

## ORIGINAL ARTICLE

# Safety Culture Maturity Assessment: Insights and Improvement Opportunities for the Oil and Gas Sector

Hafiz Rahim<sup>1,2</sup>, Nazri Che Dom<sup>1</sup>, Rahmat Dapari<sup>3</sup>

<sup>1</sup> Faculty of Health Sciences, Universiti Teknologi MARA (UiTM), 42300 Puncak Alam, Selangor, Malaysia.

<sup>2</sup> Department of Health, Safety and Environment, Flowco Malaysia Sdn Bhd, 52200 Kuala Lumpur, Malaysia.

<sup>3</sup> Department of Community Health, Faculty of Medicine and Health Sciences, Universiti Putra Malaysia, 43400 Serdang, Selangor, Malaysia

## ABSTRACT

**Introduction:** Assessing safety culture maturity is crucial for organizations to evaluate safety performance and identify areas for improvement. Without such assessments, companies may focus on nonspecific problems, hindering progress despite safety initiatives. This study assesses safety culture maturity within the Malaysian oil and gas industry and identifies specific areas for improvement. **Materials and methods:** A survey was conducted using a questionnaire based on the five HSE safety ladder dimensions, evaluating 18 key dimensions of safety culture including communication, leadership commitment, rewards and recognition, incident perception, HSE and profitability, contractor management, training and competency, HSE department efficacy, intervention practices, consequence management, process safety, procedural adherence, incident investigation, hazard reporting, lessons learned, safety meetings, auditing processes, and HSE benchmarking. **Results:** Organizations have made significant strides in achieving a generative level of safety culture maturity. However, dimensions such as incident perception, training and competency, and leadership engagement require improvement. Addressing these gaps through robust incident reporting and response mechanisms, continuous training programs, proactive leadership involvement, and enhanced communication can significantly enhance safety culture. **Conclusion:** This study provides insights into factors influencing safety culture maturity and offers a framework for targeted interventions to enhance safety practices. The findings underscore the importance of continuous assessment and targeted improvements in maintaining high safety performance. These insights are crucial for professionals in high-risk sectors aiming to develop a dynamic and inclusive safety culture. *Malaysian Journal of Medicine and Health Sciences* (2025) 21(5): 13-22. doi:10.47836/mjmhs.21.5.3

**Keywords:** Safety culture, Culture maturity level, Oil and gas, Organizational safety, Improvement

## Corresponding Author:

Nazri Che Dom, PhD

Email: nazricd@uitm.edu.com

Tel : +60332584447

## INTRODUCTION

Integrating safety culture into a company's operations is essential to ensuring a safe and sustainable work environment. However, implementing safety culture is not always easy, as it requires a holistic approach that covers a wide range of knowledge areas. One of the biggest challenges in implementing safety culture is identifying personal attitudes toward the perceptions, beliefs and values that form the basis of safety culture. Safety culture refers to the shared values, attitudes, and beliefs about safety that drive behavior in an organization (1). Other studies emphasize specific outcomes of a strong safety culture, including the assessment of an organization's overall health and safety performance. This includes evaluating how well the organization manages health and safety risks and the effectiveness of

measures implemented to reduce hazards (2, 3). It is a critical element of safety culture because it influences how employees perceive and respond to risks. However, it can be difficult to identify and measure personal attitudes toward safety culture because they are often influenced by individual factors such as upbringing, education, and personal experiences. Safety culture also requires a comprehensive, integrated vision of a systemic approach. This includes the interactions and connections among the various elements-context, organization, people, and technology-rather than looking at individual elements in isolation (4). An effective safety culture requires an understanding of all these systemic approaches and their interrelationships to ensure that the organization's safety goals are aligned with overall business objectives (5). In addition, the maturity of the safety culture may be limited by the organization's ability to integrate these knowledge domains. For example, an organization may have sound risk management practices, but if its operational practices are not aligned with its safety goals, it may not be able to achieve a high level of safety culture maturity.

Safety culture maturity refers to the level of development and effectiveness of an organization's safety culture and is a critical factor in achieving high levels of safety and minimizing risk. Organizations in high-risk industries such as oil and gas have recognized the importance of safety culture in preventing accidents and incidents. The pragmatic approach was developed to focus on improving safety culture in organizations by identifying the safety culture maturity level. These approaches are reflected in the safety culture maturity level proposed in the Shell Hearts and Minds program (6). In recent years, there has been an increased focus on safety culture maturity as companies strive to improve their safety performance and minimize risks to employees, the environment, and the public. It should be noted, however, that safety culture maturity levels can vary by industry and company. The use of maturity models to assess safety culture has gained prominence (7). Previous studies have found that each industry chooses different methods to develop or adapt safety culture maturity measurement (8). The criteria for measuring safety culture maturity were chosen based on their relevance to the organization's specific objectives and operational goals, as well as the unique needs and priorities of its workforce. Another approach is the Safety Culture Assessment Tool (S-CAT), a widely used questionnaire-based instrument that assesses the maturity of an organization's safety culture in six key areas: Leadership, Workforce Involvement, Hazard Identification and Assessment, Communication, Learning and Development, and Safety Systems and Procedures. S-CAT provides a comprehensive report that identifies areas in need of improvement and provides guidance on how to address these issues (9). In addition to these tools, there are several other methods and techniques that can be used to assess safety culture maturity, including surveys, interviews, focus groups, and observations. These methods can be tailored to the specific needs and characteristics of the organization and can provide valuable insights into the maturity of the organization's safety culture and areas for improvement. The available information on assessing safety culture maturity provides organizations with a set of tools and techniques to assess the maturity of their safety culture and identify opportunities for improvement to minimize risks to employees, the environment, and the public.

In the oil and gas industry, companies face increasing complexity, uncertainty and ambiguity. To succeed in this challenging environment, companies must innovate, develop efficient operations, and provide reliable information to respond to and predict technological innovations and market demands. Information is critical to supporting business processes and decision making, and is a source of organizational power for rapid problem solving and learning from mistakes. Safety data play a critical role in the oil and gas industry in supporting business processes and decision making. These systems provide access to real-time data and analytical tools that support efficient and effective

decision making. In addition, information systems can help companies anticipate and respond to changing market conditions and technological developments. Standardization of industry processes is also critical to improving organizational performance in the oil and gas industry. Standardization ensures process consistency and enables companies to achieve operational excellence. By standardizing processes, companies can reduce variability, improve quality and increase efficiency. This, in turn, can lead to higher productivity and profitability. Previous study shows the importance of standardization in improving business performance in the oil and gas industry (10). Their study found that standardization of industrial processes is positively associated with business performance. Standardization was found to improve process efficiency, reduce costs, and increase safety.

The oil and gas industry, recognized for its high-risk environment, has a history of significant accidents and incidents with severe consequences for workers, the environment, and the public. Notable disasters such as the Piper Alpha platform explosion in 1988 and the Deepwater Horizon spill in 2010 highlight the critical need for robust safety cultures. In Malaysia, the explosion at a petrochemical plant and petrol station, exemplifies ongoing safety challenges within the industry. According to the Department of Occupational Safety and Health (DOSH), the oil and gas sector in Malaysia consistently records high numbers of workplace accidents and fatalities (11).

Evaluating safety culture maturity is a critical process for companies in the Malaysian oil and gas industry. It helps them systematically assess their current safety performance, pinpoint specific areas that require enhancement, and implement targeted improvements to ensure a safer working environment. Malaysia is generally taking proactive steps to cultivate a strong safety culture and enhance safety culture maturity within its industries. Despite these efforts, many companies still lack a comprehensive understanding and awareness of how to assess safety culture maturity and its critical role in enhancing overall safety performance.

Companies may not have the knowledge to conduct such an assessment, leading them to focus on non-specific issues, which in turn leads to a lack of improvement in the various safety culture improvement initiatives and programs within the company. To address these issues, companies in Malaysia need to conduct a safety culture maturity assessment and prioritize the gaps to continuously improve the company's safety culture. In addition, regulators can strengthen safety enforcement and provide resources and guidance to companies to improve their safety culture. Therefore, this study aims to fill the gaps in understanding and implementing effective safety culture practices in the Malaysian oil and gas industry. By assessing the current state of safety

culture maturity, identifying areas for improvement, and providing targeted recommendations, this research will contribute to creating a safer work environment, reducing the risk of accidents, and enhancing overall safety performance in the industry.

## MATERIALS AND METHODS

### Study Design

*Case study selection:* In this study, the methodology used for selecting the case study involved the application of target population. These criteria were carefully chosen to ensure that the selected case studies were relevant to the research topic, which was the evaluation of safety culture maturity within the oil and gas industry. The first criterion was the organization operating in downstream oil and gas industry in Malaysia. This criterion was important as it ensured that the findings were specific to the industry and context of interest. In addition, this criteria can help to ensure that the selected cases were comparable in terms of their operations and risk factors. The second criterion was the organization providing services such as installation, commissioning and maintenance, within the industry oil and gas. This criterion helped to narrow down the scope of the study and ensured that the selected cases were comparable in terms of their organizational structure and operations. The third criterion was the organization that certified ISO 45001 Safety Management System. When an organization has a stable and predictable environment, it is easier to evaluate its safety culture maturity levels as it provides a clear baseline against which to measure progress. It also means that the organization's employees are more likely to understand and comply with the safety policies, procedures, and practices, which can lead to a safer working environment. This research team requested and received permission from Flowco Malaysia Sdn Bhd to conduct a case study on safety culture maturity within a high-risk industry. The study was carried out at Flowco's facility in Sri Damansara, a service provider for downstream retail pump stations in the oil and gas sector, during the period of 2022 – 2023. The location was specifically chosen based on its high incident rate reported in previous years, which provided a critical opportunity to assess and improve safety practices in a setting with significant safety challenges. Additionally, Sri Damansara's status as a key operational hub for Flowco Malaysia Sdn Bhd made it a representative site for examining safety culture maturity within the company's broader operations.

*Questionnaire:* A survey was conducted to assess the existing level of safety culture maturity using a questionnaire developed in Microsoft Excel, based on the model proposed by Hudson (12). Hudson's model was chosen due to its established relevance and applicability in assessing organizational culture, especially within safety contexts. Its phased approach aligns with the developmental stages of safety culture,

making it suitable for evaluating safety culture maturity in downstream oil and gas organizations.

*Questionnaire Development and Validation:* The questionnaire was designed by adopting safety culture dimensions from a previous study framework that explored the development of organizational safety culture (13). This framework provided a robust foundation, as each item was used as a statement to develop questions investigating how each of the five dimensions was treated in the organizations studied. The questionnaire comprised 18 questions, each targeting varied areas of concern within the safety culture dimensions, reflecting the maturity level of safety culture in the organization. To ensure reliability and validity, the questionnaire was pre-tested, and results were analyzed to confirm its effectiveness in measuring safety culture maturity.

*Survey Administration:* The survey was distributed directly to respondents, who were informed about the significance and scope of the survey. The questionnaire required respondents to select the item that best represented their company's position, with each item corresponding to one of the following stages: (a) Pathological, (b) Reactive, (c) Calculative, (d) Proactive, and (e) Generative.

*Respondents and Criteria:* Respondents included employees from various levels within the organization to ensure a comprehensive assessment of the safety culture. The inclusion criteria were based on the employees' involvement in safety-related activities, their tenure with the company, and their understanding of the company's safety practices. Exclusion criteria included employees with less than six months of experience or those not directly involved in safety-related roles. The questionnaire was designed to take approximately 15-20 minutes to complete, ensuring it was concise yet thorough in evaluating the organization's safety culture maturity.

By adopting Hudson's model and integrating dimensions from reputable sources, the questionnaire was structured to comprehensively evaluate safety culture maturity within the downstream oil and gas sector. This approach aimed to provide a reliable and holistic assessment, offering valuable insights for potential improvements in safety culture practices within these organizations. The 18 dimensions were chosen to comprehensively evaluate the multifaceted aspects of safety culture maturity within the organization, ensuring a holistic assessment that captures the complexity of safety practices and perceptions. These dimensions encompass critical areas such as communication, leadership commitment, rewards and recognition, incident perception, HSE and profitability, contractor management, training and competency, HSE department efficacy, intervention practices, consequence management, process safety, procedural adherence, incident investigation, hazard

reporting, lessons learned, safety meetings, auditing processes, and HSE benchmarking (Table I). By including these diverse dimensions, the assessment tool aims to provide a detailed and nuanced understanding of both strengths and areas for improvement, facilitating targeted interventions and fostering continuous improvement

in safety culture. The selection of these dimensions is grounded in established frameworks and industry best practices, ensuring that the evaluation is robust, relevant, and aligned with the overarching goal of achieving and maintaining a high level of safety culture maturity.

**Table I: Oil and gas safety culture dimensions**

Dimension	Description
HSE benchmarking	Use of reliable and relevant data and indicators to compare safety performance across different sites or business units within an organization, or externally, by comparing safety performance with other organizations in the same industry or sector.
Audit	Refers to the process of systematically reviewing and evaluating an organization's safety management systems to ensure they are operating effectively.
Safety meeting	Reflect feeling of collaboration and open communication among employees and management in discussing safety issues.
HSE lesson learnt	Process of reflecting on and analyzing the causes and consequences of an incident
Hazard reporting	Creating an environment where all employees feel comfortable reporting hazards, and procedures to ensure that reported hazards are promptly investigated and addressed.
Incident investigation	Refers to the process of systematically examining an incident to identify its root causes and the acceptance of the investigation report.
Procedure	Refers to availability, accessibility and efficient instructions that provide a systematic approach for performing tasks and activities that involve potential risks or hazards.
Process safety	Refers to the management of the risks associated with hazardous materials and processes used in an organization's operations.
Consequence management	Related to systematic and proactive approach taken by an organization to manage the consequences of incidents.
Intervention	Reflect positive environment where all employees are empowered to care, identify and report potential hazards or risks.
HSE department	Refer to department of an organization responsibility, authority and capability for managing the organization's health, safety, and environmental risks.
Training and competency	Refer to the process of ensuring that employees have the knowledge, skills, and abilities to perform their work safely and effectively
Contractor management	Involves the effective control and coordination of contractors to ensure their work is conducted in a safe and healthy means
HSE and profitability	Reflect management approach that integrates HSE excellence into the core of the organization's business strategy.
Incident perception	Reflects the organization's ability to accurately perceive and understand safety incidents as whole system
Rewards and recognition	Refer to the ways in which organizations acknowledge and celebrate employees who demonstrate safe work practices and behaviors.
Commitment and leadership	Reflect the extent to which organizational leaders demonstrate a commitment to safety and actively promote a positive safety culture.
Communication	Refer to engagement in exchange of information and ideas among employees and management regarding safety information

**Pre-assessment:** A pilot test was conducted using the proposed questionnaire framework involving five employees from varied positions and departments within oil and gas service companies. Although typically a pilot test involves about 10% of the sample size, the number five was chosen due to constraints such as time, availability of participants, and the specific focus of this preliminary assessment. Despite the smaller sample size, these participants were carefully selected to represent a diverse cross-section of the organization, which included varied positions and departments to capture a broad range of perspectives. The objective of this pilot test was to assess the questionnaire's effectiveness in preventing misinterpretation and ensuring clarity. Additionally, the assessment of reliability and validity was conducted by involving a diverse target population, which helped ensure the measurement consistency and

accuracy of the questionnaire. The smaller sample size allowed for in-depth feedback and quick iterations to refine the questionnaire. Based on the pilot test results, modifications were made, and the questionnaire was translated into the Malaysian national language to enhance its practicality and comprehension. While a larger pilot test might provide a more extensive validation, the focused nature of this pilot helped identify and address key issues promptly, thereby still contributing valuable insights to the development process. Future studies may consider expanding the pilot test to further validate the findings and improve the robustness of the questionnaire.

**Sample Size and Sampling Method:**

To ensure the robustness of the study design, we carefully calculated the sample size based on statistical methods.

The sample size was determined using the formula for estimating proportions in a population:

$$n = \frac{Z^2 \cdot p \cdot (1-p)}{e^2}$$

where:

- n is the required sample size,
- Z is the Z-value (1.96 for a 95% confidence level),
- p is the estimated proportion of the population with the attribute of interest (assumed to be 0.5 for maximum variability),
- e is the margin of error (set at 0.05).

Using this formula, we calculated a sample size of approximately 384 respondents to achieve a 95% confidence level with a 5% margin of error. Given the size and diversity of the workforce in the oil and gas service companies, this sample size ensures that the study results are statistically significant and representative of the population.

**Sampling Method:** We employed a stratified random sampling method to select participants. This approach was chosen to ensure that different subgroups within the population were adequately represented. The population was divided into strata based on departments and job roles (e.g., management, technical staff, administrative staff, field workers). From each stratum, a random sample was selected proportionally to the size of the stratum within the total population.

**Rationale for Sampling Method:** Stratified random sampling was chosen to improve the precision of the results by ensuring that key subgroups of the population were represented. This method minimizes sampling bias and provides a more accurate reflection of the safety culture maturity across different levels and areas of the organization. By including these details, the study design is strengthened, ensuring the robustness and reliability of the findings. The calculated sample size and the systematic sampling method provide a solid foundation for assessing the safety culture maturity within the oil and gas sector.

**Data collection**

**Respondents:** The research method employed in this study involved the distribution of a questionnaire via email to all employees of oil and gas service companies that offer installation, maintenance, commissioning, and testing of product equipment to major retail pump stations in Malaysia. The aim of the questionnaire was to gather feedback from employees and evaluate the overall maturity level of the organization's safety culture. To ensure that the feedback received was comprehensive, inclusive surveys were conducted, which involved employees at all levels within the organization, including management, executive, and non-executive staff members. Moreover, the surveys were conducted

across different work environments, both office-based and on-site, to ensure that feedback from employees in diverse working conditions was collected.

**Data Analysis**

This study used a questionnaire as the primary data collection tool and distribute it to employees within the organization. The researcher used the mean score of the responses to categorize the safety culture maturity level of the organization. The mean score is a statistical measure that represents the average value of all responses to the questionnaire. By analyzing the mean score of the 18 dimension safety culture, the researcher can determine whether the safety culture maturity level of the organization. Table II shows category of safety culture maturity level based on mean score.

**Table II: Safety culture maturity level scoring**

Mean $\overline{(X)}$	Safety Culture Maturity Level
1.00 – 1.99	Pathological
2.00 – 2.99	Reactive
3.00 – 3.99	Calculative
4.00 – 4.49	Proactive
4.55 – 5.00	Generative

**Ethical Clearance**

The study was approved by the Research Ethics Committee (REC) of UiTM under the reference number: REC/07/2023 (PG/MR/251) dated on 21st Jul 2023. The approval duration was July 2023 until September 2024.

**RESULTS**

**Demographic profile**

The research questionnaire used in this study aimed to evaluate the safety culture maturity of the organization and the respondents were asked to provide their feedback based on their perception of the organization's safety culture. The profile of the respondents were analyzed based on gender, work positions and work environment (Table III).

**Table III: Demographic profile**

	Demographic profile	Respondent (n)	Respondent (%)
Gender	Male	280	86.95
	Female	42	13.05
Position	Management	9	2.8
	Executive	33	10.28
	Non - Executive	280	87.23
Work Environment	Office	68	21.19
	On-site	254	78.88

The management's notable commitment to this safety culture maturity study facilitated the collection of 322 responses from employees at different organizational levels: management (n=9), executives (n=33), and non-management employees (n=280). The varied perspectives

offered by employees at different levels are instrumental in identifying areas for potential improvement. Previous studies have highlighted the influence of respondent demographics, such as occupation and leadership roles, on safety culture perceptions (14). Management and executives may perceive safety culture differently than non-executives, shedding light on organizational safety policies and procedures.

It is important to note that the majority of respondents were male (86.95%), while only 13.05% were female. This gender distribution may have implications for interpreting the research findings on safety culture maturity. This skewed gender distribution can potentially influence the interpretation of research findings concerning safety culture maturity, as studies have indicated differing perceptions of safety culture between genders (15). Achieving a more balanced gender representation in future studies would yield a more representative sample. Figure 1 illustrates the safety culture maturity scores by gender and highlights potential differences in safety culture perceptions between male and female employees.

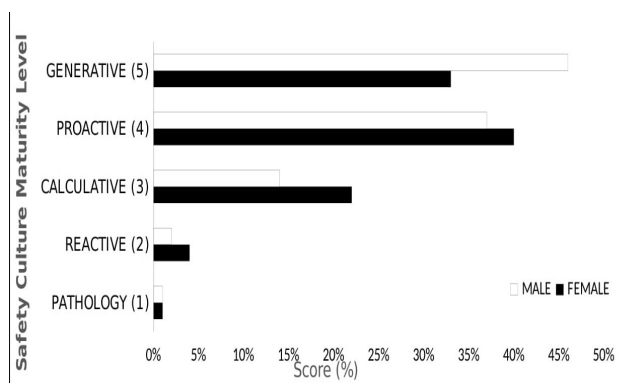


Figure 1: Safety culture maturity level by gender

**Maturity of safety culture scores**

Table IV provides a comprehensive overview of safety culture maturity across the 18 dimensions of safety

culture, based on the HSE Safety Ladder Model. The results show that the organization has a mature safety culture, with the majority of the dimensions rated at the proactive and generative levels. This indicates that the organization has implemented effective safety practices, policies, and procedures. The mean scores in Table IV refer to the average responses for each dimension of safety culture, rather than the mean of respondents. These scores help identify overall trends in safety culture maturity. The data indicates that certain dimensions, such as HSE experiences, communication, and contractor management, are rated highly by employees, suggesting these areas are particularly well-developed and important to the workforce.

It is worth noting that the organization has achieved the highest level of safety culture maturity, the generative level, in some dimensions. This demonstrates a positive safety culture that encourages continuous improvement and innovation. Conversely, dimensions such as incident perception, training and competency, and engagement and leadership are rated at the pathological level, indicating areas that require significant improvement. These findings provide valuable insights into the maturity of the organization’s safety culture. While the organization has strong safety practices overall, the identified areas for improvement highlight opportunities to further enhance safety culture maturity. Addressing these areas can help the organization develop and implement strategies to ensure a safer work environment for all employees.

In this study, the safety culture maturity levels (pathological, reactive, calculative, proactive, generative) are considered ordinal as they represent an ordered sequence of maturity. The levels of safety culture maturity are ordinal, with a natural progression from pathological to generative. Using the mean can help summarize the central tendency of responses across these levels, providing a quick overview of the organization's overall safety culture maturity

Table IV: Maturity of safety culture scores based on safety culture dimensions.

Dimension	Pathological (%)	Reactive (%)	Calculative (%)	Proactive (%)	Generative (%)	Mean $\bar{X}$
Q1: Communication	1.00	2.00	12.00	32.92	52.00	4.33
Q2: Commitment and leadership	1.55	4.35	9.32	41.61	43.17	4.20
Q3: Rewards and recognition	1.24	2.48	20.81	43.79	31.68	4.02
Q4: Incident perception	2.80	0.00	15.22	39.44	42.55	4.19
Q5: HSE & profitability	1.00	4.00	14.00	39.00	42.00	4.19
Q6: Contractor management	1.00	3.42	20.19	25.78	49.69	4.20
Q7: Training and competency	1.86	2.17	18.63	38.51	38.82	4.10
Q8: HSE department	1.00	2.00	18.32	32.00	47.00	4.25
Q9: Intervention	0.62	1.86	10.56	47.20	39.75	4.24
Q10: Consequence management	1.00	1.24	18.94	42.86	36.00	4.14
Q11: Process safety	1.00	2.00	14.00	49.00	33.00	4.15

CONTINUE

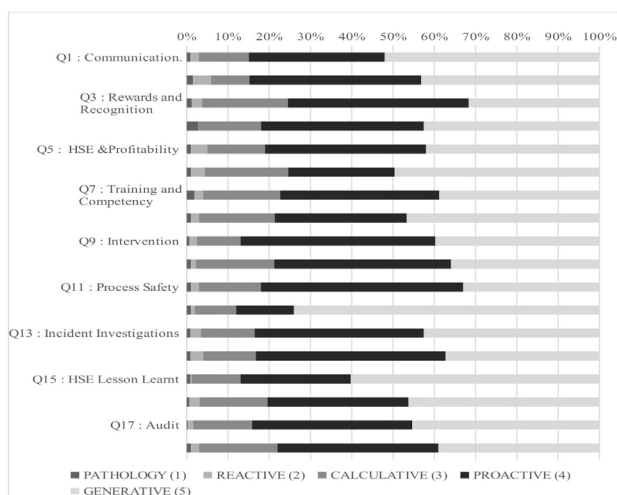
**Table IV: Maturity of safety culture scores based on safety culture dimensions. (CONT.)**

Dimension	Pathological (%)	Reactive (%)	Calculative (%)	Proactive (%)	Generative (%)	Mean $\bar{X}$
Q12: Procedures	1.00	1.00	10.00	14.00	74.00	4.63
Q13: Incident investigation	0.93	2.48	13.04	30.99	42.55	4.22
Q14: Hazard reporting	0.93	3.11	12.73	45.96	37.27	4.16
Q15: HSE lesson learnt	0.93	0.31	11.80	26.71	60.25	4.45
Q16: Safety meeting	0.62	2.48	16.46	34.16	46.27	4.23
Q17: Audit	0.31	1.24	14.29	38.82	45.34	4.28
Q18: HSE benchmarking	1.00	2.00	19.00	39.00	39.00	4.15

Note: Safety culture maturity levels were assessed using the mean, with values within the ranges 1.00 - 1.99, 2.00 - 2.99, 3.00 - 3.99, 4.00 - 4.49, and 4.55 - 5.00 corresponding to pathological, reactive, calculative, proactive, and generative values, respectively.

**Trend distribution of safety culture maturity level**

The analysis of the distribution mean for each of the 18 dimensions of safety culture shows that the maturity level of safety culture in the organization is mainly in the proactive range (Figure 2). This means that the organization proactively identifies and addresses potential safety issues before they become actual incidents. However, it should be noted that only one dimension, procedures, falls below the generative level, indicating that the organization's safety culture can still be improved. Even though the overall maturity of the safety culture in the organization is positive, it is important to recognize that there are certain areas that require more attention to further improve the safety culture. For example, the results show that the areas that received the most attention from employees were HSE experiences, communications, and contractor management. These areas may need more attention to further improve the company's safety culture. The organization should take steps to identify the root causes of deficiencies and develop appropriate strategies to address them. This may include improving communication channels, providing additional training and resources to employees, and developing more effective safety policies and procedures. By focusing on these areas, the organization can further improve its safety culture and reduce the risk of safety incidents and accidents.

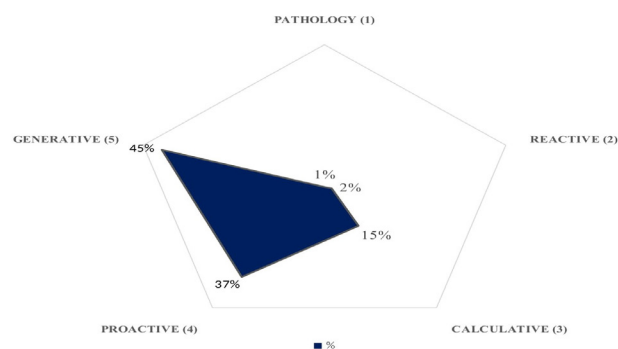


**Figure 2: Trend distribution of safety culture maturity level**

**DISCUSSION**

**Overall Maturity of Safety Culture**

The study indicates that the overall maturity level of the safety culture in the organization is quite satisfactory, falling under the generative and proactive stages (Figure 3). The attainment of the generative maturity level suggests that the safety culture is deeply embedded in the organization's values and beliefs, empowering employees to take proactive measures to maintain safety. This reflects a strong commitment to employee safety and the creation of a safe work environment. Additionally, the high percentage of responses at the proactive level indicates that the organization is continuously seeking ways to improve safety and has taken significant steps to prevent incidents. This commitment to continuous improvement is a positive sign of a robust safety culture.



**Figure 3: Organization safety culture maturity level**

The key findings of this study reveal significant insights into the factors influencing safety culture maturity within the organization, aligning with the objectives of assessing safety culture maturity and identifying areas for improvement. Specifically, the study aimed to evaluate how demographic factors such as gender, work position, and work environment influence safety maturity levels and to provide actionable recommendations for enhancing safety culture.

**Gender Influence on Safety Culture Maturity**

The demographic profile reveals a skewed gender distribution, with 86.95% of respondents being male and

13.05% female. Gender can influence perceptions and behaviors related to safety culture. Studies suggest that men and women may perceive safety culture differently due to socialization, risk perception, and communication styles (16, 17). Men, who predominantly occupy roles in high-risk industries, may exhibit higher confidence in dealing with safety issues, while women may emphasize the importance of safety procedures and adherence to protocols. This imbalance in gender representation could impact the overall safety culture maturity scores. To gain a more comprehensive understanding, future studies should strive for a more balanced gender representation.

#### **Work Position Influence on Safety Culture Maturity**

The study shows that work positions significantly influence safety culture perceptions. Management and executive roles often have different perspectives on safety culture compared to non-executive staff. Management and executives are involved in policy-making and strategic decisions, which might lead them to view the organization's safety culture more favorably due to their roles in developing and implementing safety measures (18). In contrast, non-executive employees, who are directly exposed to safety practices, might have a more critical view based on their firsthand experiences. This discrepancy highlights the need for targeted interventions that address the specific needs and perceptions of different organizational levels.

#### **Work Environment Influence on Safety Culture Maturity**

The work environment, whether office-based or on-site, also impacts safety culture maturity. On-site workers, who directly engage with potentially hazardous conditions, may have a heightened awareness of safety issues and thus different perceptions compared to office-based staff (19, 20). The study reveals that a significant portion of respondents work on-site (78.88%), likely influencing the overall safety culture maturity scores. On-site employees might prioritize practical safety measures and immediate risk management, while office-based staff might focus more on policy adherence and procedural aspects. Understanding these differences is crucial for developing comprehensive safety strategies that cater to both environments.

While the organization shows a mature safety culture overall, certain dimensions such as incident perception, training and competency, and engagement and leadership require further improvement. The lower scores in incident perception suggest a need for better incident reporting and response systems (21). Enhancing training and competency is essential to ensure all employees possess the necessary skills and knowledge to perform their tasks safely. The scores indicate that the organization should invest more in continuous training programs. Engagement and leadership scores highlight that, while management is committed to safety, there is room for enhancing their proactive involvement in safety practices.

The findings underscore the importance of a continuous improvement approach to safety culture. Regular assessments across different dimensions and implementing targeted improvements are crucial. This includes enhancing communication channels, providing regular and comprehensive training, and fostering a culture where safety is viewed as a shared responsibility (22). Management should lead by example, demonstrating their commitment to safety and encouraging employee participation in safety initiatives (23).

This study contributes to the existing body of knowledge by providing empirical evidence on the factors influencing safety culture maturity in the oil and gas industry. It highlights the significant impact of demographic factors and workplace environments on safety perceptions and behaviors, offering a nuanced understanding of how these variables interact. The study also identifies specific areas for improvement, providing a foundation for developing targeted interventions to enhance safety culture.

Given the focus of the study on identifying opportunities for improvement, several specific areas have been highlighted for management at the study location. Firstly, there is a need to implement more robust incident reporting and response mechanisms to ensure timely and effective management of safety incidents. This involves creating systems that encourage employees to report incidents without fear of retaliation and ensuring that these reports are handled swiftly and appropriately. Secondly, the organization should invest in regular and comprehensive training programs to enhance employees' skills and competencies in safety practices. Continuous training will ensure that all employees are up-to-date with the latest safety protocols and can effectively contribute to maintaining a safe work environment. Thirdly, increasing the proactive involvement of leadership in safety initiatives is crucial. Management should consistently demonstrate their commitment to safety through their actions and decisions, thereby fostering a culture of safety at all organizational levels. Additionally, improving communication channels between management and employees will help build a more transparent and responsive safety culture. Open and effective communication ensures that safety concerns are promptly addressed and that employees feel heard and valued. Lastly, there should be a focus on identifying and addressing underlying systemic issues rather than attributing blame to individuals. By developing a more constructive approach to safety, the organization can create an environment where continuous improvement is prioritized and employees are encouraged to contribute to a safer workplace. By addressing these opportunities for improvement, the organization can further enhance its safety culture maturity, ensuring a safer and more effective work environment.

## CONCLUSION

In summary, this study provides a comprehensive evaluation of safety culture maturity within the organization, focusing on 18 key dimensions, including communication, leadership commitment, rewards and recognition, incident perception, HSE and profitability, contractor management, training and competency, HSE department efficacy, intervention practices, consequence management, process safety, procedural adherence, incident investigation, hazard reporting, lessons learned, safety meetings, auditing processes, and HSE benchmarking. The findings reveal significant insights into how demographic factors such as gender, work position, and work environment influence these dimensions of safety culture maturity.

The results indicate that the organization has achieved a high level of maturity in several dimensions, particularly in proactive and generative stages, reflecting a deeply embedded safety culture. However, specific areas such as incident perception, training and competency, and leadership engagement were identified as requiring further improvement. Addressing these gaps through robust incident reporting and response mechanisms, continuous training programs, proactive leadership involvement, and enhanced communication channels can significantly enhance the organization's safety culture. Moreover, the study underscores the importance of a continuous improvement approach to safety culture. Regular assessments across the 18 dimensions and implementing targeted interventions are crucial for maintaining high safety performance. Management's commitment to safety, coupled with employee participation in safety initiatives, is essential for fostering a culture of safety. By focusing on these opportunities for improvement, the organization can create a safer and more effective work environment. The detailed analysis of the 18 dimensions provides actionable insights that are crucial for developing a dynamic and inclusive approach to safety culture development in high-risk industries. This study contributes to the existing body of knowledge by highlighting the critical factors influencing safety culture maturity and offering a framework for targeted interventions to enhance safety practice.

## ACKNOWLEDGEMENT

The author would like to express his sincere gratitude to the management of Flowco Malaysia Sdn Bhd for their willingness to participate in this study and for providing the necessary access to assess the maturity of the company's safety culture. The author hopes that the research findings will serve as a useful tool for the management team to identify improvement opportunities and work towards a generative safety culture in all dimensions of the company. The author would also like to acknowledge the support from the Dana UCS, UITM Cawangan Selangor, Universiti Teknologi MARA

(600-UITMSEL (PI. 5/4) (160/2022) which enabled the successful completion of this study. Finally, the author would like to acknowledge all the participants who contributed their time and valuable insights to this study.

## REFERENCES

1. Cooper MD. Towards a model of safety culture. *Safety science*. 2000 Nov 1;36(2):111-36, doi:org/10.1016/S0925-7535(00)00035-7.
2. Lee V, Henderson MC. Occupational stress and organizational commitment in nurse administrators. *JONA: The Journal of Nursing Administration*. 1996 May 1;26(5):21-8, doi:org/10.1097/00005110-199605000-00006.
3. Turner BA, Pidgeon N, Blockley D, Toft B. Safety culture: its importance in future risk management. In Position paper for the second World Bank workshop on safety control and risk management, Karlstad, Sweden 1989 Nov 6 (pp. 6-9), doi:org/10.1201/9781351076333-63.
4. Gotcheva N, Oedewald P, Ylönen M. Systems thinking applied to safety culture approach in Finland. In *Human Factors in the Nuclear Industry 2021* Jan 1 (pp. 73-91). Woodhead Publishing, doi:org/10.1016/B978-0-08-102845-2.00004-1.
5. Reiman T, Rollenhagen C. Does the concept of safety culture help or hinder systems thinking in safety?. *Accident Analysis & Prevention*. 2014 Jul 1;68:5-15, doi:org/10.1016/j.aap.2013.10.033.
6. Hudson P. Implementing a safety culture in a major multi-national. *Safety science*. 2007 Jul 1;45(6):697-722, doi:org/10.1016/j.ssci.2007.04.005.
7. Goncalves Filho AP, Waterson P. Maturity models and safety culture: A critical review. *Safety science*. 2018 Jun 1;105:192-211, doi:org/10.1016/j.ssci.2018.02.017
8. Ayob AN, Hassan CR, Hamid MD. Safety culture maturity measurement methods: A systematic literature review. *Journal of Loss Prevention in the Process Industries*. 2022 Oct 29;104910, doi:org/10.1016/j.jlp.2022.104910.
9. Yomura T, Shi G, Hosoda S, Inoue S. Program development for fostering safety culture in multi-tiered organizations-Finding and solving interorganizational issues. *Japanese Journal of Applied Psychology*. 2020 Jul 31;46(SpecialEdition):29-37, doi:org/10.24651/oushinken.46.SpecialEdition\_29.
10. Araujo FO, Germano AL. Development and implementation of proposals for the formalization of manufacturing processes of an industrial duct manufacturer in Nova Iguaçu/RJ. *Production and Development Journal*. 2017 Dec 1;3(3):55-73, doi:org/10.32358/rpd.2017.v3.198.
11. Department of Occupational Safety and Health Malaysia. Annual Report DOSH 2022. [Cited 2024 April 23]. Available from: [www.dosh.gov.my/index.php/ms/penerbitan/laporan-tahunan/4623-](http://www.dosh.gov.my/index.php/ms/penerbitan/laporan-tahunan/4623-)

- laporan-tahunan-jkkp-malaysia-2022/file.
12. Hudson PT. Safety management and safety culture: the long, hard and winding road. Occupational health and safety management systems. 2001;2001:3-2. [Cited 2024 January 22]. Available from: [http://mtpinnacle.com/pdfs/gen\\_ohsms\\_4231.pdf#page=11](http://mtpinnacle.com/pdfs/gen_ohsms_4231.pdf#page=11).
  13. Parker D, Lawrie M, Hudson P. A framework for understanding the development of organisational safety culture. Safety science. 2006 Jul 1;44(6):551-62, doi:org/10.1016/j.ssci.2005.10.004.
  14. Gambashidze N, Hammer A, Wagner A, Rieger MA, Brusterhaus M, Van Vegten A, Manser T, WorkSafeMed Consortium. Influence of gender, profession, and managerial function on clinicians' perceptions of patient safety culture: a cross-national cross-sectional study. Journal of Patient Safety. 2021 Jun 1;17(4):e280-7, doi:org/10.1097/pts.0000000000000585.
  15. Alkhaledi KA, Bendak S, Dashti FA. Assessing safety culture in public sector organisations: A cross-national study. International Journal of Industrial Ergonomics. 2023 Mar 1;94:103425, doi:org/10.1016/j.ergon.2023.103425.
  16. Byrnes JP, Miller DC, Schafer WD. Gender differences in risk taking: A meta-analysis. Psychological bulletin. 1999 May;125(3):367, doi:org/10.1037//0033-2909.125.3.367.
  17. Powell M, Ansic D. Gender differences in risk behaviour in financial decision-making: An experimental analysis. Journal of economic psychology. 1997 Nov 1;18(6):605-28, doi:org/10.1016/s0167-4870(97)00026-3.
  18. Al-Qubaisi SS. Incidents Investigations and Learning Approach in Oil & Gas Industry. In Abu Dhabi International Petroleum Exhibition & Conference 2019 Nov 11. OnePetro, doi:org/10.2118/197862-ms.
  19. Zohar D, Luria G. A multilevel model of safety climate: cross-level relationships between organization and group-level climates. Journal of applied psychology. 2005 Jul;90(4):616, doi:org/10.1037/0021-9010.90.4.616.
  20. Neal A, Griffin MA. A study of the lagged relationships among safety climate, safety motivation, safety behavior, and accidents at the individual and group levels. Journal of applied psychology. 2006 Jul;91(4):946, doi:org/10.1037/0021-9010.91.4.946.
  21. O'Toole M. The relationship between employees' perceptions of safety and organizational culture. Journal of safety research. 2002 Jun 1;33(2):231-43, doi:org/10.1016/s0022-4375(02)00014-2.
  22. Ekong AE, Ugbebor JN, Brown BK. Influence of Safety Culture on Employee Safety Motivation and Error Behaviour in Selected Petroleum Industries in Niger-Delta. Asian Journal of Advanced Research and Reports. 2021 Jul 16;15(4):49-62. doi:org/10.9734/ajarr/2021/v15i430390.
  23. Mullen J, Kelloway EK, Teed M. Employer safety obligations, transformational leadership and their interactive effects on employee safety performance. Safety science. 2017 Jan 1;91:405-12, doi:org/10.1016/j.ssci.2016.09.007.