DIGITALISATION

HSE in a digital world

IBM's *Dariusz Piotrowski*, *Ole Evensen* and *Scott Kimbelton* explain how oil and gas companies should start their transformational digital journey in a bid to leverage all their data for a safer workplace.*

According to the International Labor Organization, the global number of non-fatal occupational accidents and illnesses has reached a staggering 374 million annually, across all industries. Even more concerning, 2.78 million die each year from occupational accidents or work related diseases (see **bit.ly/2B2Vj4v**). Work accidents remain a huge challenge despite stringent safety regulations and procedures in the oil and gas industry, due to the unique work environment and extreme conditions both in upstream exploration and production, and in downstream operations.

We continuously hear about the challenge to find information about past incidents and learn what controls and mitigating actions lead to significant process improvement. Information from incidents is often aggregated to show trends and, due to manual processes, important details get lost. A wealth of information about incidents, how they occurred, root causes and lessons learned remain buried in hard-to-access repositories.

The challenge isn't limited to historical analysis. It includes prioritisation and understanding cumulative risk *before* work is performed, as noted in the *Maintaining safe operations* summary report from the North Sea Offshore Authorities Forum (NSOAF) see **bit.ly/2NMIi3Q**). Safety professionals believe that being able to quickly search the source documents for similar themes, work activities or injury types would lead to a better understanding of contributing factors. This additional information and context support more targeted prevention strategies and better use of health, safety and environment (HSE) resources.

The safety community recognises the value of learning from all incidents and from good safety practices implemented by others. Safety professionals have their eye on technologies to identify hazardous conditions as they occur and warn employees or response-rescue teams in real time. Even more valuable would be the ability to predict circumstances where the risk level is changing, allowing for preventative rather than reactive responses.

New analytic tools and digitisation of work processes can make a major contribution to reducing HSE risks.

Technology targeting HSE

HSE practices, standards, policies and overall effectiveness are being enhanced by technology advances in collecting and analysing safety information. Companies can collect vast amounts of data, recognise unsafe operational patterns and find critical information in millions of documents – improving their safety systems exponentially. Companies are evolving from reactive to predictive and conditions-based safety systems, in a similar way to progress that was made from reactive to predictive maintenance a few years ago. The technology-enabled ease of finding and applying safety insights can drive systemic improvement of safety at all stages, from design and build to ongoing operation of facilities and business operations.

The Norwegian Petroleum Safety Authority recently published a report summarising the impacts of digitalisation on health and safety in the petroleum industry. Two issues in particular should be noted:

- *Stakeholder involvement* – When exploring the potential of safety improvements across your organisation, be sure to involve employees, especially those directly affected. There is *no* proxy or replacement for the actual user when it comes to the functionality that will drive value.
- *Transparent analytics* – It is important to expose the logic and rationale of the analysis to gain trust and confidence in system-generated recommendations, especially with systems leveraging artificial intelligence (AI). Allowing end-users to see the evidence and validate results of AI analytics often builds this trust.

The digitalisation journey

A digital journey should have a natural starting point and allow for evolution in line with an organisation's priorities and its capacity for change. For example:

Better use of company information – While there are numerous sources of data to help understand events, causes and consequences, the natural starting point can be HSE systems containing observations, notifications, incidents, and internal and external investigations.

AI systems can be trained to read and understand natural language within the HSE domain, allowing safety professionals to explore vast volumes of historical data in ways currently not possible. Better understanding of the underlying concepts present in events allow organisations to test hypotheses and discover relationships previously not visible. The AI system will convert unstructured data, such as reports, into structured information that can be analysed.

Greater situational awareness – Mastering an organisation's history will allow people to monitor new safety data continuously, such as observations, as live indicators. Observations gathered in HSE systems should be no different than the real-time analysis of equipment data.

Organisations with good practices, culture and technology to capture safety data without delay will be able to maintain a continuously updated picture of trends and operational risk. Analysing the combined historical and continuously registered data in HSE systems can highlight the operational risk and process integrity picture. Operators can see the detailed cumulative risk picture, spanning multiple activities and different locations, in a similar fashion to 'simultaneous operations' (SIMOPS).

Connected workers – Helmets or vests with wearable sensors can provide greater situational awareness for monitoring workers' conditions, with alerts if workers enter dangerous zones. Employees' vital signs can indicate risk to health. Reaction time is critical and can prevent an injury or expedite the dispatch of rescue teams.

Better prediction of incidents – Critical equipment is commonly monitored today. Historically recorded data is analysed to identify patterns in data prior to failure. Once validated as a signature prior to failure, it is used to notify operations centres about increased risks and the need for action.

Similarly, safety data that is captured can be used to identify key indicators of increased risk.

Photo: Stock image

Information from these 'observations' is broken down into variables that AI systems can utilise. And a pattern of risks can emerge regarding critical activities, weather conditions, and the like.

In a recent pilot with a Norwegian EPC contractor, human observations were transformed into more than 5,000 such variables. When tested on a 'blind data set' (one the system hadn't seen before), it provided accurate risk predictions.

The examples outlined above show how incremental insight can reduce project risk, and allows an organisation to harvest benefits from each step of digital maturation.

Technology-fuelled transformation

The digital HSE journey requires a mix of interconnected technologies. Four key technologies help companies and individuals tap into the corporate memory, to discover new significant indicators, and connect workers.

Natural language processing – Until recently, systems couldn't handle written or spoken language because they didn't have the ability to understand and interpret natural language. As humans, we have no problem with the question 'How many near misses or injuries did we have last quarter involving hands?' We may even know the context of the facility where we work. Natural language processing allows a system to understand concepts and context the way humans do and at incredible speeds.

The AI system could review decades of incident reports and identify causes and mitigation recommendations described in them. Analysis of detailed information buried in thousands of documents can provide a wealth of insight to safety professionals. Woodside, an Australian oil and gas operator, is applying IBM's AI system to HSE and sees a future working collaboratively with other operators, to share data that will enable the industry to achieve higher quality insights regarding health and safety and improve performance for all.

Machine learning – High risk activities could be identified across current operations. Indeed, key indicators or predictors of risk could be as simple as checking the weather. However, there is often need to correlate multiple factors in order to understand patterns which determine if increased risk is present.

Predictive models leverage machine learning techniques to help identify future risk based on historical events and current factors. Machine learning models can be built by providing the system with multiple examples of an event, so it can identify future events. Predictive models are not general purpose but target a specific event type or context (eg predictive models for offshore risks may be different from onshore).

Connected workers – Understanding historical patterns and key indicators prepare teams to work more safely, eg when working at height, using new equipment or under severe environmental conditions.

This is where connected devices or the Internet of Things (IoT) come into play. IoT enables any object with embedded technology (eg sensors in hats, gloves, shoes) to communicate and interact over the internet, and be remotely monitored and controlled. Workers outfitted with sensors can be continuously monitored for signs of fatigue, over-exertion, falls or proximity to moving equipment.

Cloud – Surfacing data-driven insights can be difficult if the data history is limited or sparse, or the pool of workers covered is relatively small. The challenge of limited data in HSE is driving many businesses to seek platforms that facilitate sharing data on safety, injury audits etc, lessons learned and best practice, among multiple companies, with appropriate privacy and security.

The move from on-premise to cloud-based systems significantly improves the opportunity to share information across organisations. Cloud-based architectures support increased collaboration and insight through ease of access, modular 'microservice' functionality and the ability to scale fast. Of course, protecting sensitive and confidential information is of paramount importance. However, cyber-security advances are making cloud sharing as, and possibly more, secure than traditional on-premise systems. ●

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