Introduction
The recent downturn saw exploration activities decline steeply, dramatically reducing the volumes of oil and gas discovered (Rystad Energy UCube, December 2018). The year 2019 began with encouraging results for global conventional exploration (Singh, J. 2019) and showed that exploration in 2019 was more targeted and value-driven than ever. To strengthen their portfolios, exploration teams are competing to convince their management with solid business cases. As a result, one common trend still observed is the persistence of over-estimating the commercial chance of success and pre-drill total resource expected (Fig.1).

![Figure 1](image)

**Figure 1** Discoveries made from high-impact wells between 2013 and 2018 in the UK and Norway. *Source:* Westwood Atlas & Wildcat.

In fact, this over-estimation is not limited to a downturn period. A study in 2000 (Fosvold et al., 2000) also showed that the hydrocarbon industry, operating on the Norwegian Continental Shelf, had consistently over-estimated hydrocarbon volumes. This over-estimation was explained by Brown et al. (2000) as an over-estimation of bulk rock volume. To address the problem, new prospects guidelines were introduced, and these helped explorers provide management with more accurate estimates of future discovery volumes.

In this paper, we would like to discuss the main pain points operators are facing today and how digital solutions can help explorers minimize the gap between pre- and post-drill resource estimations. Better exploration planning requires easy access to all meaningful data and knowledge, associated with a consistent approach applied to every prospect. New digital experiences bring automation, improving explorers’ agility and adaptability to technical and market changes. Digital experience also means new ways of working, communicating, and collaborating—bridging the gap between technical and decision-making teams. As a result, sanction teams can rely on a standardized portfolio prioritisation process and have an objective and evergreen data driven view of their global exploration portfolio. We believe this will reduce human bias and drastically reduce internal competition amongst exploration teams, overall helping them be more accurate with future pre-drill resource estimations.

**Exploration Pain Points**

Working with different operators to map out their workflows, exploration processes and personnel profiles have provided valuable insight into how these operators are working and collaborating today. The main pain points in the typical exploration workflow can be grouped into three different categories:

1. **Data and knowledge management challenges**—Explorers mentioned that data is a challenge. Very often, too much information is hard to manage, and interpretation and associated knowledge is lost over time.
2. **Collaboration and communication issues**—Exploration involves many disciplines, from geoscientists to economists and the management teams who decide on the best prospects to drill based on the information provided. Everyone has different views of the same project and the right information is not easily shared.

3. **Broken links between the technical workflows and decisions**—A clear pain point emerged regarding the breakdown and lost time between multiple technical applications and final decision reporting tools. As observed frequently, final numbers presented in spreadsheets are totally disconnected from technical workflows and the associated underlying data, which makes it difficult to track and challenge when it comes to making the final decision in the board room.

**Key Benefits of New Digital Exploration Planning Experiences**

The following paragraphs explain the key benefits of digital solutions in solving the pain points above, and how this adds value to a portfolio prioritization process.

1. **Access meaningful data and capture knowledge**—Data access and management is a challenge. Digital technologies, associated with an underlying secure cloud data ecosystem, enable users to see all available data (structured and unstructured data) in the context of a map or project, while geolocation helps users select a meaningful set of data for the task at hand (Fig. 2).

![Figure 2 Structured (left) and unstructured data (right) search to select meaningful sets of data, interpretation, and knowledge. Data source: Geoscience Australia.](image)

The downturn resulted in a reduction in headcount of many operators—through redundancies and the retirement of experienced staff—leading to a loss of technical skills and damage to the industry’s ability to attract new talent. Operators are turning to digital technologies to ensure that data and knowledge is not lost when staff change projects or leave a company. An example of this is the management of unstructured data, such as images, reports, and paper well logs, which can now easily be found and consumed. The knowledge boards enable users to capture their knowledge and experience in a way that is easy to share and to find again (Fig. 3).

![Figure 3 Results and knowledge are properly captured and fully auditable, including unstructured data. Data source: Geoscience Australia.](image)
2. **New way of working—Automation, collaboration and communication**—It is clear that operators are turning to digital technologies to better manage their global exploration portfolios. It is now possible to have a spatial view of the entire portfolio with stage gates, key prospect attributes, KPIs, and personnel, tasks, and deliverables (Fig. 4). As a result, this leads to increasing teamwork, accountability, and overall increased performance.

![Figure 4](image)

*Figure 4 Global exploration funnel with stage gate. Data source: Geoscience Australia.*

A key fundamental change brought by digital technologies is the ability to react quickly to key market changes such as country risks, oil prices, mergers and acquisition opportunities, or changes to corporate strategy. Digital is linking all of the applications needed in exploration, from seismic visualization and basin analysis to economics, while having access to all relevant data through an underlying secure open cloud data ecosystem. Therefore, any changes that result from a new data acquisition, a new interpretation, or a new strategy can be quickly consumed and applied to the portfolio prioritization (Fig. 5). This is a key benefit because the global portfolio is instantly updated with the latest information available.

![Figure 5](image)

*Figure 5 (Left) Volumes and associated risks for each basin, play, or prospect. (Right) Automated ranking of volumes and risks for the full worldwide exploration portfolio. Data source: Geoscience Australia*

3. **Tighter links between the technical workflows and decision**—A key requirement from explorers is to keep a tight link between geoscience project teams and the final decision and sanction team, as we often see a disconnection between those. They also want to be able to challenge, audit, and go back quickly to the original data and interpretation, if needed, before making the final decision. The cloud integration of data and technical applications further integrated with a new workflow orchestration experience creates an evergreen connection that enables more informed decision making (Fig. 6).
Conclusions

Digital technologies and innovations are disrupting our industry by bringing new, cloud-native solutions to enable better planning and execution of exploration workflows. Being able to standardize a portfolio prioritization process globally, and instantly rank and update with key data or market changes, is key to increase planning efficiency and transparency. The examples provided in this paper show that those new digital solutions break down silos and enable closer collaboration between technical teams and decision makers.

The standardization of the portfolio prioritization process is expected to play a key role in dramatically reducing early and costly exploration spend by focusing on the opportunities that matter. In addition, this standardization associated with new ways of working is expected to minimize human bias and reduce competition amongst exploration teams. This should have a clear impact on reducing the gap between pre- and post-drill resource estimations.

Finally, capturing and sharing experience and knowledge is key for a sustainable future, and we hope that these new solutions, powered by the cloud, will help in attracting and retaining key talents to the oil and gas industry.

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