

Making Mature Fields Smarter

This paper summarizes findings of the SPE Making our Mature Fields Smarter Forum, September 2005. Participants in the Forum granted permission to present this paper on the basis that the authors represent the views of neither SPE nor of the participants' companies. We are delivering smarter fields to add value to our business. But companies do not have a common vision of what a truly smart field will look like, which contributes to the difficulty of assigning a value to "smartness." Collaboration and visualization technologies are enablers required to integrate across the core business processes and permit people working with these processes to assimilate the huge and diverse volumes of data and information.

Introduction

During the past decade, the smart-field concept has developed sufficiently that several operators, notably BP, Chevron, Norsk Hydro, Saudi Aramco, Shell, and Statoil, have flagship fields where many, but probably not all, of the smart-field technologies have been deployed. The development and deployment of these technologies normally has been in partnership between a major operator and one or more key suppliers.

This article, written by Technology Editor Dennis Denney, contains highlights of paper SPE 100024, "Making Our Mature Fields Smarter—An Industrywide Position Paper From the 2005 SPE Forum," by R. Murray, SPE, BP plc; C. Edwards, SPE, Shell; K. Gibbons, SPE, Helix-RDS; S. Jakeman, SPE, Shell; G. de Jonge, SPE, Chevron; S. Kimminau, SPE, Schlumberger; L. Ormerod, SPE, Weatherford; C. Roy, SPE, Total; and G. Vachon, SPE, Baker Hughes, prepared for the 2006 SPE Intelligent Energy Conference and Exhibition, Amsterdam, 11–13 April.

Major operators have specific terminology for smart fields as listed below. In this paper, the term "smart field" is used to mean any of the following terminology.

Operator	Terminology
BP	"Field of the Future"
Chevron	"i-field"
Shell	"Smart Fields"

During the past decade, there has been an increasing appreciation within the industry that much of the future lies with the effective management of existing production and the continued development of mature fields. What may not be so clear is how to apply smart technologies to mature fields that have legacy infrastructure and a long production history. Participants felt that maturity in itself makes a challenge for deployment and enforces the need for effective change management.

The full-length paper summarizes the findings from this forum. Fifty people attended the forum. Representation included six operators, several major suppliers, eight specialist suppliers, and three consultancies.

Vision and Value

Despite development and deployment of smart technologies, companies do not have a common vision of a truly smart field or of the value that can be assigned to the deployment of smart technologies. The industry has been slow to take up many of the smart-field technologies. Standardization of the basics and more sharing of experiences could help break a perception that smart fields are complex, expensive, and unreliable.

The vision of success appears to vary between two extremes as follows.

- Over the next decade, the way in which we understand our reservoir;

identify development options; and manage and optimize our wells, facilities, and associated production will all change radically. The result is change-management programs for each field and a substantial effect on the people working on these fields.

- Alternatively, the most successful companies during the forthcoming decade will be those that are most efficient at delivering the current activity set at the lowest cost.

Regardless of which scenario an individual or a company believes to be most accurate, the direction for deployment of smart-field technologies will be to deliver the easiest projects first. Ultimately, these deployments may well not be the highest-value projects because there is a tendency to focus on metrics that are perceived as easier to measure, such as production efficiency and uptime. One of the key decisions for an operator of a field on which it is deploying smart technologies is the point at which to move from a series of incremental steps to a major step change, as occasionally happens when a field is redeveloped.

The forum identified the following additional components of value.

- Solving challenges associated with demographics of the industry and associated knowledge-retention issues.

- Engaging the next generation of industry staff, whose childhood has been in the digital age.

- Ensuring workforce safety as more roles move to centers remote from the wells and process facilities and travel exposure is reduced.

- Breaking down barriers between disciplines.

- Making more effective use of very limited technical expertise.

- Improving quality of life for the operational staff.

For a limited time, the full-length paper is available free to SPE members at www.spe.org/jpt. The paper has not been peer reviewed.

Companies have an opportunity to embrace the digital future and place themselves in a very different position from the competition, which the forum concluded would be a very much stronger position. The recommendation from the forum was that successes and failures as well as practical experiences from the early adopters and flagship projects be publicized to align the industry.

Foundations for a Smart Mature Field

The underlying and critical enabler is the relentless, rapid, and massive increase in digital capability of the following.

- Data storage and rapid access to these data.
- Bandwidth for digital communication at an appropriate price.
- Computing capacity.
- High-resolution visualization of massive amounts of data.

However, the very rapid pace of change in these digital technologies also provides a huge challenge when attempting to maintain compatibility of the hardware and the underlying systems in the very complex environment of a producing field, which probably already relies on several generations of hardware and systems.

Getting clarity on which hardware and systems should be updated, on the resulting effects on the remaining hardware and systems, and on the implications for future changes is critical.

Data and Standards

In the smart field, the volumes of data can increase by several orders of magnitude above the data volumes that are historically used. In mature fields, these large amounts of digital data are being added to what can be many years of legacy data in numerous formats and storage media. To exploit the full power of the smart field, it is generally agreed that there is an increased requirement to improve data-system interfaces to provide a digital link between the diverse data types and storage media.

People and Skills

A very strong theme throughout the forum was that the success of deploying smart-field technologies to existing fields will be determined by the ability to manage the scale of change—techni-

cally; in business process; and, most importantly, in the skills, culture, and adaptability of the workforce. Change management will permeate the delivery of truly smart fields.

The educational base, skill sets, and competencies of the next generation of people operating and managing these assets will need to be enhanced. This enhancement will add an ability to be comfortable in a digital environment, maybe having different patterns of work, and being able to collaborate more effectively across disciplines while doing all of this remotely.

Major Processes, Workflows, and Technology

An effective smart field must have clear business processes for applying the technology. Smart fields, regardless of whether they are mature, could work across several different major processes including production optimization, drilling and completing of new wells, and optimizing reservoir development.

After the business process is clear, the workflows are mapped, and the data are effectively managed, automation can be achieved in one or more workflows. Automation is pervasive throughout many industries. There is a substantial process-control industry that has grown to address the automation needs of many industries. Efficiencies born of the automation and control industries form an integral part of the commercial model for these industries. By comparison, the upstream oil/gas industry has been relatively slow in adopting the commercial advantages of automation.

At very high levels, the business processes are company-specific because they reflect how an organization actually manages an oil or gas field. However, the fundamental principles of reservoir geology and oil and gas production are used throughout the industry. Consequently, at a lower-level workflow, most operators appear to be following the same approaches and workflows. Therefore, there is an opportunity to share the workload associated with developing the automated workflows and an associated tool kit.

The forum concurred that the vast majority of challenges associated with deploying smart fields are not in the technology, but instead in understanding workflows and managing the associated change.

To manage both the development of a field and the exploitation of the existing reserves base, the industry needs both short- and long-term approaches with all disciplines and workflows that use a common set of well-managed data. In addition, there probably is a need to build a common understanding of the objectives that each business process is required to deliver and, therefore, to obtain clarity on the best approach to use. In light of data and technology needs and the need to map the workflows and then understand the implications for the changing roles of the people developing and operating the fields, change management lies at the heart of the smart field.

Integration Through Collaboration and Visualization

To manage future development and effective production of existing reserves, it is essential to integrate across the core business processes. In the future, this integration role will require people with a broader discipline base and set of skills and who have maintained their understanding of the fundamental principles behind oil- and gasfield development and production.

The forum strongly advocated the use of visualization. Its use would enable people to assimilate the large volumes of data and information. Specifically, visualization will be required to enable an understanding of the implications of the data and information that may originate from outside of an individual's discipline.

A clear case was made for the use of collaboration environments with extensive visualization capabilities in which the people will be able to effectively view the real-time data and information and in which highly informed, high-quality, and rapid decision making will be possible. Evidence from other professions, including the military and medicine, shows that these environments must be designed around the people to function effectively and that the people require appropriate information support systems. There is strong evidence from fields and suppliers, which have implemented such centers, that there are substantial savings and efficiency improvements from being able to focus specialists' technical expertise on the operations and problems in multiple wells and fields. **JPT**