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IMPORTANCE OF SAFETY AND FUNCTIONAL TRAINING EFFECTIVENESS MEASUREMENT IN THE OIL & GAS SECTOR FOR SMART AND SAFETY COMPLIANT OPERATIONS

A IMPORTÂNCIA DA MEDIÇÃO DA EFICÁCIA DO TREINAMENTO EM SEGURANÇA E FUNCIONALIDADE NO SETOR DE PETRÓLEO E GÁS PARA OPERAÇÕES INTELIGENTES E EM CONFORMIDADE COM AS NORMAS DE SEGURANÇA

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Abstract

In the Oil & Gas sector, training has often been seen as something organizations must do, but not always as something that drives real value. Recently, though, as industrial operations grow more complex and technology advances, there is a greater focus on whether training is effective. This research examines why it's important to measure the effectiveness of safety and functional training in Oil & Gas operations. It also discusses how effective training can contribute to smarter operations, a more reliable workforce, better safety performance, and progress toward the goals of Saudi Vision 2030. This study employs a qualitative methodology, utilizing real-world industrial practices, competency frameworks, safety observations, and contemporary workforce development concepts. Rather than focusing solely on training delivery methods, the paper investigates how organizations can assess whether training leads to improved job performance, safer behaviors, increased hazard awareness, and enhanced operational reliability. The findings indicate that organizations employing structured training evaluation methods demonstrate higher regulatory compliance, improved discipline, enhanced emergency preparedness, reduced human error, and increased employee engagement. The research also highlights the growing importance of digital learning tools, competency assessment systems, behavioral analytics, and advanced monitoring technologies in organizational learning. In conclusion, the paper argues that measuring training effectiveness should be seen as a key part of running a safe and successful operation—not just an administrative task. It supports safety, long-term success, workforce growth, and

Resumo

No setor de Petróleo e Gás, a capacitação tem sido frequentemente vista como algo que as organizações precisam fazer, mas nem sempre como algo que gera valor real. Recentemente, porém, à medida que as operações industriais se tornam mais complexas e a tecnologia avança, há um foco maior na eficácia da capacitação. Esta pesquisa examina por que é importante medir a eficácia da capacitação em segurança e das funções operacionais nas operações de Petróleo e Gás. Ela também discute como um treinamento eficaz pode contribuir para operações mais inteligentes, uma força de trabalho mais confiável, melhor desempenho em segurança e progresso em direção às metas da Visão Saudita 2030. Este estudo emprega uma metodologia qualitativa, utilizando práticas industriais do mundo real, estruturas de competências, observações de segurança e conceitos contemporâneos de desenvolvimento da força de trabalho. Em vez de se concentrar exclusivamente nos métodos de ministração do treinamento, o artigo investiga como as organizações podem avaliar se o treinamento leva a um melhor desempenho no trabalho, comportamentos mais seguros, maior conscientização sobre riscos e maior confiabilidade operacional. Os resultados indicam que as organizações que empregam métodos estruturados de avaliação de treinamento demonstram maior conformidade regulatória, melhor disciplina, maior preparação para emergências, redução de erros humanos e maior engajamento dos funcionários. A pesquisa também destaca a crescente importância das ferramentas de aprendizagem digital, sistemas de avaliação de competências,

smarter ways of working, all in line with Saudi Vision 2030.

Keywords: Oil & Gas Training Effectiveness. Safety Training Evaluation. Workforce Competency Development. Operational Safety Performance. Saudi Vision 2030 and Industrial Training.

análise comportamental e tecnologias avançadas de monitoramento na aprendizagem organizacional. Em conclusão, o artigo argumenta que a medição da eficácia do treinamento deve ser vista como parte essencial da gestão de uma operação segura e bem-sucedida — e não apenas como uma tarefa administrativa. Ela promove a segurança, o sucesso a longo prazo, o crescimento da força de trabalho e formas mais inteligentes de trabalhar, tudo em consonância com a Visão Saudita 2030.

***Palavras-chave**: Eficácia do Treinamento em Petróleo e Gás. Avaliação do Treinamento em Segurança. Desenvolvimento de Competências da Força de Trabalho. Desempenho em Segurança Operacional. Visão Saudita 2030 e Treinamento Industrial.*

1 INTRODUCTION

The Oil and Gas sector operates within some of the most challenging and hazardous environments globally. Employees routinely encounter flammable products, high-pressure equipment, and confined spaces. Consequently, organizations require a workforce that is skilled, disciplined, and safety-oriented to ensure operational continuity and prevent major incidents.

Looking back at major accidents in the industry, it's clear that many failures were not just due to equipment failures. Often, problems occurred because people didn't fully understand procedures, weren't properly trained, or experienced communication lapses. That's why training courses have become so important in the industry today.

In Saudi Arabia, as industries modernize and technology advances under Saudi Vision 2030, companies must ensure their people are well-trained to operate complex systems safely. This shift puts a spotlight on the quality of training, ensuring skills are up to date and that workforce development delivers real results.

This paper examines how effective training in safety and job skills drives smarter operations, more reliable performance, better compliance, and lasting success in the Oil & Gas industry.

2 RESEARCH OBJECTIVES

The goals of this research are:

- To examine the operational importance of safety and functional training effectiveness within the Oil and Gas specialization.
- To examine the relationship between training effectiveness and workforce competence.
- To evaluate how effective training contributes to process safety and operational dependability.
- To identify challenges that affect training effectiveness measurement.
- To explore how training evaluation systems support the Saudi Vision 2030 objectives.

3 LITERATURE PERSPECTIVE

Recent studies show that just showing up for training isn't enough. What really matters is whether employees use what they learn, improve how they work, and are ready for the real challenges on the job.

Research in high-risk industries suggests that testing real skills on the job is more useful than classroom learning alone. Standards like ISO 45001 and OSHA's rules focus on regularly assessing skills and helping employees keep learning and growing their capabilities.

Studies also show that companies with strong learning cultures have fewer accidents, better discipline, and more closely follow rules. New tools like digital learning, virtual reality, and skill tracking are changing how training works today.

The idea of 'Smart Oil & Gas field operations' has made training even more important, as it now includes data analysis, digital technology, and methods for tracking employee performance and reliability.

4 SAFETY AND FUNCTIONAL TRAINING IN OIL & GAS OPERATIONS

Safety training teaches people to recognize dangers, respond to emergencies, follow rules, and work safely. Functional training is more about the hands-on skills needed to do the job—like running equipment, doing inspections, and maintaining systems.

In Oil & Gas, safety and functional training go hand in hand. Whether someone is working at a fuel farm/terminal, in a refinery, in aviation fueling, or handling fuel, they need to know both the operational steps and how to spot and control hazards.

Examples of operationally important training areas include:

- Permit-to-work systems
- Management of Change (MoC)
- Risk Assessment & Management
- Fuel quality management
- Tank farm operations
- Fuel delivery procedure to customers
- Confined space entry
- Firefighting and emergency response
- Spill containment procedures
- Process safety awareness
- Lockout and tagout systems
- Hazardous chemical handling
- Human factors and fatigue management

Companies are realizing that the real test of training is how well people perform on the job, not just whether they finished a course.

5 MEASURING TRAINING EFFECTIVENESS

Older ways of measuring training—like checking attendance or test scores—don’t really show if someone can use what they learned when it matters most at work.

Effective training measurement requires evaluation across multiple dimensions, including:

- Knowledge retention

- Practical competency
- Behavioral improvement
- Operational performance
- Incident reduction
- Emergency response capability
- Compliance improvement
- Human reliability indicators

Many companies now use more practical ways to assess skills, such as on-the-job demonstrations, observing employees at work, and gathering feedback from peers and supervisors.

The Kirkpatrick evaluation model remains widely referenced within industrial learning environments. The model evaluates training effectiveness across four levels:

1. Participant reaction
2. Learning achievement
3. Behavioral application
4. Operational results

But in high-risk industries, companies are starting to blend old evaluation methods with new tools such as performance analytics and systems that regularly assess skills.

6 SMART OPERATIONS AND DIGITAL LEARNING TRANSFORMATION

Digital technology is changing how companies train and develop workers in the Oil & Gas industry. New tools make it easier to track skills, observe how employees behave on the job, and ensure everyone is ready to work safely and effectively.

Examples of modern learning technologies include:

- Virtual reality safety simulations
- AI-supported learning systems
- E-learning platforms
- Digital competency tracking systems
- Mobile learning applications
- Smart inspection technologies
- Data-driven performance dashboards

Virtual reality is especially useful for dangerous jobs. It lets employees practice dealing with emergencies safely, helping them spot hazards quickly, make decisions faster, and better understand procedures.

As the industry moves towards smart Oil & Gas field operations under Saudi Vision 2030, it becomes even more important to connect digital learning with systems that track and manage performance.

7 OPERATIONAL CHALLENGES IMPACTING TRAINING EFFECTIVENESS

Even though companies invest heavily in training, there are still real-world challenges that can affect how effectively it works in the Oil & Gas sector.

Workforces composed of people from diverse backgrounds can face communication challenges. Employees who speak different languages or have different educational backgrounds might interpret safety rules differently, especially when things get stressful.

Another problem is training fatigue. If workers keep sitting through the same theory-heavy sessions without hands-on practice, they can lose interest and forget what they learned.

Sometimes, the push to keep production/operations going means there's less time for practical training, coaching, or keeping skills sharp.

As technology moves quickly, companies need to keep updating their training and skill checks to ensure they align with industry developments.

8 DISCUSSION

This study shows that how well training works has a direct impact on how reliable operations are, how confident workers feel, how safe things run, and how strong the organization is overall.

Companies that can really measure how effective their training is are better at identifying skill gaps, improving discipline, following rules, and reducing human errors.

The research also found that good training helps build a proactive safety culture, where people take responsibility, keep learning, report hazards, and act consistently.

It's important to see measuring training effectiveness as part of the bigger picture—not just paperwork. It should be tied to safety, leadership, workforce planning, and ensuring the organization succeeds over the long term.

9 RECOMMENDATIONS

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

1. Organizations should establish integrated competency assurance systems aligned with operational risk levels.
2. Practical assessment methods should be prioritized over classroom-based evaluation alone.
3. Digital learning technologies should be integrated into the workforce development programs.
4. Supervisors should actively participate in competence verification activities.
5. Emergency response simulations should be conducted regularly.
6. Organizations should measure training impact using operational performance indicators.
7. Contractor personnel should be included in competency development programs.
8. Learning systems should support Saudi workforce localization initiatives.
9. Behavior safety indicators should be incorporated into training evaluation models.
10. Organizations should promote a continuous learning culture through leadership engagement.

10 CONCLUSION

The Oil & Gas industry needs skilled workers who can work safely in challenging, hazardous environments. That is why effective safety and functional training are so important for keeping operations reliable, workers capable, and organizations strong.

This research shows that strong training systems help not just with safety rules, but also with smarter operations, reliable people, modern ways of working, and lasting success for the organization.

The study also says that companies need to go beyond just tracking who attended training and start using systems that really check practical skills, behavior, and how training changes performance.

For Saudi Vision 2030, measuring how well training works is a key part of developing the workforce, modernizing industry, staying competitive, and keeping things running smoothly and sustainably.

In the end, companies that really connect training with their strategy, technology, and leadership will be in the best position to run safe, smart, and sustainable operations.

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