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Unlocking Insights: Data Analytics to Predict Unplanned Production Deferment in Offshore Oil and Gas Wells

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Abstract

This paper presents findings from a project focused on addressing challenges related to deferments in injection and production wells within an offshore facility in Sarawak waters, Malaysia. The main objective of the project was to derive actionable insights from data collected from various sources, such as PI data and downtime history, to identify the root causes of deferment issues and suggest appropriate solutions to improve operations and reduce production losses. The methodology for the project was divided into two distinct phases, each targeting a crucial aspect of the data management process. The first phase involved gathering, cleaning, and visualizing the data, which was a critical step in ensuring the reliability and accuracy of the subsequent analysis. Data was collected from multiple wells and cleaned using Python scripts to address common data quality issues, including outliers, missing values, and incorrect unit conversions. This cleaning process not only enhanced the reliability of the data but also standardised it for further analysis. The cleaned data was then exported to MS Excel for preliminary checks and later stored in an MS Access database, which served as a structured and centralised repository for all project-related data. This organizational approach ensured easy access and retrieval of information for the analysis phase. The second phase of the project focused on data modeling and analysis, where the cleaned data was utilized to generate visualizations and identify patterns that could explain the causes of deferments. Power BI was employed as the primary tool for data visualisation, allowing the team to effectively analyse trends in production, downtime, and well-test data over time. By using this methodology, the project team was able to better understand the factors contributing to deferments, which included a range of operational, mechanical, and external factors, and pinpoint areas where improvements could be made to minimise downtime and enhance production efficiency. The results of the project included detailed visualisations derived from the cleaned data, manual analysis of observed trends, and critical insights that emerged from data exploration. One of the key findings was that identifying consistent patterns in downtime categories proved challenging due to inherent inconsistencies in the data. Despite this, the use of Python scripts for automating data processing and improving data quality played a crucial role in increasing the reliability of the analysis. The analysis also highlighted the importance of maintaining high-quality, consistent data to ensure that decisions based on the data were well-informed and accurate. This finding underscores the value of digital twin technologies, which rely on precise and consistent data to create virtual representations of physical systems for better management of offshore wells. The novelty of this study lies in the application of digital twin technologies for well management, coupled with the innovative use of Python scripting to automate and streamline data cleaning and analysis processes. The paper offers valuable insights into the practical challenges faced when implementing twin digital technologies in offshore well operations, providing recommendations for improving data quality and ensuring more accurate analyses in future projects. Additionally, the study emphasizes the need for a more nuanced understanding of deferment patterns, as the data analysis revealed that deferments were influenced by multiple, often unpredictable factors, and did not follow consistent or easily recognizable patterns. This variability in the causes of deferment underscores the complexity of managing offshore oil and gas wells and highlights the need for a more sophisticated and adaptable approach to well management. The findings suggest that improvements in data quality, along with the adoption of advanced modeling techniques, could significantly enhance the ability to predict and mitigate deferments. This, in turn, would lead to more efficient well management practices and improved operational efficiency in offshore facilities. The

lessons learned from this study provide a foundation for future research and development efforts aimed at addressing deferment issues in offshore oil and gas wells, as well as advancing the application of digital twin technologies for more effective well operations.