

Integrating the Intelligent Oilfield

The Intelligent Oilfield (IOF) is not a one-size-fits-all solution. Part one of this three-part series defines the IOF and looks at the business case for it.

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The dynamic and dramatic evolution of the oil industry continues. It was a mere 10 years ago that the industry was feeling bloated with staff as energy demand provided only cautious optimism for the future. Only 20 years ago, personal computers were introduced into the workforce. At that time, the production engineer's only data source was to be found on an operator's clipboard or in a stack of old, daily reports found in a file cabinet in someone else's office. It took weeks to route an Authority For Expenditure (AFE) for any type of well or facility work. Planning, scheduling and implementing a simple workover took weeks to months.

The work and workplace continue to change. Competition for hydrocarbons has driven companies to explore and produce in harsh and remote locations, where even the simplest logistical tasks can be difficult, dangerous and costly. As the environment grows more unforgiving and the challenges more complex, skilled technical resources are becoming scarce. New projects bring more risk, which, in turn, requires a greater quantity and quality of data from which to learn. Importantly, the information and communication technology that supports (and at times drives) the industry has dramatically improved. These factors have set the stage for use of the IOF.

The IOF defined

Frequently captured data, distributed, evaluated and acted upon in real time forms the basis for any IOF approach. Also known by many of its synonyms (the Digital Oilfield, Field of the Future,

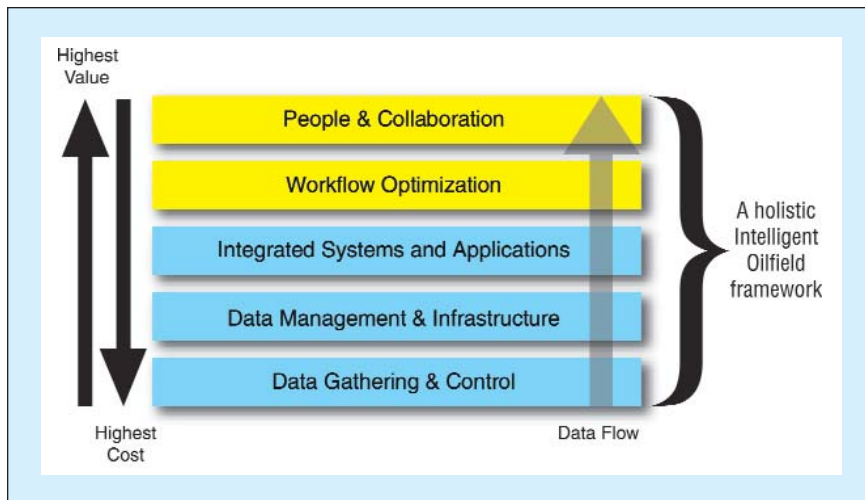


Figure 1. The IOF is composed of five key components, encompassing people, process, and technologies. (Graphics courtesy of IBM)

i-Field, e-Field, Real-time Operations, and Real-time Optimization), the IOF can reduce the uncertainties of the looming "great crew change" and ever-increasing project complexity. And, the IOF holds great promise for a future of higher productivity, increased recovery, lower costs and reduced health, safety and environmental exposure.

The IOF is composed of five key components, encompassing people, process and technologies, which need to be addressed for any IOF vision to be truly realized (Figure 1).

Addressing each of these five components reduces the risks of sub-optimization and confusion, and even complete failure. Similar to links in a chain, the ultimate success of a project demands that each component contribute to the overall strength of the project.

Temptations to reduce the IOF to merely an automation project or a remote operations and collaboration room with plasma screens limit the greater benefits that can be achieved. Projects that are considered to be related to the IOF can be diverse, yet they all share the common theme of frequently captured data, distributed, evaluated and acted upon in real time.

Consider an automation project that gathers wellhead data and controls the plunger lift cycles. An additional, related IOF project is the high-bandwidth, wireless network that distributes the data into a real-time historian that stores and manages the data. Add an integration approach such as Service-Oriented Architecture or middleware that allows all the necessary systems and applications to share the same information — creating "one source of the truth." Layer in an improved workflow that can leverage the real-time data and the new behaviors to collaborate and act on the information. This is an example of a comprehensive IOF.

Each application, solution or project above represents one of the five components, and is a part of a larger IOF approach. As the number of individual efforts, projects or components grows larger, the need for rigorous integration between the projects as a cohesive program grows more critical.

Business case for the IOF

The path to the IOF vision may take years (particularly in mature or brown-field legacy environments) and can be tortuous. Some have heralded IOF as

Business Issues	Intelligent Oilfield Benefits
Big Crew Change	<ul style="list-style-type: none"> • Knowledge Management tools to capture and disseminate lessons learned • Point-of-need Learning tools to increase skills • Increased automation and electronic information capture & distribution to reduce manual effort • Information Management tools and processes to ensure the appropriate information is available for decisions
Globalization & Remote Project Management	<ul style="list-style-type: none"> • Virtualization & collaboration tools to improve working at a distance • Enhanced use of video and high-bandwidth networks • Central collaboration hubs to manage support (suppliers, internal experts and academia)
Rising Costs	<ul style="list-style-type: none"> • Collaboration systems to reduce rework on large, capital projects • Increased automation and electronic information capture & distribution to reduce manual effort • Energy Grid management
Increased Oil & Gas Demand	<ul style="list-style-type: none"> • Increased production by reducing downtime • Improved forecasting with automated history-matching simulation tools • "Smart" alarming focuses analysis efforts • "Smart" devices take simple actions without requiring slower, human intervention
Increased Data Overload	<ul style="list-style-type: none"> • "Smart" alarming focuses analysis efforts • Service Oriented Architecture or middleware helps create "one source of truth" • Integrated applications reduce data entry requirements and smooth workflow

Figure 2. A sampling of upstream issues and how an IOF approach may address them.

the "next big thing" in the oilfield, and it certainly can provide a powerful set of tools and approaches. Yet, there remain few examples of IOF implementations-at-scale, and even fewer that can show sustainable results. Therefore, it is timely to ask fundamental questions regarding the business value, implementation lessons, and possible future directions of the IOF.

Though not a panacea, the IOF can address many of the current and future issues facing the upstream industry. An IOF implementation should be tailored based on the exact nature of the need and the status of the current state. In other words, there is a large probability that no two IOF programs will look alike as there are no two wells in the world that are exactly alike. Figure 2 displays a sampling of upstream issues and how an IOF approach may address them.

The IOF approach is not new — most large integrated oil companies developed their own real-time drilling support centers years ago. These early centers were the analogy to today's production-related central collaboration environments. They relied on streaming data from the rig, though little of it came from the drill string or bit. The

development experiences; provide additional safety assurance through video surveillance and use as a best practice sharing vehicle. But as valuable as the centers have been, they had a limited life span (though many companies are re-vitalizing their real-time drilling centers in addition to developing real-time production support centers). Today, the technologies have changed, and workforce demographics have been slowly shifting, and the demands for real-time approaches are more varied.

A key lesson is that a real-time center existed for as long as the need for real-time support existed. What requires real-time support is the degree of immediate risk, exposure, or opportunity, such as an exploration well in a frontier area, or the deeper completion in a new horizon, or monitoring the high-rate oil well in deepwater (Figure 3). When considering an investment in elaborate support centers or building a comprehensive IOF strategy, oil companies should consider the criteria in Figure 3.

As petrotechnical professionals, we can all sense the potential value of an IOF approach — it is technically sound and reflects our collective experiences. That said, the obvious question remains

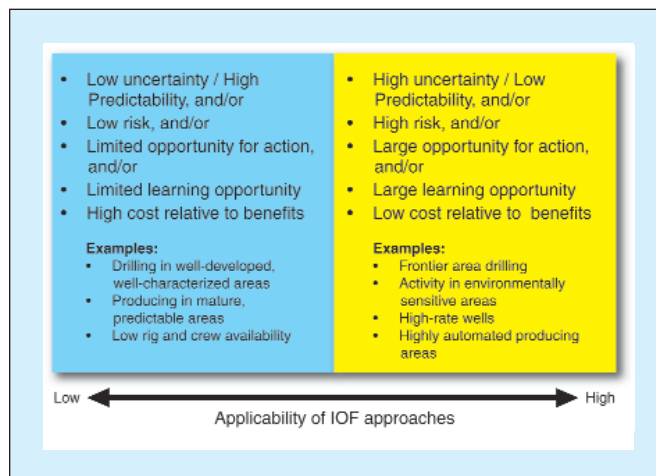


Figure 3. When considering an investment in elaborate support centers or building a comprehensive IOF strategy, oil companies should consider these criteria.

intent was the same as it is now: provide full-time, real-time technical support for time-critical operations; use as learning and devel-

opment experiences; provide additional safety assurance through video surveillance and use as a best practice sharing vehicle. But as valuable as the centers have been, they had a limited life span (though many companies are re-vitalizing their real-time drilling centers in addition to developing real-time production support centers). Today, the technologies have changed, and workforce demographics have been slowly shifting, and the demands for real-time approaches are more varied.

— why the apparent slow uptake? Part of this perception is related to the high expectations for the IOF. Once defined and theorized, impatience has grown even in the midst of the significant work that continues to occur in older fields. It is now commonplace to find Programmed Logic Controllers (PLCs) and Remote Terminal Units (RTU) in the brownest of fields — a small signal that the IOF is reaching more than just the high-profile locales of deepwater. Other reasons can be traced to generically slow uptakes of many technology-led approaches even though the IOF relies on as much people and process changes as it does on technology. But the foundation of the slower-than-desired deployment is the large need for integration between the five components (refer back to Figure 1). This integration crosses many organizational and departmental boundaries, demands a reflection of current governance structures and distributes the benefits and costs over many different groups of users and administrators. In an atmosphere of dreadfully low prices or extremely high ones, these issues have not carried the same gravity as the other issues of the day.

Part two of this three-part series will examine how the people and process aspects of the IOF, defined as the People & Collaboration and Workflow Optimization components in the IOF framework, affect the benefits and costs for an IOF program. **EXP**