Smart Assets Through Digital Capabilities

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INTRODUCTION

The history of oil and gas (O&G) production on the Norwegian Continental Shelf (NCS) dates back to the early 70s and began with the discovery and subsequent development of the great *Ekofisk asset* in 1969. Ever since, North Sea has been an attractive region, and Norway in particular has been a major supplier of O&G to the world energy market. The remaining production prospect on the Shelf is also said to be substantial and the more recent estimates indicate that it is equivalent to twice the already produced amount. However, a major part of the Norwegian O&G production portfolio will approach maturity by 2007/2008. Both *declining production* and *marginal discoveries* have given a clear indication that the Norwegian O&G industry will undergo a series of significant challenges during the next few years. These critical issues, in conjunction with volatile business environment, have brought a major turning point demanding immediate steps to enhance operational efficiency and to reduce operating risk in offshore exploration and production (E&P) activities on NCS.

BACKGROUND

Norwegian Oil Industry Association (OLF) constantly raised its concerns since the mid 90s about this emerging situation owing to its substantial commercial impact. By 2000-2002, major challenges for E&P activities on NCS became more visible and obvious. These included:

- declining investments and activity level on NCS and its immediate impact on the production profile and sustained growth;
- the need to enhance recovery efficiency to keep supply levels and to add more value;
- rising lifting costs and its direct impact on the cost of operatorship; and
- the volatile oil price and its direct implications on profit performance of offshore E&P activities.

Subsequently it appeared that the Norwegian O&G industry requires, a dedicated plan to re-engineer conventional practices in order to reduce commercial risk and to enhance value creation (see discussions by Lindgren & Bandhold, 2003). Thus, the O&G production scenario on the NCS stepped into its so-called *3rd efficiency leap* with the effect from 2003 (see Norwegian Oil Industry Association, 2003). This macro-scale national program is expected to induce a step change particularly related to smart use of advance information and communication technologies (ICT) and new data management techniques, and is completely dedicated to adapt to a fully integrated operational setting to smartly manage offshore-onshore activities by the year 2010. Issues related to this new development scenario were envisioned in the government white paper; *Storting white paper 38:2003–2004: On the petroleum activities* in 2003.

SMART ASSETS THROUGH *INTEGRATED E-OPERATIONS*

In more general terms, *smart assets* and *integrated e-operations* largely dedicate the Norwegian O&G industry toward:

- joint exploitation of advanced technologies, digital ICT capabilities, and real-time operational and technical data to optimize decisions, and
- tighter integration of work processes, decision loops with effective and efficient division of work to optimize activities.

This aims at enhancing connectivity and interactivity between offshore O&G assets and their onshore support systems (for further highlights see Barabasi, 2003). Advancement in information sciences and technologies, and long-term commercial benefits of their successful usage, have contributed much to the ongoing change process. Partner industries, particularly those related to electronic and communication technologies in general, play pivotal roles to establish the necessary stable and reliable *digital environment* around offshore assets and activities (see further discussions by

During, Oakey et al., 2002). The key enabling technologies that are already under implementation include:

- fiber-optic-based ICT-net laid on the sea-bed of the North Sea, and wireless communication capability ;
- smart sensors, intelligent transducers, and equipment with advanced functionalities;
- real-time visualization, 3D visualization, and simulation tools;
- online diagnostic and prognostic engineering capability;
- process automation and real-time data acquisition techniques; and
- online video monitoring and conferencing facilities.

Such a technological leap not only systematically builds strategic *digital capabilities*, but also provides necessary *digital environment* for active *knowledge and intelligent data* management. The onshore support system, with the support of such application technologies, systematically advances toward a highly connective and interactive *extended digital enterprise* through active strategic collaboration breaking the conventional inter-organizational gaps (see also Dyer, 2000; Faulkner & Rond, 2001; Lipnack & Stamps, 1997; Spekman, 2003; Tidd, 2001; Tonchia & Tramontano, 2004). This new organizational setting is capable of:

- joint online monitoring of offshore E&P activities at dispersed *onshore support centres*;
- real-time data acquisition, joint data analysis and data interpretation; and
- 24/7 network-based connectivity for collaborative decision making and work planning.

A diagramatic model of the new operating environment is illustrated in Figure 1.

The network-based and collaborative environment requires a highly robust ICT infrastructure to support decisions, core tasks, and activities (see also Barabasi, 2003; During, Oakey et al., 2002; Hosni & Khalil, 2004). *SOIL* (Secure Oil Information Link), introduced in 1998 to the NCS, is the result of the current industry demand to acquire necessary *digital infrastructure* using a large-scale information and communication network through a common data-hub, a large-scale network, and centralized information system, which is highly *reliable* (stable and dependable), *secure* (control of access and routing), and possesses a large *bandwidth* (high traffic capacity).

Today, SOIL is extended into the UK and functions as a collaboration arena, a secure interconnection point, and an industry network. This digital network between offshore facilities, major producers, and third-party organizations facilitates the connectivity through the use of fiber-optic cables, radio links, and satellite communications. A unique feature of SOIL application today is that it has moved the information sharing and communication capabilities from conventional setting to a *one-to-many* collaborative setting. SOIL allows consolidation of a traditional information and communication network into one single hub building 24/7 online and real-time information sharing and communication capabilities between O&G producers and their business partners. This is one of the most important application

Figure 1. New operational environment establishes an extended enterprise on the basis of advanced technological capability, digital infrastructure, and active collaboration