

Informal leadership redundancy: Balancing structure and flexibility in subsea operations¹

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Abstract

This article identifies how a reliability-seeking organization can respond flexibly to disruptive events. We study complex subsea operations that inspect, maintain and repair oil and gas installations on the Norwegian continental shelf. A superordinate leader is put in charge of a tightly coupled ‘multiteam system’ in the crucial execution phase of the operation, and his primary leadership function is task coordination. When unexpected disruptive events occur, which the formal leader cannot address, other individuals contain the event by performing leadership functions in his place, without explicit delegation. We call this mechanism *informal leadership redundancy*. We provide verification of it through an extended case study, making use of both field observations and interviews. We explore the conditions under which this form of redundancy can be effective.

Keywords: Multiteam systems, redundancy, high-reliability organizations, ambiguity, improvisation, subsea operations.

In complex organizations engaged in high-risk work, where operations are tightly coupled, there is little margin for error. The impact of external challenges and internal difficulties can set in motion consequences that are hard to predict and difficult to control. For those reasons, accidents and failure in complex organizations are in one sense ‘normal’ (Perrow 1999a). There are, however exceptions, and studies of high reliability organizations (HROs⁴), such as aircraft carriers, nuclear power plants, power grids and air traffic control towers have sought to understand how some organizations avoid the failure rates that one might expect (Bigley &

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⁴ A difficulty with the term HRO is that it is held up as an ideal and also serves as a descriptive term for organizations that operate successfully and safely with high-hazard technologies. Vogus and Welbourne (Vogus & Welbourne, 2003) have made a distinction between HROs that operate in dangerous environments and high-reliability seeking organizations where the risk concerns competition and innovation, and not physical danger. In this article, we use the term HRO more loosely, to describe organizations of both types.

Roberts, 2001; Bourrier 1996; Klein, Ziegert, Knight, & Xiao, 2006; Roberts 1990; Weick & Roberts, 1993).

Two decades of research have found that such organizations, to be successful, must be both structured and flexible (Faraj & Xiao, 2006; Weick, Sutcliffe, & Obstfeld, 1999). As Faraj and Xiao state, “(...) on the one hand, there is a need for tight structuring, formal coordination, and hierarchical decision making to ensure a clear division of responsibilities, prompt decision processes, and timely action; but, on the other hand, because of the need for rapid action and the uncertain environment, there is a competing need to rely on flexible structures, on-the-spot decision making, and informal coordination modes. Thus, such organizations paradoxically emphasize both formal and improvised coordination mechanisms” (Faraj & Xiao, 2006, p. 1157). While the concept of balancing structure and flexibility is broadly accepted as a key success factor in reliability-seeking organizations, research continues to examine how this balance operates in practice; for example, *who* makes decisions when unexpected and disruptive events occur, *how* authority migrates in a hierarchical system, and to what degree actions are taken *outside or within* existing procedures (Barton & Sutcliffe, 2009).

The present research is a case study of complex subsea operations that inspect, maintain and repair oil and gas installations on the Norwegian continental shelf. The work is complex, high-risk, strongly regulated and dictated by procedures. Previous research has shown that standardized rules and explicit procedures can enable people to coordinate their actions, detect and correct errors, and resolve conflicts (Hale & Borys, 2013; Pelegrin 2013). Schulman (Schulman 1993), in his study of a nuclear power plant, noted the ‘zealotry’ and competitive spirit with which employees at all levels engaged in drafting new procedures.

However, while detailed rules and processes reduce uncertainty, they assume a level of predictability (Weick & Sutcliffe, 2007). Knowing the specific steps to take in a situation is useful as long as the situation conforms to expectations based on past experience; but in dynamic environments predictability can be elusive. An important question is how organizations that rely on procedural discipline can respond flexibly when unexpected events occur. Previous research has described a variety of factors that enable HROs to anticipate and contain the unknown (Bigley & Roberts, 2001; Bourrier 1996; Klein et al., 2006; Roberts 1990; Weick & Roberts, 1993; Weick & Sutcliffe, 2007), one of which is to take advantage of redundancies or slack⁵ (Roberts 1990; Weick & Roberts, 1993; La Porte 1996; Roberts 1990)

In this research we focus on one particular way of creating organizational slack through leadership redundancy. By leadership redundancy we mean individuals (other than the person normally in charge) who take the lead in coordination, decision making, problem solving, coaching, and other leadership functions, “the things that need to be done for the team to meet its needs and function effectively” (Morgeson, DeRue, & Karam, 2010, p. 9). Leadership redundancy can be a formal arrangement, such as when a co-pilot steps in for the pilot. In our research, however, we found situations where individuals, without explicit delegation, and on their own initiative, take care of leadership functions (Morgeson et al., 2010) *outside* their formal role. We show that slack informal leadership resources are utilized to contain disruptive events, which we refer to as *informal leadership redundancy*.

Subsea operations are conducted by multiteam systems (Johannessen, McArthur, & Jonassen, 2012)– a complex organizational structure. Mathieu et al. (Mathieu, Marks, & Zaccaro, 2001) define a multiteam system as a group of component teams, which work towards a common, overarching goal. Multiteam systems are increasingly being used in dynamic environments.

⁵ The terms are often used interchangeably in the literature. Both are talked about as surplus resources, while redundancy sometimes is also used to describe *a particular arrangement* to make use of such resources.

However, multiteam systems face many challenges due to their complexity, particularly regarding leadership (Mathieu, Marks, & Zaccaro, 2001). Multiteam systems are, by design, collective leadership structures. How the team leaders in a multiteam system coordinate activities has been identified as a key leadership challenge (Mathieu et al., 2001). We need to understand how this coordination is structured and executed. In the case of subsea operations, Johannessen et al. (Johannessen, McArthur, & Jonassen, 2012) found that a superordinate leader, the shift supervisor, is dedicated primarily to coordinating the execution of detailed Task Plans – a highly demanding role that requires focused attention. The Shift Supervisor is legally and practically confined to his control room for the execution phase of the operation, which can limit his awareness of events that might disrupt the operation. When disruptive events occur that the shift supervisor cannot attend to, other individuals step in to help. The ability of these individuals to act when needed constitutes a potential resource for the multiteam system - a kind of leadership redundancy. While this form of redundancy may enable the system to respond flexibly to changing demands, it may create unintended consequences by adding complexity and the potential for conflict.

Our study aims to shed light on two questions:

1. Can informal leadership redundancy be verified as one of several ways that the multiteam systems in our context handle unanticipated disturbances?
2. If verified, what can we learn about the conditions under which it may be effective?

Our research confirms the first question. To our knowledge, this has not been documented by previous research on multiteam systems. In addition, informal leadership redundancy adds to related types of distributed leadership (e.g. ‘deference to expertise’) in extant research on HROs. Finally, our research design also addresses a call for studying ‘micro-level interactions’ (Barton & Sutcliffe, 2009) in the context of high-risk operations (Hannah, Uhl-

Bien, Avolio, & Cavarretta, 2009), to better understand how high-reliability organizations respond flexibly to disruptive events in daily practice. Since such events come at unpredictable intervals, they can be difficult to study. We use a two-tier model, which includes field observations of a few such events that we then test with a larger number of informants. This methodology allows us to verify the existence of informal leadership redundancy, and assert that what we observed in the field actually constitutes a pattern. Finally, the interviews also allow us to explore the conditions that enable this kind of redundancy to be effective in a highly proceduralized environment. We begin our discussion by briefly reviewing the research on slack and redundancy in HROs.

Slack as a Managerial Resource⁶

In her classic study of nuclear powered aircraft carriers, Roberts (Roberts 1990) found many types of slack, such as duplication of equipment, overlapping tasks, data stored in multiple places, and multiple people involved in critical operations. Having multiple people involved in an operation, Roberts argued (1990, p. 168), increases the likelihood that weak signals of failure will be noticed in the heat of the moment and is used “(...) to decompose the tight time frames that are a part of tight coupling. If things are done quickly, but many pairs of eyes serve as watchdogs, the many pairs of eyes are a substitute for unavailable time. In a short time three pairs of eyes should be able to spot a problem that may take one pair of eyes longer to detect”. At the Diablo Canyon Power Plant, Schulman (Schulman 1993) identified three broad categories of slack: resource slack (time, money and personnel), conceptual slack (diverging perspectives, theories, and models) and control slack (decision discretion and decentralized authority). He concluded that slack, rather than being a source of inefficiency, ‘is a critical, if under-appreciated, managerial resource’ (Schulman,1993, p. 353). At the level of organizational culture, Weick et al. (1999) have described diversity and institutionalized

⁶ We have borrowed the expression from Paul Schulman (Schulman 1993).

skepticism as a form of redundancy that “(...) involves cross checks, doubts that precautions are sufficient, and wariness about claimed levels of competence” (Weick et al., 1999). More recently, researchers have investigated how various forms of slack impact organizational flexibility, such as budgetary slack (Davila & Wouters, 2005), personnel redundancy in hospital trauma teams (Klein, Ziegert, Knight and Xiao, 2006), and redundant task knowledge in emergency response organizations (Bechky & Okhuysen, 2011).

Given our focus on informal leadership redundancy, we are particularly interested in how reliability-seeking organizations distribute authority, thereby creating and utilizing all three forms of slack (resource, control and conceptual), identified by Schulman. For example, at the Diablo plant, Schulman found that there were multiple departments and committees responsible for ensuring safety, each with veto power over the other, which created a ‘balanced, even fractionalization of administrative authority’ (Schulman 1993, p. 355). In another example, in a study of hospital trauma teams, Klein et al. (2006) found that the redundancy provided by skilled nurses allowed senior physicians to delegate decision making fluidly and rapidly to more junior physicians, a process they refer to as *dynamic delegation*. This form of structured and flexible decision making authority enabled the trauma units to achieve two primary goals - saving lives, as well as professional development.

The form of distributed leadership that has perhaps received the most attention in the literature on HROs is known as *deference to expertise* (Weick & Sutcliffe, 2007). This is the process by which authority can migrate to an individual with the most relevant situational expertise, regardless of rank. Deference to expertise has been shown to enable flexible coordination and decision-making. Studies of aircraft carriers (Roberts 1990; Roberts, Stout, & Halpern, 1994), emergency response organizations (Bigley & Roberts, 2001), and pediatric

Intensive Care Units (Roberts, Bea, & Bartles, 2001) have all found that authority can migrate across organizational boundaries, outside the formal chain of command, from those who are formally in charge, to those with the most relevant expertise to address a local problem. For example, Bigley and Roberts (Bigley & Roberts, 2001) quote an engine company captain on the importance of authority migration in an Incident Command System - a hierarchical, yet flexible, emergency response organization: “As a manager, it is really incumbent on me to recognize my weakness [in a particular area], and that I don't have as much knowledge as maybe a guy standing here next to me. Maybe I've got one of the premier national USR [urban search and rescue] truck captains standing next to me, and this guy knows it like bread and butter. So I'd be a much better manager, and I'd basically build the trust of people better, if I said, ‘Okay, here's what the over-all goal in this incident is: to get this truck off this guy. Okay? And Bob over here on Truck 45, or whatever, is the one that's going to basically direct the point-by-point operation of this.’ ” (Bigley & Roberts, 2001, p. 1288).

While redundancy in its many forms can enable high-risk organizations to operate safely and reliably, it has also been criticized for adding expense, complexity, ambiguity, and a false sense of security (Rijpma 1997; Sagan 1994, Perrow 1999a). Regarding the limitations of distributed leadership in HROs, Barton and Sutcliffe (Barton & Sutcliffe, 2009) have identified a potentially problematic aspect of deference to expertise. In a study of teams that fight wildfires, they found that most successful firefighting events involved a re-evaluation and change in strategy. This suggested that the ability to change a set course (to ‘interrupt a dysfunctional momentum’) was a critical capability for these teams. By focusing on ‘micro-level interactions’ - interviewing firefighters in detail about their actions in successful and unsuccessful events - they found that firefighters sometimes assumed that someone with general expertise and authority had adequate knowledge of the current situation when, in fact,

they did not. Consequently, firefighters would question their own hunches and insight, withhold their concerns, and allow themselves to be led into an ineffective course of action. Similar dynamics have been found in airline crashes, where co-pilots defer to the expertise of the pilot and give only subtle warnings about impending danger (Fischer & Orasanu, 1999). Barton and Sutcliffe found that two key mindsets were critical in order for actors to interrupt a dysfunctional momentum: *skepticism of expertise*, (Barton & Sutcliffe, 2009, p. 1341), which leads individuals to voice concerns about the current course of action, and *situated humility* (Barton & Sutcliffe, 2009, p. 1344), which leads them to seek alternative points of view. Both mindsets enable deference to expertise to operate as an effective form of distributed leadership.

Focusing on how slack can be put to productive use, several studies of HROs have found that *improvisation* is a key element of organizational flexibility, and that redundancy can enable improvisation. For example, in a comparative study of SWAT teams and film crews, Bechky and Okhuysen (Bechky & Okhuysen, 2011) found that team members engage in ‘organizational bricolage’ - a form of improvised action in which team members cope with unanticipated problems by piecing together whatever material, cognitive and social resources are on hand. Members of these teams are able to quickly shift roles and responsibilities because they have redundant task knowledge - shared mindsets and knowledge of each others’ roles based on either past job experience, or rigorous cross-training. In their study of Incident Command Systems (ICS), an organizational structure for responding to emergency situations, Bigley and Roberts found that members “appear able to structure and restructure themselves on a moment-to-moment basis” (Bigley & Roberts, 2001, pp. 1282), by engaging in both pre-planned and improvised actions. Bigley and Roberts underscore that, to be effective, improvisation must take place within constraints. Supervisors allow subordinates to

improvise (either in the use of tools, the application of rules, or the execution of procedures) as long as they have sufficient experience, take actions that are consistent with the overall goals and strategies of the ICS, and do not increase risk to members. If these conditions are not met, such actions are considered ‘freelancing,’ and found unacceptable by ICS members (Bigley & Roberts, 2001, p. 1289).

To summarize, in this paper we examine how the balance of structure and flexibility takes place in practice in a high reliability seeking organization – a multiteam system that conducts subsea operations on the Norwegian continental shelf. While redundancy (or slack) in many forms has been identified as a key factor in maintaining this balance, we focus narrowly on one form of distributed leadership, which we refer to as leadership redundancy. While formal leadership redundancy is well known (e.g. pilot and co-pilot), we focus on *informal* leadership redundancy, which, to our knowledge, has received less attention in the literature. Previous research on HROs has identified a form of distributed authority known as *deference to expertise* in which authority is delegated – most typically down the chain of command - to those who are closest to and most familiar with the issue at hand.

In the current research we use a combination of field observation and interviews to study micro-interactions in which individuals interrupt a dysfunctional momentum (Barton & Sutcliffe, 2009). We found a dynamic of distributed authority that differs from deference to expertise, in that it is not delegated. Given the lack of delegation, our data suggest that for informal leadership redundancy to be an effective resource three conditions must be met: individuals must be *available* to act, *willing* to act, and their actions must be *accepted* by others. In our research context, certain individuals are available to act given slack in their roles. They are willing to act given their sense of responsibility for operational safety, their status and experience, and the quality of trust and respect in their working relationships.

When individuals step in for the shift supervisor, they are improvising outside of established procedures, but their interventions take place within constraints. Whether others accept their actions depends on whether there is a shared understanding of the boundaries of these constraints. We found that there was variance among our informants in how they perceived these constraints, which suggests that while informal leadership redundancy can add flexibility to the system's ability to cope with surprise, it can also add the potential for conflict. Below we describe our research context and methodology, and present the data that illustrate our findings.

Research Context and Method

The subsea infrastructure off Norway's coast is the world's largest, and connects offshore oil and gas fields with the UK, continental Europe and Norway. This infrastructure requires inspection, maintenance, and repair known as IMR operations. The operations in our study are performed from specialized vessels⁷. An IMR vessel is a high-tech environment with state-of-the-art safety measures. Some 70 crewmembers are on board for a typical two-week trip, during which several operations may be carried out. A complex set of planning processes and quality checks lead up to the work on the installation. A Task Plan is created that describes the discrete steps in the execution of a single operation⁸.

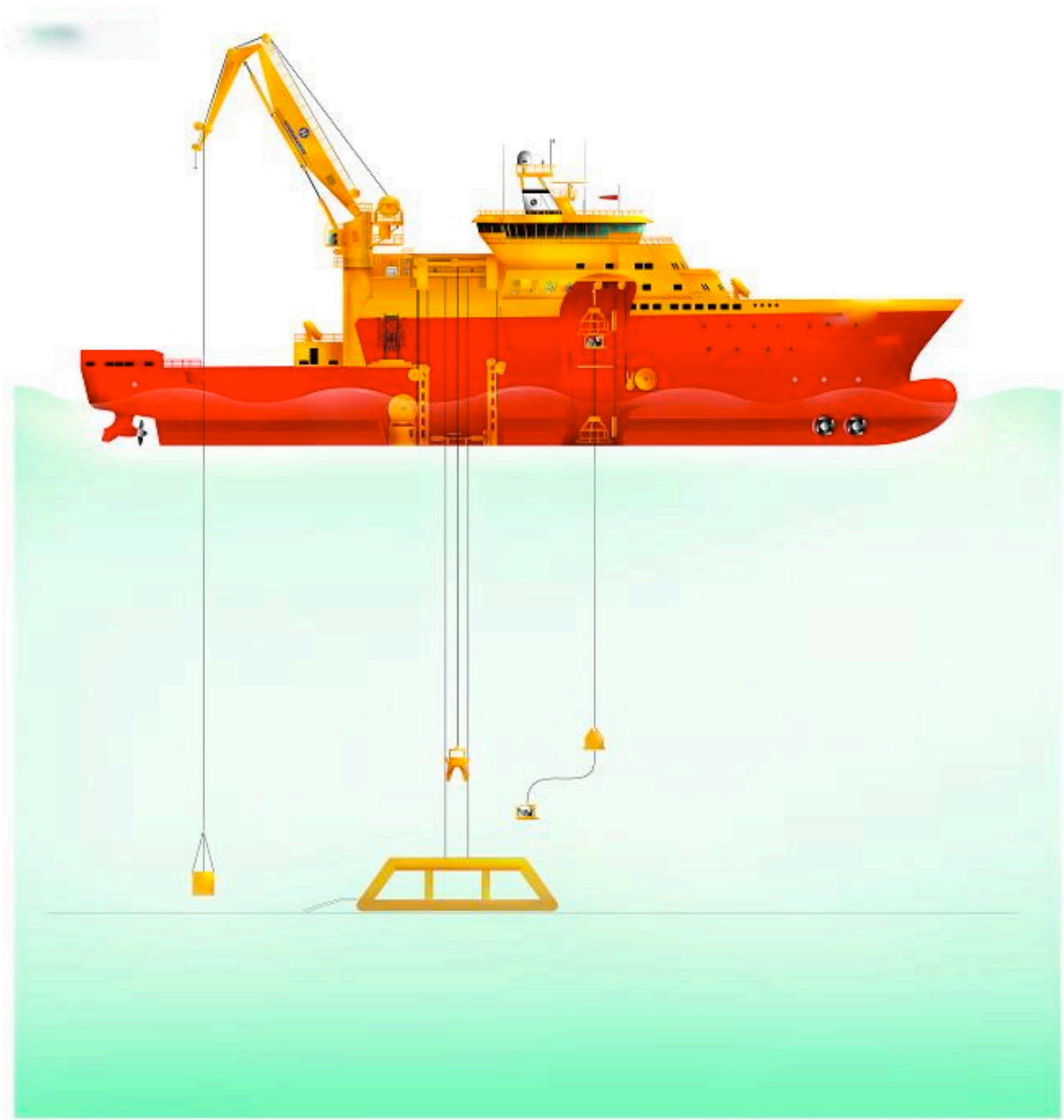
Each IMR campaign (a series of trips and operations) is a collaboration between four (or more) companies involving up to seven on-board teams on one trip. Oil companies hire the subsea contractor who specializes in subsea operations. The subsea contractor hires a specialized vessel with captain and crew from a shipping company. This is reflected in the on-board organization of the IMR vessels. The client rep is the liaison for the oil company that

⁷ IMR operations can also be performed from rigs, but the introduction of specialized vessels radically reduced the cost.

⁸ Johannessen, I. A. *Review of IMR Operations*, manuscript (unpublished).

has commissioned the work, the offshore manager leads the operational personnel, and the captain leads the marine crews and is responsible for safety.

Figure 1: An IMR vessel in dynamic positioning mode



When the IMR vessel reaches its destination it switches to dynamic positioning (“DP”) mode. This technology fixes the vessel’s position, so that the remotely controlled robotic vessels (ROVs) and tools can be lowered to begin work (see Figure 1). Simultaneously, the individuals and component teams (across companies) that are directly engaged in the execution phase of the operation are put under the direct command of a single leader, the shift supervisor. Such integration of several teams to execute a superordinate goal has been

described as a multiteam system (Mathieu et al., 2001). This transformation creates tight coupling between the interdependent component teams. The shift supervisor is primarily confined to his control room, and monitors the minute-to-minute operation on monitors. Coordinating the interdependent teams that conduct the operations takes up most of the shift supervisor's time and attention (Johannessen, McArthur, & Jonassen, 2012)⁹.

The ROV team is the core of the operation. From their control room, pairs of pilots 'fly' the robotic vehicles using mechanical arms ('manipulators') to perform work on subsea installations. Two or more pairs can work at the same time, lead by an ROV supervisor. While the pilots enjoy the safety and comfort of their control room, mistakes on their part can do damage and even jeopardize the operations. The work of the deck team is challenging in different ways. Over the deck, tower crane operators control large cranes. On deck, a deck foreman leads deck hands that perform multiple tasks (including operating smaller cranes). ROVs and other objects are lifted or lowered over the railing or through openings in the vessel's hull ('moon pools'). This busy and noisy place is physically the most dangerous on the vessel.

Despite comprehensive planning, unforeseen and disruptive events do occur. In such cases, the shift supervisor or others may put the operation on hold (an 'All Stop'). However, during our field study, we observed several situations where disruptions were contained without interrupting the operation.

⁹ Johannessen, I. A. *Review of IMR Operations*, manuscript (unpublished).

The informal leadership redundancy hypothesis

The findings in this study are based on both field data collected in 2009, and a set of stimulus case interviews conducted in 2011. The purpose of the field trip was to familiarize our team with the research context, and to develop focused research questions. One result was the development of our hypothesis on leadership redundancy (Johannessen, McArthur, & Jonassen, 2012).

Field Trip Data (2009)	Follow-Up Interviews (2011)
Designed to familiarize researchers with the case, and develop focused research questions.	Designed to validate and explore further how the on-board organization can respond flexibly to unexpected events.
Collected on a two-week trip on a subsea vessel	Conducted on visits to vessels on port calls
14 semi-structured interviews	35 stimulus case interviews
16 unstructured interviews	7 shifts on 4 vessels
138 hours of observation	
(5 background interviews were carried out on-shore prior to the field trip)	

Table 1: Field Trip data and follow-up interviews

Our analysis of the field data was informed primarily by high reliability theory (Weick et al., 1999), which has advocated that reliable operations require both structure and flexibility (Faraj & Xiao, 2006), and has articulated a set of principles that increase an organization's capacity to contain unexpected events (Weick & Sutcliffe, 2007). In light of this, it made sense to look more closely at the execution phase of IMR operations where the system's tight coupling is put under the highest stress (Perrow 1999b).

The field study had familiarized us with the key role of the shift supervisor in the execution phase. We learned that he needed to remain on his post in his control room and that he seemed to prioritize task coordination during the execution phase, a key leadership function identified by multiteam systems theory (Mathieu et al., 2001). This insight led us to look into how functional team leadership frameworks (Morgeson et al., 2010) have been applied to understand team dynamics. Functional leadership theory focuses on the ‘what’ rather than the ‘who’ or ‘how’ of leadership. Seen through this lens, the shift supervisor’s primary leadership function is task coordination. We asked ourselves how other leadership functions under the purview of the shift supervisor were accommodated (or not) when events occurred that could disrupt the operation.

We searched our field data (organized in an NVivo data base) for examples of the kinds of events that the shift supervisor was either unaware of, or unable to respond to given his focus on task coordination, and recorded how they were managed. We found that other individuals stepped in, unasked, to manage the situation, sometimes improvising outside standard procedures. The actions taken by these individuals were consistent with a subset of leadership tasks identified by functional leadership theory (Morgeson et al., 2010), such as boundary management, problem solving, and coaching.

To test our hypothesis that informal leadership redundancy contributes to the system’s ability to balance structure and flexibility, and to understand how this occurs in practice, we extended our case study to include interviews with new informants, using stimulus cases based on our field observations.

Purpose and design of stimulus case interviews

The concept of informal leadership redundancy is difficult to study systematically. Where and when disruptive events are likely to occur is unpredictable, and we had a relatively low number of examples from the field study. But, as Flyvbjerg has pointed out, ‘atypical and extreme cases often reveal more information because they activate more actors and more basic mechanisms in the situation studied’ (Flyvbjerg, 2011, p. 306), and such cases can make new sense of events that were considered outliers. In our case, we seem to have identified a dynamic that gave the system a greater capacity for flexible response, which, to our knowledge, had not been described in previous research. We could not be sure if what we had observed in the field were isolated examples (a verification issue), and we had limited information about the conditions for successful use of informal leadership redundancy (an issue that called for further exploration). Our specific contribution to extant HRO theory is in an early stage of development, which also indicated that a case study could be the most effective research strategy (Edmondson & McManus, 2007). We looked for ways to extend the initial field study to examine the same type of subsea operations, collecting new data while keeping variance of contextual factors low (Flyvbjerg 2011).

Given we could not afford new and longer periods of observation, we needed a more efficient way of gathering data. We drew on a variant of critical incidents techniques used in studies of education (Angelides 2001), which we combined with our own experiences in designing leadership training programs (Johannessen, McArthur, Jonassen, & Leirbaek, 2013).

We designed a set of stimulus cases based on examples of informal leadership redundancy from our field data, all taken from the busy execution phase of the operations. We used these cases as the basis for semi-structured interviews. In order to ensure that the stimulus cases were clearly written and did not contain any misunderstandings of subsea operations, we

sought input from business insiders, both in individual conversations and in a seminar. New subjects read the cases and were asked if they recognized the examples, whether they evaluated the intervention as appropriate or not, and the reason for their evaluation. The cases were tested on one vessel on a port call in June 2011. One ambiguous case was replaced, and minor clarifications were made to the others. Findings from three of the cases are included in the present article¹⁰.

¹⁰ The fourth case concerned boundary management. That leadership function was already represented in case #1, so the fourth case was left out in the present article to save space.

Table 2: The Stimulus Cases¹¹

	<p>During an operation to recover (a tool from the sea bed), there is a sudden leak of hydraulic oil from a manipulator on one of the ROVs. Oil spills directly into the sea under (high pressure).</p> <p>The client rep, the third party experts and the senior ROV supervisor are present in the ROV control room. The offshore manager has just arrived. The shift supervisor is in the adjacent control room, busy containing the damage while keeping the operation in motion.</p>
Case # 1	<p>The client rep starts a discussion about why and how the incident could happen. He uses a critical tone and tries to engage the pilots in a discussion. The offshore manager interrupts the conversation, and quickly guides the group away to a different room to continue there, leaving the pilots behind to go on with their work. Two pilots continue working with the intact ROV while the other pilot team recovers the leaking ROV to the surface for repairs.</p>
Case #2	<p>A client rep gives an example of when they became aware of an unresolved problem in an upcoming operation. It concerned (a broken tool). He commented: “Strictly speaking, it is the shift supervisor’s responsibility to anticipate challenges and make sure that the work moves smoothly from one operation into the next. But we all need to be able to step in when necessary”.</p> <p>The client rep and the offshore manager sat and talked about how they could solve it. They made some sketches, puzzled over it, walked around the departments, and after 1 hour and 20 minutes they had a solution. After the initial discussion the client rep then went to the project engineer and proposed the solution. The engineer considered the technical aspects and performed detailed calculations to make sure it was feasible. Then the client rep and the engineer went to the tower crane operator and modified the solution, and finally took it to the offshore manager for approval. When that was granted, the engineer worked out a task plan for the operation. From the time they started working on the idea until the (tool) lay on the deck took 8 hours.</p>
Case #3	<p>The medic has time to walk around and have informal contact with people, and is more likely than many others to pick up early signals of problems and needs. He notices the new deck foreman talking with his two (deck hands). The (deck hands) are new; the medic has not seen them before. The deck foreman walks over to a small crane and begins to operate it, while several other operations are in progress on deck. It strikes the medic as odd that the (deck hands) are left standing idly behind.</p> <p>Over several days, he notices a pattern, and gets concerned. The deck foreman does not seem to fill some of his leadership role; of keeping an overview, having an eye on safety, delegating duties, and coaching the new (deck hands) when needed. The medic decides to see if the deck foreman may be open to some feedback and advice himself, and asks to talk with him in private when he is off-duty. The deck foreman turns out to appreciate this opportunity to talk to someone about his work.</p>

Data collection and analysis

In line with the strategy for extending the case study, we selected contexts (vessels and shifts) from the same type of subsea operations as in the field study, with a similar mix of companies, similar arrangements for leadership and inter-organizational cooperation, all under the same (Norwegian) regulatory regime. From June to December 2011 two researchers conducted interviews on IMR vessels during port calls. We selected subjects that were all

¹¹ In this version, we have substituted some technical terms with more generic terms to make it easier for readers unfamiliar with the business. The substitutes are in parentheses.

involved (directly or indirectly) in the execution phase of the operations, and who were in a role that would have information¹² on one or several of the examples of informal leadership redundancy that we had observed in the field study.

All interviews were recorded and transcribed verbatim. A log was created to keep track of who was interviewed, and the circumstances around each port call. In December 2011 a sample of the interviews was discussed amongst the authors, and a procedure for validation and analysis was developed.

¹² Our educated guesses of who possessed relevant information proved right in most cases. The exception was that we also interviewed captains who all explained that they were too far removed from the execution of the operations to have insight in our examples. These interviews were therefore excluded from the analysis.

Table 3: Informants by role and affiliations

Role	Affiliation	Informants	Description
Client Representative	Oil Company (The Operator)	6	A client rep represents the oil company (the 'Client'). He monitors the ongoing work on the vessel.
Offshore Manager	Subsea Contractor	4	The offshore manager is the highest-ranking officer of the operator company on the vessel.
Project Engineer	Subsea Contractor	5	The project engineer is an aide to the offshore manager and helps translate overarching plans into practical detail.
Medic	Subsea Contractor/ Shipping Company	6	The medic is on-call when first aid is needed (infrequently) and assists the offshore manager in matters of health, safety and environment.
Shift Supervisor	Subsea Contractor	8	The shift supervisor directly controls and coordinates all resources in the execution phase of an operation.
ROV Supervisor	Subsea Contractor	5	The ROV supervisor leads the team of pilots that 'fly' the subsea, remotely controlled robots (the ROVs)
Deck Foreman	Subsea Contractor	1	The deck foreman leads and coordinates the operational work on deck (where immediate physical hazards are highest).
SUM		35	

A template was created to summarize each researcher's individual analysis of the informants' responses to the cases in each interview (see Appendix). The template was designed to keep track of 1) whether subjects could confirm or disconfirm if they recognized the behavior described in the case and 2) how subjects evaluated and made sense of the behavior in each case.

Each researcher scored if informants had participated in or witnessed interventions like the ones described in the cases, and, if not, if they saw them as plausible or implausible. Similarly, each researcher scored the evaluation in the interview as positive, negative or undecided, and identified the relevant quotes in each interview. Each interview was analyzed by a minimum of two researchers, who met for validation meetings. For the validation meetings, a tailor-made Bento¹³ database was created, in which scores, notes and quotes were stored. If there was disagreement between the scores and a closer look at the data could not lead to reconciliation, the ‘strictest’ interpretation was chosen. In the case of confirmation/disconfirmation, the disconfirming alternative was chosen. In the case of the evaluation, doubtful scores were recorded as undecided. We conducted a total of eight validation meetings. Finally, a summary document of relevant findings was created, and checked for accuracy¹⁴.

These inquiries have enabled us to: 1) validate if subjects on other vessels and shifts could recognize the triggering events and the interventions we had observed in the field study; and 2) explore how and under what conditions informal leadership redundancy worked. We report our findings in the following section.

¹³ Bento is a simple data base tool from FileMaker.

¹⁴ Details of the methodology are recorded in a separate report (Johannessen et al., 2013).

Findings

The stimulus cases are based on events that were observed in the field. In each event an individual took initiative on their own to resolve a problem that was officially under the purview of the shift supervisor, but which the shift supervisor could not address at that moment, given his other priorities. In the actual examples on which the scenarios are based, each case was resolved successfully in that the disruptive event was contained, and in a way that did not create unintended consequences.

The first step in our analysis was to establish if our subjects recognized the case scenarios as realistic triggering events (i.e., that an insider would see as a problem that would require an intervention). We also needed to check whether our informants saw the events as outside the ‘interventionists’ formal role and within the shift supervisor’s purview. The second, more explorative step was to determine under what conditions (enabling factors) our informants would see the intervention itself (as described in the case scenario) as realistic and effective.

Realism of the Stimulus Cases

The majority of informants confirmed, regardless of their role, that the situations described in the stimulus cases were realistic, and would pose a risk to the safety and success of the operation: technical breakdowns needing immediate, undivided attention can occur during operations (Case #1); assumptions that underlie the Task Plan do not always match the realities at the site, and gaps must be corrected quickly (Case #2); and ineffective delegation can jeopardize the safety or effectiveness of the operation (Case #3).

Informants also confirmed that the individuals who intervened in each case were not doing so as part of their formal responsibilities. Each of the situations fall under the purview of the shift supervisor who may be unable to respond in the moment given the constraints of his role. For example, one shift supervisor (08) said that “90% of the time” he would prevent any

disturbances to the ROV teams, like the one illustrated in Case #1. However, as medic 06 commented, the shift supervisor may be unable to do so if he must focus his attention on the recovery of the ROV. “Technically, the shift supervisor should probably have drawn the line (...) and moved [the client rep] away from the situation (...). However, the shift supervisor is probably [more concerned with what is going on in front of him].”

Regarding problems with the Task Plan (Case #2), client rep 09 said, “The shift supervisor has his hands full with the operation. He can’t sit down to solve such a problem.” Another client rep (04) commented that, “(...) it is a fact that, if you are very focused on a task, your vision can get quite narrow, and you may not notice the obstacle outside your visual range. But those sitting a bit on the sideline of the operation may notice it.” Or, as a shift supervisor (07) said, “Sometimes the shift supervisor has already moved from the deck (...) They’re not always on deck to see everything; whereas you’ve got deck foremen, riggers, engineers, and so on, who hopefully catch it before that, which does happen on lots of occasions.” Finally, regarding problems with the deck crews (Case #3), one shift supervisor (06) said about his potential inability to intervene, “(...) I have no way of picking up on this situation. I can, of course, see them on deck when I am working with the camera, but I am paying attention to other things also. So, it is not certain that I can see the situation for what it is.”

To summarize, our subjects recognized the case scenarios as events that might occur and that might call for an intervention. They also described the interventionists in the examples as stepping out of their ordinary role in performing the intervention, and that the leadership function in question was normally under the purview of the shift supervisor.

Enabling Factors

Below we present the factors that our informants suggest influence the effective use of slack leadership resources. As we reviewed the transcripts, we found that informants’ responses fell

into three categories; 1) the *availability* of an individual to take action, 2) the *willingness* of that individual to act, and 3) whether the intervention was likely to be *accepted* and why.

Below, we illustrate each of these elements.

Availability to intervene

Medic 01 commented that while the shift supervisor should have prevented the client rep from disturbing the ROV pilots, “the offshore manager is probably more able to get an overall impression, just take a step back, and let [the pilots] deal with [the recovery of the ROV, and] take [the client rep] aside”. Similarly, in Case #3, where the medic provides coaching to the deck foreman, several people commented that the medic’s role enables him to have the time to walk around and observe, and “be a researcher of sorts (project engineer 10).” In Case #2, a shift supervisor (07) commented that the client rep could be a useful resource because his formal role, unlike the shift supervisor on duty, gave him some distance on the situation: “Say you are working on a jigsaw puzzle. When you are that close to the jigsaw puzzle, you can’t see all the pieces. You can’t see the ones over there. If you’ve just come into the room, you can say, ‘Hey you are missing a piece. It’s over there.’ It’s as simple as that”. All of these examples suggest that slack in one’s formal role may provide an opportunity for heightened awareness and capacity to consider what may be needed, and what can be done. However, previous research on HROs (Barton & Sutcliffe, 2009) has argued that awareness alone is not enough to contain disruptive events. People must also be *willing to take action*.

Willingness to intervene

Informants said they were motivated by a sense of responsibility for the safety and effectiveness of the operations. Client rep (06), reflecting on Case #2, said that it was “(...) out of the question that I, as the client on board, would sit down and wait for the problem to emerge when I had noticed it.” shift supervisor 07, reflecting on the same case, said that

during an operation, “(...) if something crops up (...) it’s up to the people who see it, or who can sort that problem out.”

Informants also said that their willingness to act could be influenced by the status of their role and their degree of experience. For example, project engineer 10 commented that if a shift supervisor is not able to maintain the boundary around the pilot team so they can work undisturbed, “(...) the offshore manager runs things, so it is easiest for him to put his foot down.” ROV supervisor 07 added, “If the offshore manager is around, he would automatically take the initiative. If he is not, then I would, if I were there, politely give [the client rep] feedback (...), if I am not there, then it is guaranteed that the assistant ROV supervisor or the pilots would draw the line, they are so confident.”¹⁵ Other informants qualified this by saying that it would take some gravitas (Norwegian: ‘pondus’) to confront a client rep, (“typical trainees would not do this” (project engineer 10)) or to complain about a leader.

Our informants also indicated that the willingness to intervene depends on trust and respect in their work relationships, and that such qualities may need deliberate cultivation. For example, shift supervisor 07 commented that when problems occur on deck that the shift supervisor is unaware of, “(...) hopefully, the deck foreman has a good enough working relationship with the shift supervisor to go and say, ‘Look we’re going to have a problem with this’.” Another shift supervisor (03) also stressed the importance of the same relationship: “In my experience, when you come to a new place, one of the first that I get in touch with and try to get to know is the deck foreman, for he is my eyes and ears on (...) deck. And that relationship needs to be

¹⁵ The confidence of the pilots may be partly influenced by the status of their role and the fact that their salaries are among the highest on board.

built on mutual respect.” Client rep 04, talking about his own willingness to raise issues, commented, “I may have asked about stuff with the wrong person and been told that that was maybe [inappropriate], and I think that is OK. But then maybe you ask again and you reach an agreement, and it is no big deal, because you develop flexibility by being flexible yourself. It is give and take the whole way.” Client rep 04 suggested that some amount of trial and error must to be tolerated, and, that being criticized for mistakes also must be tolerated.

To summarize: For some informants, willingness to intervene seems to be grounded in a sense of shared responsibility for the safe and effective execution of the operations. While it may be easier for individuals with experience and high status to voice their concerns, similar initiatives from less experienced, junior people are also considered possible. Flexibility, trust and respect can be developed when members of multiteam systems negotiate the boundaries of an acceptable improvisation.

Acceptance of the intervention

The interventions in the actual situations on which the case scenarios are based were effective in that they 1) solved the perceived problem that triggered the intervention, and 2) did not create unintended side effects, such as confusion or conflict. The semi-experimental stimulus case interviews cannot robustly test the effectiveness of interventions in the first sense, but they provide insight into how controversial the interventions might be.

According to our informants, the strongest criteria for accepting an intervention are the *degree* and *urgency* of risk to the operation. The consensus was that immediate risk called for immediate action, and, if necessary, an ‘All Stop’¹⁶. For example, in Case #1, informants agreed that the offshore manager (or anyone regardless of rank or role) would be right to

¹⁶ The general mandate to call a halt to an operation if perceiving danger, see page 12.

intervene with the disruptive client rep in order to allow the ROV pilots to work undisturbed. In cases of imminent danger there was agreement that anyone had the right, if not an obligation, to completely stop the operation. This concern for safety was relevant to how some informants reacted to the medic's intervention with the deck foreman in Case #3. For example, ROV supervisor 07 said that if the medic observed something that posed an imminent danger, and, "(...) if it was a very critical operation he should have interrupted right there and then." Or, as offshore manager 06 commented, "(...) if [the medic] sensed that this would jeopardize safety, meaning that people were not in full control of the deck, (...) I need to know that. We can't have that."

In situations that did not pose an immediate threat to safety, informants' evaluations of the cases were influenced by three factors: how *procedures*, and *the chain of command* are taken into account, and if the interventionist has the *appropriate skills*. For example, in reference to following procedures, shift supervisor 07 said, "I try not to deviate from what is written down. If it is not written down, then I'll want confirmation from somebody else before I will deviate from that path. I'm not going to deviate from what I am supposed to be doing, especially in this industry, because then it opens up a whole new can of worms." An offshore manager (05) seconded the importance of following a structured approach to change when he said, "(...) so we're trying to agree ahead of time, we'll have this and this policy, if there are to be changes, we want it in writing. And if [the client rep] comes and asks for changes we'll say, ok, we can't start doing things outside the procedure that we have established here. If so, we need to sit down and create a new procedure. (...) this [is something that] goes on the whole time - how flexible we want to be and what we let happen (offshore manager 05)." Or, finally, as client rep 07 said, "If I have an idea I will vent it, (...) 'Can we do this? Can we try that?' But everything here is guided [by] procedures, as well. So, in order to deviate from the

procedures, we call an ‘All Stop’ and discuss what we want to do. We do the risk assessment, and then we do the Management of Change¹⁷. Once it’s all agreed and approved by everybody on board, and depending on the type of change we have, it either goes onshore or not. After that, we continue the work in a new way that is set in stone.”

Several informants expressed a concern related to procedural discipline - respect for the chain of command. For example, regarding Case #3, one shift supervisor commented, “It is a good thing that the medic observes. That’s his job, and he is an HSE advisor, so that is only positive. But, I don’t think that it is right that he goes straight to the deck foreman to talk with him about how he does his job. It would have been more appropriate to come and talk with us who are responsible for the deck. Either talk to me or to the offshore manager if he has a concern.” All of the medics that we interviewed also said that respecting the chain of command was important, and that if they were to give feedback to a deck foreman they would also include the deck foreman’s supervisor.

Finally, some informants indicated that how they perceived an individual’s skill level could influence whether or not they accepted an intervention by that individual. In the case of the coaching intervention performed by the medic in Case #3, some thought that he lacked the sufficient technical skills to justify commenting on the deck foreman’s work performance. Others saw him as somebody, who, as an observer and aide, could intervene based on more generic coaching skills. As a shift supervisor argued, part of the medic’s mandate is to be, “an independent person who can go and speak to different people” on his own initiative with the potential to “raise [his concern about the deck foreman privately] and say what he has observed, and check if he has seen correctly” (project engineer 10).

¹⁷ The procedure to change a procedure, for example to create a new Task Plan.

Participants did not agree on how the criteria of acceptance applied to the examples in the stimulus cases. Their disagreements were based either on how they assessed the intervention against a particular criterion (e.g. loyalty to chain of command), or on which criteria they considered most relevant (e.g. chain of command vs. possessing a relevant skill). As an example of the first, some informants thought that the client rep in Case #2 who made changes to the Task Plan had not followed proper procedure because he had not included the shift supervisor. As shift supervisor 10 commented, “No, this is all wrong. (...) The shift supervisor is supposed to get to read and comment on a task plan. That’s the [proper] process (...)” Other informants, however, thought that as long as the client rep involved the offshore manager and the project engineer he could take the lead in creating a solution. For example, one client rep (06) commented, “(...) he contacted the offshore manager to discuss it, and that’s the natural thing to do. These are the proper communication channels.” The latter comment suggests that the client rep does not deviate from proper procedure, but rather emulates that procedure by going through the same steps that the shift supervisor would have.

To summarize, our interview data indicate that there is agreement on how slack leadership resources can take action when there is an imminent safety risk, or when the efficient and effective execution of an operation is clearly compromised. However, in situations that do not call for an ‘All Stop’ (which is costly in terms of time and money), but still require a flexible approach, informants had different views on what constitutes an acceptable improvisation. Our data indicate that creating alignment around how to achieve flexibility potentially involves two different negotiations: 1) how a particular criterion, such as command lines, or procedures, should apply in a given situation, and 2) which criterion is the most relevant in

determining whether an action is acceptable or not - e.g., command lines, procedural guidelines, and necessary skills.

Discussion

Research on HROs has claimed that these organizations are successful because they balance structure and flexibility (Faraj & Xiao, 2006; Weick et al., 1999). The current study contributes to an understanding of how this balance takes place in practice by documenting a form of distributed leadership that we have named informal leadership redundancy. In the following sections we discuss our contribution in light of extant literature on authority migration, constrained improvisation, and the capacity for interrupting problematic courses of action. We then examine some ambiguities associated with informal leadership redundancy. In conclusion, we point out limitations in our study and potential for future research.

Authority migration

Previous research on HROs has identified deference to expertise as a mechanism for migrating authority to those individuals with the most relevant knowledge and expertise in order to make quick and effective decisions. The individuals to whom authority migrates are executing tasks that are part of their formal role. Therefore, their availability and willingness to take action is ensured, and the acceptance of their actions by others is likely. Deference to expertise exists in IMR operations, as well. For example, authority migrates to the shift supervisor when the IMR vessel reaches the installation site and the execution phase begins. Authority also migrates to other individuals when their formal role requires them to make quick decisions. Like deference to expertise, informal leadership redundancy can add capacity for flexible response, but it is distinct from that principle; the formal leader does not delegate the tasks that others take on, even though these tasks concern functions that are usually associated with the leader's position. The individuals that take action in our examples are available because of slack in their formal role during the execution of the operation, they

perceive a need that they believe they can address, and they then choose to intervene. Furthermore, unlike with deference to expertise, the key issue with informal leadership redundancy is whether others accept the improvised actions that are taken. Here, our findings contribute to research on HROs, which has found that improvisation is acceptable within constraints.

Constrained improvisation

In the case scenarios, individuals chose to improvise outside their normal role. In this regard, the scenarios are consistent with Bechky and Okhuysen's (Bechky & Okhuysen, 2011) concept of *role shifting* as a form of organizational bricolage (making improvised use of available resources). For example, the client rep in Case #2 decides that he can and should take the lead in creating an alternative approach to the next phase of the operation, since conditions do not conform with the existing Task Plan. He temporarily fills a role that under other conditions would be filled by the shift supervisor. This illustrates how the 'interventionists' in our research improvise in two ways: first, by taking initiative outside their formal responsibilities; and, second, by coming up with solutions that are not anticipated in plans and procedures.

According to Bechky and Okhuysen (2011), organizational bricolage is possible when groups have *shared task knowledge* and *common work flow expectations*. Similar conditions are present in our research. On each trip, the whole crew goes through familiarization meetings to create the mindful attention to safety that they may need after 2-4 weeks off¹⁸. In the same meetings, the upcoming operations are also outlined, so that all have a shared understanding of the work ahead. Crewmembers that have a direct role in the planning and execution of an operation are not only briefed, but are to varying degrees engaged in formulating and refining

¹⁸, Johannessen, I. A. *Review of IMR Operations*, manuscript (unpublished)..

the Task Plan. Many, if not all crewmembers will share an understanding of the nature of the operation, the expected sequence and, for the more experienced, a readiness for things that can go wrong.

Our findings on improvisation in IMR operations are also consistent with those of Bigley and Roberts in their study of Incident Command Systems in that the improvisations are constrained - they both 'spring from and tend to be limited by' (Bigley & Roberts, 2001, p. 1289) rules and procedures. For example, in case #2, when the client rep steps in and bypasses the shift supervisor, he emulates what the shift supervisor would have done if he had the time. He coordinates with the shift supervisor's superior (the offshore manager) and involves the same people that the shift supervisor would in developing a new Task Plan. This is what leads some informants to see the intervention as appropriate, as if the client rep were following the spirit, if not the letter of the established procedures. Similarly, our informants accepted the improvised actions taken by the offshore manager, the client rep, or the medic, if they were seen as consistent with the purpose and goals of the operation. Those who objected to the interventions most often saw them as not respecting existing command lines and operating procedures. Those who defended the more controversial interventions argued that though unusual, they were still in compliance with goals, command lines and operating procedures. This respect for structure on the part of our informants appears to be a key factor that shapes how improvisation is perceived and enacted, even when informants had different interpretations of how these principles applied in a given situation.

The kind of constrained improvisation we observe on the part of slack informal leadership resources in IMR operations differs in an important respect from what Bigley and Roberts found in an emergency response organization. Bigley and Roberts frame constrained

improvisation in terms of giving able subordinates freedom to adapt. They write, “When a commander believes subordinates possess sufficient experience, training, and resourcefulness to adapt to local conditions, he or she typically leaves the task partially unstructured (unless an unusual degree of directed coordination is required for some other reason). In other words, supervisors provide subordinates with a degree of latitude to improvise—that is, to activate and coordinate their own routines and to apply novel tactics to unexpected problems” (Bigley & Roberts, 2001, p. 1289). In each stimulus case in our study, tasks have not been left deliberately unstructured to provide subordinates the opportunity to exercise their own judgment. These interventions are of a different nature in that they are a response to an unexpected event, and have not been delegated. This makes constrained improvisation by informal, slack leadership resources more complex than improvisation within one’s formal role, and suggests that the individuals involved would need to have a shared understanding of how they interpret goals, operating procedures and command lines.

Interrupting dysfunctional momentum

Our research also adds to recent work on the factors that contribute to this kind of improvisation. In their study of wildfire teams Barton and Sutcliffe (2009) showed that in most cases where fire fighting had been successful, the course of action had changed from the initial strategy. Somebody had become aware that following the initial strategy would constitute a *dysfunctional momentum*. Barton and Sutcliffe also demonstrated that awareness of a problem is not enough to trigger change; people must also *voice their concern*, in order to change a current course of action. In our research we also found that actors need to be aware of warning signs, and be willing to raise concerns. But, when they choose to take on a leadership function under the purview of the shift supervisor, they are not only raising a concern, they take action to address the problem. To do so, they need to see themselves as the

right person to intervene, as personally capable, and sufficiently involved to take responsibility.

Since unexpected events at times fall outside any contingency plan, containing them requires novel initiatives. Informal leadership redundancy may provide the capacity needed for improvisation to occur - both in regard to who takes initiative, and how they address the problem. Implicitly, an interventionist makes a judgment that his action is relevant, necessary and appropriate. Since this is necessarily a private judgment, others may in fact disagree, and the exercise of informal leadership redundancy may be contested. Next, we look at the tensions that we found were associated with informal leadership redundancy.

The ambiguities of informal leadership redundancy

The fact that even well planned operations can face unexpected events comes as no surprise to our informants. Several acknowledged that the unexpected situations that they faced in the operations could be ambiguous, without an obviously right response. All informants acknowledge that improvisation may be necessary to contain unanticipated events¹⁹. The open questions concern who to involve in specific decisions, and when and how to blend improvisation with following procedures.

In their discussion of the Incident Command System, Bigley and Roberts (2001) identified 'freelancing' as an inappropriate form of improvisation: an action that was not aligned with the overall goals of the ICS, or that might jeopardize safety. Our informants used similar criteria to assess whether the interventions in our stimulus cases were appropriate. Respect for procedures and lines of command are salient values both for those who favor the more controversial interventions in the stimulus cases and those who have doubts. Concerns for

¹⁹ If the disturbance is so great that the operation must be put on hold, a procedure for changing procedures (Management of change) will be evoked and enacted. Here, we are more interested in those instances when adaptation happens by way of improvisation.

safety appear to override all other concerns in the evaluations. However, as the responses to Case #2 and Case #3 indicate, the benefit of implementing informal leadership redundancy is controversial. Informants did not always agree about which criteria were relevant in their assessment of a particular case, and even when they agreed on the evaluation criteria, they did not always agree on how to apply those criteria in a given situation. This suggests that informal leadership redundancy can be a resource that promotes flexibility, but also adds complexity if people are not aligned on when and how it should be implemented.

Unexpected events will, by definition, always challenge a rule-bound and proceduralized organization (Weick 1993). As Barton and Sutcliffe found, responding effectively to surprise in order to interrupt a dysfunctional momentum requires certain mindsets. Skepticism of expertise (the attitude that no expertise is omniscient) enables people to raise concerns, and situated humility (the attitude that complex, dynamic situations may change and require new knowledge) enables people to actively seek out diverse perspectives. Our data suggest the inclusion of a third mindset, which also enables constrained improvisation – *tolerance for ambiguity* (Schulman 1993). Schulman has argued that a tolerance for ambiguity is essential for conceptual slack - the inclusion of diverse perspectives, which may help an organization handle the unexpected. Such tolerance may apply more widely, and also be relevant to the use of informal leadership redundancy (a form of resource slack and control slack as well as conceptual slack) in order to interrupt a dysfunctional momentum.

In our interviews, we saw some evidence of tolerance for ambiguity. When informants commented on interventions that they had problems with, they did not attribute negative motives to the actor, and they weighed arguments for and against his actions. As shift supervisor 08 put it, when deciding whether to operate outside established procedures, “There

are lots of grey areas”. An offshore manager (06), asked how he would explain to a medic when it was okay for him to coach a deck foreman said, “That’s a little intricate and a good question”. Client rep 04, who reflected on his willingness to intervene, accepted the risk of making mistakes and standing corrected. These reactions indicate that the informants embrace the ambiguities in the operations as a reality that calls for negotiation, trial and error.

Conclusion

We have examined how individuals handled a set of disruptive events and identified how a reliability-seeking organization can respond flexibly to disruptive events through the use of redundant informal leadership resources. The focus and design of our study answers calls for research on reliability-seeking organizations to attend to both context (Hannah et al., 2009) and micro-level interactions (Barton & Sutcliffe, 2009). Our organizational context - subsea operations that inspect, repair, and maintain the oil and gas infrastructure on the Norwegian continental shelf - adds to the contexts studied in previous research on high reliability organizations.

In informal leadership redundancy we have identified a mechanism for authority migration that differs from both deference to expertise and dynamic delegation. We found that it can add to a system’s capacity for flexible adaptation, but also to the potential for conflict. Our findings contribute to research on constrained improvisation (Bigley & Roberts, 2001) and to the factors that enable individuals to interrupt a dysfunctional momentum (Barton & Sutcliffe, 2009; Bechky & Okhuysen, 2011). When we examined informants’ reactions to our examples, we found that they evaluated the improvisations based on an underlying respect for procedural discipline. In our examples, the ‘interventionist’ does not just notice a potential problem; they take action outside their normal role to solve it, and do so without explicit delegation. Everyone involved in the operation may not share an understanding of these

interventions, which can create the potential for conflict. However, experienced people in these systems also know that it may not be possible to reach consensus on the right course of action in the heat of the moment. This may lead to a tolerance for ambiguity that makes the use of informal leadership redundancy more acceptable and, therefore, more effective.

Limitations and Future Research

The initial observational study was explorative, and took place on one vessel, with one crew. The follow-up interviews using stimulus cases were designed to extend the field observations to more crews and vessels with similar technology, tasks, multiteam structures, and regulatory constraints. As with all case studies, further research is needed to determine how our findings are generalizable to other contexts.

One of the unique structural features of IMR operations is that they are conducted by a set of interdependent teams from four or more companies. Mathieu et al. (2001) have labeled this type of organizational structure a *multiteam system*. Our multiteam system is engaged in high-risk work in a demanding, potentially extreme environment (Hannah et al., 2009). We found that the responsibility for coordinating the teams is centralized in the role of the shift supervisor, which has advantages as well as limits. While the shift supervisor needs to be aware of everything that could potentially impact the success of the subsea operation, his sphere of direct influence is usually limited to what he can do from the confines of his control room. As we have documented above, the shift supervisor cannot always be aware of, and respond to, everything that can impact the success of the crucial execution phase; informal leadership resources supplement his centralized coordinating role. Future research could determine how our findings are generalizable to other kinds of reliability-seeking organizations that are organized as multiteam systems. In the commercial system that we studied, we found a different form of control slack than has been reported in research on

Incident Command Systems, and on military HROs such as aircraft carriers and nuclear submarines. All of these organizations operate in dynamic environments where surprise is expected and tight coupling can lead to rapid escalation of errors. Further comparative research is needed to understand if, and how, organizational mission and purpose influence forms of distributed authority.

Our study shows that slack leadership resources can be useful, but can also add complexity. It would be simplistic to say that organizations should just design slack into an individual's role. We have identified some of the points of tension that could lead people to have different points of view, and that would need to be negotiated. To understand more of those tensions and how they are handled would be a research focus that could have implications for practice. As far as we are aware, the medic role is the only one where slack is built in by design. Our examples show, however, that other roles also involve slack that can enable individuals to compensate for the vulnerabilities of complexity and tight coupling. While some of our informants argued that the Medics had too much spare time, our research results should be taken into account if calls for a leaner design of these types of operations are discussed.

Our informants' evaluations of the stimulus cases provide us with insight into their thinking about interventions that challenge the procedural rigor of the system. However, our data have been collected in a situation where the informants are 'off-line' from their daily, busy interactions, and may not accurately reflect how they would react in the heat of the moment. A similar limitation is that informants may have downplayed controversial safety-related issues, given the strong public commitment that companies in this business - and regulatory authorities - place on safety. Future research could explore how different views about the appropriate implementation of control slack are negotiated 'on-line'.

The Theory of Action perspective (Argyris 1990; Argyris & Schön, 1992) has proposed that the rules that people say they follow to cope with embarrassment or threat (their espoused theories) differ from the rules that actually guide their actions (their theories-in-use), and that individuals are unaware of this gap. Argyris and Schön have found that individual and organizational defenses are easily triggered when people make errors, which undercuts their effectiveness and ability to learn. These ideas seem to be contradicted by the extant research on HROs, which claims that principles of mindfulness enable HROs to cultivate a ‘healthy’ focus on error (Weick & Sutcliffe, 2007), and that developing a ‘just culture’ (Dekker, 2012) that combines tolerance for error with focus on safety is possible (Jordan & Johannessen, 2014). Conducting a study to illuminate these questions could be a significant contribution to theory. The context that we have studied, and the ambiguous situations triggered by a phenomenon like informal leadership redundancy, may provide a promising arena for such research.

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Appendix: Analysis Template

Stimulus Case Interview: File name
 Informant: Informant category and number
 Researcher: Name of researcher who did the interview
 Analyst: Name of researcher who did the analysis
 Date:

Existence	Description	Check	Evaluation		
			+	-	?
Confirmation	I have seen it				
	I have done it				
	It could have happened				
Disconfirmation	I have not seen it				
	I have not done it				
	It could not have happened				

Comments

Stimulus Case #1

1. Confirmation/disconfirmation, and evaluation
2. What is the logic behind the informant's evaluation of the case, including contingencies?
 Why an intervention is necessary
 Who is the appropriate interventionist
3. What does the informant say specifically about the appropriate lines of command in this case and who is the appropriate "owner" of the leadership challenge illustrated?
4. What are the challenges and dilemmas for the role?
5. What are the challenges and dilemmas for the multiteam system, including balancing flexibility and structure?
6. New themes and additional quotes

Stimulus Case #2

1. Confirmation/disconfirmation, and evaluation
2. What is the logic behind the informant's evaluation of the case, including contingencies?
 Why an intervention is necessary
 Who is the appropriate interventionist
3. What does the informant say specifically about the appropriate lines of command in this case and who is the appropriate "owner" of the leadership challenge illustrated?
4. What are the challenges and dilemmas for the role?

5. What are the challenges and dilemmas for the multiteam system, including balancing flexibility and structure?
6. New themes and additional quotes

Stimulus Case #3

1. Confirmation/disconfirmation, and evaluation.
2. What is the logic behind the informant's evaluation of the case, including contingencies?
3. What does the informant say specifically about the appropriate lines of command in this case and who is the appropriate "owner" of the leadership challenge illustrated?
4. What are the challenges and dilemmas for the role?
5. What are the challenges and dilemmas for the multiteam system, including balancing flexibility and structure?
6. New themes and additional quotes