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Analysis Implementation Safety Management System Oil and Gas and Safety Culture That Influence on Safety Performance and Worker Motivation To Work Safely

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Abstract: The offshore oil and gas industry is a high-risk work sector that requires a strict occupational safety system and a strong safety culture. This study aims to analyse the effect of the implementation of the Oil and Gas Safety Management System (SMKM) and safety culture on occupational safety and health (OHS) performance, as well as worker motivation to work safely in the Wellhead Central Processing Platform (WHCPP) construction project on the Hidayah Project in 2025. The study employs an associative quantitative approach, utilizing a survey method by distributing questionnaires to project workers. The independent variables consist of SMKM and Safety Culture, which have five main dimensions, while the dependent variables include OHS Performance and Worker Motivation. Data analysis was conducted using multiple linear regression to examine the partial and simultaneous effects of the variables. The study's results are expected to provide an empirical picture of the effectiveness of SMKM implementation and the contribution of each dimension of safety culture to enhancing OHS performance and worker motivation. These findings are expected to be the basis for recommendations for project management and stakeholders in strengthening safety programs and building a safe work culture in the oil and gas industry.

Keywords: Oil and Gas Safety Management System, Safety Culture, Safety Performance, Worker Motivation to Work Safely.

INTRODUCTION

At the end of the 19th century the invention of the internal combustion engine that requires energy derived from crude oil, this can be said to trigger the second industrial revolution with the formation of the current industrial world and its continued development, petroleum products from crude oil that were originally used for the energy needed by internal combustion engines, have mushroomed to become the basis and source of some of our chemical and pharmaceutical products, the development of the crude oil refining industry and the internal combustion engine have influenced each other during the 20th century. other factors also contributed to accelerating the development of both, the main factors of which are the increasing awareness of environmental pollution, and the increasing demand for faster travel which led to

the development of the aircraft industry with its need for higher quality petroleum fuels (Jones, 2006)

Indonesia has set an ambitious target of achieving oil production of 1 million barrels per day and natural gas production of up to 12 billion cubic feet (BCF) by 2030. This target is not just a dream, but a realistic goal that is expected to maintain national energy security and reduce dependence on imports. The oil and gas sector are expected to be able to encourage an increase in lifting or Indonesian oil and gas production, which is currently still around 600,000 barrels per day. Currently, Indonesian oil consumption reaches around 1.6 million barrels per day (BOPD). Meanwhile, domestic oil production is still far below that figure. This means that Indonesia still must import around 1 million BOPD to meet domestic needs. Indonesia needs a breakthrough to increase oil lifting, which has long been below target. This year, for example, the lifting target set in the 2024 State Budget was 635,000 BOPD. The realization was only 576,000 BOPD. A similar thing happened to gas production, which only reached 5,301 million standard cubic feet per day (MMSCFD) from the target of 5,785 MMSCFD (Government of the Republic of Indonesia 2024).

The development of the Hidayah field cannot be realized immediately, as several phases are required during the construction phase, one of which is the Wellhead Central Processing Platform (WHCPP) construction phase.

The Wellhead Central Processing Platform (WHCPP) is a key infrastructure in offshore oil and gas project development. The WHCPP serves as the initial collection point for oil and gas production from several production wells (wellheads). This platform not only accommodates well-controlled facilities but also integrates various hydrocarbon preprocessing systems before they are distributed to other receiving facilities, such as Floating Production Storage and Offloading (FPSO) or onshore receiving facilities.

The Urgency of Research

The upstream oil and gas industry in Indonesia notes that work incidents, particularly Lost Time Injuries (LTIs) and fatal accidents, predominantly involve the contractor workforce, not operator employees. This phenomenon is supported by various data from the Special Task Force for Upstream Oil and Gas Business Activities (SKK Migas) and the Ministry of Energy and Mineral Resources (ESDM).

A. Data and Regulations Related to Oil and Gas Safety

1. The SKK Migas Annual Report states that HSE implementation in the upstream sector continues to be a priority; however, several incidents still frequently occur in contractor activities, particularly in lifting operations, hot work, and work at height.
2. ESDM Ministerial Decree No. 176.K/MG.01/MEM.M/2024 (July 25, 2024) establishes Guidelines for Assessing the Implementation of the Oil and Gas Safety Management System (SMKM). This regulation was created to ensure that the oil and gas safety aspects are managed following the law and to improve the safety of workers, installations, and the industrial environment.

Challenges in SMKM Implementation by Contractors

According to ESDM Ministerial Decree No. According to Regulation No. 176/2024, the obstacles faced in implementing the SMKM include:

a. Operational complexity,
b. Cultural resistance,
c. Limited resources,
d. And differences in standards between operators and contractors.

The Contractor Phenomenon and Incident Proneness

Although regulations such as the SMKM have been strengthened, contractor incidents remain high. This indicates that administrative compliance (SOPs, training) is not enough—true implementation of a safety culture is required.

Problem Formulation

The Hidayah Project is a national strategic project targeted by the government to begin operations in 2027 and contribute to increasing national oil production. To ensure the project's timely completion, it requires the involvement of a large workforce, the use of heavy equipment, and the implementation of high-risk work in accordance with field requirements. Based on the background description, the focus of this research, with the following problem formulations, is as follows:

1. Does the implementation of the Oil and Gas Safety Management System (SMKM) contribute to the achievement of Occupational Safety and Health (OHS) performance and motivate workers to work safely during the construction of the Hidayah Project Wellhead Central Processing Platform (WHCPP) in 2025?
2. Does safety culture significantly contribute to the achievement of Occupational Safety and Health (OHS) performance and motivate workers to work safely during the construction of the Hidayah Project Wellhead Central Processing Platform (WHCPP) in 2025?
3. This research will also explore the relationship between the six main dimensions of safety culture: management commitment, HSE/HSE policies, vision and mission, regulations and procedures, communication, and workforce training and competency.

METHOD

A research method is the steps or procedures taken to collect data to solve a problem or test a hypothesis. In this study, the researcher used quantitative research. Quantitative research is a research method based on the philosophy of positivism, used to study specific populations or samples. Data collection utilizes research instruments and statistical analysis, with the aim of testing the established hypothesis (Sugiyono, 2019). According to Arikunto, as quoted by Ayuni and Sati 2022), quantitative research, as its name suggests, requires the use of numbers, from data collection, interpretation, and presentation of the results.

Research Design

The research method used in this thesis (Associative Quantitative) focuses on examining the preparation process for implementing the Oil and Gas Safety Management System (SMKM) in the construction of the Hidayah Project Wellhead Central Processing Platform (WHCPP) in 2025, concerning the provisions stipulated in Minister of Energy and Mineral Resources Decree No. 176 of 2024.

Characteristics of Associative Quantitative Research:

1. There are two or more variables that are interrelated.
2. The goal is to determine the relationship or influence between variables.
3. Data is collected using a standardized instrument (usually a questionnaire).
4. Analysis uses inferential statistics (e.g., correlation tests, regression).

Therefore, in this method, the researcher becomes the main instrument in the data collection process which is carried out through triangulation, namely combining various data sources to obtain a comprehensive picture, the analysis process is carried out inductively, namely by drawing conclusions based on patterns or meanings that emerge from the collected data, not just making generalizations (Sugiyono, 2016). This is in line with the view of

(Muhadjir 2000), who stated that the core of the post-positivism paradigm is the search for deep meaning from the data obtained.

Location of Research

This research was conducted on the Hidayah offshore development project managed by PT. XYZ and built by the construction company PT. ABC Fabricators during the period of January 2025 to December 2026. And the construction of this project is in Serang Regency, Banten Province.

Research Target/Subject

The research sample consisted of 87 workers, who were obtained using the Slovin formula:

$$n = \frac{N}{1 + Ne^2} \quad n = \frac{646}{1 + 646(0,10)^2} = \frac{646}{1 + 646(0,01)} = \frac{646}{1 + 6,46} = \frac{646}{7,46} \approx 86,58$$

The primary data used in this study includes:

Data from questionnaires distributed to respondents, consisting of workers and safety personnel directly involved in the construction phase of the Wellhead Central Processing Platform (WHCPP) of the Hidayah Project in 2025. This questionnaire was designed to measure respondents' perceptions of the research variables:

1. Implementation of the Oil and Gas Safety Management System (SMKM),
2. Safety Culture,
3. Occupational Safety and Health (OHS) Performance, and
4. Worker Motivation to Work Safely.

Research Procedure

In this study, there are two independent variables (X1 and X2) and two dependent variables (Y1 & Y2), which are explained as follows:

1. Independent Variable (X)

a. X1 – Implementation of the Oil and Gas Safety Management System (SMKM)

This variable describes the extent to which the Indonesian safety management system in oil and gas implementation complies with Minister of Energy and Mineral Resources Decree No. 176 of 2024.

b. X2 – Safety Culture

This variable measures organizational and individual attitudes, perceptions, and values toward occupational safety.

2. Dependent Variable (Y)

Y1 – Occupational Safety and Health (OHS) Performance

Y2 – Worker Motivation to Work Safely

Instruments and Data Collection Techniques

The questionnaire instrument was constructed using a 1–5 Likert scale and contained statements representing the dimensions of each variable. This primary data was then statistically analyzed to determine partial and simultaneous effects between variables using multiple linear regression methods.

Data analysis technique

Validity and Reliability Testing

a. Validity testing: Using Pearson Product-Moment correlation
b. Reliability testing: Using Cronbach's Alpha (≥ 0.6 is considered reliable)

Classical Assumption Test

Before conducting the regression analysis, classical assumption testing was conducted, including:

a. Normality test
b. Multicollinearity test
c. Heteroscedasticity test

RESULTS AND DISCUSSION

This study involved 87 respondents. After conducting a pilot survey to determine validity and reliability, the questionnaire was distributed to the main sample. The following are the results of the testing with the actual sample.

1. Validity Test Results

a. Validity Results of the Oil and Gas Safety Management System (SMKM)

b. Validity Results of the Safety Culture

Table 1. Safety Management System (SMKM) & Safety Culture Validity Test Results

Statement Items	r count	r table	Remark	Statement Items	r count	r table	Remark
Item 1	0,458	0,279	Valid	**Item 1**	0,409	0,279	Valid
Item 2	0,364	0,279	Valid	**Item 2**	0,442	0,279	Valid
Item 3	0,575	0,279	Valid	**Item 3**	0,609	0,279	Valid
Item 4	0,594	0,279	Valid	**Item 4**	0,376	0,279	Valid
Item 5	0,713	0,279	Valid	**Item 5**	0,611	0,279	Valid

c. Validity Results of the Safety Performance

d. Validity Results of the worker's motivation to work safely

Table 2. Safety Performance & Workers' Motivation to Work Safely Validity Test Results

Statement Items	r count	r table	Remark	Statement Items	r count	r table	Remark
Item 1	0,683	0,279	Valid	**Item 1**	0,710	0,279	Valid
Item 2	0,550	0,279	Valid	**Item 2**	0,521	0,279	Valid
Item 3	0,595	0,279	Valid	**Item 3**	0,663	0,279	Valid
Item 4	0,572	0,279	Valid	**Item 4**	0,521	0,279	Valid
Item 5	0,550	0,279	Valid	**Item 5**	0,726	0,279	Valid

Referring to the table, all items have a calculated r value greater than the table r (0.279) with a significance level below 0.05. Thus, all statements related to the oil and gas safety management system (SMKM), Safety Culture, Safety Performance, and worker motivation for work safely variables are declared valid.

Reliability Test

Table 3. Reliability Test Results

No	Variable	Cronbach's Alpha	Remark
1	Safety Management System in Oil and Gas	0,801	Reliable
2	Safety Culture	0,765	Reliable
3	Safety Performance	0,832	Reliable
4	Worker's Motivation to Work Safely	0,752	Reliable

Based on the reliability test results presented in the table, the Cronbach's Alpha coefficient value was obtained at 0.801 for the Oil and Gas Safety Management System (SMKM) variable, 0.765 for the safety culture variable, 0.832 for the OHS performance variable and 0.752 for the Worker Motivation to Work Safely variable. All of these values are above the minimum threshold set, which is 0.6, so each variable can be declared to have an adequate level of reliability. Thus, the instrument used in this study is considered consistent and suitable for use in further data collection.

Normality Test

Table 4. Normality Test Results

Variabel	Sig.	Level of Sig.	Keterangan
Residual	0,200	0,05	Normal

The results of the normality test in this study showed a significance value of 0.200. Because this value exceeds the significance limit of 0.05, it can be concluded that the data used in this study is normally distributed.

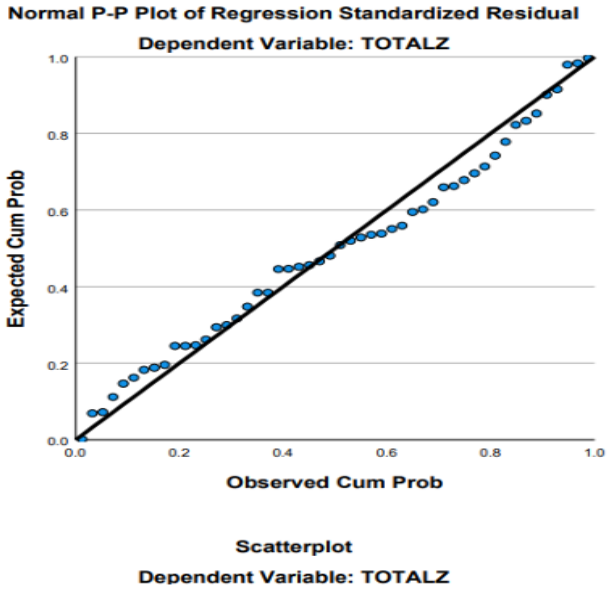

Figure 1. Grafic Normal P-P Plot

As illustrated in the figure, the data points the data points are scattered around the diagonal line and follow the direction of the line. This indicates that the regression model meets the assumption of normality, making it suitable for analyzing the relationship between the independent and dependent variables.

Multicollinearity Test

The multicollinearity test was conducted to identify pure correlations between variables, without the influence of other independent variables that could affect the analysis results. The presence or absence of multicollinearity in this research's regression model can be determined from the Variance Inflation Factor (VIF) values presented in the table.

Table. 5 Results of the Variable Non-Multicollinearity Test

Variable	VIF	Critical Value	Remark
Safety Management System in Oil and Gas	1,117	10	There is no multicollinearity
Safety Culture	1,117	10	There is no multicollinearity
Safety Performance	1,117	10	There is no multicollinearity
Motivation workers to work safely	1,117	10	There is no multicollinearity

Referring to the Table above, it can be concluded that the Safety management system, Safety Culture, Safety Performance, and motivation workers to work safely variables have Variance Inflation Factor (VIF) values below 10, each at 1.117. This value indicates that there are no symptoms of multicollinearity among the independent variables in the multiple linear regression model. Thus, the regression model is declared free of multicollinearity, and the data are suitable for use in this research analysis.

Heteroscedasticity Test

The heteroscedasticity test is carried out to determine whether there is inconsistency in the variance of the residuals between one observation and another.

Table. 6 Heteroscedasticity Test Results

Variable	Sig	Critical value	Remark
Safety Management System in Oil and Gas	0,527	0,05	No heteroscedasticity
Safety Performance	0,106	0,05	No heteroscedasticity
Safety Culture	0,506	0,05	No heteroscedasticity
Motivation Workers to Work Safely	0,115	0,05	No heteroscedasticity

Referring to the Table. 6, all significance values in the heteroscedasticity test are above 0.05. Thus, it can be concluded that the estimation model in this study does not contain symptoms of heteroscedasticity.

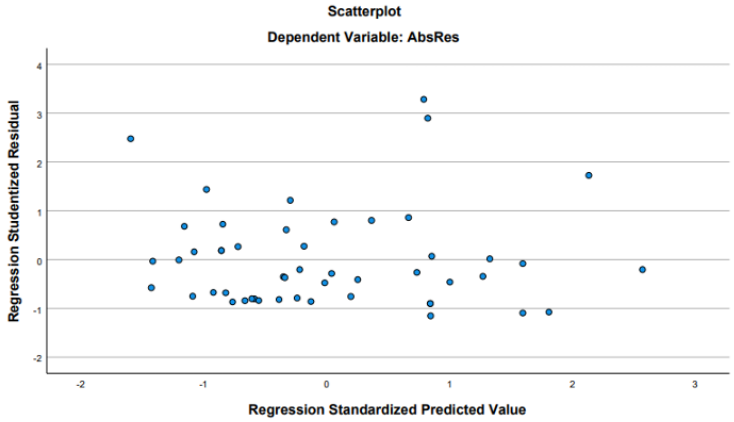

Figure 2. Heteroscedasticity Test Results

Based on Figure 2, it can be concluded that the regression model does not exhibit any symptoms of heteroscedasticity. This is indicated by the random distribution of points above and below the zero line on the Y-axis.

Table. 7 Simultaneous Test Results (F Test)

ANOVA[a]						
Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	1.229.533	2	614.766	51.924	.000[b]
	Residual	556.467	47	11.840		
	Total	1.786.000	49			

a. Dependent Variable: Kinerja K3
b. Dependent Variable: Motivasi
c. Predictors: (Constant), SMKM, Budaya Keselamatan

Based on the data above, the calculated F value > F table were 51.924 > 3.19 with a significance level of 0.000 < 0.05 so that it is stated that the independent variables, namely occupational safety and health (OSH) have a simultaneous effect on work productivity as a dependent variable.

CONCLUSION

Based on the results of the research conducted on the WHCPP Hidayah Project construction project in 2025 at PT. ABC, several conclusions can be drawn as follows:

1) The implementation of the Oil and Gas Safety Management System and Safety Culture has
   a. Significant Impact on Occupational Health and Safety Performance and Worker Motivation.

   This research shows that the implementation of the Oil and Gas Safety Management System and the safety culture have a positive and significant impact on achieving occupational safety and health (OSH) performance, as well as on workers' motivation to work safely. This is demonstrated through the results of multiple linear regression tests, which indicate that both independent variables have a simultaneous contribution to the dependent variable.

2) The Influence of Safety Culture on HSE Performance

   If the safety culture and oil and gas safety management system are applied simultaneously, both have a significant influence on workers' motivation to work safely. This is evidenced by the F test (ANOVA).

3) Important Indicators of Safety Culture

   The most critical indicators in the safety culture are:
   (1) The promotion of a safety culture by the company
   (2) Workers' understanding of occupational health and safety regulations, and
   (3) Strict supervision of the implementation of work procedures.

   These three indicators fall into the extremely critical category, indicating the importance of strengthening cultural aspects in the implementation of workplace safety.

4) (Challenges in the Implementation of Oil and Gas Safety Management Systems in the Field

   Even though the oil and gas safety management system has been well implemented administratively, challenges are still found in the field, such as low worker involvement in hazard reporting, fluctuations in compliance with procedures, and the occurrence of minor

incidents. This indicates the need for strengthening the internalization of safety culture, not just focusing on documentation or formal compliance.

5) The Correlation of Safety Culture with Workers' Motivation to Work Safely

A strong safety culture positively impacts workers' motivation to work safely. The higher the awareness and involvement of workers in OHS activities, the greater their tendency to behave safely, comply with procedures, and show concern for their own safety and that of their colleagues.

6) The Need for Continuous Evaluation and Improvement

The implementation of the oil and gas safety management system and safety culture needs to be continuously evaluated and improved. The application of safety rewards and punishments, routine training, safety culture campaigns, and strengthening safety leadership at the managerial level are very important to create a safe, healthy, and productive work climate.

Closing Paragraph

Overall, this research shows that the implementation of Oil and Gas Safety Management Systems and safety culture plays an important role in driving optimal OSH performance and enhancing workers' motivation to work safely. Through a measured and sustainable approach, companies can create a safe, productive, and highly competitive work environment. These findings are expected to serve as a basis for consideration in policymaking and safety management practices in the oil and gas industry, especially during the construction phase of national strategic projects such as WHCPP Hidayah. With strong managerial commitment and worker participation, the zero accident target is not an impossible goal to achieve.

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