



## Digitalisation

*(Linn Iren Vestly Bergh – Petroleum Safety Authority Norway)*

The petroleum industry is becoming increasingly dependent on digital systems, and companies have ambitious plans for increased use of digital technology along the entire value chain. Specific initiatives aim at optimising production, efficiency and reducing cost without negative effects on health, safety and the environment. The introduction of digital technology involves increased use of data collection, automatization, machine learning and access to computer resources in order to analyse large volumes of data.

Norway's petroleum industry must give a high priority to safety and the working environment when developing and implementing digital technology. This means every company must take ownership of the risk, ensure an integrated assessment of the effect of new solutions, and facilitate collaboration and genuine worker participation. As such, the Petroleum Safety Authority Norway (PSA) has increased its follow-up of digitalisation initiatives in the industry.

The PSA's goal is to ensure that the petroleum activity gives high priority to safety, health and working environment when digital technology is developed, assessed and implemented in companies across the industry. Supervisory activities and follow-up related to digitalisation initiatives are risk-based, building on input and experience from several audits and projects over the years.

On an overall level, PSA's effort can be categorised into the following main areas:

**Knowledge development:** Based on the need to increase knowledge on specific topics related to digitalisation and health, safety and environment (HSE) risks, the PSA has initiated several studies in collaboration with external research establishments/organisations. Studies have focused on issues related to the impact and consequences of the implementation of digital technology on health and safety. The studies initiated by the PSA provide an important foundation for risk-based follow-up of the industry. Furthermore, they promote increased awareness and knowledge of HSE issues when digital technology is developed, assessed and implemented in companies across the industry.

**Auditing:** As a regulator, the PSA performs risk-based audits of oil and gas related companies. In order to do so, the PSA actively uses findings from studies in its prioritization and planning of supervisory activities. When following up with the industry, the PSA ideally tries to follow digitalisation projects from early design phase to testing/qualification, building and implementation. PSA oversees the different stages to understand how the risk picture is changing and to verify that the regulations are followed and that the companies actively work to prevent undesirable consequences for safety and work environment.

**Collaboration with stakeholders:** One of the PSA's main regulatory strategies is to give guidance on rules and regulations, provide new knowledge and facilitate sharing and tripartite collaboration in the industry. Several arenas for tripartite collaboration have been established in the petroleum sector, most central are the Regulatory Forum and Safety Forum. Digitalisation and HSE consequences are important topics in these collaboration forums. For example,

digitalisation is a topic in the Safety Forum, where a task force has been established. The PSA also collaborates with other regulators nationally and internationally. In order to contribute to an industry where digitalisation and new technology continually change the way we work, collaboration between employers, employees and government is key.

Based on the PSA's follow-up, three key points sum up the experience and expectations related to the industry's work on digitalisation;

**An integrated perspective on human, technological and organisational (HTO) aspects.**

The companies must assess vulnerability and risk from a holistic and integrated perspective, which includes an HTO perspective. This is especially important when companies increasingly introduce automatization in the workplace. A critical factor to successful implementation of new technology is the correct specification of the end user requirements from the outset, which requires input from all levels in the oil and gas company. Business analysts should review the requirements closely and develop a specification for acceptance

Automatization involves systems ability to take their own decisions (without involving external systems or operators) and actions related to a given task. The degree of independence can vary from solutions where personnel have overall control of most operations to ones that work entirely without human intervention. For example, in drilling and well services the use of digital well planning and automated drilling is increasing.

Despite greater automation, the industry will to a large extent depend on people's ability to monitor systems and intervene if the technology breaks down. Although, there is no reason to dispute that reducing human error can increase safety through increased use of digital technology. Nevertheless, one should not take for granted that the introduction of new technology is necessarily related to the reduction of human error.

Digital technology and autonomous systems must also be designed to reduce technical faults, minimize human errors, support the ability of people to make the right decisions, and to be in line with the regulations and good practice.

Increased use of digital technology is a major area of commitment, and the PSA observes that the industry is making itself ever more dependent on digital and automated systems. This may create new opportunities for enhancing efficiency and safety but could also lead to changes in roles and responsibilities for both technical systems and people. It is important to be aware of this – and to take it into account.

**Ownership to risk management.**

Each company must take ownership of and manage the risk related to the implementation of new systems and technological solutions. Whoever owns a risk is responsible for managing it. That also applies to digitalisation work. Each company must accept ownership and management of the risk associated with the implementation of new systems and technological solutions. They must monitor and understand the risk and ensure that uncertainties are dealt with.

In this context, we observe that companies set clear goals for cost-reduction, but there is often a lack of specific HSE goals related to project deliverables. This is of concern, because without clear HSE goals the companies might lose the opportunity to identify, mitigate and continuously improve HSE as part of the digitalisation projects. Even though the projects often have clear risk reduction potential, there is lack of clear HSE goals. Risk reduction assumes that goals are revisited throughout the different phases of the projects to find possible risk reducing solutions.

Development and implementation of digital solutions must contribute to improving the working environment and safety. Regulatory requirements demand that the players set specific goals for how new technology and solutions will help to increase safety.

Risk management processes for developing and implementing new technology and digital solutions in the companies will continue to be followed up by the PSA. The companies have an independent responsibility for ensuring that processes related to qualifying and adopting such innovations are prudent and that associated uncertainty is evaluated and dealt with. Extensive user acceptance testing and development of suitable technical documentation and training materials is essential prior to implementation. Parallel testing might be appropriate for safety systems.

### **Securing workforce involvement and training**

Involving and training employees are crucial for promoting expertise, gaining workforce acceptance and risk understanding. Introducing new technology and digital solutions will often lead to changes in work assignments and processes. The division of responsibility, distribution of tasks between humans and machines, organisational structures, forms of collaboration and business models may be affected. These changes may also have consequences for the employee expertise and competence.

Digital expertise is important not only for developing, understanding and dealing with technology, but also for protecting the systems sufficiently against undesirable incidents. Companies must provide training to users to ensure adequate understanding and appropriate levels of trust. Digitalisation initiatives should be introduced with training to allow personnel to develop accurate mental models of how it works, an understanding of its limitations and reliability in different situations, and information on how to detect and recover from abnormal events, failures, hazards and accident situations.

Involvement of employees – both end users and the safety delegate responsible – is crucial for promoting expertise and risk understanding. As such, the PSA observes that many new systems are developed and implemented over a short time frame. If the risk associated with these changes is not prudently managed, the result could be increased uncertainty, a lack of trust in the technology and a reduced understanding of the new position.

Experience acquired by the PSA through investigations, studies of causes of major incidents and audits shows that the underlying causes of undesirable incidents may reflect inadequate understanding of the technology and/or operating the system inaccurately and with insufficient understanding of human factors and important performance influencing factors.

The PSA expects the companies to ensure that employees have the necessary expertise tailored to changed assignments and new technology, that sufficient time is allocated for training, and that such learning is provided at the right time.

### **Conclusion**

Our regulatory requirements are designed to promote technological development. However, all changes must be managed, and risk assessed in a systematic and sound manner. The regulations require that the industry's commitment to digitalisation must help improve safety and security.

Going forward, the PSA will continue to initiate studies on topics related to digitalisation and follow up the industry as they develop and implement new technology and new ways of working. Topics such as human factors and its role in automated processes, digital worker and the use of drones (autonomous aerial and underwater vehicles) will be of particular interest.

Knowledge and technology development are fundamental prerequisites for the continuous improvement of work in the petroleum industry, emphasizing the potential for new technology to contribute to increased efficiency and safety. In this context, companies are responsible for ensuring soundness in processes relating to qualification and implementation of new technology so that the associated uncertainty is evaluated and mitigated.

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