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How Decision Quality Powered by AI is Dramatically Improving Project Value in Capital-Intensive Industries

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In capital-intensive industries like oil and gas, pharma, and others, multi-million and even billion-dollar high-stakes decisions are made on a regular basis. In making these business-critical, high-stakes decisions, success depends on an effective decision-making process and high-quality choices.

Large capital projects in resource-intensive industries, such as energy and mining, typically include a Concept Select stage, as shown in Figure 1. Sound decisions made early in this phase of the project lifecycle contribute to significantly more value generation than good project execution later. The impact of missing out on a potentially higher-value concept can't be offset by efficient execution of the next-best alternative.

Improving the quality of Concept Selection decisions is the key to maximizing the value of projects. One way to achieve this goal is to improve the efficiency of the existing stage gate decision-making framework by supplementing it with technology.

Weaknesses in traditional decision-making processes

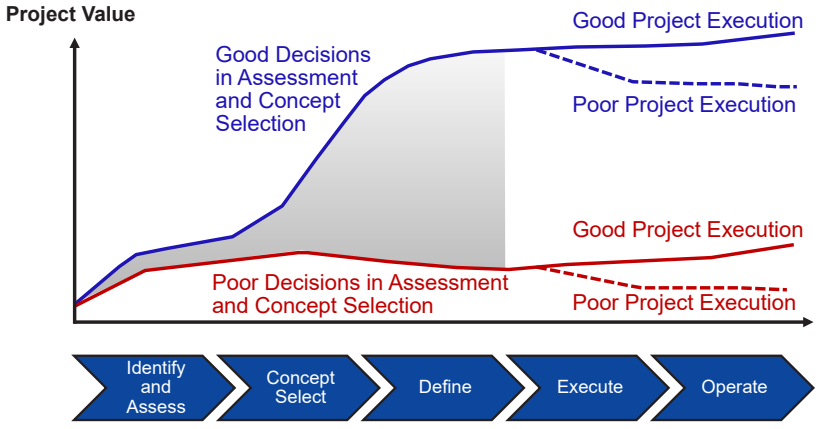
It's critical that project teams are confident in their decision processes and in their ultimate decisions. That's because once a choice is made on a large capital project, it becomes difficult and costly to revoke the commitment to a specific course of action.

Many organizations address this challenge by applying the classic stage gate framework. But the decision process in the Concept Stage can be cumbersome and contains numerous potential pitfalls such as:

- ***The process is lengthy.*** Multiple disciplines like capital, production, technology, and commercial must collaborate to create customized evaluation models and define development alternatives. This work can often take many months.
- ***Data gathering is time consuming.*** Collating the latest cost data is complex and resource intensive.
- ***Assumptions can change.*** Changing assumptions can have a profound effect on project outcomes.
- ***A limited number of options is considered.*** Due to resource constraints, most teams can only evaluate five to seven possible alternatives.
- ***Human decisions can be biased.*** Without meaning to have biases, process participants may experience motivational bias, favoring certain concepts over others and seeking to influence the outcome of project decisions. Process participants may also experience cognitive bias, since each participant's views are formed by their unique experiences and training.

There is little question that generating high-quality project alternatives is costly and takes time. It is also heavily dependent on the knowledge of the team. As a result, credible, value-adding alternatives can easily be missed.

Figure 1: Project Value Creation and the Stage Gate Process



The potential value lost by missing a great, high-value concept cannot be recovered through better project execution. Decisions made in the concept selection phase are critical to overall project value.

Source: Walkup, G.W. Jr and Ligon, J.W.: "The Good, the Bad, and the Ugly of the Stage-Gate Project Management Process in the Oil and Gas Industry," SPE Annual Technical Conference and Exhibition, 2006

Although the traditional stage gate process is the industry standard, it can be improved upon to generate better and more efficient results, especially when decisions are repeated.

Repeated, high-stakes decisions can be optimized with digital technology

Integrating digital and AI-based technologies with good decision-making processes can improve how organizations make similar and repeated large capital investment decisions.

Imagine that you had a virtual advisor that you could ask for recommendations about an important decision. This person has all the information you need and can generate all of the possible decision options. Next, imagine that you could plot these options along cost and value axes to measure "bang for the buck" and then double click on any individual concept to see the underlying details.

This scenario is now a reality, thanks to technology that develops logic for choices and uses an AI engine to draw from the most important information. While a human will ultimately make the final decision about which path to select, the use of technology creates a logic that helps team members make better and less biased choices.

High-quality decision making in action: A case study from the oil & gas industry

Background

Professionals in the oil and gas industry are faced with high-stakes decisions on a regular basis, and the nature of these decisions is often similar.

Even under the International Energy Agency's "Net Zero by 2050" scenario, which would minimize the use of fossil fuels, oil and gas companies are still projected to spend more than $500 billion annually on traditional hydrocarbon resource development over the next decade. Deepwater developments will comprise a large fraction of that total investment.

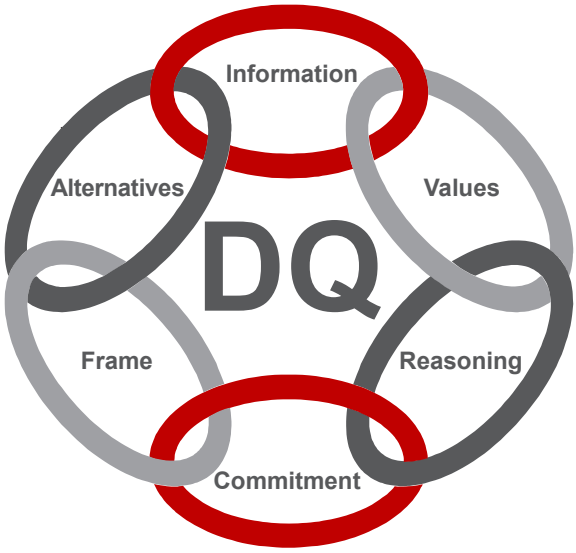
Making the right choices about where and how to invest in deepwater development projects is critically important for the bottom line, yet the decision process is subject to bias and may miss out on the best option. Typically, it takes eight to nine months for an oil and gas company to create only three to five development concepts.

Solution

SDG recently worked with ExxonMobil to enhance its deepwater decision-making process. The company sought to build a decision support system that spanned from exploration all the way through to operation. As part of that initiative, ExxonMobil wanted a technology-based solution to guide them through the entire project lifecycle.

During the Concept Select stage, SDG took its decision quality framework (Figure 2) and integrated an AI-based database and software from Deep Seed Solutions called Field Layout Concept Optimizer (FLOCO) to build an adaptive workflow for ExxonMobil.[1]

Figure 2: SDG's Decision Quality Framework



[1] This work is based on a collaboration between ExxonMobil's iDASH (Intelligent Deepwater Advanced Solutions Hub) team, Deep Seed Solutions, and Strategic Decisions Group. The work was published at the 2022 Society of Petroleum Engineers (SPE) Annual Technical Conference and Exhibition (ATCE) and is available online for a fee to SPE members and non-members.

An algorithm in FLOCO rapidly generates hundreds of feasible and optimized deepwater development alternatives and evaluates them with the latest market and cost data that is continually updated from public sources.

Imagine using a huge choice space listing all the possible decisions and options available for each decision. Some choices are ***strategic*** such as the FPSO (floating production storage and offloading) location, while others are ***operational***, such as what size pipeline to use.

FLOCO picks from all the possible and feasible paths, while discarding nonsensical ones using built-in logic. The evaluation engine then evaluates concepts to determine the "bang for the buck"—that is, the project value given the required capital expenditure.

Benefits and Results

Since FLOCO contains the most current market data, the team's data-gathering time and effort are minimal. Technology enhances the efficiency of the process. Teams can be confident that all the alternatives have been considered and that the most valuable design concept has been identified. They can evaluate hundreds of options, not just the limited handful of concepts they could generate on their own. Efficiently generating more design concepts increases the likelihood that the entire range of alternatives has been considered. This creates confidence that the best choice has not been missed and guides future work for the team by eliminating inferior choices.

The digital technology-driven process improves decision quality and disrupts the traditional stage gate approach. Using SDG's process and Deep Seed Solution's software, the ExxonMobil team evaluated a hypothetical project, generating ***120 development concepts in just one week***, based on different inputs for five variables. They also identified the likely NPV and capital expenditure for each configuration based on low and high production projections. This was a source of uncertainty since the team couldn't know prior to developing a field whether it would be a high- or low-producing property.

Strategies that perform well in both a high-production and low-product environment are the ultimate goal for energy companies. Although they can be hard to uncover, these strategies are extremely valuable once found. Using SDG's approach, ExxonMobil identified concept alternatives that are consistently high value in both low- and high-reservoir productivity conditions. ExxonMobil has now integrated this process and technology into its development planning process.

Conclusion

Disrupting the traditional stage gate process has enhanced decision quality in the oil and gas industry, and it also holds promise for other industries involved in repeated, high-stakes decisions. This approach could be extended to other capital-intensive industries where similar high-value decisions are made regularly. Potential targets include fabrication facility investment decisions for semiconductor plants, as well as asset decisions in the pharma sector, such as dosage, targets, and clinical trials for a compound.

The ExxonMobil case study highlights how SDG leverages digital technology to improve business decision making. By combining AI technology with SDG's proven framework for decision quality, SDG is reinventing how organizations can apply the stage gate process to any large capital investment and generate tremendous value in environments where repeated decisions are made.

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Sang-Won Kim leads the global energy practice of Strategic Decisions Group. With Yifei Zeng et al., he is a co-author of "Finding the Right Concept Via a Decision Quality Framework with Rapid Generation of Multiple Deepwater Conceptual Alternatives," presented at the 2022 Society of Petroleum Engineers Annual Technical Conference and Exhibition, on which this article is based.