

Oil & Gas Practice

How the oil and gas industry can improve capital-project performance

Management practices and digital technologies used by other industries can help oil and gas companies boost capital-project productivity.

by Alastair Hamilton, Jan Koeleman, and Koen Vermeltfoort



With the price of oil recovering, many oil and gas (O&G) companies worldwide are launching new capital projects in pursuit of growth. But because many projects now are competing with renewables, success will require keeping costs down and maintaining timetables better than in the past. According to a 2017 McKinsey Global Institute report,¹ the increase in productivity in the O&G construction sector lags behind that of sectors like manufacturing and retail.

O&G companies can use management practices and digital technologies deployed by other industries to boost capital-project productivity. Project Production Management (PPM), digitizing processes, advanced analytics, and agile ways of working can all yield significant improvements.

But simply copying such practices won't be sufficient because O&G projects are unusual in some important respects. In particular, no O&G project is the same as the one that preceded it, and lead times are extremely long. Moreover, team personnel often change with the project. Consequently, each new project brings a new set of challenges and a new learning curve, thus limiting the potential for boosting performance.

If O&G companies can adapt these practices to meet the needs of their unique environment, considerable improvement is possible: by our estimate, reducing development time alone has the potential to deliver 15 to 30 percent in cost savings.

As more typical installations and technologies become more commoditized, O&G players that don't revamp their approach to capital projects now may be forced into ever more technically specialized—and often costlier—projects. The potential benefits could be worth billions.

Four ways to improve project delivery

O&G companies can draw on a wide variety of management practices and technologies to improve

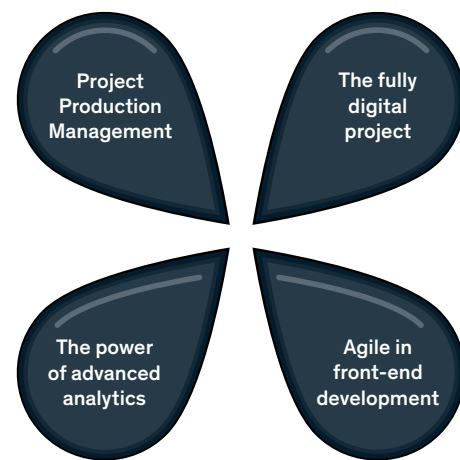
capital-project performance. In our view, four are especially promising: PPM, automation and digital technologies, advanced analytics, and agile ways of working (Exhibit 1). While each of the four is especially applicable to one particular phase of development or construction, they are all useful for other phases as well.

Embrace Project Production Management as the third era of project delivery

The current O&G approach to project management focuses on the critical path and increasingly detailed planning. Companies would benefit from adopting PPM,² which views a project as a collection of discrete production systems, each with its own set of processes. Managing each system separately thus makes it easier to optimize performance. PPM gives project managers control over the overall project-production process, that is, the ability to adjust capacity, inventory, and response

Exhibit 1

There are four main building blocks for reshaping the oil and gas industry.



Source: McKinsey analysis

¹Reinventing construction: A route to higher productivity," *McKinsey Global Institute*, February 2017, mckinsey.com.

²Ramachandra Shenoy and Todd Zabelle, "New era of project delivery: Project as production system," *Journal of Project Production Management*, November 2016, Volume 1, pp. 13–24.

time to mitigate unforeseen changes in supply or demand. Hess, for example, used PPM to eliminate performance variability and so was able to reduce its US onshore drilling and construction costs by 58 percent between 2011 and 2016.³

During on-site construction, O&G companies need to focus on flow efficiency, which aims to minimize work in process while maximizing throughput. Operations research practices, used by companies in manufacturing industries since the 1970s, are particularly helpful in this regard. Perhaps the best example is lean manufacturing. Intended to minimize waste while fostering continuous improvement, lean can reduce costs and accelerate timetables considerably.

Imagine the fully digital project

Digital has the potential to greatly improve a wide range of processes used in O&G capital projects. Used in conjunction with automated engineering processes, five-dimensional building-information modeling (5-D BIM) will likely eliminate the manual execution of many repetitive tasks, reduce the effort required for contract management, and make it possible to automate some quality-control functions.

Procurement processes also can benefit from the application of technologies. Automating and digitizing purchase-ordering processes and communications with suppliers can greatly reduce the amount of manual work required, accelerating the supply chain while giving it a whole new level of transparency. Cloud-based should-cost modeling, which evolves from project to project, is not used much in O&G projects; nor are e-auction and electronic-request tools. Yet these technologies are mature and could be implemented quickly.

Digital technologies can make construction projects more productive as well. Digital twins, real-time digital replicas of physical assets created by laser scanning of a construction site, make it possible to do site inspections and track progress in real time from the office. With the use

of radio-frequency identification and Bluetooth tagging, parts can be automatically tracked from manufacturer to installation site, improving schedule predictability. Used in combination, 5-D BIM and digital twins will likely soon become the new norm for designing and monitoring civil construction projects.

The digitization of permits, handovers, goods receipts, and as-built drawings has yet to become the norm for O&G companies, though it would eliminate copious amounts of paper used on most sites today.

Exploit the power of advanced analytics

Data offer a wealth of useful information for O&G capital-project teams. Project data can be used to determine what drives better performance, while inspection reports can be used to improve project quality. Data produced by tag-and-track technologies can help improve supplier performance monitoring, predictive site scheduling, and workforce management.

But O&G project teams rarely make full use of the project data available to them. That's largely because such data exist in thousands of electronic spreadsheets or even on paper, with no central repository. And since O&G project reporting is done in different formats, styles, and systems, the way data are captured is not standardized. As a result, any data generated from a project are in effect lost once it has come to an end.

To get the most from project data, therefore, O&G companies will need to standardize how it is captured and stored as well as dedicate analysts to overseeing the effort. It's a good idea to create what we call the "cloud control tower," a central database that consolidates real-time performance data from projects across the company. Accessible to all employees, the cloud control tower enables project teams to anticipate and mitigate issues related to cost, schedule, and quality. We are now seeing building and construction companies where

³ "Radical improvement in project delivery: A call to action," Hess, November 30th, 2016.

executives are able to track live progress on-site by simply logging in from their office.

Safety issues are a good place for organizations to start. A transportation company, for example, analyzed existing health-and-safety-environment data from human resources and shift records, in combination with incident reports, to identify high-risk situations. The firm used these insights to prevent such hazardous situations from recurring.

Adopt agile in the front end of projects

Introduced to the management lexicon by the software industry, agile management practices have been in wide use for nearly 20 years. But O&G companies began consciously deploying them in the concept phase only recently.

Agile relies on small, exceptionally well-coordinated cross-functional teams, rapid learning, fast technology-enabled decision cycles, and a common sense of purpose to get to key decision points faster than other approaches.⁴ It thereby allows a company to respond quickly to changes in the competitive environment.

Adopted for the O&G context, agile involves organizing in small teams. These teams all report to a product owner who has a vision for the project, understands how quickly it can be completed, and knows what's needed to achieve that timetable. The owner develops a road map outlining all the decisions required for each particular stage and the minimum amount of information needed to make those decisions. The teams then work for two to three weeks at a time in parallel sprints, with each team executing its own set of tasks. To facilitate the rapid, coordinated nature of agile working, decision makers are available whenever the teams need them.

Agile allows teams to lock down decisions as they go, which means less work later. While the conventional stage-gate process remains a helpful framework for managing project finances and stakeholders, its role in technical and nontechnical

decision making will need to be adapted to align with agile working practices.

Early experiments with agile approaches demonstrate that they can cut months or even years off of projects compared to conventional ways of working. Shorter project cycle times translate into higher net present value for owners.

Imagining the project of the future

O&G companies that incorporate production-management approaches, automation and digital technologies, advanced analytics, and agile ways of working will be able to run what we call the "Project of the Future." This represents a production operation rather than a sequence of stage gates (Exhibit 2).

Development

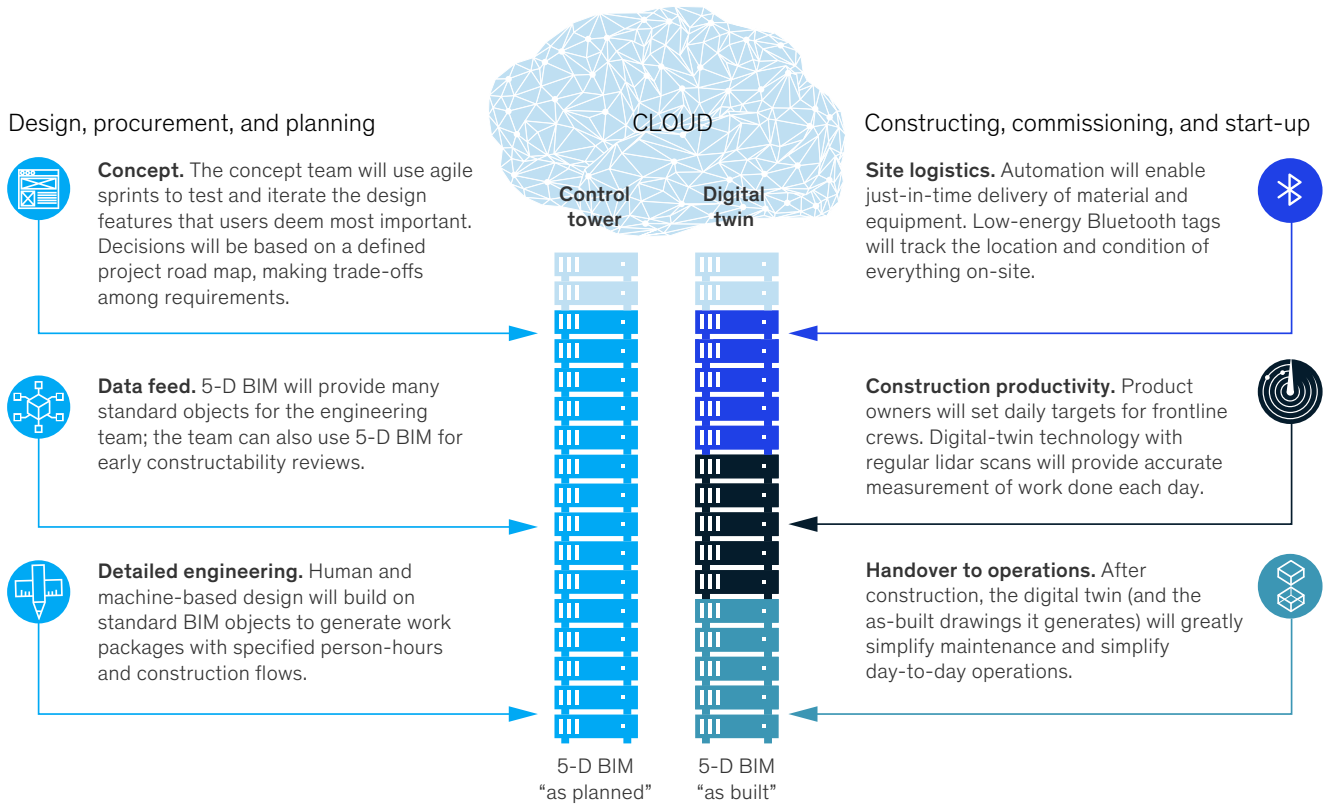
- **Concept.** In the concept stage, the project team will use agile sprints to test and iterate the design features that end users deem most important. The team will make decisions on the basis of a defined project road map, making trade-offs between functional requirements.
- **Data feed.** 5-D BIM, the backbone of the entire development process, will provide a large assortment of standard BIM objects for the engineering team to choose from during the front-end phase of design. The team will also use 5-D BIM to conduct early constructability reviews.
- **Detailed engineering.** A mixture of human and machine-based design, detailed engineering will build off of industry-standard BIM objects. It will generate standard work packages that stipulate a fixed number of person-hours and an agreed flow of construction activities.

Construction and postconstruction

- **Site logistics.** The automation of processes will enable just-in-time delivery of material and equipment. Low-energy Bluetooth tags will

⁴ Wouter Aghina, Aaron De Smet, Gerald Lackey, Michael Lurie, and Monica Murarka, "The five trademarks of agile organizations," January 2018, McKinsey.com; "How to create an agile organization," October 2017, McKinsey.com.

5-D building-information modeling (BIM) will be the backbone of the project of the future.



Source: McKinsey analysis

make it easy to track the location and condition of everything on-site.

- **Construction productivity.** Product owners will deploy production controls to set daily targets for frontline crews, and takt control meetings (takt being the available production time per unit demanded) to increase production reliability. Lidars (laser scanners), used in conjunction with digital-twin technology, will provide a fact-based review of the work done on any given day.
- **Handover to operations.** After construction is completed, the project manager will hand over a digital twin of the site to the operations team. In addition to automatically generating as-built

drawings, the digital twin will greatly simplify maintenance planning and reduce the number of people required on the operations team.

Capturing the opportunities

The time is right for O&G companies to rethink the way they carry out capital projects. Opportunities to improve productivity exist all along the development and construction cycle. Companies that seize them can complete construction projects faster, reduce costs, and improve schedule predictability.

This will be a long journey. Product owners will need to lead the way: As the ultimate integrators of most projects, they are in a position to mandate

standards, technologies, and working practices.

As a critical first step, owners need to articulate a vision of what these new practices mean for the organization as it builds the Project of the Future. That vision then needs to be translated into a set of actions that will allow the project to deploy new solutions.

To realize the benefits that these new practices afford, O&G companies will need to rewrite their rule books regarding policies, project management, engineering practices, IT, and supply-chain engagement. They will need to be willing to try out new technologies. And they will need to instill

collaborative practices not only among product owners but also between internal engineering, procurement, and construction teams and external suppliers. Although deep collaborations based on trust are currently rare in the O&G industry, they will be critical in the future.

Since capital-project management aims to improve every single project, cultural change will be necessary as well. Specifically, when it comes to trying out innovative approaches, the attitude of “not on my project” needs to become a thing of the past. To realize lasting improvements, an open mind is essential.

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