Safety Science xxx (xxxx) xxx–xxx

Contents lists available at ScienceDirect

Safety Science

journal homepage: www.elsevier.com/locate/safety

How many blowouts does it take to learn the lessons? An institutional perspective on disaster development

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ARTICLE INFO

Keywords:
Disaster development
External institutional context
New institutional theory
Offshore oil and gas industry

ABSTRACT

Accident researchers have long tried to understand why similar disasters and near misses keep recurring within and across organizations in high hazard industries. So far such explanations have primarily addressed organizational causes and mechanisms. We argue that these models of disaster development do not adequately capture the influence of the external institutional environment that often affects an entire sector. Instead we propose institutional theory as a broader theoretical perspective that helps to understand how the institutional environment affects disaster development in organizations, and why similar disaster development patterns can persist even after they have been identified and targeted in recommendations before. This paper also provides an empirical illustration of the institutional perspective on disaster development in the offshore oil and gas industry. Our qualitative analysis shows how inadequate beliefs about major accident risk have become institutionalized in the offshore industry through occupational training practices. As such, problematic institutionalized beliefs and practices become the accepted normality across many organizations in the industry, leading to systemic shortcomings in risk management in the entire sector. Hence, we argue for the need for professionalization in occupational training in the offshore drilling industry to improve risk management.

1. Introduction

In this paper we argue that new institutional theory (DiMaggio and Powell, 1991; Scott, 2008) can help to understand how disasters develop and why similar disaster occur across different organizations. Most approaches to disaster development conceptualize it largely as organizational phenomenon: investigations identify organizational contributing factors and theories propose organizational mechanisms that contribute to disaster development (e.g. Reason, 1997). In contrast, the institutional perspective argues that organizations are *open systems* whose internal processes are affected by the institutional context in which they are embedded (Scott, 2008). Anything that happens in organizations, and hence also disasters, must be understood from the context of the institutional environment, which transcends individual organizations. While an organizational view of disasters may conclude that harmful practices are unique to the organization(s) involved a particular disaster, an institutional perspective allows us to see that these harmful practices are in fact be institutionalized across an industry (Dyhrberg and Jensen, 2004; Elliott and Smith, 2006; Wicks, 2001).

Institutions are socially accepted rules, norms, values, and beliefs, which define appropriate ways of behavior in a society or industry (Berger and Luckmann, 1991; Scott, 2008). When organizations integrate institutions in their practices, stakeholders – e.g. regulators, politicians, industry associations, customers, the wider public – will grant them a 'public license to operate'. This will drive similar behavior across organizations in an industry (Meyer and Rowan, 1977; Scott, 2008). Institutions may thus contribute to the development of similar disasters in *multiple* organizations (Dyhrberg and Jensen, 2004; Elliott and Smith, 2006; Shrivastava et al., 1988; Wicks, 2001).

Institutions are relatively resistant to change (Berger and Luckmann, 1991; Jepperson, 1991). As organizations adhere to institutions in their practices for a long time, these practices become increasingly persistent and taken-for-granted as 'the way we do things here'. This can create problems when operational conditions change rapidly, and institutionalized practices can become dysfunctional (DiMaggio and Powell, 1991). In high-hazard industries, dysfunctional institutionalized practices can undermine organizational safety and contribute to the persistent recurrence of similar disasters in different organizations or plants (Elliott and Smith, 2006).

The influence of the institutional context is increasingly being taken into account in accident research. For instance, dysfunctions in the regulatory context, such as political pressures for efficiency and inadequate safety regulations, can contribute to disaster development

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https://doi.org/10.1016/j.ssci.2018.06.011
Received 14 August 2017; Received in revised form 28 May 2018; Accepted 18 June 2018

(Dekker, 2011; Leveson, 2011; Lindoe et al., 2011; Reason, 1997; Vaughan, 1996, 2005; Wilpert, 2007). While explicit regulatory pressures have been acknowledged in this research (e.g. Vaughan, 1996), Dyhrberg and Jensen (2004) argue that a systematic analysis from an institutional perspective, in particular of the influence of less evident, taken-for granted occupational beliefs and norms on disaster development is missing (for three exceptions in the management literature see Elliott and Smith, 2006; Hynes and Prasad, 1997; Wicks, 2001). We follow this call to adopt an institutional perspective to investigate the influence of taken-for-granted occupational beliefs and norms on disaster development. We show the potential of the institutional perspective by providing an empirical illustration from the offshore drilling industry. This industry is of interest because as our findings show institutionalized practices of risk management have failed to co-evolved with the increasing complexity of drilling operations to reach out to deeper waters and harsher natural environments, which we argue contributes to similar accidents in the industry.

2. Added value of institutional theory for disaster research

To indicate the added value of the institutional perspective for disaster research, we first discuss new institutional theory's core premises and concepts. Then we specify these insights for disaster development to explain how institutions may contribute to the occurrence of disasters, and why similar disasters recur so persistently in industries.

2.1. Institutional theory

The term 'institution' as it is used in organizational sociology refers to socially approved and relatively stable rules, norms, values and beliefs that prescribe what kinds of behavior are considered appropriate in a society or industry (Berger and Luckmann, 1991; Scott, 2008; Jepperson, 1991; Meyer and Rowan, 1977). It is beneficial for organizations to align their organizational practices with these institutions so that stakeholders grant them social approval and legitimacy. Legitimacy is "*a generalized perception or assumption that the actions of an entity are desirable, proper, or appropriate within some socially constructed system of norms, values, beliefs, and definitions*" (Suchman, 1995, p. 574). In contrast, when an organization does not conform to institutions it is perceived as illegitimate, and stakeholders may use a variety of pressures to realign behavior, like financial penalties or consumer boycotts. Hence, legitimacy can be understood as a social, political and regulatory license to operate, which improves chances of organizational survival. As such, institutions shape the behavior of organizations (Scott, 2008).

Concerns for legitimacy push organizations towards comparable conduct (DiMaggio and Powell, 1983). This process of homogenization is called institutional isomorphism, defined as "*a constraining process that forces one unit in a population to resemble other units that face the same set of environment conditions*" (DiMaggio and Powell, 1991, p. 66). As more organizations incorporate particular institutions in their practices it becomes more likely that other organizations will also conform to them (Scott, 2008). As such, certain practices become increasingly widespread in industries. As these practices are continuously applied over time, they become customary and persistent. They do not get actively questioned anymore – these practices have become taken-for-granted and institutionalized (Scott, 2008; Jepperson, 1991; Berger and Luckmann, 1991).

Scott (2008) distinguished between three types of institutions – (1) regulative, (2) normative, and (3) cultural-cognitive: (1) Regulative institutions include regulations and other formal rules that are backed by enforcement power (Scott, 2008). Regulative institutions are explicit and written down, in other words, they are the formal 'rules of the game'. Specialized actors, like regulators, inspect conformity to regulative rules and, when necessary, provide rewards or punishment to influence future behavior. DiMaggio and Powell (1983) called this process coercive isomorphism. (2) Normative institutions include values – notions of what is desirable – and norms, which define *how* to pursue values (Scott, 2008). Normative institutions may be explicit, like standard operating procedures, or implicit, such as unwritten expectations. Norms and values are often role-specific: we have different expectations of people in their family role than in their professional role. Normative isomorphism in industries is normally associated with professionalization – e.g. definition of professional standards, extensive training, etc. (DiMaggio and Powell, 1983; Wilensky, 1964). (3) Cultural-cognitive institutions have a more intangible character than regulative and normative institutions. While regulations, norms, and values have a rule-like character – i.e. clarifying what can and cannot be done – cultural-cognitive institutions are shared cognitive frames of reference. These include widely spread assumptions, beliefs, and worldviews through which actors unconsciously make sense of the world around them (Scott, 2008). Cognitive interpretive processes are shaped by "external" cultural frameworks, creating similarities in perspectives among actors in a collective. For instance, Carroll (1998) showed that occupational groups like engineers and human factors specialists have different ways of interpreting and understanding how industrial incidents occur. To a large extent, cultural-cognitive institutions reinforced through imitation, for instance when actors are socialized in a particular group. This is called mimetic isomorphism (DiMaggio and Powell, 1983). For taken-for granted cultural-cognitive institutions, non-conformity is inconceivable and will lead to confusion, because particular behavior is understood as 'the way we do these things' (Jepperson, 1991; Vaughan, 2005).

2.2. An institutional perspective on disaster development

We use the concept 'disaster development' (Turner, 1976) rather than disaster causation to avoid simplistic images of single 'broken parts' that cause disasters (Dekker, 2011) and to acknowledge that disasters incubate over long periods of time through complex interactions of contributing factors. Institutions can also contribute to disaster development (Elliott and Smith, 2006; Vaughan, 1999; 2005; Wicks, 2001) yet they are not immediate causes: they interact with organizational, human, and technological factors inside organizations in a complex disaster incubation phase.

When investigating a mine explosion in Canada researchers found that a variety of implicit normative institutions contributed to the disaster (Hynes and Prasad, 1997; Wicks, 2001): The miners took more risks because they had developed a mindset of invulnerability. This was a consequence of norms and values associated with their occupational culture, like their blue-collar identity and their essential role as providers for their families. Similarly, in their analysis of four similar soccer stadium disasters in the UK, Elliott and Smith (2006) found that regulators and stadium officials held the persistent, but incorrect belief that hooliganism was the primary risk in the soccer industry. This made them blind to new risks related to the ever-increasing amount of people attending soccer matches. This risk blindness resulted in disastrous crowd crushes across four different stadia.

These examples show that dysfunctional practices and beliefs may persist in organizations across an industry, even when they are no longer appropriate for particular situations (DiMaggio and Powell, 1991). Dysfunctional practices may be so taken-for-granted that actors do not question the appropriateness of these practices, even following disasters (Elliott and Smith, 2006). In this situation, institutionalized practices become harmful and contribute to the recurrence of similar disasters across different organizations. So far the emphasis has been on the influence of more evident regulative institutions (Dyhrberg and Jensen, 2004). We therefore focus on the role of normative and cultural-cognitive institutions – i.e. norms and beliefs – and investigate the role of occupational training, which shapes normative rules about professional behavior, beliefs and competences of the workforce (DiMaggio and Powell, 1991; Meyer and Rowan, 1977).

3. Method

3.1. Research context

We chose the offshore drilling industry as a research context to illustrate the influence of the institutional environment on disaster development. This context was suitable because the sector experiences blowouts and other high potential well control incidents rather frequently – according to the International Association of Oil and Gas Producers (2014) the global offshore drilling industry experienced 11 severe and 69 lesser loss of primary control events in 2013 – which allowed us to compare multiple accidents. Many of these accidents and near misses closely resembled each other in terms of underlying contributing causes (National Commission on the BP Deepwater Horizon Oil Spill and Offshore Drilling, 2011; Petroleum Safety Authority Norway, 2014; SINTEF, 2011). Most reports state that this problem originates from the growing gap between (a) the increasing complexity of drilling operations as the industry approaches reservoirs in increasing water depths and more complex geological formations, and (b) stagnant practices of safety management employed in industry and regulators (e.g. SINTEF, 2011). This gap is particularly manifest in the training and practice of risk management for major accidents. Compared to other high hazard settings, such as aviation and nuclear energy production, the degree of professional safety training in the offshore drilling is deemed relatively low (National Academy of Engineering, 2011). It is recognized that "the industry must strive to improve well control competence of personnel involved with all oil and gas well operations consistently throughout the world" (International Association of Oil and Gas Producers, 2012). We focus on this example because it provides a clear illustration of how institutionalized beliefs and practices can negatively affect safety levels and contribute to disaster development.

3.2. Research approach

We applied an exploratory qualitative research approach to compare multiple cases of major accidents and serious near misses in the offshore drilling industry. Such an analysis of multiple investigations into different disasters can uncover similarities in causation patterns that point to the impact of harmful institutionalized practices beyond the idiosyncrasies of specific incidents. Including also near miss investigations was useful for this study, because near misses follow similar development trajectories as major accidents – with the exception of not culminating in disaster – and happen more frequently (Christiansen et al., 2009; Weick and Sutcliffe, 2007).

We gathered publicly available investigation reports about the Macondo and Montara disasters that occurred in the offshore drilling industry in 2009 and 2010. We selected thirteen Macondo investigation reports and one Montara investigation report. Several reports highlighted similarities in disaster development patterns between the two disasters, but also similarities with other offshore incidents (e.g. National Commission on the BP Deepwater Horizon Oil Spill and Offshore Drilling, 2011; Petroleum Safety Authority Norway, 2014; SINTEF, 2011). We collected six investigation reports of other well control incidents that were indicated as being similar to the Macondo and Montara disasters. The similarities between these incidents pointed to institutionalized harmful practices at the level of the industry. To triangulate our data from the investigation reports, we also collected industry reports that evaluated the lessons learned from the Macondo disaster and other incidents. In total, twenty-two documents were collected from governments, regulators, and (inter)national industry associations from the UK, the Netherlands, and Norway (see Table 1).

We also conducted six expert interviews: two trade unionists, a well control training instructor, a drilling consultant, and two safety specialists. These interviews were under the condition of anonymity and provided more information on industry-wide issues with risk management and training. Finally, we included observational notes of five days of non-participant observations and informal conversations at a well control training center in the Netherlands, which provided insight in risk management competencies of offshore work and training practices.

In our data analysis, we identified harmful institutionalized practices using a Template Analysis approach (King, 2012). Central to Template Analysis is the development of a coding scheme that is based on a subset of data, which is then applied to further data, adapted, and reapplied. It is particularly useful for exploratory studies that deal with large sets of data, like our own. We used a number of sensitizing concepts (Blumer, 1954) based on our theoretical framework of institutional factors such as regulations, industry-level professional standards, and shared understandings about safety, and refined them as we continued our analysis.

4. Results

Our findings indicate that operations in the offshore drilling industry have become more complex, but organizational risk management practices have not sufficiently coevolved to match this complexity. In particular, we identify an insufficient degree of professionalization of risk management for major accidents in the drilling industry as a whole. This statement is based on two main findings. First, we find that taken-for-granted conceptualizations of major accident risk are inadequate for managing the risk of low probability-high impact disasters. Specifically, *risk management practices depict a static, fragmented, and solely technical conceptualization of risk*, rather than a more appropriate conceptualization of risk as holistic, integrated and dynamic. Second, we found that these *inappropriate conceptualizations of risk are reinforced by practices of occupational training* in the industry. Training is focused on strengthening technical-procedural competence at expense of non-technical skills and systems risk management. We now zoom in on the two main findings.

4.1. Risk management practices depict an inadequate conceptualization of risk

Our analysis has indicated that risk is generally conceptualized in the drilling industry as a static, fragmented, and technical phenomenon. We argue that this represents an institutionalized belief that is taken-for-granted in the industry and generally not actively questioned.

4.1.1. Static conceptualization of risk

Offshore operations are characterized by the continuous occurrence of unanticipated events. According to the SINTEF report, "*offshore drilling is often referred to as a continuous process of problem solving where new and unexpected situations arise and must be managed on the spot. This increasing complexity results in new demands on how we think about safety*" (p. 1). This dynamic nature of offshore drilling requires practices to deal effectively with changing circumstances and risk levels. The offshore drilling industry commonly refers to such practices as 'management of change' (MoC), which involves reassessments of risk and the implementation of mitigating measures. Despite the importance of MoC in drilling, our analysis shows that the inappropriate application of MoC was a recurring issue in the industry. Instead a *static* perception of risk seemed to dominate amongst the offshore workforce. This revolves around an implicit belief that system risk levels will stay stable despite changes in drilling conditions and operations. For instance, the Norwegian drilling regulator argued "*Post-Deepwater Horizon reports have exposed a number of deficiencies in risk management, including […] change management*" (PSA Deepwater Horizon report, p. 12). We found that this was not limited to the Deepwater Horizon disaster. Insufficient change management regarding well design, procedures, and personnel shifts were also found to have contributed to the Gullfaks C incident in Norway in 2010, the MG Hulme incident of the coast of West Africa in

Table 1
Reports included in analysis.

Abbreviation	Document title	Year
BOEMRE report	Report Regarding the Causes of the April 20, 2010 Macondo Well Blowout	2011
BP report	Deepwater Horizon Accident Investigation Report	2010
Hopkins investigation	Disastrous decisions – The Human and Organizational Causes of the Gulf of Mexico Blowout	2012
Republic of Marshall Islands report	Deepwater Horizon Marine Casualty Investigation Report	2011
Transocean report	Macondo Well Incident – Transocean Investigation Report Volume I	2011
US Coast Guard report	Report of Investigation into the Circumstances Surrounding the Explosion, Fire, Sinking and Loss of Eleven Crew Members Aboard the Mobile Offshore Drilling Unit Deepwater Horizon in the Gulf of Mexico, April 20 – 22, 2010, Volume I	2011
NAE report	Macondo Well Deepwater Horizon Blowout – Lessons for improving offshore drilling safety	2011
DHSG report	Final report on the investigation of the Macondo well blowout	2011
President report	Report to the President: Deep Water – The Gulf Oil Disaster and the Future of Offshore Drilling	2011
CSB volume 1	Investigation Report Volume 1 – Explosion and Fire at the Macondo Well	2014
CSB Volume 2	Investigation Report Volume 2 – Explosion and Fire at the Macondo Well	2014
CSB Volume 3	Investigation Report Volume 3 – Explosion and Fire at the Macondo Well	2016
CCR Report	Macondo – The Gulf Disaster	2011
PSA Snorre A report	Investigation of gas blowout on Snorre A, well 34/7-P31A	2004
PSA Gullfaks C report	Audit of Statoil's planning for well 34/10-C-06A	2010
Montara report	Report of the Montara Commission of Inquiry	2010
MG Hulme Jr. report	Incident investigation report M.G. Hulme well control incident – riser unloading	2009
Bardolino Operations Advisory	Operations advisory – loss of well control during upper completion	2010
OLF report	Deepwater Horizon – Lessons Learned and Follow-up	2012
PSA DwH report	Concluding Report on its follow-up of the Deepwater Horizon accident	2014
SINTEF report	The Deepwater Horizon accident: Causes, lessons learned and recommendations for the Norwegian petroleum activity	2011
Maitland report	Offshore Oil and Gas in the UK – an independent review of the regulatory regime	2011
Government response to Maitland report	Offshore Oil and Gas in the UK – Government Response to an Independent Review of the Regulatory Regime	2012
House of Commons report	UK Deepwater Drilling—Implications of the Gulf of Mexico Oil Spill – Second Report of Session 2010–11, Volume I	2011
HSE Deepwater Horizon Interim report	Deepwater Horizon Incident Review Group Interim Summary Report	2011
OSPRAG report	Strengthening UK Prevention and Response – Final Report	2011
OGP report 460	Cognitive issues associated with process safety and environmental incidents	2012
OGP report 463	GIRG Deepwater Wells	2012
OGP report 476	Recommendations for the enhancement to well control training examination and certification	2012
NSOAF report	Multinational Audit "Human and Organizational Factors in Well Control"	2012
PSA RNNP report	Study in Trends in the Risk Level in the Petroleum activity	2012

2009, the Snorre A blowout in Norway in 2004, and the Montara blowout in the Timor Sea in 2009. Following Macondo, there was a surge in attention for MoC. For instance, industry associations in the UK and Norway aimed to create more awareness of the dynamic nature of risk and the importance of MoC in drilling (OGP 476, OLF Deepwater Horizon report). Nonetheless, it seems that this awareness of the importance of MoC still needs to trickle down to individual oil companies. For instance, in 2012 the North Sea Offshore Authorities Forum (NSOAF) concluded that in some companies "*MoC procedures were not covering changes to drilling and well operations*" (p. 15). Similarly, an interviewed drilling consultant stated that *"Collectively, there is an inability to deal with the unexpected […] Generally, operations are planned for in a detailed fashion, but when something unexpected happens, replanning does not always happen. We don't train crews to do that."*. Other informants explained that change management is a challenge in the industry, because it does not seem to match with the workforce's pervasive "*can do, get it done*" mentality (interview with HSE manager) – the preference of offshore workers to get on with drilling rather than taking the time for replanning. Hence, our analysis suggests that the dynamic nature of risk was still only insufficiently recognized.

4.1.2. Fragmented conceptualization of risk

Our data also suggests that risk is conceptualized as *fragmented* phenomenon. Investigations of several well control incidents have concluded that risk management frequently focused on system *components*, rather than the system as a whole. This ignores that different component risks may interact to create system risks. For instance, the CCR (2011) argued that in the Macondo case "*the lack of rigorous risk assessments led decision makers to solve problems in isolation instead of considering the cumulative impact their solutions might have on the rest of the project."* (p. 244). Similarly, in the case of the Snorre A accident, frequently "*only the sub-operation was discussed [during the risk assessment]; and not the overall status of well barriers.*" (PSA, 2004, p. 15). As these quotes show, a recurring contributing cause of drilling incidents was that unexpected problems in system components would be solved *locally* without the rig personnel recognizing the impact of their local solution on the overall risk level of the system as a whole. The fact that changes in a system component – human or technical – will have system consequences was often not addressed.

The dominance of fragmented risk management also becomes evident in the context of barrier management. In the offshore industry it is best practice to use a defense-in-depth strategy, with at least two independent, physical barriers in place at all times during operations. This ensures that if one barrier fails another barrier will prevent loss of control. A defense-in-depth strategy thus represents a *systems* perspective on barrier management. Yet, our analysis of Macondo investigation reports suggests that defense-in-depth remains an elusive concept. These investigations focused predominantly on the failure of a *single* barrier: the Blowout Preventer (BOP). Before Macondo, the BOP had "*an almost mythical status*" (Hopkins investigation, p. 4) in the industry as a fail-safe device. Our data suggests that the failure of the BOP initially shattered the belief of the BOP as a fail-safe barrier. However, it seems that the persistent belief in the BOP as a panacea for all problems reemerged. For instance, the NAE investigation report argued that, "*the design capabilities of the BOP system should be improved so that the system can shear and seal all combinations of pipe under all possible conditions, with or without human intervention.*" (p. 73). Yet, this focus on just the BOP ignores the importance of the entire barrier system. As Hopkins argued in the Macondo case: "*the BOP was only the last line of defence and, arguably, not the most important. The defence-in-depth metaphor is the key to a much more sophisticated understanding of this accident.*" (p. 4). Hence, we argue that the fragmented perspective on risk management persisted despite evidence from the Macondo disaster investigations had indicated the importance of a *systems* perspective on risk management.

4.1.3. Technical conceptualization of risk

The emphasis on the BOP following the Macondo disaster also illustrated a focus on technical causes and solutions. The NSOAF (2014) found that in trying to learn from Macondo "*considerable effort was being paid to address hardware failures*" (p. 5). The CSB argues that there is a "*natural tendency [in the drilling industry] […] to focus on technical barriers because they are physical in nature, and in deepwater drilling they clearly show how they stop the flow of hydrocarbons from the well*" (Vol 2, p. 61). Hence, the CSB observed that incident investigations exhibited "*still all-too-frequent focus on technical causes without sufficient focus on systemic and organizational factors*" (Vol 3, p. 245). We argue that the conceptualization of barriers as a physical piece of equipment tends to direct the attention of the rig crew towards tangible barrier elements and away from more intangible human or organizational factors. Several reports state that a predominantly technical understanding of risk and accident causation fails to represent the complexity of an accident causation trajectory. Conceptualizing risk and barriers solely as technical matters ignores the non-technical dimension of risk, such as human and organizational factors. This is again clearly illustrated by the failure of the BOP in the Macondo disaster. The rig crew placed substantial trust in an open BOP as a barrier because they assumed it would function as required:

> *"an open BOP was perceived as an acceptable barrier because it was assumed the BOP could either be closed manually to control the well during an influx of [oil and gas], or automatically by backup emergency systems in the event of loss of well control." (CSB Vol 2, 2014, p. 22)*

However, "*the BOP did not operate independently of previous barriers. It depended for its effectiveness on the alertness of the drillers on the rig. Given that they had dropped their guard, the BOP was quite unreliable as a barrier against blowout"* (Hopkins investigation, p. 59). As the second volume of the Chemical Safety Board report confirms, "*failure of a technical barrier, such as the BOP, is rooted in inadequate operational and organizational barriers"* (CSB Vol 2, 2014, p. 62). Understanding this interaction between technical and non-technical barrier elements remains of fundamental importance for rig crews, as industry association IOGP argued following Macondo that they would still *"regard a BOP as a barrier for the purposes of [a two-barrier] policy even when operated in the open position"*, on the condition that the BOP is "*verified, tested, and certified"* (Deepwater Wells, p. 7). As such, the Petroleum Safety Authority Norway (2014) argues for *"a strengthened understanding of the interaction between technical, organizational, and operational elements"* (p. 15). However, our analysis showed that of all incident investigations of the Macondo blowout, only Hopkins' investigation and the third volume of the CSB investigation thoroughly addressed how non-technical factors contributed to the disaster.

4.2. Occupational training reinforced institutionalized conceptualizations of risk

In the previous section we showed how institutionalized conceptualizations of risk as static, fragmented, and technical do not match the complexity of major accident risk in the drilling industry. In this section we show how these inadequate conceptualizations of risk have been reinforced by common occupational training practices. We argue that improving risk management in the offshore drilling industry requires a critical re-evaluation of the institutionalized meaning of competence and occupational training practices.

Most incident investigations that were analysed conclude that the workers involved in the incident were not adequately trained and did not have the right competence. According to a British HSE manager, the common reaction after incidents was: "'*How the hell did those guys do that in those circumstances? They must have been either incompetent or improperly trained or we didn't have sufficient procedures.*'". Consequently, it was observed that "*more job-specific training is often the recommendation in the aftermath of a catastrophic incident*" (CSB Vol. 3, pp. 66–67). For instance, the CSB (2016) observed how traditional training in the offshore drilling industry was "*focused on technical skills*" (Vol. 3, p. 82) and "*teaching crews to manage conditions based on plans. As such, post-incident investigations often focus on "the need to improve […] knowledge of procedures and ability to execute them, and steps are taken to revise procedures and manuals* (p. 67). This individualized approach to competency development exhibits a belief that a lack of competence can be solved by 'fixing the individual' through remedial training or by selecting appropriately trained individuals. However, our analysis indicates that the problem did not simply lie with individual workers. Instead, this supposed lack of competence seems to have institutional precursors: occupational training practices do not adequately prepare offshore workers for managing major accident risks. In particular, this training practice seems to reinforce technical conceptualizations of risk. Yet, a technical orientation appears to be just one part of the equation. As the CSB argued:

> *First, task-specific or technical competency training does not guarantee error-free performance. A highly skilled, technically competent person can make glaring human errors […] Second, within complex systems, "rules, regulations, policy or procedures cannot be written to address all the situations that people may face,". Consequently, "expertise is required to recognize when the unexpected is present or may arise." Thus, technical competency is only one aspect of an individual's performance capabilities (CSB Vol 3, 2016, p. 67).*

The quote indicates that technical competence is inadequate for dealing with unexpected situations. Therefore, several reports recommend developing workers' *non-technical* skills, such as "*interpersonal communication, situational awareness, problem solving, decision-making and management"* (OLF, 2012, p. 29). According to the CSB (2016) *"non-technical skills are necessary to prepare individuals to manage the natural variability inherent within the complex system."* (Vol. 3, p. 67).

Our observations in the well control training center provided a clear example of the need to improve non-technical skills among the offshore workforce. In one instance in the simulator room, the crew was working through a scenario that included a slowly developing well control incident. The crew realized that something was not right, but were not able to identify the exact problem. In their confusion they grew silent, focusing solely on their individual tasks and trying to figure out what was going on. This caused breakdowns in communication, situational awareness and collective decision-making, contributing to a deteriorating situation. What this observational note and the quotes illustrate is that the dominant conceptualization of competence should be expanded to include both technical and non-technical elements would arguably be beneficial for major accident risk management. However, our interviewees also point out that it would be difficult to achieve: "*having this conversation [about non-technical skills] is extremely hard* [because] *that reflective attitude is pretty weak actually in the oil and gas culture*" (interview British HSE manager).

Furthermore, we found that the training of technical-procedural competence promotes skills to do individual tasks at the expense of *system* risk management competences. For instance, the NAE (2011) investigation states "*One indication of the lack of appreciation for an overall system safety view is the limited level of system safety training provided by the operators and contractors"* (p. 96). This seems to undermine the ability of offshore workers to oversee the increasing complexity of offshore operations. The National Commission (2011) reports a "*scarcity of experienced personnel that can grasp the complexity of offshore operations and make quick and correct decisions."* (p. 229). The Norwegian regulator similarly concluded "*that drilling contractor personnel sometimes have a too narrow focus and that they do not have a big picture perspective*" (RNNP report, 2011, p. 18). It seems that offshore workers had an understanding of technical and task-specific risks, but lacked a systems perspective on risk management.

According to the CSB (2016), disasters like the Macondo blowout should raise questions "*fundamentally about the meaning of competency*"

(p. 67). While our analysis showed that risk management for major accidents requires training in non-technical skills and systems risk, in the offshore drilling industry competency is mainly conceptualized as technical and task-specific. This institutionalized meaning of competence is reinforced through occupational training practices, which instill particular skills and knowledge in workers. In turn, offshore workers apply their largely technical, fragmented, and static perspective on risk in risk management practices. This creates a reinforcing cycle in which the technical, fragmented, and static perspective gets further institutionalized in the industry. We claim that offshore workers are not sufficiently equipped with the competencies necessary to deal with the increasing complexities of offshore drilling. We argue that a broader meaning of competency is necessary. The introduction of training on system risk management and non-technical skills will partly help to achieve that.

Yet, we argue that the impact of such changes to occupational training will not be sufficient. We found that personnel training and selection practices are highly variable in the industry. For instance, the NAE report points out "*different companies have training and career paths that vary greatly. There are few industry standards for the level of education and training required for a particular job in drilling.*" (p. 107). It seems that such variability across installations and organizations was widely accepted and taken-for-granted in the industry as appropriate practice. Companies argue that this allows them to adapt training to local conditions, like geological conditions or division of roles on a particular installation. For oil companies, maintaining the flexibility to adapt practices to organizational needs is a deeply embedded institutional norm. Attempts for standardization of practices is therefore generally resisted. However, without addressing this taken-for-granted variability in training, it is unlikely that occupational training in risk management for major accidents will reach a uniformly high level in the industry. In particular, we found that the pervasive variability in training also is driven by the 'boom-and-bust' cycle in the oil industry. Periods of high investments followed by periods of underinvestment have created chronic discontinuities in experience and competence across the pool of industry workers. A well control instructor that we interviewed mentioned "*Out of necessity people are promoted quickly. An assistant driller becomes driller after half a year. [He] can't ever get the right experience, but after half a year he is training an assistant driller himself. This way poor competence is fostered*".

5. Discussion

The objective of this paper was to illustrate how taken-for-granted beliefs and institutionalized practices in an industry can contribute to recurring disaster development patterns in organizations. Empirically this paper focused on specific taken-for-granted practices and beliefs in one specific industry: risk management and occupational training in the offshore drilling industry. We identified that simplistic conceptualizations of risk – static, fragmented, and technical – can be traced back to persistent institutionalized training practices in the industry, which have not co-evolved with the increasing complexity of offshore operations. In this section we discuss how High Reliability Organizations (HROs) may mitigate the potential harmful effect of institutions. Based on this analysis, we present two calls for action: the need (1) to professionalize occupational training practices, and (2) to broaden the scope of learning from failure to the institutional context.

5.1. Institutional vs. organizational factors

Our argument to pay attention to the institutional context of organizations does not imply a deterministic understanding that institutions *cause* disasters, but that they may contribute to 'holes in the Swiss cheese' model (Reason, 1997) in some organizations. An accident that seems to be a unique and isolated incident may in fact originate from practices and beliefs that are institutionalized in a wide variety of organizations (Elliott and Smith, 2006; Wicks, 2001). The institutional environment may entail harmful institutionalized practices and beliefs that permeate organizational boundaries and have detrimental effects on safety levels across organizations. As such, harmful institutionalized practices make organizations more 'crisis-prone' (Pauchant and Mitroff, 1992). Yet, not all organizations in an industry experience the same kind of disasters or near misses, or at the same rate. While organizations in an industry is subject to similar institutional processes, not every organization will be affected by and respond to institutional influences in a similar fashion (DiMaggio and Powell, 1991; Scott, 2008). Organizations can mitigate or interpret institutional influences differently based on specific internal organizational attributes. Mindful and resilient organizations (Weick and Sutcliffe, 2007) with a strong safety culture may go beyond conforming to taken-for-granted, but dysfunctional practices and implement additional training requirements. For instance, Ely and Meyerson (2010) investigated two high reliability oil platforms where workers reoriented away from traditional and potentially disruptive masculine norms, identity and beliefs towards mindful practices and beliefs. As such, organizations may be able to avert penetration by and proliferation of an institutional source of risk in their organizational structure and practices. However, organizations that lack a strong safety culture may be rather susceptible these institutional risks, and even mindful organizations may have difficulties to protect itself from the continuous exposure of an institutional risk in the long run, slowly drifting into failure (Dekker, 2011). Hence, it is important for accident and safety research to recognize that organizational safety results from the combination of influences from the institutional environment and organizational characteristics.

5.2. Professionalization of occupational training needed

We argue that taking an individualized approach to occupational training – 'fixing the individual' through more technical training – is insufficient, because this does not recognize the influence of the institutional environment. Instead, we argue for the need to alter the *nature* of occupational training for risk management through professionalization. Highly professionalized occupations are characterized by actors with deep occupational knowledge acquired through long prescribed training and the existence of high-level professional standards (Wilensky, 1964). Hence, professionalization may be demonstrated by universality of credential requirements and the robustness of graduate training programs (DiMaggio and Powell, 1983). Professionalization drives homogenization of the workforce, as individuals increasingly possess similar high-quality competence, assumptions and normative beliefs.

In contrast, we have identified that a large degree of variability in training practices exists throughout the offshore oil and gas industry. While there are benefits to tailoring practices to local operational circumstances, variability in industry-wide competence can undermine the quality of organizational safety decisions across organizations (Rasmussen, 1997). This is problematic, because it leaves open the possibility that offshore workers may receive insufficient training to match the increasingly complex offshore drilling systems and technologies (Dekker, 2011; Read, 2011). When safety practices are stagnant in the face of technological advances, this creates a reinforcing cycle of decreasing safety (Marais et al., 2006). As such, we strongly argue to professionalize competence development by standardizing at least some facets of occupational training. In particular, we propose to standardize non-technical skills and system risk management training, given the relevance of such competencies regardless of specific circumstances. Although it takes effort and perseverance to change institutionalized practices, we claim that professionalizing occupational training practices will better equip the workforce for dealing with major accident risk.

Despite the taken-for-granted variability in workforce development and competence, workers still resembled each other in one respect:

their static, fragmented, and technical conceptualizations of risk, and their 'can-do, get-it-done' mentality. These implicit assumptions are deeply ingrained in the offshore occupational culture and seemed very persistent even in the wake of multiple disasters. Research on male-dominated occupations in hazardous, frontier workplaces, such as offshore drilling (Ely and Meyerson, 2010), mining (Hynes and Prasad, 1997; Wicks, 2001), NASA (Vaughan, 2005) and the Australian Air Force (Hopkins, 2006) has shown that this mindset is embedded in the shared identity and cultural beliefs of the workforce. Furthermore, men in physical and dangerous workplaces tend to be preoccupied with manual, technical work and "pride themselves on their skill in handling tools and machinery" (Ely and Meyerson, 2010, p. 7). Part of this persistence likely originates from the fact that the majority of offshore workers in the industry come from a technical or mechanical background, and that this training and education have created important normative determinants for behavior (DiMaggio and Powell, 1983). Accident investigations and subsequent improvements are also likely to focus on technical issues (Lundberg et al., 2009), often resulting in the promulgation of more technical procedures (Hale and Borys, 2013). However, the predominant focus on technical competence in training and development will have only limited effect on organizational safety if it ignores the role of non-technical skills, which has been indicated by scholars as fundamentally important for understanding how disasters are caused (e.g. Dekker, 2014; Perin, 1995)

5.3. A new perspective on learning from failure

Finally, we argue that the application of the institutional perspective to accident research has important implications for understanding learning from failure. The problematic nature of learning from failure is reflected in the fact that accidents with seemingly similar causation trajectories keep recurring (e.g. Vaughan, 2005). Some scholars have concluded rather pessimistically that we fail to learn (Hopkins, 2008; Kletz, 2003). Yet the institutional perspective can shed more light on why this failure to learn occurs: Because the *occurrence* of disasters ultimately is an organizational phenomenon, accident investigations tend to focus on identifying organizational causes (Carroll, 1998; Elliott and McGuinness, 2002). For instance, much has been written in accident investigation reports and accident literature (e.g. Hayes, 2012) on how worker competence plays a role in major accident causation. Yet, these practical reports and scientific studies tend to locate the lack of competence development in the organizational system. Consequently, recommendations aimed to improve worker competence have focused on the individual, team, or organizational levels of analysis. Yet, we argue that the culmination of contributing causes into an *organizational* accident does not imply that all important contributing causes originate from within organizational boundaries. It is important for accident investigations to also deal with the *institutional* context outside the culpable organizations (Elliott and Smith, 2006; Wicks, 2001). For instance, professions shape the collective and shared assumptions and norms from which individual actors work (DiMaggio and Powell, 1991; Perin, 1995). As such, an institutional perspective to accident research emphasizes the need for macro-level learning at the level of the industry (Elliott and Smith, 2006). Authors adopting a complex systems approach (e.g. Dekker, 2011; Leveson et al., 2009) have emphasized the importance of analyzing macro-level factors in major accident causation. Similarly, researchers in the field of learning from accidents have increasingly stressed the need for macro-level learning to capture lessons of value for collectives of actors in a field (Cedergren, 2013; Hovden et al., 2011). Yet true systemic learning that addresses relation between different levels of analysis is still rare (Dekker, 2011), and the institutional context rarely receives adequate attention (Dyhrberg and Jensen, 2004; Elliott and Smith, 2006). Future research should aim to develop a deeper understanding of the influence of institutional environment on organizational safety (Elliott and Smith, 2006). We invite scholars to apply the institutional perspective to identify other institutional sources of risk in diverse high-hazard industries to develop a better understanding of the role of the institutional environment in accident causation and recurrence.

6. Conclusion

In this paper we aimed to deepen our understanding of why similar disasters recur in high hazard industries. We build upon Dyhrberg and Jensen's (2004) suggestion to apply institutional theory to accident research to understand the persistence behind this phenomenon. We argued that taken-for-granted beliefs and practices may become sources of risks if their rigid nature prevents them to co-evolve along with changing operating conditions. Institutionalized beliefs and practices will penetrate organizations in an industry and may contribute to similar accident development patterns. Empirically, we illustrated this by using the example of the practice and training of risk management for major accidents in the offshore drilling industry. This example shows how causes for accidents that appear to originate from within the involved organizations may actually have institutional origins. We argue that to learn effectively from disasters and prevent their recurrence, one should look outside of organizations for the contributing influence of institutions on disaster development. Looking for similarities between disaster development patterns is one way to identify the influence of taken-for-granted beliefs and practices.

Appendix A. Supplementary material

Supplementary data associated with this article can be found, in the online version, at https://doi.org/10.1016/j.ssci.2018.06.011.

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