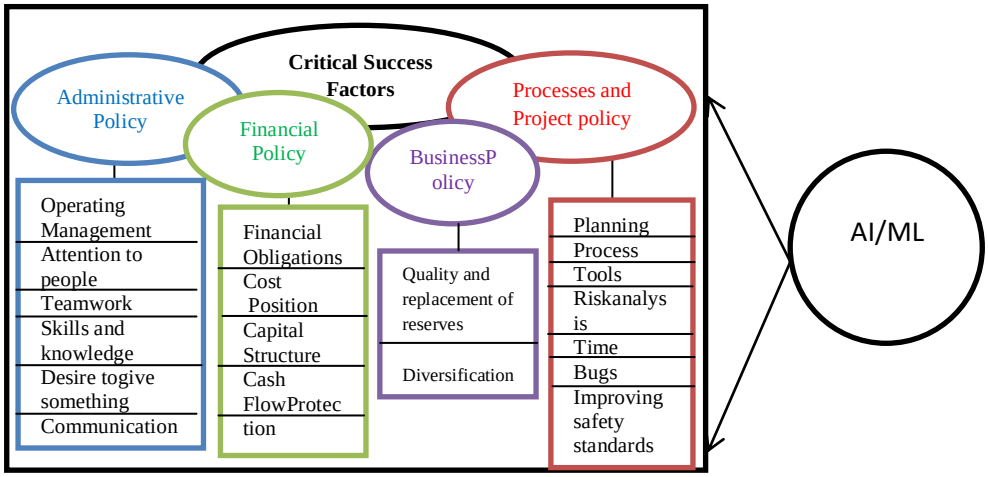

Figure1. Critical Success Factors

The above figure illustrates the critical success factors of the information centers identified in 20 factors and it is divided into four main elements with the integrating AI and machine learning with them to meet current and future challenges.

There was an industry-wide motive to move data such as geological information into digital formats that creating large sets of information that companies could search for visions using powerful data collection programs, until the factories can operate more efficiently, safely, and with less emissions. And there is another factor that catalyzes the introduction of AI in oil companies is to help capture the knowledge of retiring workers as the industry's workforce ages. And creating of an algorithm to retain the expertise of workers in various fields such as water or sand management to able advises in the future.

Advances in machine learning and low cost of data storage are key factors in stimulating large oil to harness the potential of artificial intelligence. And using the machine learning algorithm to extract data is the best way to mix hydrocarbons to obtain different types of petroleum products. It also provides insights to expert teams throughout the company.Artificial intelligence is one of the components of the broader digital transformation that the oil and gas industry is going through, and also it can help reduce costs by addressing a range of problems. It is also through the deployment of AI in upstream operations where it leads to collective savings in capital and operating expenses. And installing the AI program monitors data from sensors connected to pumps and glitches in the flags before causing them to shut down.

Comparing with the previous findings, and the integration of the application of artificial intelligence and machine learning with critical success factors, we find that this has led to additional advantages in the overall strategy of work, such as:

For the labor policy factor: AI/ML will lead to operational excellence, prediction of workers at risk. For the fiscal policy factor: AI/ML will reduce costs.

For the administrative policy factor: AI/ML will lead to more quality-based decisions that stimulate deeper and valuable insights, making recommendations on buying or selling decisions, and applying Machine Learning will solving problems quickly.

For operations and project policy factor: AI/ML will result in data usage in ways never before - processing large volumes quickly, increasing truck uptime, and driving better engine performance, and applying Machine Learning will improve subsurface characterization, and optimizing drilling operations. With Machine Learning,can pinpointing exactly where to dig, and predict operational outcomes

6. Conclusion and future work

Critical success factors for information centers can be used to their importance in continue of the company, and improving its performance automatically and this require expertise, understanding of context, and familiarity with the implementation team .In addition, critical success factors will greatly increase of the chances of success of the project, and will be more important in real-time participation. Clarity of determining the critical success factors and their importance in the company's survival in the market, and how they are aligned with the business strategy is essential in meeting current and future challenges and creating a coherent and consistent vision for change and development.When AI and ML are coupled with critical success factors, the combined effect has the potential to create lasting competitive advantage and reduce costs, increase the speed and quality of decisions, build new capabilities, make better and faster decisions, and leverage the vast amounts of data and analysis needed to explore, exploit and operate oil wells.Thus, further studies across other oil supplier countries In order to reduce the gap between the companies of oil supplier countries and the leading companies in the gas and oil industry. Finally, in order to succeed in implementing these factors must be officials have a force to manage all important aspects.But most oil companies have refrained from applying artificial intelligence and machine learning due to high costs.

References

[1]. Adel Ismail Al-Alawi, Nayla Yousif Al-Marzooqi and Yasmeen Fraidoon Mohammed," Organizational culture and knowledge sharing: critical success factors", Journal of Knowledge Management, Vol. 11, No. 2, April 2007, pp.22-42.

[2]. Mojtaba Naghavi, Amir Hossein Dastaviz and Hossein Nezakati, "Relationships among Critical Success Factors of Knowledge Management and Organizational Performance" Journal of Applied Sciences, Vol. 13, 2013, pp. 755-759.

[3]. R. Lombard1, C. C. van Waveren1, K.-Y. Chan," Factors Affecting Quality in a Manufacturing Environment for a Non-Repairable Product", Conference: IEEE International Conference on Industrial Engineering and Engineering Management, Pretoria, January 2014.

[4]. Elías Bjarnason,"Critical Success Factors for Planning, Scheduling and Control in Design and Construction", Master Thesis, Reykjavík, Iceland, June 2015.

[5]. Wan Ab Kadir Wan Dollah, Adibah Ahmad, Muhamad Khairulnizam Zaini, Intan Nurbaizura Zainuddin, Razilan Abdul Kadir, Mohd Sazili Shahibi, Saiful Farik Mat Yatin," Critical Success Factors of Knowledge Sharing: A Case Study in a University Library ", Australian Journal of Basic and Applied Sciences (AENSI), Vol. 9, No. 3, 2015, pp.90-95.

[6]. Michael Amberg, Florian Fischl, Martin Wiener, "Background of Critical Success Factor Research", Working Paper, Friedrich Alexander Universität Erlangen, Nürnberg, No. 2, 2005

[7]. Ahmed B. Farid1 and Khalid M. Salama2, "Delivering Business Intelligence to the Ministry of Communication and Information Technology for Enhanced ICT Capacity Planning in Egypt A Case Study", Egyptian Computer Science Journal Vol. 37 No. 5 September 2013.

[8]. Ragna Seidler-de Alwis and Simone Fu, "Success factors for the future of information centers, commercial and public libraries: a study from Germany", Interlending & Document Supply Journal, Vol. 38, Iss 3, 2010, pp.183-188.

[9]. Esteves, J.,"Definition and Analysis of Critical Success Factors for ERP Implementation Projects", Doctoral thesis at the Universitat Politècnica de Catalunya, Barcelona, 2004.

[10]. Senan A. Ghallab, Nagwa Badr, Muhamed Hashem , Abdel Badeeh Salem and Mohamed Fahmy Tolba," Modeling an Application for Oil and Gas Ratio Prediction Using ANFIS", Egyptian Computer Science Journal ,ECS ,Vol. 36 No. 3, September 2012.

[11]. CRISTINA I. HERRERA," OUTSOURCING LOGISTICS IN THE OIL AND GAS INDUSTRY " , A Senior Scholars Thesis, Texas A&M University, May 2012.

[12]. Wen-zhou WANG et al., "Literature Review on Critical Factors for Project Success", Journal of China Soft Science, Vol. 1, 2010, pp. 96-101.

[13]. TJAART NICHOLAAS VAN DER LINDE," Key Success Factors for Implementing A Shared Services Center", master degree, RAND AFRIKAANS, 2002.

[14]. Rodney Turner, "Project Success: Successful Factors", Journal of Project Management Technology, Vol. 5,2006,pp. 56-59.

[15]. Dev Sajjan, Henrik Petersson," Success Factors for Quality in Product Development A case study from automotive product development" Master's Thesis Business Administration, Karlskrona Sweden, August 2014.

[16]. Abdullah, M.M., &Uli, J. ," Direct, Indirect and Total Effect of Critical Soft Factors On Organizational Performance: Evidence From Malaysian Electrical And Electronics Firms. *UnitarEJournal Vol.* 3, No. 2 , 2007, pp.11-26.

[17]. Fazilah Mat Yatim, ShahabuddinAmerudin, Zulkepli Majid," The Key Success Factor Of Geographic Information System Re- Implementation In Tenaga Nasional Berhad Distribution, Malaysia: A Case Study Of Cheras Tenaga Nasional Berhad Distribution Station", International Journal of Built Environment and Sustainability, Vol. 6, No. 1, April 2019.

[18]. Ali Yahya, Marzanah A. Jabar, YusmadiJusoh, NorhayatiMohd, " The Critical Success Factors (CSFs) for IT Projects", Journal of Telecommunication, Electronic and Computer Engineering , Vol. 9, No. 3, 2017, pp.3 – 13,.

[19]. Frefer AA1, Mahmoud M1, Haleema H2 and Almamlook R3," Overview Success Criteria and Critical Success Factors in Project Management", IndEng Manage journal, Volume 7, Issue 1 ,2018.

[20]. Khadija Elmeziane, , ShuaiChuanmin, and MouradElmeziane, " The Importance of Critical Success Factors of Enterprise Resources Planning Implementation In China", Business Management Dynamics, Vol.1, No.6, Dec 2011, pp.01-10 .

[21]. Zaheer Habib, "The Critical Success Factors in implementation of Software Process Improvement Efforts: CSFs, Motivators & Obstacles", Master Thesis in Software Engineering and Management, University of Gothenburg, Gothenburg, Sweden, May 2009.

[22]. Oruwari Humphrey, Adewale Dosunmu," The Critical Success Factors for Marginal Oil Field Development in Nigeria", Journal of Business and Management Sciences, Vol. 5, No. 1, 2017, pp.1-10.

[23]. Mehdi Sheikhzadeh, Mohammad Reza Arasti and Rouzbeh Kotobzadeh," Identifying key success factors in upstream sector of oil and gas industry in Iran", African Journal of Business Management, Vol.6, No.1, May 2012.

[24]. Iman Attarzadeh, Siew Hock Ow, " Project Management Practices: The Criteria for Success or Failure", Communications of the IBIMA, Vol. 1, 2008.

[25]. Samira Soheili Rad1," Critical Success Factors (CSFs) in Strategic Planning for Information Systems", Journal of Applied Environmental and Biological Sciences, Vol.5, No.6, pp.334 -339, 2015.

[26]. Damiebi Denni-Fiberesima and Nazatul Shima Abdul Rani," An evaluation of critical success factors in oil and gas project portfolio in Nigeria", African Journal of Business Management Vol.5, No.6, 18 March, 2011, pp. 2378-2395.

[27]. Zakari Tsiga, MichaelEmes, and Alan Smith,"Critical success factors for projects in the petroleum industry Center for Information Systems Research", Procedia Computer Science Journals, Vol. 121, 2017, pp. 224-231.

[28]. Hamed Taherdoost, Abolfazl Keshavarzsaleh, "Critical Factors that Lead to Projects' Success / Failure in Global Marketplace", 9th International Conference Interdisciplinarity in Engineering, Romania, 2015.

[29]. Sandy, "Exploring the impact of artificial intelligence on offshore oil and gas", OFFSHORE TECHNOLOGY, 2019.

[30]. GILLIAN RICH, "What's Got This Oil Giant 'Super Excited' About Using Artificial Intelligence?", INVESTOR'S BUSINESS DAILY, 2019.

[31]. Lance Mortlock , "AI in oil and gas: Extracting collective value by humanizing data" , EY Building a better working world, 2019.

[32]. Kumba Sennaar,"Artificial Intelligence in Oil and Gas–Comparing the Applications of 5 Oil Giants",Eme RJ Artificial Intelligence Research, 2019.

[33]. Neanda Salvaterra, " Oil and Gas Companies Turn to AI to Cut Costs: Artificial intelligence helps predict equipment glitches, manage workers and increase output", BUSINESS JOURNAL REPORTS: TECHNOLOGY, The WALL STREET JOURNAL, 2019.