

STRENGTHENING WORKFORCE COMPETENCY AND SAFETY CULTURE THROUGH TRAINING IN THE OIL & GAS SECTOR

FORTALECIMENTO DAS COMPETÊNCIAS DA FORÇA DE TRABALHO E DA CULTURA DE SEGURANÇA POR MEIO DE TREINAMENTOS NO SETOR DE PETRÓLEO E GÁS

Article received on: 1/23/2026

Article accepted on: 4/24/2026

Mirza Shoaib Ahmed*

*Jeddah, Saudi Arabia

Orcid: <https://orcid.org/0009-0005-6600-3516>

mirzashoaibahmed@yahoo.com

The authors declare that there is no conflict of interest

Abstract

Given the inherent risks of the Oil & Gas industry, such as flammable substances, high-pressure systems, and heavy equipment, maintaining workforce competency and safety culture is essential for ensuring operational reliability and sustained growth. This paper examines how targeted safety training programs enhance workforce competency and safety culture within the Oil & Gas sector, supporting organizations' efforts to achieve the strategic objectives outlined in Saudi Vision 2030. The study uses a qualitative approach grounded in literature, industry practices, global standards, and case studies from terminal operations, aviation fueling, and process safety. It shows the link between competency training, human performance improvement, hazard awareness, emergency preparedness, and institutional strength. The findings indicate that organizations implementing structured competency systems, safety programs, leadership initiatives, and ongoing development achieve better safety outcomes and reduced risk. Challenges identified include managing multicultural teams, bridging communication gaps, addressing training fatigue, adapting to technological changes, and improving practical competency assessments. This study concludes that focused investment in workforce development, digital learning tools, leadership-driven safety culture, and competency assurance frameworks is critical for advancing operational excellence and directly supporting the strategic goals of Saudi Vision 2030. The main argument is that competency-based safety training provides the foundation necessary for these outcomes within the Oil & Gas sector.

Keywords: Oil & Gas. Workforce Competency. Safety Culture. Safety Training. Process Safety. Human Performance. Saudi Vision 2030. HSE.

Resumo

Dados os riscos inerentes ao setor de Petróleo e Gás, tais como substâncias inflamáveis, sistemas de alta pressão e equipamentos pesados, manter a competência da força de trabalho e a cultura de segurança é essencial para garantir a confiabilidade operacional e o crescimento sustentável. Este artigo examina como programas de treinamento em segurança direcionados aprimoram a competência da força de trabalho e a cultura de segurança no setor de Petróleo e Gás, apoiando os esforços das organizações para alcançar os objetivos estratégicos delineados na Visão Saudita 2030. O estudo utiliza uma abordagem qualitativa fundamentada na literatura, nas práticas do setor, em padrões globais e em estudos de caso de operações de terminais, abastecimento de combustível para aviação e segurança de processos. Ele mostra a relação entre treinamento de competências, melhoria do desempenho humano, conscientização sobre riscos, preparação para emergências e solidez institucional. Os resultados indicam que as organizações que implementam sistemas estruturados de competências, programas de segurança, iniciativas de liderança e desenvolvimento contínuo alcançam melhores resultados de segurança e redução de riscos. Os desafios identificados incluem a gestão de equipes multiculturais, a superação de lacunas de comunicação, o combate à fadiga de treinamento, a adaptação às mudanças tecnológicas e a melhoria das avaliações práticas de competências. Este estudo conclui que o investimento direcionado no desenvolvimento da força de trabalho, em ferramentas de aprendizagem digital, em uma cultura de segurança impulsionada pela liderança e em estruturas de garantia de competências é fundamental para promover a



excelência operacional e apoiar diretamente as metas estratégicas da Visão Saudita 2030. O argumento principal é que o treinamento em segurança baseado em competências fornece a base necessária para esses resultados no setor de Petróleo e Gás.

Palavras-chave: *Petróleo e Gás. Competência da Força de Trabalho. Cultura de Segurança. Treinamento em Segurança. Segurança de Processos. Desempenho Humano. Visão Saudita 2030. HSE.*

1 INTRODUCTION

The global Oil & Gas sector is technically demanding and hazardous because of the complexity of exploration, production, transportation, storage, refining, and distribution. Employees in upstream, midstream, and downstream units face hazards such as fires, explosions, toxic gases, confined spaces, high-pressure systems, and heavy equipment.

Historical incidents in the Oil & Gas industry highlight the risks associated with insufficient safety measures and a lack of workforce expertise. Events such as the Piper Alpha catastrophe, the Texas City refinery explosion, and the Deepwater Horizon disaster emphasize the critical need for effective process safety management, reliable human performance, comprehensive emergency preparedness, and the cultivation of a robust safety culture.

Modern organizations find that technical systems alone do not ensure safety. Factors like human behavior, leadership, learning, and workforce competency strongly affect performance and risk management.

In Saudi Arabia, Oil & Gas play a strategic role in economic growth and sustainability. Saudi Vision 2030 prioritizes the development of expertise, local skills, human capital, technology, and operational excellence. As a result, sector organizations must improve workforce competency and safety culture to meet national and international goals.

This research paper evaluates how strategic safety training, when aligned with workforce competency and safety culture initiatives, enables organizations in the Oil &

Gas sector to meet and advance Saudi Vision 2030 objectives. The central argument is that such alignment is indispensable for sectoral transformation.

2 LITERATURE REVIEW

Research literature consistently identifies workforce competency and organizational safety culture as essential factors influencing accident prevention and operational dependability in high-risk industries.

The National Academies of Sciences states that safety culture is more than just compliance; it requires ongoing leadership, worker engagement, communication, and learning. OSHA also emphasizes that process safety depends on employee competency, discipline, and hazard awareness.

Studies show that competency-based training reduces incidents and improves dependability and safety behavior. Mercado *et al.* (2019) found that safety culture enhances resilience and shapes attitudes toward hazard reporting, compliance, and risk.

Ramos *et al.* (2021) showed that many high-risk incidents stem from human limits, poor training, and communication failures. The study highlights the need for ongoing learning, practical checks, and safety awareness.

Safety standards like ISO 45001 and API also state that training and competency checks are essential for safe, low-risk operations.

Even with more safety spending, many groups still struggle with multicultural teams, contractor issues, tech changes, and inconsistent competency checks.

This work adds to the literature by examining how safety training aligns with Saudi Vision 2030 in the oil & gas sector.

3 RESEARCH METHODOLOGY

This study uses a qualitative method with secondary data, literature, industry reports, standards, and case examples.

The method includes:

- Review of published academic literature related to safety culture and workforce competence.
- Analysis of worldwide safety standards, including ISO 45001, OSHA Process Safety Management guidelines, and API operational regulations.
- Evaluation of industrial practices within aviation fueling operations, oil storage terminals, and process safety environments.
- Examination of organizational training systems and competency management approaches commonly applied within the Oil & Gas industry.

A qualitative approach allows in-depth study of organizational behavior, workforce development, leadership, and safety performance.

4 WORKFORCE COMPETENCY IN THE OIL & GAS SECTOR

Workforce competency means having technical knowledge, skills, experience, attitudes, and safety awareness for safe & effective work.

In Oil & Gas, competency management is vital, as failures can cause injuries, deaths, environmental harm, financial losses, and reputational damage.

- Competent personnel contribute toward:
 - Hazard identification and risk mitigation.
 - Compliance with operational procedures.
 - Effective emergency response.
 - Process safety management implementation.
 - Safe operation of specialized equipment.
 - Operational reliability and efficiency.
 - Reduction of human error.

Aviation fueling staff must know fuel contamination prevention, grounding, fueling safety, shutdown systems, and quality control.

Storage terminal workers need skills in the permit-to-work system, confined-space entry, firefighting, tank operations, fuel handling, and emergency response.

With more automation and digital technologies, organizations need to update employee skills using structured and hands-on training.

5 SAFETY CULTURE WITHIN HIGH-RISK OPERATIONS

Safety culture is the set of values, beliefs, attitudes, and practices that guide an organization's safety management.

Organizations with a strong safety culture generally demonstrate:

- Visible leadership commitment.
- Effective communication systems.
- Employee participation in safety activities.
- Continuous learning and improvement.
- Strong procedural compliance.
- Open reporting of hazards and near misses.
- Positive behavior towards safety practices.

Weak safety culture leads to rule-breaking, poor supervision, poor communication, unsafe actions, and increased accident risk.

Leadership strongly shapes safety culture. When leaders prioritize targets over safety, employees may ignore safety rules to meet targets. When leaders emphasize safety and participate in training, staff adopt safer behaviors.

Building a strong safety culture requires long-term commitment, not short-term rule-following.

6 ROLE OF SAFETY TRAINING IN ORGANIZATIONAL PERFORMANCE

Safety training represents one of the most effective organizational tools for strengthening workforce competence and promoting a positive safety culture.

- Effective training programs provide employees with:
 - Technical operational knowledge.
 - Hazard recognition capability.
 - Emergency response competency.
 - Process safety awareness.
 - Behavioral safety understanding.
 - Risk assessment skills.

- Leadership and communication ability.

The major categories of safety training commonly implemented within the Oil and Gas industry include:

a) HSE Induction Training

HSE-Induction programs introduce employees to business policies, operational hazards, emergency procedures, reporting systems, and safety expectations before entering operational areas.

b) Technical Competency Training

Technical training focuses on operational activities such as:

- Tank farm management.
- Loading/offloading of Bridgers
- Aviation fueling operations.
- Pipeline systems.
- Electrical safety.
- Lockout/tagout systems.
- Permit-to-work procedures.
- Working at height.
- Hazardous chemical/petroleum products handling.

c) Process Safety Management Training

Process safety training addresses major accident hazards, including:

- Fire and explosion prevention.
- Safety-critical equipment.
- Hazard identification.
- Risk assessment.
- Management of change.
- Incident investigation.

d) Emergency Response Training

Emergency drills and simulations improve employee preparedness during fuel spills, fires, toxic releases, medical emergencies, and operational failures.

e) Behavioral Safety Programs

Behavioral safety training focuses on employee attitudes, communication, observation techniques and active risk management behavior.

Organizations investing in continuous training and competency assurance programs generally show better operational performance, reduced accident frequency, and stronger workforce engagement.

7 TRAINING AND SAUDI VISION 2030

Saudi Vision 2030 places strong emphasis on workforce development, industrial sustainability, operational excellence and localization of expertise.

The Oil & Gas sector contributes directly to these national objectives through:

- Economic diversification.
- Human capital development.
- Industrial modernization.
- Technological innovation.
- Localization initiatives.
- International competitiveness.

Competency-based training systems support Vision 2030 by developing highly skilled professionals capable of operating advanced industrial technologies safely and efficiently.

Several organizations within the Kingdom have increasingly implemented:

- E-learning systems.
- Simulator-based operational training.
- Leadership development programs.
- Digital competency management systems.
- Virtual reality safety simulations.
- International certification frameworks.

For example, aviation fueling companies operating in Saudi Arabia provide specialized operational training in fuel quality management, aircraft fueling safety, emergency response systems, and international aviation operational standards.

Terminal operators and refinery organizations conduct process safety workshops, emergency response exercises, risk assessment training, and contractor competency programs to strengthen organizational resilience plus operational dependability.

8 DISCUSSION

The findings of this study indicate that workforce competency and safety culture are strongly interconnected within high-risk environments of Oil & Gas.

Organizations that implement competency-based training programs supported by leadership engagement, practical assessments, and persistent learning systems generally experience better operational performance and lower accident rates.

The study further demonstrates that safety culture cannot be established only through procedural documentation as well as regulatory compliance. Sustainable safety culture requires active employee participation, organizational trust, effective communication, and continuous reinforcement of safety values.

The deployment of digital technologies and modern training methods also plays an increasingly important role in strengthening operational competence. Virtual reality scenarios, web-based learning platforms, digital tracking systems, and analytics-based competency assessments enable organizations to improve learning effectiveness and operational readiness.

However, organizations must also address challenges associated with multicultural workforce environments, communication barriers, contractor management, and technological transformation to ensure long-term training effectiveness.

9 CHALLENGES AFFECTING TRAINING EFFECTIVENESS

Despite significant investments in safety systems, many organizations continue to face challenges that affect workforce competency development.

9.1 Multicultural workforce environment

Employees of diverse nationalities and educational backgrounds may experience communication difficulties affecting safety understanding and procedural compliance.

9.2 Training fatigue

Repetitive classroom training sessions without practical engagement often reduce employee attention and knowledge retention.

9.3 Insufficient practical assessment

Some organizations focus heavily on theoretical learning while failing to validate practical operational competency.

9.4 Technological transformation

Rapid implementation of digital systems and automation technologies requires continuous updating of employee knowledge and technical capability.

9.5 Operational pressure

Production targets and operational deadlines sometimes limit opportunities for effective competency development.

9.6 Weak leadership engagement

Training initiatives become less effective when supervisors and managers fail to reinforce safety expectations during routine operational activities.

10 RECOMMENDATIONS

Based on the results of this research, the following recommendations are presented:

- Organizations should establish integrated competency management systems linked directly to operational risk profiles.
- Safety training programs must combine theoretical learning with practical assessments, simulations and field evaluations.
- Leadership teams should demonstrate a visible dedication to safety culture and workforce development initiatives.
- Organizations should implement digital learning technologies, such as virtual augmented reality simulations and competency tracking systems.
- Regular emergency response exercises should be conducted to improve organizational readiness.
- Contractor personnel should be included within competency assurance and safety culture programs.
- Training effectiveness should be continuously evaluated through incident trends, behavioral observations, and competency assessments.
- Organizations should strengthen multilingual communication systems to improve workforce understanding.
- Learning culture initiatives should promote the open reporting of hazards, near misses and operational concerns.
- Training systems should align with international standards, including ISO 45001, OSHA Process Safety Management requirements, and API operational guidelines.

11 CONCLUSION

The Oil and Gas sector remains one of the most operationally complex and hazardous industries in the world. Under such conditions, workforce competency and organizational safety culture are crucial for ensuring operational dependability, accident prevention, and durable industrial growth.

This research shows that safety training substantially improves technical competence, strengthens hazard awareness, reduces human error, enhances emergency preparedness, and promotes preventive safety behavior.

The study further concludes that organizations investing in competency management systems, leadership engagement, digital learning technologies, and continuous vocational development are more likely to achieve operational proficiency and maintain a sustainable safety performance.

Within the context of Saudi Vision 2030, workforce development and safety excellence continue to be key strategic priorities supporting economic diversification, industrial sustainability, localization of expertise, and global competitiveness.

Therefore, organizations operating within the Oil and Gas sector must continue to strengthen their competency development systems and promote a positive safety culture to support long-term national development objectives.

REFERENCES

- [1] National Academies of Sciences, Engineering, and Medicine. (2016). *Beyond compliance: Strengthening the safety culture of the offshore oil and gas industry*. National Academies Press.
- [2] Kingdom of Saudi Arabia. (n.d.). *Saudi Vision 2030*. <https://www.vision2030.gov.sa>
- [3] Occupational Safety and Health Administration. (n.d.). *Process safety management guidelines*. <https://www.osha.gov/process-safety-management>
- [4] International Organization for Standardization. (n.d.). *ISO 45001: Occupational health and safety management systems*. <https://www.iso.org/iso-45001-occupational-health-and-safety.html>
- [5] Mercado, M. P., Duarte, F., Gallier, U., & Alonso, C. (2019). Safety culture: A systematic review for the oil and gas industry. *Revista Ação Ergonomêca*, 13(2).
- [6] Ramos, M., Major, C., Ekanem, N., Malpica, C., & Mosleh, A. (2021). *Human reliability analysis for oil and gas operations: Analysis of available methods*. <https://arxiv.org/abs/2109.14096>
- [7] International Association of Oil & Gas Producers. (n.d.). *Safety performance indicators report*. <https://www.iogp.org>
- [8] International Civil Aviation Organization. (n.d.). *Manual on civil aviation jet fuel supply*. <https://www.icao.int>

- [9] American Petroleum Institute. (n.d.). *Recommended practices for oil and gas operations*. <https://www.api.org>
- [10] Cairney, F. (2015). Safety management enhancement: The case of Mintra Academy. *International Journal of Management and Applied Research*, 2(3).