



A conceptual framework and practical guide for assessing fitness-to-operate in the offshore oil and gas industry[☆]



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ABSTRACT

The paper outlines a systemic approach to understanding and assessing safety capability in the offshore oil and gas industry. We present a conceptual framework and assessment guide for understanding fitness-to-operate (FTO) that builds a more comprehensive picture of safety capability for regulators and operators of offshore facilities. The FTO framework defines three enabling capitals that create safety capability: organizational capital, social capital, and human capital. For each type of capital we identify more specific dimensions based on current theories of safety, management, and organizational processes. The assessment guide matches specific characteristics to each element of the framework to support assessment of safety capability. The content and scope of the FTO framework enable a more comprehensive coverage of factors that influence short-term and long-term safety outcomes.

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1. Introduction

Industries operating in high-hazard environments must manage complex technical and social processes in a competitive economy with finite resources. Investigations of major accidents consistently identify how organizations¹ have failed to manage this complexity. Devastating events since 2009 include the BP Macondo disaster in the Gulf of Mexico in 2010, and the PTTEP Montara oil spill in the Timor Sea in 2009, as well as smaller events such as Chevron's 2012 oil spill in Brazil.

Public enquiries, research studies, and investigations highlight that better organizational practices and regulatory oversight could have prevented major accidents. Some of the issues identified include whether the organizations managing facilities

encouraged questioning of operational data; communicated adequately with sub-contractors; understood and used designated lines of authority; and effectively managed pervasive cost pressures. These issues raise fundamental questions about the safety capability of organizations that are amplified by the rapid rates change in technology, engineering, and workforce demographics (Hopkins, 2009; Leveson, 2011a).

There is now a growing need to incorporate a broad view of the capabilities which allow organizations to operate safely (Grote, 2007) and to understand how safety capability is created, monitored, and improved (Strutt et al., 2006). However, the nature of safety capability is not well understood or articulated. In this study, we develop a systemic approach to the safety capability of organizations operating in high-hazard environments. In particular, we introduce a model of 'Fitness-to-operate' (FTO) developed in conjunction with the National Offshore Petroleum and Environmental Management Authority (NOPSEMA) as part of their stewardship of a strategic agenda item of the International Regulators Forum (IRF), a group of ten regulators of health and safety in the offshore upstream oil and gas industry. The FTO model provides the overarching framework for integrating diverse approaches to safety capability. We also outline practical guidelines for assessing FTO that can be used by regulators and organizations.

We define safety capability as "the capability to maintain the safety of complex systems operating in uncertain and interdependent environments". Managing uncertainty is important

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¹ Throughout the paper we use the term "organization" to describe the entity responsible for managing and operating a facility. A range of terms are used across industries and countries (e.g., "duty holder") to reference the responsible entity so we use this general term to denote primary legal and management responsibility for a facility.

for operating effectively in both predictable and unpredictable environments, managing interdependence is important for coordination across diverse technical and social processes. Although safety capability is critically important it is inherently difficult to observe: major events occur relatively rarely and are prevented through multiple processes such as appropriate monitoring systems, effective team communication, and sustained vigilance. We develop the concept of “enabling capitals” to describe the observable characteristics and activities through which organizations achieve safety capability. In particular, we identify three forms of enabling capital that we label “organizational capital”, “social capital” and “human capital”. These three forms of capital have been extensively researched within the framework of intellectual capital to explain how organizations achieve a wide range of capabilities (Kang and Snell, 2009; Youndt and Snell, 2004). Based on our elaboration of safety capability and enabling capitals, we define FTO of an organization as “demonstrating appropriate organizational, social, and human capital to manage safety in uncertain and interdependent environments”.

The current paper is divided into three main sections. First, we review the regulatory context of offshore oil and gas. We describe the progress of international regulators to develop a more systemic view of safety capabilities. Second, we develop a model that describes FTO in terms of safety capabilities and the enabling capitals that contribute to these capabilities. Third, we describe an assessment guide for evaluating FTO that has been developed with NOPSEMA. We describe how we have identified and developed measures of the enabling capitals that can be used in ongoing communication between regulators and organizations. We conclude with a discussion of implications and further development of the framework and guide.

2. Regulating safety capability in oil and gas

The IRF for Global Offshore Safety brings together regulators from Australia, Brazil, Canada, Denmark, Mexico, Netherlands, New Zealand, Norway, the UK and the USA. Oil and gas companies that operate in IRF member regimes must comply with licences granted by these regulators based on national legislative frameworks (Australian Offshore Petroleum and Greenhouse Gas Storage (Safety) Regulations; Norwegian HSE Framework Regulations, 2011; UK Offshore installations (Safety Case) Regulations, 2005). For entry to, or to operate in, IRF jurisdictions the regulators must determine if organizations possess the necessary competence, capability and capacity to meet the health, safety and environmental requirements stipulated in the regulations.

Most members of the IRF have moved from a prescriptive to a goal-setting regime for regulating occupational health and safety. A guiding principle underlying these goal-setting regimes, also known as outcome-oriented or performance based regimes, is that the primary responsibility for ensuring health and safety should lie with those who create risks and those who work with them. In the Australian oil and gas industry context this means that direct responsibility for the ongoing management of safety on individual facilities is the responsibility of the primary duty holder and not the regulator. Obligations on owners, licensees and operators (duty holders) of offshore oil and gas facilities are also set out in legislation.

Regulators use a range of formal and informal systems for ensuring legislative obligations are met and to provide insights into safety capability. In some regimes (for example Australia and the UK) a safety case is an integral part of this assessment process. A safety case is typically comprised of a facility description, formal safety assessment description, and safety

management description. These items include information about policy, organizational structure and accountabilities, planning and standards, performance measurement, audit and review. In other regimes (for example Norway, Canada and New Zealand) there are alternative assessment processes to review operators' applications. The Netherlands State Supervision of Mines requires a short document outlining systems and commitments which the regulator is then able to follow up with more in-depth questions. The Norwegian Petroleum Safety Authority (PSA) has a similarly short document for the consent to operate, with much of the supporting information already understood by the regulator through pre-submission discussions and dialog. In most regimes the regulator must be assured that the operator's management system is adequate to ensure compliance with the relevant statutory provisions and that risks to the facility from Major Accident Events have been reduced to a level that is “as low as reasonably practicable” (ALARP).

The move from prescriptive to goal setting regimes started with the 1972 Robens report in the UK, which found prescriptive methods inadequate for assessing and regulating the safety capability of a facility. This reported resulted in reduced reliance on volumes of prescriptive legislation but resulted in the regulatory challenge of assessing how duty holders met their goals (Hopkins and Hale, 2002). Additionally, given recent disasters and ongoing change in the industry, it is also important to consider the limitations in the adequacy of the safety case and other assessment methods for assessing long-term capability to manage operations in a safe and environmentally sustainable manner (Leveson, 2011b).

Recent offshore oil and gas industry accidents have generated considerable analysis of the roles of human and organizational factors in these events (Bills and Agostini, 2009; National Commission on the BP Deepwater Horizon Oil Spill, 2011; Skogdalen and Vinnem, 2011). A challenge for regulators is that these types of human and organizational factors and their potential impact on the execution of processes cannot readily be conveyed in a safety case or similar documentation before operation commences. Once the facility is operating, visits by the regulator for inspections and audits provide opportunity to make more direct observations of the people that work there and the organizational culture. The collective observations of the inspectors form part of the regulator's view of the facility and its ability to meet legislative requirements and create a safe workplace.

However, it is still difficult to incorporate complex social factors such as safety culture in the assessment of safety capability. The PSA in Norway requires the operator to have a sound safety culture (see <http://www.ptil.no/framework-hse/category408.html#p15> which notes “culture is not an individual quality, but something that is developed in the interaction between people”) but there are no specific guidelines for assessment or integration with other measures. Bills and Agostini's (2009) review of the Varanus Island explosion identified limited opportunities for the Australian regulator to address safety culture and leadership within national legislation. They suggest that FTO concepts provide regulators with a framework to directly consider organizational issues such as safety culture, leadership, operator past history, motivation and current organizational capacity in the regulatory approvals process (Bills and Agostini, 2009).

To develop a more systematic view of the many factors that contribute to FTO, regulators need to create a common framework for discussion and assessment. To address this challenge NOPSEMA has supported a research project to develop a model of FTO that will support inter and intra-regulator discussion of factors relevant to assessing the competency, capacity and capability of operators. A goal of the FTO project is to assist inspectors, who come principally from technical and operational backgrounds, to assess human and

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