International Journal of Engineering Research and Reviews ISSN 2348-697X (Online)
Vol. 11, Issue 3, pp: (41-47), Month: July - September 2023, Available at: www.researchpublish.com

Adopting AI Systems in the Management of Brown Field Projects

Abdulmajeed M. Al-Dhargham

DOI: https://doi.org/10.5281/zenodo.8202464

Published Date: 01-August-2023

Abstract: **Intelligence Brownfield projects significantly benefit from Artificial Intelligence (AI) as project managers adopt different machine learning tools to support the planning, design, execution, control, and monitoring of oil and gas projects. The technological advancements in data science contribute to sustainable developments in brownfield projects as engineers, project managers, and investors look for sustainable means to improve project efficiency and minimize construction costs. For instance, understanding data science through machine learning improves project schedules. The project managers rely on AI algorithms to predict cost variations, labor force performance, and potential risks such as adverse weather patterns. In addition, AI tools such as machine learning are vital for engineering design and procurement. Engineers can make adjustments to their designs based on the risk assessment data. However, quality design outcomes rely on accurate data. The procurement team also requires accurate data to estimate costs, cut costs where necessary, and provide alternatives. Therefore, the paper presents AI's role in enhancing safe and sustainable engineering designs for brownfield projects. The research paper also discusses the role of chatbot tools in retrieving important documents such as Engineering Design Codes. The project stakeholders can rely on the AI applications to access the project information and provide feedback. With AI technology, the design team, such as structural engineers, architects, and quantity surveyors, can simulate the project and share it with other stakeholders, such as project managers and the client. Therefore, AI is suitable for the planning, design, execution, management, control, monitoring, and operation of brownfield projects**

Keywords: **Brownfield Projects, AI, Machine Learning, Chatbots, project costs and scheduling, engineering design and procurement, stakeholders engagement, data science.**

1. INTRODUCTION

Artificial Intelligence (AI) supports machine learning for data collection and analysis. Machine learning techniques employed in reservoir engineering are known as supervised learning. Most reservoir engineering implementations relying on AI tools frequently employ evolutionary optimization methods like Particle Swarm Optimization (PSO) and Genetic Algorithm (GA). Apart from machine learning, AI systems also explore deep learning capabilities that support the developments and applications of neural networks in data processing. Deep learning algorithms are critical in information processing in layer formats to analyze complex data. In addition, AI system application also involve natural language processing (NLP) tools that define models and algorithms for interpreting generated human language. Thus, AI systems such as machine learning, deep learning, and natural language processing tools are essential for managing brownfield projects by gas and oil companies.

2. AI IN PROJECT COST AND SCHEDULE MANAGEMENT

The application of AI in the impact predictions for project cost and schedule relies on its data analytic capabilities. Through the adoption of pattern recognition, AI systems can predict project costs by making significant predictions on performance factors. AI algorithms can assess and analyze project schedules, cost records, modification orders, and other pertinent project information that affect the overall cost. AI can forecast prospective costs and schedule consequences based on similar past events by locating correlations, patterns, and links within the previous data (Mohaghegh, 2011). Pattern recognition and data analysis support the anticipation and planning of delays, risks, and project cost overruns. In

addition, AI systems also facilitate project risk assessment procedures. AI can evaluate project risks and forecast how they affect costs and schedules. Artificial intelligence (AI) algorithms can pinpoint project risk factors and their probability of occurring by examining industry trends, project data, and outside factors.

AI also supports change order processes and analysis through real-time monitoring. With brownfield projects, AI can help analyze and evaluate the effects of modification orders on budget and time (Rebernik et al., 2023). AI algorithms can forecast suggested changes' possible cost and schedule ramifications by examining project specifications and historical data. Project managers can use this information to assess the viability of change orders, bargain with stakeholders, and make defensible judgments about how to implement them. In addition, AI-powered systems can keep track of a project's progress and gather and analyze real-time data to spot alterations to the budget and timeline (Al Shehhi et al., 2022). AI algorithms may produce in-the-moment alerts and forecasts about potential implications on costs and schedules by combining data from various sources, including field reports and sensor data.

Project planning is an integral part of project management. It sets the project's scope and the goals necessary to carry it out. A project plan outlines the project's execution, monitoring, control, and closure procedures. Project limitations, such as prices, resources, risks, and deadlines, are part of the plan (Mohaghegh, 2011). Project managers can handle a variety of responsibilities during each stage of the process with the help of AI-based solutions. In addition, it allows project managers to analyze detailed project data and find trends that could influence project execution. AI also automates most redundant jobs, increasing staff productivity and engagement. The computer software that mimics the knowledge and problem-solving abilities of one or more human experts is known as a knowledge-based expert system (Rebernik et al., 2023). The system records the human expert's knowledge and codes it for better understanding by any user. Therefore, AI applications are essential for the project planning stage that defines the success of the implementation process.

A computer system called artificial neural network (ANN) processes information similarly to the human brain. An ANN relies on processing units known as neurons joined by nodes and functions like a human brain. The neurons process the input and generate output based on the information posted by the user (Al Shehhi et al., 2022). The ANN processes the input through backpropagation to eliminate potential error that compromises the authenticity of the data. The ANN logs the data and contrasts the fed data's initial and actual solutions. The errors from the solution move back to the network and influence the algorithm that writes the final result. ANN forecasts cost overruns depending on several factors, including the project scope, the contract's nature, and the project managers' skills (Rebernik et al., 2023). Following the functional requirements, it also aids in automating the scheduling of project activities. In civil engineering, ANN is also utilized for categorization, system modeling, prediction, and optimization.

3. AI FOR ENGINEERING DESIGN AND PROCUREMENT

Several AI applications in engineering design and procurement include machine learning, natural language processing, pattern recognition, and automated data extraction. AI simplifies these corrective duties and uses software to decipher complicated systems and resolve problems (Bergmann et al., 2020). Contract management, procurement support, spending analysis, and strategic sourcing are some tasks that can be integrated into an algorithm that handles all the leverage and labor-intensive work. In addition, AI enables speedier insight into massive data analytics for engineers and procurement professionals. Contracts contain vital information and are a crucial component of the procurement process. Procurement experts only had easy access to this data after introducing AI into the project analysis process (Wamba-Taguimdje et al., 2020). Therefore, text parsing algorithms have changed the game as they can now extract vital information through natural language processing (NLP). Artificial intelligence (AI) systems can scan and comprehend vast amounts of contracts and translate crucial data. Some AI systems, like optical character recognition software, provide advanced data analysis capabilities that improve the performance output of procurement officers. The AI can recognize texts in photos or actual contract copies.

Data is a vital tool for procurement officers as it helps keep track of spending and manage the equipment supply for the construction process. A project manager can reduce expenses and determine vendor performance risk by gathering more detailed data (Wamba-Taguimdje et al., 2020). Most procurement teams frequently make their purchasing decisions in a situation of scarcity. The project manager can gain a competitive edge over rivals in the market by developing projects at a fraction of the project cost developed by other competitors. AI applications can also inform the manager and the procurement team about the potential in a new market they wish to explore. The software will help the procurement officer evaluate any current suppliers, analyze and locate potential vendors, and forecast market prices (Sircar et al., 2021). In addition, contract discussions are easier to conduct and more successful if one thoroughly understands these

procedures due to easy access to information. AI is also applicable in the collection of automatic data in real-time. Therefore, procurement managers can make judgments more accurately and quickly with the help of AI tools.

The application of AI is fundamental in responding to various design issues involving brownfield projects. For example, it is vital in design optimization to improve efficiency and reliability (Bergmann et al., 2020). AI algorithms examine many data, such as performance data, historical design data, and the sector's best practices. AI can optimize equipment architecture, electrical systems, and piping networks to increase space utilization, reduce energy use, or improve safety. AI's simulation and modeling capabilities improve the design processes and help locate and address potential challenges (Sircar et al., 2021). AI can help with sophisticated design simulation and modeling. Artificial intelligence (AI) can simulate several design possibilities and evaluate their effectiveness using computer methods and machine learning. It allows designers to assess ideas, foresee future problems, and decide on the best solutions. AI also provides an overview of the history of work performance.

AI systems also provide decision-making support systems and knowledge discovery capabilities. AI can analyze vast volumes of design and operational data to find patterns, insights, and correlations that guide design choices. By mining data from previous projects and industry databases, AI algorithms can pinpoint effective design techniques, lessons learned, or possible design problems. Through design assistance, verification, and validation features, AI influences the project design outcomes in the brownfield industry (Wamba-Taguimdje et al., 2020). AI can assist in project design by offering real-time comments, ideas, and suggestions. AI algorithms can analyze design inputs, needs, and restrictions to provide design possibilities and material recommendations. Procurement decisions for brownfield projects can be optimized through AI applications. AI tools enable an interpreter to prepare subsurface volume maps and integrate them into creating amplitude, saturation, and porosity maps. The model utilizes inversion techniques and data parameters from the results of subsurface models. Heuristic and artificial neural network techniques are frequently used to improve the target prospects' size and hydrocarbon volume (Sircar et al., 2021). Methods like Monte Carlo simulation and evolutionary programming are used to determine the stochastic range of hydrocarbon in the subsurface and a suitable technique to bring it to the surface.

4. AI BENEFITS FOR CONSTRUCTION WORK

Besides design management, AI is fundamental in human resource management regarding brownfield investment performances. Gas and oil companies can rely on AI tools to recruit top talents and train employees based on different performance demands. In brownfield projects, AI can improve and speed up the hiring process. AI algorithms can examine resumes, applications, and candidate profiles to find the best eligible individuals for a position based on particular requirements (Ramos & Akanji, 2017). This screening procedure can save time and effort by automatically sorting through many applications. In addition, AI-driven virtual assistant features can communicate with applicants, respond to their inquiries, and share details about the project and available positions.

Complex Wavelet Transform (CWT) and artificial intelligence are combined to achieve this. The time-frequency domains of waveforms can be studied with the CWT, a wavelet-based transformation (Al Shehhi et al., 2022). The full-wave tomography approach can use an artificial neural network or a knowledge-based artificial neural network to choose practical seismic window pieces.

Computational simulations are necessary for creating subsurface property maps and PVT analyses, modeling, and experiments. Massive amounts of data are modeled to create static and dynamic models. Machine learning methods integrate data from the core analysis, well log, and seismic for stochastic field programs and appraisal plans (Choubey & Karmakar, 2021). AI tools, including Genetic Algorithms and Artificial Neural Networks, facilitate the transition of complex pressure systems in oil and gas explorations.

It is essential for skill assessment and offering the proper training to meet the regulatory requirements and enhance the industry's best performance outcome. AI can help evaluate worker abilities and competencies for brownfield projects. AI algorithms can identify skill shortages and suggest suitable training programs by analyzing employee performance records, project needs, and training gaps. The approach ensures that the employees have the abilities and knowledge to carry out their duties successfully (Ramos & Akanji, 2017). In addition, AI can assist the performance management process. AI algorithms can offer insights into employee performance by monitoring real-time data such as individual input, project status, and performance feedback.

Risks are present in any project and can result in delays, termination, or additional resource allocations. When managing projects, AI can reliably forecast the number of flaws or quality. The application of AI models at various project stages can assist in identifying and warning teams whether a procedure is dangerous (Koroteev & Tekic, 2020). AI, for instance, can monitor real progress and contrast it with the initially set schedule. Machine learning capabilities enable the project manager to retrieve parametric data when needed. For instance, the manager may forecast future projects' realistic timelines using historical data, such as anticipated start and end dates. The algorithm can provide upper and lower limits to accommodate the potential changes in the dates to account for reasonable delays (Blumenthal et al., 2020). Therefore, applying AI systems such as machine learning improves the success rates of brownfield projects. Project managers should encourage using AI tools during project scheduling and risk management.

AI tools like machine learning and natural language performance (NLP) support adaptive resource management. The proper individuals need to be working on project initiatives to make sure they stay on course. AI researches the past to provide the project manager with current knowledge on resource engagement (Waqar et al., 2023). For example, the project manager can assemble the project team and assign specific team members duties and responsibilities. Additionally, AI tools ensure project managers run their teams efficiently and adhere to deadlines. AI enables remote access to valuable training materials for project personnel, enabling them to quickly advance their abilities and knowledge. The project manager might determine whether the resources are prepared for deployment. If there is a discrepancy between the hours needed and the predicted availability, the manager can add more help or remove workers from the project (Koroteev & Tekic, 2020). As a result, it takes less time to onboard them for new projects. Project delivery is accelerated, and the clients get clarity around project deployments.

5. AI SYSTEMS CAN HELP IMPROVE SAFETY

Work safety and efficiency in the construction of brownfield projects can be improved through AI applications. Maintenance tasks in brownfield projects can be optimized with AI technologies like machine learning and data analytics. AI systems can forecast equipment breakdowns and maintenance requirements by examining sensor data, previous maintenance logs, and other pertinent data (Devold & Fjellheim, 2019). It enables resource allocation optimization, downtime reduction, and proactive maintenance planning. AI is suitable for the optimization of various processes involved in brownfield projects. AI may also help decision-making by offering in-the-moment insights and suggestions from data analysis, which increases effectiveness and lowers costs. AI algorithms can produce insights and suggestions that support decision-making by examining various data sources (Koroteev & Tekic, 2020). AI can assess production costs, market trends, and price data to back decisions on pricing strategies, production volumes, or investment opportunities in brownfield projects. The results of a project can be improved overall by using AI-powered decision assistance to encourage data-driven and more-informed decision-making practice.

AI systems such as machine learning, deep learning, and natural language processing tools improve safety in constructing brownfield projects. AI technologies predict and support prevention initiatives (Sircar et al., 2021). Through video analytics technologies, AI is suitable for monitoring the movement of heavy equipment to improve safety at the construction site. Using artificial intelligence algorithms, developers have produced a variety of realistic application technologies for research and manufacturing. Drilling quality and costs have significantly improved thanks to new drilling equipment, including an autonomous drilling rig and pipe. AI algorithms are suitable for monitoring workers' safety by identifying and eliminating potential hazards (Waqar et al., 2023). In addition, Augmented Reality (AR) is also suitable for the training of construction workers on safety measures. Refining the development plan with historical data output is the primary application of AI technology in oilfield development. AI also supports intelligent work site planning to enhance work efficiency and safe deliveries. Therefore, AI algorithms are essential for the promotion of construction worker safety.

Through predictive analysis, AI applications such as machine learning help to minimize the risks associated with brownfield projects. Future event predictions are made using predictive analytics. It can produce future insights based on past data and analytics methods like machine learning and statistical modeling (Blumenthal et al., 2020). Businesses can accurately predict trends and behaviors using historical and present data. Project managers can better predict the time and materials needed to finish a project. The predictive analytical tools alert the project manager to an abundance or deficiency of the appropriate resources. Predictive forecasting seeks to spot and mitigate hazards before they overwhelm the project deliberately. It assists the manager in creating the ideal project timeline. Project managers can get help from AI in seeing possible risks and suggesting ways for mitigation (Devold & Fjellheim, 2019). AI algorithms can reduce the probability of project failure and ensure timely and cost-effective project delivery by analyzing preliminary project data and identifying potential difficulties.

AI algorithms can identify potential risks and hazards for brownfield construction by analyzing project specifications, historical data, and site conditions. AI systems can assist in assessing and prioritizing risks by considering elements like environmental contamination, structural integrity, and potentially hazardous materials, allowing for implementing preventative safety measures (Sircar et al., 2021). It is possible to deploy AI-powered monitoring systems to gather real-time data on construction operations and site conditions. These technologies can identify potential safety risks, such as shaky construction or hazardous material leaks, and send immediate alerts to managers and employees. The safety of the staff on-site may be ensured, and hazards can be quickly reduced with the help of timely notifications. AI systems rely on real-time data, project information, and previous safety data to design predictive models for safety planning. AI algorithms can forecast prospective safety issues and identify high-risk locations or activities by finding patterns and connections (Waqar et al., 2023). It aids resource allocation, safety procedure planning, and the implementation of preventative actions by construction teams before accidents or problems happen.

AI systems with computer vision skills can analyze images and videos taken on building sites. They can spot risky situations like poor PPE usage, shoddy fall protection, and risky equipment operation. Artificial intelligence (AI) technologies can support proactive safety actions and guarantee adherence to safety standards by automatically monitoring and evaluating visual data (Koroteev & Tekic, 2020). AI-powered virtual reality (VR) and augmented reality (AR) technologies are essential for conducting safety training for the project team. Virtual training programs that replicate dangerous situations and offer interactive safety instructions are available to employees. Before beginning on-site tasks, employees can utilize VR and AR to make virtual tours of brownfield building sites to familiarize them with the surroundings and potential dangers. AI systems promote safety compliance by automating the documentation of the required safety policies and enhancing compliance among the project team (Blumenthal et al., 2020). AI systems can minimize human mistakes, speed up reporting, and enable thorough safety audits by automating safety paperwork.

6. AI ENHANCEMENT FOR STAKEHOLDER ENGAGEMENT

Chatbot applications in construction planning and implementation procedures enhance stakeholder engagements. For instance, chatbot tools can retrieve essential documents such as Engineering Codes of Practice. AI supports data driven-communication with all the stakeholders involved in brownfield activities. It enhances the analysis and interpretation of large amounts of data, including operational data, community feedback, and environmental data. AI algorithms can produce insightful reports and insights from processed data, which can then be distributed to stakeholders (Blumenthal et al., 2020). Thanks to this data-driven communication, Stakeholders can better comprehend the brownfield operations' existing situation, progress, and difficulties. It also facilitates open and fact-based dialogues, fostering stakeholder credibility and confidence.

AI also has real-time monitoring and reporting capabilities that support stakeholder engagement. AI-driven monitoring systems can offer real-time information on various brownfield features, including environmental effect, regulatory compliance, and safety performance (Koroteev & Tekic, 2020). Stakeholders, such as regulatory agencies and local communities, can monitor current activities and their effects through real-time monitoring. VR tools can offer engaging simulations and impressive experiences for stakeholders. For example, stakeholders can digitally tour the brownfield site, comprehend the proposed changes, and envision possible outcomes. The established interactive approach improves stakeholder engagement.

7. DATA SCIENCE IN PROJECT MANAGEMENT

Project managers can foresee probable risks and consequences thanks to data science tools like forecasting and predictive modeling. Project managers can predict risk factors relating to project performance and assess the necessary performance input to optimize performance (Blumenthal et al., 2020). Data science also enables project managers to make informed decisions by reviewing historical data to find patterns and trends regarding potential risk factors. Data about project requirements, team capabilities, and availability are analyzed using data science to help with resource allocation optimization. Project managers may improve timetables, allocate resources effectively, and avoid bottlenecks using machine learning techniques. Project managers can more effectively analyze and manage risks thanks to data science. Data scientists can create risk models and give project managers early warning signs by examining past project data, such as regulatory changes (Ramos & Akanji, 2017). It aids in locating possible dangers and creating effective mitigation plans. Therefore, data science is essential to project management as it shapes the decision-making process regarding performance optimization and maintenance operations.

Project managers can track and keep an eye on the progress of their projects in real-time, thanks to data science. Data visualization and Key performance indicators (KPIs) tools allow project managers to see how their projects are progressing, spot areas for improvement, and move quickly to fix problems (Koroteev & Tekic, 2020). Project managers

can make better decisions using analytical tools and methods made available by data science. Project managers can evaluate numerous project scenarios, assess the effects of different actions, and make data-driven decisions using machine learning and data analysis techniques. Using data science, project managers can better grasp expectations, stakeholder preferences, and comments. Project managers can learn about stakeholder sentiments, spot possible problems, and adjust project strategy by analyzing customer surveys and other data sources. Project management techniques can be continuously improved thanks to data science (Tran Thi Hoang et al., 2019). Project managers can find inefficient regions, assess the efficacy of project techniques, and apply data-driven process improvements by gathering and evaluating project data.

Big data analytics can aid project planning which examines vast amounts of data from diverse sources. It comprises previous project information, market trends, client feedback, and outside variables. Big data may help project managers discover potential risks and opportunities, predict project durations and costs, and produce more precise projections. Big data can help project managers allocate resources more effectively (Ramos & Akanji, 2017). Project managers can ensure that the appropriate resources are allocated to the appropriate tasks at the appropriate time by accessing data based on skills, resource availability, and utilization rates. By doing so, bottlenecks can be avoided, productivity can be increased, and project efficiency can be increased. Big data technologies allow the project manager to track and monitor a project's progress in real-time. Project managers can receive data on project progress, resource usage, and quality indicators by integrating data from numerous sources, including project management systems, IoT devices, and sensors. Big data analytics is applicable in the management of project quality (Choubey & Karmakar, 2021). Project managers can spot patterns, quality problems, and chances for improvement by evaluating massive amounts of data from quality control procedures, inspections, and customer feedback. It facilitates the implementation of corrective measures, improves the quality of the good or service, and guarantees customer happiness.

8. THE FUTURE OF AI SYSTEMS IN THE CONSTRUCTION

Autonomous systems use AI algorithms to negotiate challenging settings, make informed judgments, and carry out duties effectively. The construction sector will significantly improve AI's forecasting skills. AI can deliver precise simulations and forecasts for numerous construction aspects using real-time inputs, historical data, and cutting-edge machine-learning techniques (Windisch & Doppelreiter, 2019). Predicting project costs, deadlines, and potential dangers is a part of this, enabling decision-making and proactive planning to improve project results. VR and AR will keep playing a big part in the building industry. They offer immersive experiences that support teamwork, project planning, and design visualization. By identifying objects, evaluating spatial data, and digital modeling, AI algorithms can improve AR/VR applications (Tran Thi Hoang et al., 2019). The combination improves design accuracy, clash detection, and stakeholder communication. AI systems can significantly improve safety in the construction industry by continuously monitoring working sites, spotting possible hazards, and instantly warning workers. Sensor-based technologies supported by AI can identify risky behaviors or circumstances to adhere to safety protocols. AI-driven safety systems can also examine accident data to spot trends and suggest precautions to lower workplace injuries.

AI systems such as machine learning enable project managers to automate document management, resource allocation, and data tracking. Natural Language Processing (NLP) is applicable in predictive management and planning of future deliverables. AI systems also process project data to identify inefficiencies and improve resource allocation. Therefore, AI applications in project management improve decision-making processes throughout the project life cycle (Tran Thi Hoang et al., 2019). The AI systems are also applicable in selecting and designing sustainable building materials. They are used to proactively maintain brownfield projects and reduce lifecycle costs through performance optimization. Therefore, AI systems improve the performance output of brownfield projects through sustainable and efficient construction processes. Brownfield projects can be monitored and managed in real-time using digital twin technology and AI. AI algorithms analyze and process IoT-generated data and building systems by developing a virtual representation of the constructed facility. The process monitors energy usage, optimizes maintenance, and boosts operational effectiveness throughout the facility (Windisch & Doppelreiter, 2019). AI systems can spot patterns and probable failure indications by examining sensor data, previous maintenance logs, and equipment specs. The AI systems make it possible to plan preventative maintenance, cut downtime, and increase the lifespan of crucial assets. AI-powered tools help improve risk management and safety oversight in brownfield projects. AI can identify hazardous situations, track employee activity, and send out instantaneous notifications for potential dangers by analyzing data from cameras, sensors, and wearable technology. AI algorithms can analyze previous safety data to find trends, give information for proactive risk mitigation, and enhance safety performance.

9. CONCLUSION

Access to quality data, qualified individuals, and appropriate data governance systems for creating and maintaining AI models are necessary to adopt AI in brownfield projects successfully. Carefully planning and implementing change management strategies and their integration into the AI systems with current operations and workflows improve industry performance efficiency and sustainability. AI can enhance the safety, productivity, and efficiency of brownfield projects. It can also minimize human error, improve collaboration, and develop stakeholder trust through the construction process. Therefore, data science is fundamental for improving brownfield investment decisions to achieve efficiency and sustainability. A more inclusive and participatory approach in project development, improved relationships, and informed decision-making processes are impacts of the successful application of AI in brownfield projects. It should be noted that effective AI deployment in brownfield projects necessitates cooperation between construction experts, technology suppliers, and subject specialists. It is necessary to overcome obstacles such as data integration and data privacy and security concerns to fully realize the capabilities of AI system applications in brownfield projects.

REFERENCES

[1]. Al Shehhi, M. A., Al Naqbi, H. K., Alhemeiri, S. S., Chellappan, S. K., Soares, S. M., Idicula, A. P., & Khan, S. H. (2022, October). Subsurface to surface congestion management with holistic sustainable development of super giant multi stacked Brown Field. In *ADIPEC*. OnePetro. https://doi.org/10.2118/211276-MS

[2]. Bergmann, M., Hertling, F., & Marquardt, S. (2020, November). How deep graph analysis based on piping & instrumentation diagrams can boost the oil & gas industry. In *Abu Dhabi International Petroleum Exhibition & Conference*. OnePetro. https://doi.org/10.2118/202811-MS

[3]. Blumenthal, R., El Naser, A., & Blug, C. (2020, November). Generating green value from data: applying AI–based analytics to monitor and manage energy usage across oil and gas operations. In *Abu Dhabi International Petroleum Exhibition & Conference*. OnePetro. https://doi.org/10.2118/203175-MS

[4]. Choubey, S., & Karmakar, G. P. (2021). Artificial intelligence techniques and their application in oil and gas industry. *Artificial Intelligence Review*, *54*(5), 3665-3683. https://doi.org/10.1007/s10462-020-09935-1

[5]. Devold, H., & Fjellheim, R. (2019, November). Artificial intelligence in autonomous operation of oil and gas facilities. In *Abu Dhabi International Petroleum Exhibition & Conference*. OnePetro. http://dx.doi.org/10.2118/197399-MS

[6]. Koroteev, D., & Tekic, Z. (2020). Artificial intelligence in oil and gas upstream: Trends, challenges, and scenarios for the future. *Energy and AI*, 3, 100041. https://doi.org/10.1016/j.egyai.2020.100041

[7]. Mohaghegh, S. D. (2011). Reservoir simulation and modeling based on artificial intelligence and data mining (AI&DM). *Journal of Natural Gas Science and Engineering*, *3*(6), 697-705. https://doi.org/10.1016/j.jngse.2011.08.003

[8]. Ramos, G. A., & Akanji, L. (2017). Application of artificial intelligence for technical screening of enhanced oil recovery methods. *Journal of Oil, Gas and Petrochemical Sciences*.

[9]. Rebernik, L., Vojvodíková, B., & Lampič, B. (2023). Brownfield data and database management—the key to address land recycling. *Land*, *12*(1), 252. https://doi.org/10.3390/land12010252

[10]. Sircar, A., Yadav, K., Rayavarapu, K., Bist, N., & Oza, H. (2021). Application of machine learning and artificial intelligence in oil and gas industry. *Petroleum Research*, *6*(4), 379-391. https://doi.org/10.1016/j.ptlrs.2021.05.009

[11]. Tran Thi Hoang, G., Dupont, L., & Camargo, M. (2019). Application of decision-making methods in smart city projects: a systematic literature review. *Smart Cities*, *2*(3), 433-452. https://doi.org/10.3390/smartcities2030027

[12]. Wamba-Taguimdje, S. L., Fosso Wamba, S., Kala Kamdjoug, J. R., & Tchatchouang Wanko, C. E. (2020). Influence of artificial intelligence (AI) on firm performance: The business value of AI-based transformation projects. *Business Process Management Journal*, *26*(7), 1893-1924. https://doi.org/10.1108/BPMJ-10-2019-0411

[13]. Waqar, A., Othman, I., Shafiq, N., & Mansoor, M. S. (2023). Applications of AI in oil and gas projects towards sustainable development: a systematic literature review. *Artificial Intelligence Review*, 1-28. https://doi.org/ 10.1007%2Fs10462-023-10467-7

[14]. Windisch, C., & Doppelreiter, D. (2019, November). Integrated approach for smart brownfield concept-application model for production optimization technologies. In *Abu Dhabi International Petroleum Exhibition & Conference*. OnePetro. https://doi.org/10.2118/197871-MS