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ANALYSIS OF THE TECHNICAL CONDITION OF OFFSHORE OIL PLATFORMS: METHODS AND RESULTS

Tamerlan Babayev Emin
Azerbaijan State Oil and Industry University,

Abstract
The following scientific article pursues research objectives for the study and analysis of the technical condition of offshore oil platforms, with special emphasis and emphasis on the methods, methodology, and results. The introductory section consists of an overview of the current problems and challenges associated with and included in the general concept of the material on this article and topic, namely the operation of modern offshore oil platforms, in addition, the validity and necessity of this research method are indicated. In the main section of the methodology of this scientific article, the keywords listed below are used. The discussion of the results can provide information, as well as compare the data obtained with the currently available standards and practical rules, which in turn allows for the development of various recommendations for improving the previously mentioned methods. The conclusion allows emphasizing the importance of the obtained data on the study and for improving such important parameters as the efficiency and safety of the operational sector of offshore oil platforms, and sets clear vectors of direction for further study in this topic.

Key words: Assessment methods, visual inspection, ultrasonic diagnostics, magnetic flaw detection, vibration analysis

Introduction

Offshore oil platforms play a significant role in such sectors as hydrocarbon resource extraction, energy sector, and also have an impact on the formation of world reserves of oil, gas and other natural resources. These unique engineering structures are constantly exposed to the elements of nature, in particular their operation in extreme conditions, namely, such as high-intensity loads, chemical corrosion of platform materials, physical impact from the load of high gusts of wind and sea waves, and in general the impact of the marine environment. Taking into account the previously mentioned factors, the efficiency factor and maintenance of the working technical condition of these platforms is very important in the design of these platforms. Which in turn critically affects safety and minimization of risks, both environmental and human, in addition, this leads to an increase in the service life of the elements used, which ultimately affects the financing sector. The main problem in modern mechanical engineering concerning offshore platforms, related to their technical condition, is mainly expressed in the need to implement reliable diagnostic methods, as well as methods of multi-stage monitoring of offshore installations. For example,

structural damage most often leads to emergency situations, such as accidents, which in turn affects financial losses and environmental disasters. It is because of this that it is very important to timely identify problems in this equipment and structures, as well as the work of operators and engineers monitoring these safety parameters. The purpose of this study is to conduct the most comprehensive and comprehensive analysis of the technical condition of offshore structures using the latest advanced and modern methods of analysis and diagnostics. Particular attention will be paid to comparing the methods and assessments of the condition of the platforms in question, as well as finding and disseminating advantages and disadvantages, as well as summarizing the information in the form of recommendations for operators and engineers. Most of the article is devoted to the study of wear from corrosion, wear which is the main factor in damage and subsequent accidents on these platforms. The environment in which this equipment is operated, namely the marine environment, is an environment rich in various chemical elements and substances, including salt and aggressive compounds. A special aspect is the study of vibration effects on platforms, and the nature of their occurrence, which allows identifying damage at an early stage and taking the necessary safety measures in advance. Thus, in this study, the task is to study and develop a common integrated solution to the analysis of the technical condition of offshore oil platforms, which will ultimately improve such important parameters as the safety and efficiency of using offshore equipment.

Monitoring the Technical Condition of Stationary Platforms: Challenges and Strategies

Critical to the energy sector, fixed platform monitoring presents numerous technical, environmental, economic and geopolitical challenges. Addressing these challenges is vital to the sustainable and long-term viability of oil production operations. Developing alternative solutions and improving monitoring techniques are important steps towards achieving these goals.

Technical Challenges

-Reservoir Complexity:

The complexity of oil reservoirs poses significant technical challenges. Many reservoirs are located in geologically complex structures, making them difficult and expensive to access. Enhanced Oil Recovery (EOR) techniques are often required to exploit unconventional resources or remaining reserves. These advanced techniques require careful monitoring to ensure efficiency and safety.

-Declining Production Rates:

A common problem in oil fields is the natural decline in production rates over time. Older fields experience declining production, necessitating new reserves and increased capital investment in advanced recovery technologies. Continuous monitoring is essential to optimize production rates and extend the life of existing fields.

-High Operating Costs:

Oil production requires significant initial investment and ongoing operating costs, including drilling, extraction, transportation, and refining. Volatility in oil and other commodity prices can significantly impact the profitability of these operations. Effective monitoring systems can help manage costs and improve operational efficiency.

2. Environmental Issues

-Carbon Emissions:

Oil production is a major source of greenhouse gas emissions, which contribute to global warming and environmental degradation. Reducing emissions and switching to cleaner energy sources are critical to mitigating environmental impacts. Advanced monitoring systems can track emissions and support efforts to minimize the carbon footprint of oil production.

-Water Use and Pollution:
Techniques such as waterflooding and hydraulic fracturing (fracking) used in oil extraction can deplete freshwater resources and contaminate groundwater with pollutants. This poses risks to ecosystems and human health. Monitoring water consumption and pollution levels is essential to ensure environmental compliance and the protection of natural resources.
3. Effective Monitoring Strategies
-Integrated Monitoring Systems:
Implementing integrated monitoring systems that combine a variety of diagnostic tools and techniques can provide a comprehensive view of the technical condition of fixed platforms. These systems can include visual inspection, ultrasonic testing, magnetic particle inspection, and vibration analysis, enabling early detection of potential problems.
-Data-Driven Decision Making:
Using data from monitoring systems to inform decision-making processes can improve the effectiveness of maintenance and operations strategies. Data analytics can identify trends and predict potential failures, allowing proactive action to be taken before problems worsen.
-Compliance with regulations and standards:
Compliance with regulations and industry standards is critical to maintaining the technical integrity of fixed platforms. Monitoring systems must be designed to meet these standards, ensuring that platforms operate safely and efficiently while minimizing environmental impacts.
-Continuous improvement:
Regularly updating and improving monitoring methods is essential to keep pace with technological advances and changing industry needs. Investments in research and development can lead to the discovery of new methods and tools for more effective monitoring and maintenance.
In conclusion, monitoring the technical condition of fixed platforms is a multifaceted task that requires an integrated and proactive approach. By addressing technical and environmental challenges with modern monitoring systems and data-driven strategies, the oil industry can improve the sustainability and efficiency of its operations, ensuring long-term viability in a rapidly changing world.

Methods

Assessing the digital systems used in the fixed platform health monitoring phase is critical to understanding their functionality, strengths, weaknesses, and potential future improvements. This analysis is critical to identifying system deficiencies, optimizing processes, and improving decision-making capabilities in the industry. Key aspects to consider include: Assessing Current Systems
A comprehensive assessment of existing systems is essential to ensure reliable and robust monitoring across all stages, from exploration to refining and distribution. Key points to consider include:
System Reliability and Usability: Review the robustness, usability, and overall adequacy of digital information systems deployed across the various equipment and stages of oil production. This includes exploration, production, refining, transportation, and distribution.
Data Usage and Workflow Automation: Prioritize the strengths and weaknesses in how data is used, the degree of workflow automation, integration capabilities, and user interface efficiency.
System Reliability and Scalability: Assess whether current systems are sufficiently reliable, resilient, and secure to support the organization's changing needs. Determine whether the infrastructure can adapt to technological advances and regulatory changes.
Technology Stack Review
A detailed technology stack review is necessary to understand the components and their effectiveness in supporting fixed platform monitoring. Consider the following:
Component Identification: Identify the individual devices and elements within existing information systems, such as databases, servers, network devices, and software applications, that are critical to monitoring operations. Compliance and Standards: Assess the technology stack's alignment with

industry standards and best practices, ensuring that all components comply with acceptable regulations and guidelines.

Adoption of Advanced Technologies: Analyze the feasibility and cost-effectiveness of integrating emerging technologies, such as cloud computing, big data analytics, the Internet of Things (IoT), and artificial intelligence (AI), into existing systems. These technologies can significantly improve monitoring capabilities and data processing efficiency.

Data Management and Integration

Effective data management and integration are critical to achieving a comprehensive understanding of platform conditions. Key considerations include:

Data Collection and Processing: Examine how data is collected, processed, stored, and managed in current systems. This includes both structured and unstructured data sources such as seismic surveys, well logs, production records, and sensor data.

Data Aggregation and Integration: Evaluate the effectiveness of data aggregation methods within the organizational structure. Aim to integrate data from multiple sources to develop a single view of operations, assets, and performance.

Data Quality and Integrity: Identify any data quality issues, inconsistencies, and duplications that could hinder accurate decision making and disrupt operations. Ensuring high data quality is essential for reliable monitoring and analysis.

Improving Monitoring Systems

To improve fixed platform monitoring systems, it is important to focus on continuous improvement and innovation. Consider the following strategies:

Regular system upgrades: Continuously update and upgrade monitoring systems to incorporate the latest technological advances and meet changing industry requirements.

Training and development: Invest in staff training programs to ensure they are proficient in using advanced monitoring tools and technologies.

Collaborative approaches: Encourage collaboration across departments and stakeholders to ensure a holistic approach to monitoring and data management.

Conclusion

Evaluating and improving digital systems used to monitor fixed platforms is a complex but important task. By carefully assessing current systems, reviewing the technology stack, and improving data management practices, organizations can significantly improve their monitoring capabilities. This, in turn, will lead to better decision making, process optimization, and increased operational efficiency, ensuring the long-term sustainability and safety of fixed platforms in the oil industry.

Result

Creating an information system designed for monitoring the technical condition of fixed platforms involves developing a complex multi-level structure that meets all the necessary requirements and tasks. This integrated approach ensures that the system is reliable, robust and efficient. Below is an expanded overview of the main considerations when designing such a system:

Scalable and flexible infrastructure

Developing an adaptive and expandable infrastructure is critical. This architecture must integrate various components, including data acquisition devices, processing units, analytical engines and user interfaces. The system must support real-time data collection, storage, analysis and visualization, allowing operators to make informed decisions quickly. The architecture must also take into account future technological advances and changing operational needs.

The architecture must seamlessly integrate the various elements of the system, ensuring smooth data flow and compatibility. This integration facilitates end-to-end monitoring, enabling efficient management of all aspects of platform operations, from initial exploration to final distribution.

Comprehensive Operational Requirements

Identifying and establishing the functional requirements of the information system is essential. This includes consideration of all operational activities associated with fixed platforms, such as drilling, production, processing, transportation and distribution. The system should include modules for asset management, production tracking, predictive and condition-based maintenance, supply chain optimization and regulatory compliance.

Developing sophisticated software that meets these functional needs is critical. The software should improve operational efficiency and productivity by providing tools for real-time monitoring, data analysis and decision support. It should also include predictive maintenance features to prevent equipment failures and optimize the overall life cycle of platform components.

Data Quality and Integrity

Ensuring excellent data management is paramount. This includes adhering to strict standards for data quality, integrity and security. Data must be sourced from a variety of devices, machines, and operational databases, providing a comprehensive and accurate data set for analysis.

Developing robust methods for integrating, cleaning, and normalizing data is vital. These processes ensure that data from different sources is standardized and usable, providing decision makers with a single view of operations. Effective data management enables better analysis, leading to more informed and strategic decisions.

Real-Time Data Collection and Analysis

Implementing systems that support real-time data collection and analysis is essential for effective monitoring. This capability allows operators to quickly respond to any issues or anomalies, minimizing downtime and ensuring continuous operation of fixed platforms.

Visualization and User Interfaces

Creating intuitive user interfaces that facilitate data visualization is critical. These interfaces should provide clear and actionable insights, allowing operators and decision makers to quickly understand complex data and make informed decisions. Visualization tools can help highlight trends, identify potential problems, and support strategic planning.

Security and Compliance

Ensuring the security of an information system is fundamental. The system must be designed to protect sensitive data from unauthorized access and cyber threats. In addition, it must comply with all relevant regulations and industry standards to ensure legal compliance and operational integrity.

Conclusion

Designing an information system for monitoring the technical condition of fixed platforms involves a multifaceted approach that considers system architecture, functionality, and data management. By developing a scalable and flexible infrastructure, defining end-to-end functional requirements, and ensuring data quality and integration, organizations can create a robust system that improves operational efficiency and supports strategic decision making.

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IMPACT OF ARTIFICIAL INTELLIGENCE APPLICATIONS ON THE OIL AND GAS FIELD DEVELOPMENT SECTOR

Mudasir Ali Rind, Pirali Aliyev
Khazar University Baku Azerbaijan
Baku Slavic University Baku Azerbaijan

Abstract
AI applications have implemented in several sectors where these applications are helping these sectors in developing the new ideas for sustainable development and new trends in education, environmental developments, health and hygiene and disaster management systems. In this field of oil and gas sector AI has also importance according to the applications that are helping the engineers, oil, and gas development industry where these applications are utilizing for safety and management of different processes that are used in oil, and gas industry. AI applications in the field of oil and gas is utilized in the maintaining of machines and working of machines in smooth ways. There is AI application that has been developed by the two different organizations IBM and SOCAR in Azerbaijan that is called by name as ALIYA that will develop the new trends in the file of oil and gas sector. Most of the other applications are developed by different companies for the betterment of oil and gas industries. This ALIYA artificial intelligence application in SOCAR company will help the engineers for development of this sector and this application will also help the engineers to resolve the intricate technological challenges. This AI application ALIYA can bring new advancement in the field of oil and gas sector with complex information sets, measurements of different complex systems and management the different, complex measurements.
Key words: AI applications, ALIYA, and oil industry, Advancement of oil and gas industry with AI applications, Sustainable developments with AI applications.

Introduction
Technologies have reconstructed the traditional education system into new innovative systems of learning. Day by day technologies have been increasing and new technological applications have been added in technological innovation. Artificial intelligence has also helped in erudition in different fields, new technological have been added to develop the new trends in different sectors. In the field of oil and gas AI applications have got the new advancements for the development of the oil and gas sector.
Moreover, the developments for oil and gas fields most of the research has been done on the new advancements in oil and gas fields through the AI applications. These AI applications have helped the oil and gas fields in the oil field production dynamics predications, development plan optimizations, residual oil identifications, fracture identifications and quick response on any fracture identifications with smart technologies with operative developments and oil recovery methods are also provided by these applications. Many AI applications have been composed to enhance the compatibility of systems but