Evaluating Well Service Rig Utilization for Competency-Based Training in the Oil and Gas Energy Sector

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ABSTRACT

Indonesia's significant oil and natural gas reserves necessitate the development of a highly skilled workforce to support and advance well-service operations. Ensuring that personnel possess the required blend of theoretical knowledge and practical experience is essential, and this can be achieved most effectively through hands-on training. The Center for Human Resources Development of Oil and Gas (PPSDM Migas) employs Rig #99 as a mobile training facility to address this need. This study aims to investigate the potential of Rig #99 utilization as a well-service training school that can produce competent human resources for the oil and gas sector. First, it identifies the training needs for oil and gas well service competencies in Indonesia. Second, it determines the competencies required based on the Indonesian National Work Competency Standards (SKKNI) for well service. Third, it assesses the readiness and suitability of Rig #99 as a well-service training facility at PPSDM Migas. This study provides comprehensive insights into the effectiveness of using Rig #99 as a training tool by evaluating training data, curriculum, participant demographics, duration, and post-training outcomes. The findings indicate that Rig #99 plays a critical role in developing the competencies necessary for well service, aligning with the SKKNI standards, and fulfilling the demand for qualified personnel in Indonesia's oil and gas industry. Feedback from participants demonstrates high satisfaction levels, reinforcing Rig #99's role as an effective platform for cultivating skilled well-service operators and establishing a solid foundation for well-service training schools.

Keywords: well service, mobile rig, training, competency

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1. Introduction

Indonesia is one of the world's leading oil and natural gas producers, with large untapped reserves that present significant opportunities for the country's energy sector. As these resources continue to be explored and developed, there is a growing need for skilled workers capable of handling the complexities of oil and gas operations [1]. One key area that requires highly competent workers is well service and workover activities, which are essential for maintaining and increasing the productivity of oil and gas wells. However, developing proficiency in this field requires more than just theoretical knowledge; it de-

mands hands-on experience and practical skills that can only be acquired through direct exposure to real-world drilling and well service operations [2]. Indonesia's oil and gas industry must focus on training programs that blend theoretical learning with practical experience to meet this demand.

Training is a systematic process designed to enhance an individual's knowledge, skills, and competencies, enabling them to perform their roles more effectively [3]. In the context of well service in the oil and gas industry, training equips workers with the necessary skills to handle complex tasks, operate equipment safely, and respond to emergencies. Effective training bridges the gap between theoretical knowledge and practical skills, ensuring trainees can confidently apply what they have learned in real-world scenarios.

Well-service training is crucial for developing skilled personnel capable of managing the complexities of well workover and servicing operations. This training typically includes both classroom-based theoretical instruction and hands-on practical experience, providing trainees with a comprehensive understanding of the well-service process. The combination of classroom learning, hands-on practice, and simulation ensures trainees grasp technical concepts while developing the practical skills needed to work safely and efficiently on-site [4]. The primary goal is to prepare individuals for the challenges they will face in their roles, reduce the risk of accidents, increase operational efficiency, and ensure the longevity of the equipment and infrastructure they use [5].

Evaluating training effectiveness is essential to ensure the program delivers the desired results and adequately prepares trainees for their roles. Several methods can measure training effectiveness, including pre- and post-training assessments, practical performance evaluations, feedback from trainees, and on-the-job performance observations. Pre-training assessments establish a baseline of trainees' knowledge and skills, while post-training assessments indicate how much they have learned [6]. Practical performance evaluations allow trainees to demonstrate their skills in a controlled environment. Feedback from trainees provides insights into how well the training program met their needs and areas for improvement. Observing on-the-job performance after trainees return to the workplace is one of the most reliable ways to measure training effectiveness, as it tracks how well trainees apply their skills, handle challenges, and contribute to overall productivity and safety [7].

The Center of Human Resources Development for Oil and Gas (PPSDM Migas) has provided training in the oil and gas sector since 1966, approximately 90 years after the first oil discovery in Indonesia in the 1870s. As an agency under the Ministry of Energy and Mineral Resources, PPSDM Migas offers several educational and training facilities, including laboratories and workshops. The drilling laboratory is equipped with essential equipment such as Drilling rigs, drilling simulators, and Mobile rigs. The mobile Rig #99 was chartered for two years in 2020 for well-service in the Nglobo, Semanggi, and Ledok fields managed by Pertamina EP. In 2022, the rig ended its service in the field and went back to the laboratory for training. Thus, this rig could be a functional well-service rig used for training and certification purposes, offering trainees the unique opportunity to gain practical experience in a controlled environment.

PPSDM Migas could use this rig to simulate various well-servicing scenarios, enabling trainees to apply their theoretical knowledge to practical tasks. This hands-on approach enhances trainees' technical skills and helps them develop problem-solving abilities and a deeper understanding of safety protocols, which are essential qualities for professionals in the oil and gas industry [8].

Rig #99 is a portable Derrick Rig designed explicitly for well service operations, making it a crucial asset in the field of oil and gas exploration, as shown in Figure 1. Unlike fixed rigs, Rig #99 offers enhanced mobility and flexibility due to its smaller, more compact tower structure, allowing for easier transportation and setup across different well sites. Manu-

factured by Skytop Brewster and built/ rebuilt in 1976/2017, the Rig is rated with 550 HP and has a mast height of 50 feet, making it capable of handling a nominal drilling depth of up to 1500 meters. The Rig features a double drum drawwork system with a main line diameter of 7/8" and a sand line of 9/16", and it is mounted on a 3-axle truck carrier, further enhancing its mobility. The diesel engine, coupled with an Allison transmission, provides the necessary power for the Rig's operations, while its maximum hook load of 150 tons ensures it can handle heavy-duty well service tasks effectively.

Figure 1. The operational of Rig #99 in Nglobo Field

The hoisting system of Rig #99 is designed to facilitate the lifting and lowering of tubing during well service operations, as shown in Figure 2. This system is vital for handling significant vertical and horizontal loads that arise from the tower, tubing, and wind pressures. Complementing this is the supporting structure, built from a steel frame tower above the wellhead. This structure comprises the substructure, drill floor, and drilling tower, each playing a crucial role in maintaining the stability and functionality of the Rig. The substructure serves as a platform that supports heavy loads, while the drilling floor accommodates various smaller drilling equipment, providing space for the crew to operate efficiently. The drilling tower itself is essential for the vertical movement of drill pipes and casing assemblies, with its various components, such as the gin pole, water table, and monkey board, facilitating safe and efficient operations.

Overhead tools are integral to Rig #99's well service capabilities, supporting operations such as lifting and lowering heavy equipment. The crown block, traveling block, hook, and elevator are the primary overhead tools used, with each playing a specific role in the overall lifting mechanism. The crown block is a stationary pulley that supports the traveling block, which moves up and down to lift the hook and attached drill pipe assembly. This arrangement allows for precise equipment handling, ensuring safety and efficiency during well services. Additionally, the drilling line, which connects all the components in the lifting system, plays a critical role in maintaining the load-bearing capacity of the Rig, allowing it to handle heavy equipment with precision.

Rig #99 is also equipped with several auxiliary systems and safety mechanisms that enhance its operational efficiency and safety. The Blow Out Preventer (BOP) system is one such feature that ensures the safety of well operations by preventing uncontrolled pressure releases. Meanwhile, auxiliary equipment such as the sand line, guyed line, tongs, top drive, and pumps contribute to the Rig's versatility, allowing it to handle a wide range of well service tasks. Finally, the down-hole pumping system, which includes components

like well casing, pump tubing, sucker rods, and down-hole pumps, ensures effective oil extraction and movement within the well-bore, making Rig #99 a comprehensive and versatile solution for well-service operations.

Figure 2. Hoisting system in Rig #99

This study aims to investigate the potential of Rig #99 utilization as a well-service training school that can produce competent human resources for the oil and gas sector. First, to identify the training needs for oil and gas well service competencies in Indonesia. Second, to determine the competencies required based on the Indonesian National Work Competency Standards (SKKNI) for oil and gas well service. Third, to assess the readiness and suitability of Rig #99 as a well-service training facility at PPSDM Migas.

This investigation is crucial to ensure that Indonesia can develop a workforce capable of meeting the current demands of the oil and gas industry and is adequately prepared to face future challenges.

2. Methods

This research employs a mixed-method approach, incorporating both quantitative and qualitative data. The quantitative aspect focuses on the specifications of Rig #99 and its operational procedures, which serve as a foundation for curriculum development aligned with the Indonesian SKKNI. The qualitative data include insights gathered from training sessions conducted using Rig #99 and post-training evaluations. Training data collected spans from January 2023 to September 2024, covering 16 training sessions with 268 participants. These sessions were evaluated based on the curriculum, training hours, and post-training assessments.

Additionally, this study utilizes a descriptive approach to detail Rig #99's specifications, components, operational mechanisms, and standard operating procedures, providing an in-depth picture of the training environment and its effectiveness. The primary focus of this research is on how the mobile rig ish b directly related to the implementation of well-service training and certification. Data sources include primary data obtained through field surveys and questionnaires and secondary data from literature, documents, and reports on well-service operations in the oil and gas industry.

3. Results and Discussion

Achieving competency in well-service requirements meeting specific industry standards that define the necessary knowledge, skills, and abilities for well-service professionals. These standards ensure that

individuals are fully equipped to perform well service activities effectively and safely, minimizing the risk of accidents and operational failures. Competency standards typically cover areas such as well surface and subsurface equipment, rig equipment, well control techniques, safety procedures, and equipment handling. Trainees must also demonstrate their ability to diagnose common well problems, implement appropriate maintenance strategies, and respond to emergencies.

3.1 Well Service Training

PPSDM Migas introduced training with Rig #99 in 2023 as an essential component of the well-service division's efforts to develop a skilled workforce. A total of 16 training sessions are planned until September 2024, with programs lasting 6, 8, 15, and 26 days. These sessions cater to different audiences: the shorter six and 8-day sessions are designed for university students on short-term internships, covering key topics such as Mobilization/Demobilization, Rig Up/Down, Safety Induction, Well Control, and Well Services Operations. Meanwhile, the longer 15 and 26-day training sessions are tailored for beginners entering the oil and gas industry, providing more comprehensive training on Completion Fluid, Well Head/X-Mastree, Casing and Tubing, Artificial Lift Equipment, Rig Maintenance, and Safety.

The Well Service Floorman Training, designed for beginner operators with limited experience, is a cornerstone of this training initiative. Since 2023, 10 sessions have been conducted, offering 15-day and 26-day programs that blend theoretical knowledge with hands-on practice. The 15-day course includes 90 hours of classroom instruction and 50 hours of practical training, while the 26-day course offers a more intensive experience with 57 hours of theory and 137 hours of field practice, complemented by discipline training from the Indonesian National Army. This comprehensive training ensures that participants gain the necessary skills and knowledge to excel well service floormans as well.

Furthermore, community training programs, supported by the Ministry of Energy and Mineral Resources (KESDM) under Regulation No. 13 of 2022, aim to extend training assistance to individuals from producing and potential areas, remote regions, and communities with limited access to training opportunities. The Well Services Operation and Internship Training, tailored for petroleum engineering students from institutions such as Universitas Bhayangkara Jakarta Raya, Universitas Trisakti, and Institut Teknologi Dili, offers six and 8-day sessions to enhance both theoretical and practical skills. Feedback from these sessions has shown that participants gain significant confidence and skills, making them more competitive and employable in the oil and gas industry.

Well-service activities are essential for managing oil and gas wells throughout their lifecycle, starting from the initial completion phase, which prepares wells for production, to workover operations that ensure sustained productivity. These operations are crucial for maintaining and enhancing well production rates, addressing any operational issues, and ensuring efficient functioning over time. Key activities in this field include rig up, rig down, rig moving, tripping in and out, and sand pumping—all vital for uninterrupted well operations. Therefore, developing a competency-based training curriculum for well service must encompass these core activities to equip trainees with the necessary skills and knowledge for the oil and gas sector.

3.1.1 Rig Up

The Rig Up curriculum provides a comprehensive guide to the preparation and procedural steps required for a rig's safe and efficient setup. The process begins with ensuring all personnel have the complete Personal Protective Equipment (PPE) and conducting a Pre-Job Meeting to assign tasks and develop a Job Safety Analysis (JSA). This phase also includes essential checks, such as verifying hydraulic oil levels, inspecting the Rig and its equipment using the Rig Safety Checklist, and preparing the ground anchor for stability. Proper communication is emphasized, especially for work near power lines, to ensure safety throughout the preparation.

The procedural steps involve the systematic adjustment and setup of various rig components. This includes adjusting screw jacks, bleeding air traps, and ensuring the hydraulic pressure reaches the required levels (1800-2000 PSI) according to industry standards like API Specification 4E. Operators are instructed to lift the lower and upper masts cautiously, monitor for any obstructions, and install safety pins and load guy lines for stability. Special attention is given to safety measures, such as keeping personnel away from the Draw work during mast lifting and using harnesses when accessing elevated areas.

Once the upper mast is correctly positioned and secured, the supervisor directs the installation and tensioning of guy lines, ensuring proper grounding and installation of equipment such as the crown load and wind load guy lines. Ground anchor installation is conducted meticulously, with guidelines ensuring it is free from underground hazards and positioned according to API RP 4G standards. The final steps include installing escape poles, flags, and safety guards to ensure the Rig is fully operational and adheres to safety standards, reflecting a thorough and safety-oriented approach to the rig setup.

3.1.2 Well Service Operation

The Well Service curriculum outlines the essential human resources, procedures, equipment, and contingency plans required for effective well maintenance operations. It begins by emphasizing the importance of qualified and certified personnel, as illustrated in Figure 3. All rig crew members must possess valid competency certificates, ensuring that key roles such as Rig Superintendent, Tool Pusher, Derrickman, Driller, and Floorman are filled by appropriately trained individuals. Additional requirements include maintaining accurate worker identification, ensuring annual medical check-ups are validated by a certified field doctor, and supervising job roles to prevent personnel from performing tasks outside their designated responsibilities.

The procedural aspect of the curriculum ensures adherence to safety protocols and operational guidelines. Before starting any well-service work, Safe Work Permits (SIKA), JSA, and site entry procedures must be in place and communicated effectively to all crew members. A Health, Safety, and Environment (HSE) plan and emergency response protocols must be printed, available on-site, and understood by the team through daily briefings. Regular emergency drills, such as Kick Drill, BOP Drill, and Fire Drill, are also mandated to ensure readiness. Additionally, maintaining cleanliness, good housekeeping practices, and following the Rig Operation Checklist to address and resolve any findings are essential curriculum components.

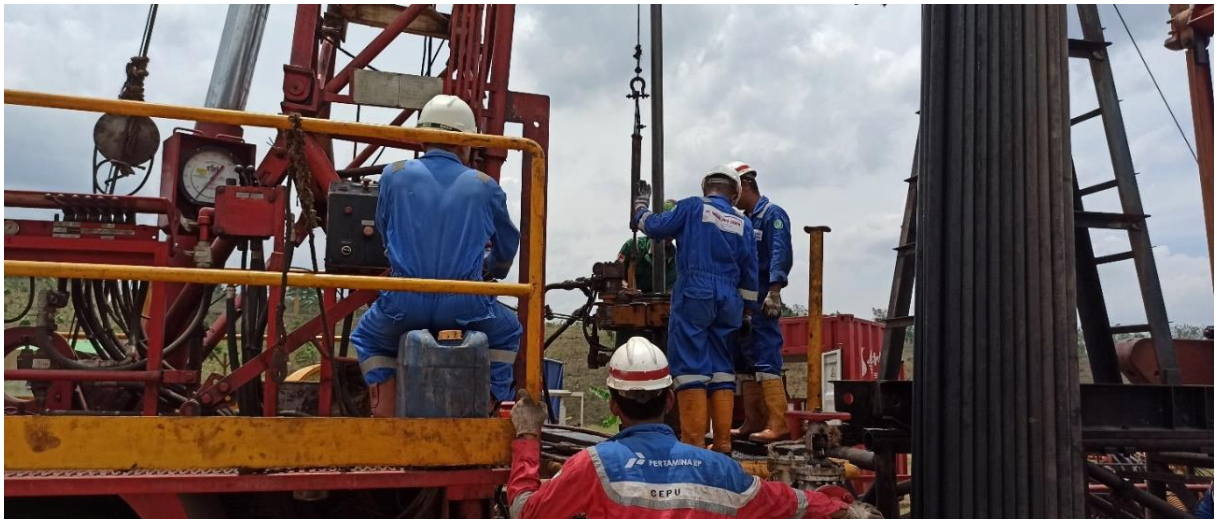

Figure 3. Well service operation using Rig #99

Regarding equipment, the curriculum stresses the importance of ensuring that all certifications, such as the Oil and Gas Rig Certificate, certificates for cranes and forklifts, and calibration certificates for pressure gauges and weight indicators, are valid and present on-site. Function tests for all equipment, including BOP systems, fire pumps, and communication devices, must be conducted and documented before initiating operations. Effective communication is ensured by providing functioning Handy Talky radios to all key personnel.

The contingency plan section covers crucial safety measures for unexpected situations. Before the Rig operates, the annulus must be connected to the flowline. If a kick or flow occurs, the safety valve must be installed on the tubing, and the BOP must be closed immediately. Coordination with the operator to control fluid flow and ongoing observation is necessary, followed by bullheading and continuous monitoring to manage any potential well control issues. This comprehensive curriculum ensures that all aspects of well service operations are conducted efficiently, safely, and in compliance with industry standards.

3.1.3 Rig Down

The Rig Down curriculum outlines the steps to dismantle and prepare a rig for transportation safely. It starts with the preparation phase, where a tailgate meeting is conducted to assign tasks and coordinate the rig crew. During this phase, all attached guy lines and escape lines must be removed from ground anchors, including those connected to the bumper rig. Additionally, special attention is required to ensure there are no subsurface cables before rotating the ground anchor.

The procedure phase involves a series of detailed steps to dismantle the Rig. First, the electrical inlet cable and grounding connected to the upper mast are removed, and the rigging on the Monkey Board is secured to prevent snagging. All personnel must use climbing devices and belts for safety when climbing the mast. The air is then bled from the telescoping ram to ensure smooth hydraulic operation, and the traveling block, sand line, and cat line cable are elevated to a safe height. The process continues by raising the upper mast and carefully removing the locking pawl before lowering it slowly. Throughout this step, it's essential to monitor wire lines and avoid any snagging or sudden movements that could damage the rig components.

The next steps involve bleeding air from the raising cylinder in a controlled manner, removing safety pins from the derrick leg, and gradually lowering the rig mast using the control valve. This phase requires meticulous attention to ensure wire lines do not interfere and to prevent rough handling, which could cause damage to the Rig's structural integrity or seals. Following this, all drilling lines, sand lines, cat lines, escape lines, and guy lines are rolled up and secured properly to prevent them from coming loose during transportation.

The final steps include folding and securing the rig floor, retracting the manual jack, releasing the leveling jack, and switching the transfer gear from the "DRAW WORK" position to the "CARRIER" position. A thorough inspection of all rig tires, oil systems, lubrication, steering, brake systems, and lighting systems is conducted to ensure they are in proper working condition. The Rig is also checked for any oil spills or trash around the site to maintain environmental safety, as shown in Figure 4. Once all equipment is properly loaded and secured, the Rig is declared ready for movement, marking the completion of the Rig Down process. This curriculum ensures a systematic and safe dismantling process for efficient and accident-free rig transportation.

3.1.4 Rig Moving

The Rig Moving curriculum provides a comprehensive guide to safely and efficiently relocate a rig to a new site. It begins with the preparation phase, which emphasizes the importance of ensuring that all required permits, such as CP-21-167 (Working Near Power Line) and Excavation Permits, are completed and available. All personnel must be equipped with the appropriate PPE. Before

starting the moving process, a Pre-Job Meeting is conducted with all involved parties to outline the procedures, risks, and safety measures. Necessary documentation like the Journey Management Moving plan, JSA, and Journey Management System form must be completed. The convoy leaders (Senior Toolpusher and Truck Pusher) must be equipped with revolving lights, red flags, and radio communication devices, and they should be accompanied by a competent Moving Team that includes field officers and an HSE representative.

Figure 4. Rig down and be ready for moving

The procedure phase outlines the steps involved in safely executing the rig move. It starts with a thorough inspection of the route to be taken, including checking road width, intersections, pipe positions, and power line heights. The Rig and equipment must be loaded carefully onto transport vehicles, ensuring the load is securely tied and does not exceed the transport's capacity. If the load surpasses the maximum length or width, it must be marked with red flags and approved by the Wellwork leadership. Repairs to the moving or abandoned location must be done if necessary, and all vehicle systems like tire pressure, engine oil, brakes, lights, and safety features must be checked to ensure proper functioning.

During the rig moving, safety is a top priority. The Rig is to be transported in a convoy led by the Convoy Leader, with a maximum of three vehicles per convoy. The convoy leader maintains a safe distance and assists the rig driver in navigating exits and entrances. The convoy should maintain a minimum distance of 30 meters, and the speed of the Rig should not exceed 40 km/h. In adverse conditions such as slippery roads, safe convoy distances must be doubled and speed reduced accordingly. Throughout the journey, communication between convoy members is maintained using radio, lights, and horn signals to ensure smooth coordination. Rig personnel are not allowed on the rig carrier during movement to avoid accidents. After approximately 25 km, a trip inspection is conducted to ensure everything functions correctly and safely. Upon arrival at the new site, the Rig is parked in a safe location, ensuring that it adheres to the layout procedure and safety measures, with the transmission gear set to neutral, parking brakes engaged, and tire chocks properly installed. This curriculum ensures that the rig moving process is conducted safely, efficiently, and in compliance with all safety regulations.

3.2 Competency Standard for Well Service

The Rig #99 training program is designed to align with these competency standards, ensuring that trainees acquire the skills needed to meet industry requirements. These com-

petency standards are crucial for developing a skilled workforce capable of maintaining the productivity and safety of oil and gas wells, contributing to the long-term sustainability of Indonesia's oil and gas industry.

3.2.1 SKKNI for Well Service Operation

The Decree of the Minister of Manpower Number 52 of 2022 established the Indonesian SKKNI for the Mining and Quarrying sector, specifically for Oil, Gas, and Geothermal Mining in the field of well service and workover. This decree ensures that well-service workers have the skills and competencies needed to perform their duties efficiently and safely, serving as an official guideline for industry professionals.

The decree follows the provisions of Article 31 of the Regulation of the Minister of Manpower Number 3 of 2016, which outlines the procedures for determining national work competency standards. The need for this decree was reinforced during a national convention on December 7, 2021, in Bogor, where key industry stakeholders agreed on the draft standard. This collaborative approach ensured the standard was comprehensive and met practical industry requirements. Additionally, a letter from the Director of Oil and Gas Engineering and Environment (Number B-2918/MG.06/DMT/2022), dated April 8, 2022, emphasized the importance of clear competency standards for workover and well service sector workers. The decree was officially ratified on May 20, 2022, providing a legal framework and standards for workforce competency in this sector.

Well-service competency standards have been in place in Indonesia since 2007, following the Decree of the Minister of Manpower and Transmigration Number KEP.243/MEN/V/2007 [9]. According to the Ministry of Manpower's competency mapping (2022), eleven competencies are currently identified in well-service operation [10]. However, this recent competency mapping does not specify the levels or qualifications of personnel. In contrast, the earlier decree identified five qualifications that can be attained. It also categorized the competencies into three types: general competencies (comprising 3 units), core competencies (6 units), and special competencies (1 unit). This updated competency standard is developed based on the Regional Model Competency Standard (RMCS), guided by job competency analysis, and is officially endorsed by the Minister of Manpower based on the outcomes of the national convention on SKKNI for onshore drilling. According to the International Labour Organization [11], the RMCS consists of three main elements: industry description and scope, function, and primary units. Each unit is further structured into four sub-components: performance criteria, evidence requirements, critical skills and essential knowledge, and scope statements, as illustrated in Figure 5.

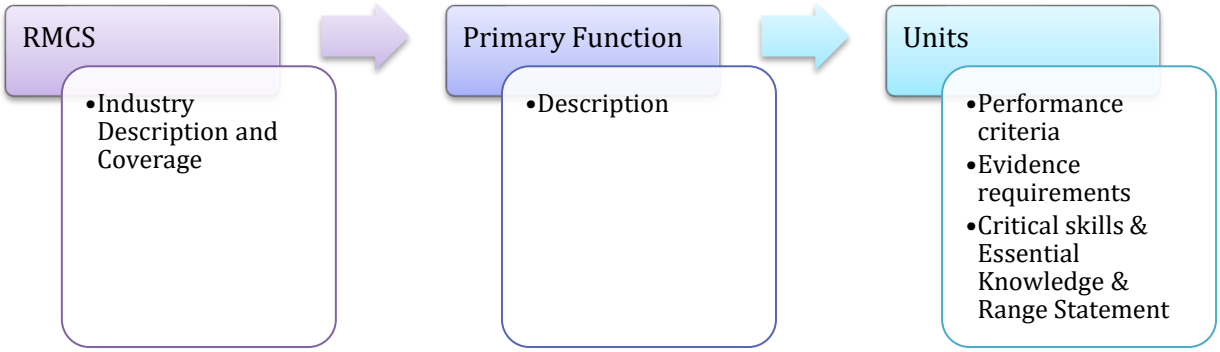

Figure 5. Main Functions and Units detailed in RMCS [11]

A significant advantage of having a single standard is that it enables centralized training and certification for workers, ensuring that only a select number of authorized professional training and certification institutions can issue well-service competency certificates. However, this centralized approach may limit the ability to quickly expand the

workforce to meet industry demands within a short timeframe [12]. Therefore, it is essential to strengthen the competency-based capacity development system to address future needs more efficiently.

The standards outlined in the SKKNI are further detailed in job scheme certifications, which help identify the specific competencies required for individuals to obtain a job competency certificate. The Well Service Job Certification Scheme is designed to provide competency certification for workers in the role of Rig Well service operator, in accordance with the Indonesian SKKNI. This certification ensures that individuals meet the essential competency requirements for this position, serving as a benchmark for assessments conducted by the Professional Certification Body (LSP) and qualified competency assessors. The scheme aims to achieve several key objectives, primarily by ensuring legal and regulatory compliance, which guarantees that every worker has the right to gain recognition for their competencies acquired through education, training, and work experience. Furthermore, the certification emphasizes the importance of having workers who are adequately skilled and competent in their roles, thereby enhancing overall safety and efficiency in well service operations.

3.2.2 Well service Floorman

The job description for a certified Well Service Floorman encompasses several critical responsibilities, including implementing oil and gas and geothermal mining regulations, maintaining occupational safety and health standards, executing barrier system equipment dismantling and installation, handling the tripping in and out, preventing blowout, addressing well service issues, performing fishing jobs, and carrying out well completion tasks.

To qualify for this certification, applicants must meet specific basic requirements. They must possess a health certificate that confirms their physical ability, vision, hearing, and mobility are in good condition. Additionally, they should have relevant education, training, and experience. This includes a minimum high school education with at least six months of experience in workover and well service as a helper or roustabout rig, along with a recommendation from their company. Alternatively, applicants can have completed drill floor operator training with similar experience or possess a minimum of four years of work experience in the field of workover and well service, all with appropriate company endorsement.

3.2.3 Well service Derrickman

The Well Service Derrickman certification scheme is vital for ensuring that individuals in this role are equipped with the necessary competencies. The job description for a certified Derrickman encompasses several responsibilities that are essential for maintaining operational safety and efficiency. These include implementing oil and gas regulations, adhering to occupational safety, health, and environmental protection standards at the workplace, and executing well-killing procedures. Additionally, Derrickman is responsible for the dismantling and installation of barrier system equipment, tripping in and tripping out, and preventing wild gushes, which are crucial for maintaining well integrity.

Moreover, Derrickman must be proficient in handling workover and well service issues, carrying out fishing jobs, and ensuring successful well completion. This diverse range of responsibilities underscores the need for well-rounded training and certification, which not only enhances individual competence but also contributes to the overall safety and productivity of well service operations.
To qualify for this certification, applicants must have a health certificate that confirms their physical ability, vision, hearing, and mobility are in good condition. A minimum education level of high school is required, along with at least one year of experience in workover and well service as a floorman. Additionally, applicants must hold a Drilling Floorman/Well service Floorman certificate and be recommended by their company.

3.2.4 Well service Driller

The job description for a certified Well Service Driller includes a variety of critical

responsibilities aimed at maintaining safety and efficiency at workover and well maintenance sites. Key duties involve implementing oil and gas regulations, ensuring compliance with occupational safety, health, and environmental protection standards, and executing well-killing procedures. Additionally, the Driller is tasked with dismantling and installing barrier system equipment, managing the tripping-in and out of circuits, preventing blowout, and controlling well pressure.

Moreover, the Driller must effectively handle workover and well service challenges, perform fishing jobs, and oversee well-completion activities. To qualify for certification, applicants must provide a health certificate that verifies their physical ability, vision, hearing, and mobility are in good condition. Candidates should be a minimum of high school graduates, with two years of work experience as a tower operator or assistant driller, holding a Derrickman certificate for at least two years, and receiving a recommendation from their company. Alternatively, candidates may qualify with one year of experience as a well service supervisor, well service engineer, completion engineer, rig operation engineer, or rig supervisor. Additionally, those moving up from a driller position must possess an active Driller certificate.

3.2.5 Well service Tool pusher

The Tool pusher's job description includes implementing oil and gas regulations, as well as occupational safety, health, and environmental protection measures at workover and well service sites. Key responsibilities involve performing well-killing procedures, dismantling and installing barrier system equipment, and executing tripping-in and out circuit operations. Furthermore, the Tool pusher is tasked with preventing blowouts and maintaining well pressure control, all while effectively handling various workover and well service challenges. This position also requires the implementation of fishing jobs and the supervision of all workovers and well service activities, emphasizing the importance of leadership and technical expertise.

To qualify for certification as a Well Service Tool pusher, a health certificate is required to confirm that candidates possess the necessary physical abilities, including vision, hearing, and mobility. The educational and experience criteria are designed to ensure that only qualified individuals assume this critical role. Candidates may qualify by holding a minimum high school diploma with at least four years of work experience as a driller, possessing a driller certificate for four years, and receiving a company recommendation. Alternatively, individuals with a bachelor's degree in engineering can qualify with a minimum of two years of experience in junior well services supervision, well service engineering, completion engineering, rig engineering, or rig supervision, along with holding a driller certificate for at least one year. Lastly, candidates with a bachelor's degree in engineering who have three years of experience as a well service supervisor may also qualify without the need for a driller certificate, provided they receive a company recommendation. Importantly, those transitioning from the Drilling toolpusher position must maintain an active certificate. By adhering to these stringent requirements, the certification process ensures that Well Service Toolpushers are highly skilled and competent, thereby enhancing the safety and efficiency of well service operations.

3.3 Post-training Evaluation

The post-training evaluation plays a crucial role in assessing the effectiveness of training programs and identifying areas for improvement. For the evaluation, each training participant completed a Likert scale questionnaire to measure their level of agreement with various aspects of the training experience. The questionnaire included 11 essential elements, such as the schedule and duration, learning materials, alignment of pre-tests and post-tests, and the quality of IT-related facilities.

The evaluation results demonstrated varying degrees of satisfaction across different training programs, as shown in Figure 6. The Well service Floorman Training scored between 86.67 and 100, indicating a generally high level of satisfaction, albeit with some areas that could be improved. In contrast, the Well

Service Operations and Internship Training consistently received a perfect score of 100, suggesting that this program met or exceeded participant expectations in all aspects. The Oil and Gas Operations and Internship Training scored 94.44, which, while high, indicated that there is still room for minor enhancements. These results suggest that while all programs were effective, the Well Service Operations and Internship Training stood out as the most well-received.

Comparing these findings with similar studies in the field of vocational training, such as the study by Holderby and Van Domelen [13], which evaluated technical training programs in the energy sector, the consistently high scores in this evaluation align with the general trend that hands-on, practical training tends to yield higher participant satisfaction. Smith et al. noted that training programs with a strong emphasis on practical, real-world applications, coupled with comprehensive learning facilities and resources, achieved significantly better outcomes in terms of participant satisfaction and skill acquisition. This comparison reinforces the idea that the more a training program can mimic real-life work environments and offer adequate support facilities, the higher the likelihood of achieving optimal training outcomes.

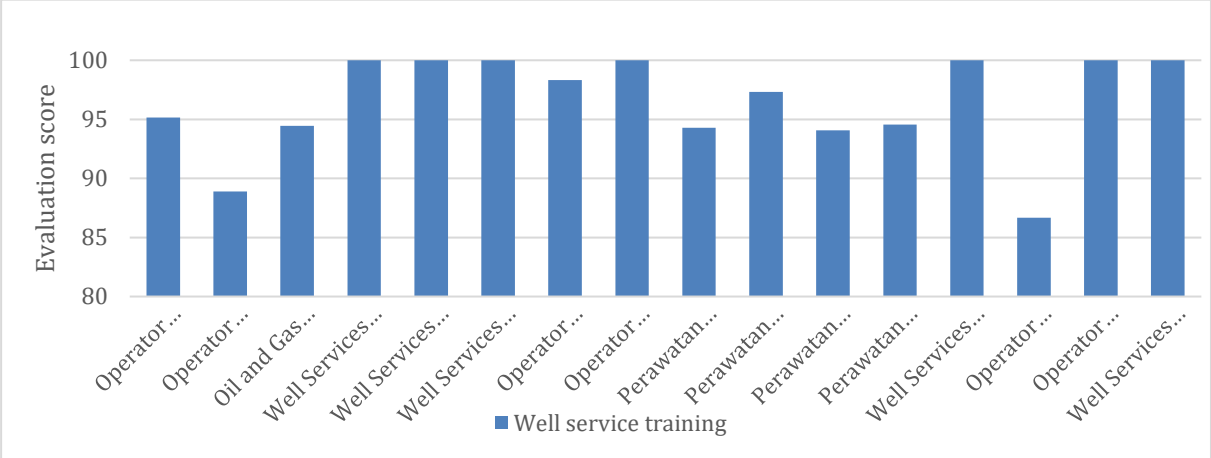

Figure 6. Average score from well service training participants from the 2023-2024 period

Participants' suggestions for improvement also provided valuable insights into areas that could enhance the training experience, as shown in Figure 7. For instance, participants recommended better time management for field practice and suggested limiting discipline training to morning sessions to avoid fatigue. Additionally, there were calls to increase the availability of Personal PPE to prevent reuse, extend the duration of the well service program to allow for more effective field practice, and ensure thorough preparation with complete equipment to aid in understanding the materials and techniques. These suggestions are consistent with feedback from other vocational training programs, where participants often emphasize the importance of adequate resources, time, and support for maximizing learning outcomes.

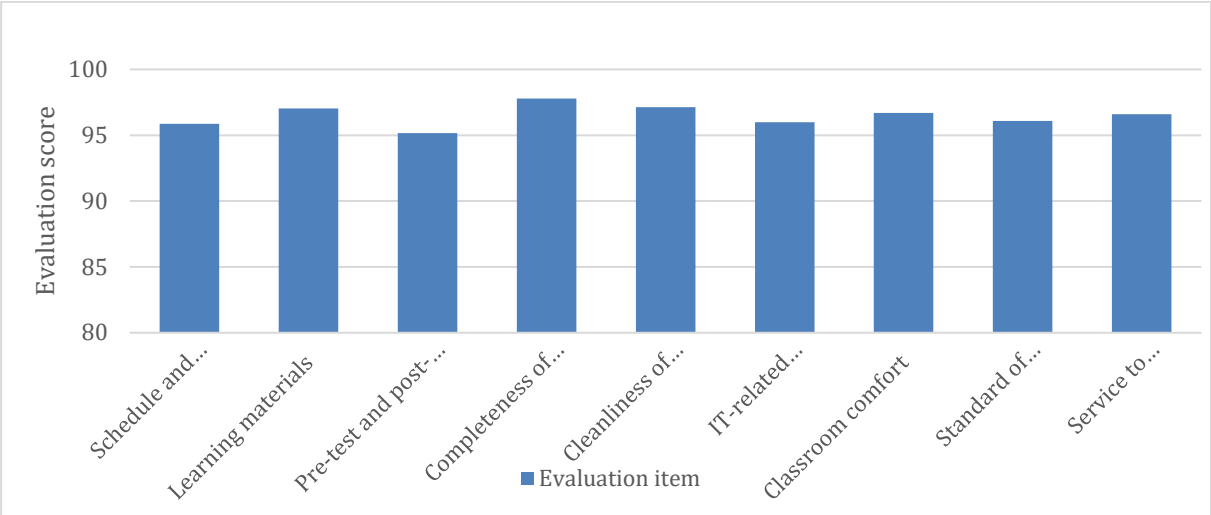

Figure 7. Average evaluation score per category

4. Conclusion

This study aimed to explore the potential of Rig #99 as a well service training school capable of producing competent human resources for the oil and gas sector in Indonesia. This was done by first identifying the training needs for oil and gas well service competencies, as well as determining the required competencies based on the Indonesian National Work Competency Standards. Additionally, the study assessed the readiness and suitability of Rig #99 as a well service training facility at PPSDM Migas.

The findings revealed that the training programs using Rig #99 were effective in developing practical competencies and enhancing participants' readiness for real-world applications. Evaluation scores showed that the programs generally met the needs of participants, with the Well Service Operations and Internship Training scoring the highest satisfaction levels, consistently reaching 100 across all criteria. The study also identified other programs, such as the Well Service Floor Operator Training and the Oil and Gas Operations and Internship Training, which demonstrated high scores ranging from 86.67 to 100, indicating overall satisfaction with the training quality.

These results suggest that Rig #99 is well-suited as a training facility for developing competencies in the oil and gas sector. However, areas for improvement were identified, including better time management, increased availability of Personal Protective Equipment, and enhanced preparation and equipment. Addressing these suggestions will help further refine the training experience and ensure that Rig #99 continues to produce highly competent individuals who are well-prepared to meet the demands of the oil and gas industry in Indonesia.

5. References

[1] T. R. Wanasinghe *et al.*, "Digital Twin for the Oil and Gas Industry: Overview, Research Trends, Opportunities, and Challenges," *IEEE Access,* vol. 8, pp. 104175-104197, 2020, doi: 10.1109/access.2020.2998723.

[2] M. Mulder, "Competence-based Education and Training," *The Journal of Agricultural Education and Extension,* vol. 18, no. 3, pp. 305-314, 2012, doi: 10.1080/1389224x.2012.670048.

[3] E. Salas and K. C. Stagl, "Design Training Systematically and Follow the Science of Training," in *Handbook of Principles of Organizational Behavior*, 2012, pp. 57-84.

[4] T. M. Komulainen, A. R. Sannerud, and M. Cheng, "Learning transfer through industrial simulator training: Petroleum industry case," *Cogent*

Education, vol. 5, no. 1, 2018, doi: 10.1080/2331186x.2018.1554790.

[5] C. V. Amaechi *et al.*, "Guidelines on Asset Management of Offshore Facilities for Monitoring, Sustainable Maintenance, and Safety Practices," *Sensors (Basel),* vol. 22, no. 19, Sep 25 2022, doi: 10.3390/s22197270.

[6] P. Ghosh, J. Prasad Joshi, R. Satyawadi, U. Mukherjee, and R. Ranjan, "Evaluating effectiveness of a training programme with trainee reaction," *Industrial and Commercial Training,* vol. 43, no. 4, pp. 247-255, 2011, doi: 10.1108/00197851111137861.

[7] A. Tsiboukli and K. Wolff, "Using focus group interviews to understand staff perceptions from training in the therapeutic community model," *J Drug Educ,* vol. 33, no. 2, pp. 143-57, 2003, doi: 10.2190/FUK5-BQVL-R53W-4RG7.

[8] S. O. O. Johnsen, E. Okstad, A. L. Aas, and T. Skramstad, "Proactive Indicators To Control Risks in Operations of Oil and Gas Fields," *SPE Economics & Management,* vol. 4, no. 02, pp. 90-105, 2012, doi: 10.2118/126560-pa.

[9] Kementerian Ketenagakerjaan dan Transmigrasi (2007). Keputusan Menaker Nomor KEP.243/MEN/V/2007 tentang Penetapan Standar Kompetensi Kerja Nasional Indonesia Sektor Industri Minyak Dan Gas Bumi Serta Panas Bumi Sub Sektor Industri Minyak Dan Gas Bumi Hulu Bidang Produksi Sub Bidang Perawatan Sumur.

[10] Kementerian Ketenagakerjaan (2022). Keputusan Menaker Nomor 52 Tahun 2022 tentang Penetapan Standar Kompetensi Kerja Nasional Indonesia Ketegori Pertambangan dan Penggalian Golongan Pokok Pertambangan Minyak Bumi dan Gas Alam dan Panas Bumi Bidang Kerja Ulang dan Perawatan Sumur (Workover and Well Servicing). .

[11] ILO, "Regional Model Competency Standards: Core competencies. ," in "Regional Skills Programme, Regional Office for Asia and the Pacific," International Labour Organization, 2015. [Online]. Available: http://www.ilo.org/wcmsp5/groups/public/---asia/---ro-bangkok/documents/publication/wcms_420961.pdf

[12] O. Elijah *et al.*, "A Survey on Industry 4.0 for the Oil and Gas Industry: Upstream Sector," *IEEE Access,* vol. 9, pp. 144438-144468, 2021, doi: 10.1109/access.2021.3121302.

[13] E. Holderby and M. Van Domelen, "Advancing Multidisciplinary Training and Development for Young Professionals in the Oil and Gas Industry," in *SPE Annual Technical Conference and Exhibition*, 2015, vol. Day 2 Tue, September 29, 2015, D021S010R009, doi: 10.2118/176745-ms. [Online]. Available: https://doi.org/10.2118/176745-MS