Chapter 20
IO, Coagency, Intractability, and Resilience

Erik Hollnagel
University of Southern Denmark, Denmark
& Norwegian University of Science and Technology, Norway

ABSTRACT

Technological developments continuously create opportunities that are eagerly adopted by industries with a seemingly insatiable need for innovation. This has established a forceful circulus vitiosus that has resulted in exceedingly complicated socio-technical systems. The introduction of Integrated Operations in drilling and off-shore operations is one, but not the only, example of that. This development poses a challenge for how to deal with risk and safety issues. Where existing safety assessment methods focus on descriptions of component capabilities, complicated socio-technical systems must be described in terms of relations or even functional couplings. In order to design, analyse, and manage such systems, it must be acknowledged that performance adjustments are a resource rather than a threat. Safety can no longer be achieved just by preventing that something goes wrong, but must instead try to ensure that everything goes right. Resilience engineering provides the conceptual and practical means to support and accomplish that change.

INTRODUCTION

The term Integrated Operations (IO) is by now firmly established within the off-shore industry and also slowly spreading to other industries. In recognition of this development, the purpose of this chapter is to consider what consequences IO has, or should have, for how we think of the off-shore industry as a system, specifically the ways in which safety issues are or should be treated.

Although the use of the term IO is widespread, and has been so for some years, that does not necessarily mean that it is well-defined. Indeed, at the time of writing this chapter (mid-2011) there does not seem to be any generally accepted definition. In one of the early documents (OLF, 2003), IO was described as the “processes and tools for effective real-time utilisation of increased data.”

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Since then the meaning has become extended so that IO now is used as a rather generic term to cover most aspects of the oil and gas industry, especially the role of information, communication and cooperation (of the above-mentioned ‘increased data’) in off-shore and on-shore operations. It also covers a number of other aspects of oil and gas industry activities, including drilling operations, reservoir management, production optimisation, maintenance, and safety management.

IO was from the beginning promoted as an approach to increase the efficiency and safety of the industry (OLF, 2003 & 2005). Today it is also used in the broader sense as a characterisation of how the industry has developed from the mid 1990s and onwards. (As an aside, the practically uncontrolled use and dependence on information technology in the industrialised societies means that they also can be seen as an example of integrated operations, although by necessity rather than by intention.) This development has been driven by the enthusiastic use of the possibilities offered by cutting edge information and communication technologies. (These technologies are however not specific to the off-shore industry, which is why a similar trend can be seen elsewhere, for instance in health care.) The application of new technological solutions to improve the industry – not least the productivity – obviously affects everyday work processes as well. The increased integration has consequences for how resources are allocated and used (not least human resources), for how activities are planned and scheduled, for how downstream functions become dependent on upstream functions (and how difficult it becomes to predict outcomes of actions and interventions), and for how safety and effectiveness can be provided, managed, and maintained.

Thus, despite the uncertainty about what IO precisely is, the steadily growing use of IO has irrevocably changed how the industry operates. Because of that, it is necessary also to change the way in which we think of how the system works and how it can remain safe, in particular the way we describe it and the way we analyse it. This is so regardless of whether we consider a specific subset of the operations or whether we look at how the system functions as a whole.

**RELOCATED SYSTEM BOUNDARIES**

The oil and gas industry considered as a system, and using the term loosely, had become both larger and more complicated. If we use a classical definition of a system as “a set of objects together with relationships between the objects and between their attributes” (Hall & Fagen, 1969, p. 81) – or even more broadly as anything that consists of parts connected together – then the industrial systems of today have definitely become larger. The size or extent of a system is determined by how the boundaries are defined, i.e., where one considers that the system ends and the context or environment begins. These boundaries are however rarely absolute or well-defined, but depend on a number of considerations that have to do with concerns for safety, operations, or business. During the last 30 years or so, rampant technological and societal developments have together with rapid changes in the business environment made it necessary to enlarge the boundaries of the systems that we work with and need to control.

- A first extension has enlarged the boundary ‘vertically’ to include the entire system, from technology at the bottom to management at the top. (The terms ‘bottom’ and ‘top’ that normally are used to describe organisations imply a hierarchical structure, which does not necessarily correspond to reality.) Whereas it was common practice to limit efforts of both design and investigation to the so-called sharp end (Hollnagel, 2004; Reason, 1993), it is now necessary to look beyond the sharp end to include also the blunt end. Where it used to be sufficient to consider work at