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The challenge of accountability in complex regulatory networks: The case of the *Deepwater Horizon* oil spill

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Abstract

A puzzle that faces public administrators within regulatory governance networks is how to balance the need for democratic accountability while increasingly facing demands from elected officials to optimize oversight of industry by utilizing the expertise of the private sector in developing risk-based standards for compliance. The shift from traditional command and control oversight to process oriented regulatory regimes has been most pronounced in highly complex industries, such as aviation and deepwater oil drilling, where the intricate and technical nature of operations necessitates risk-based regulatory networks based largely on voluntary compliance with mutually agreed upon standards. The question addressed in this paper is how the shift to process oriented regimes affects the trade-offs between democratic, market, and administrative accountability frames, and what factors determine the dominant accountability frame within the network. Using post-incident document analysis, this paper provides a case study of regulatory oversight of the deepwater oil drilling industry prior to the explosion of the *Deepwater Horizon* rig in the Gulf of Mexico, to explore how the shift to a more networked risk-based regulatory regime affects the trade-offs and dominant accountability frames within the network. The results of this study indicate that a reliance on market-based accountability mechanisms, along with the lack of a fully implemented process-oriented regulatory regime, led to the largest oil spill in US history.

Keywords: accountability, complexity, governance networks, process-oriented regulation.

1. Introduction

Traditional government-centered approaches to regulatory oversight typically focus on specific, unyielding mandates that are ensured through inspections by agency personnel. Alternative regulatory regimes, referred to as process-oriented (Gilad 2010) or management-based regulation (Coglianese & Lazer 2003), focus on collaboration between the regulated firm and the regulatory agency through standard setting and voluntary information disclosure. The shift from government-centered to process-oriented regulatory regimes has led to a proliferation of actors from the public, private, and non-profit sectors involved in compliance, monitoring, and oversight functions previously reserved for government agencies. This proliferation of actors has drastically altered the "principal–agent" relationship between regulator and regulated firm to one that is increasingly collaborative, interconnected through networks of actors, and built upon the sharing of information related to the internal operation of the firm (Koliba *et al*. 2010; Carrigan & Coglianese 2011). The shift from a traditional principal-agent to a networked regulatory regime has serious implications for accountability, given the various perspectives and motivations of actors involved in ensuring compliance. The challenge of ensuring accountability in a process-oriented regulatory regime is particularly difficult in complex industries, such as deepwater oil drilling.

On 20 April 2010, the *Deepwater Horizon* oil rig experienced an explosion and sank 50 miles off the coast of Louisiana in the Gulf of Mexico's Outer Continental Shelf (OCS). A high-pressure bubble of methane gas rose three miles through the *Deepwater Horizon*'s drill column, destroying a previously damaged blowout preventer (BOP) on

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its way upward. When the methane bubble reached the surface of the rig and ignited, the result was a massive explosion that killed 11 rig workers, injured 16 others, and unleashed the largest oil spill in US history (McKinlay 2012). By the time the Macondo well was capped on 19 September 2010, over 205 million gallons of oil (Hoch 2010) had been discharged into the Gulf of Mexico and over 650 miles of coastline habitat were covered in oil (National Commission 2011). The *Deepwater Horizon* case gives rise to several questions related to the multidimensional nature of accountability in regulatory environments where agencies rely increasingly on the expertise of firms through process-oriented regimes (Gilad 2010) to encourage compliance. These questions include: What are the trade-offs between market and administrative accountability frames within regulatory governance networks dominated by the voluntary exchange of information between the firm and the regulatory agency? And how does the complexity of the policy environment affect the dominant accountability frame within regulatory governance networks?

In this paper, we apply the governance network accountability framework developed by Koliba *et al.* (2011) to the *Deepwater Horizon* disaster to identify the dominant accountability frames (democratic, market, and collaborative) within the regulatory regime prior to the disaster, the trade-offs in accountability frames that are apparent, and the breakdowns in accountability within the regulatory regime that contributed to the largest oil spill in US history. The results of the analysis indicate that the lack of a fully implemented process-oriented regulatory regime, the lack of professional expertise at Minerals Management Service (MMS) to fully operate a process-oriented regime, and an over-reliance on shareholder accountability, rather than professional accountability structures in the decisionmaking processes by BP, Transocean, and Halliburton, were contributing causes of the *Deepwater Horizon* disaster. Our findings support the conclusions of Gormley (1986) who noted that as processes become increasingly complex, agencies often defer to the professional expertise of industry while decisionmaking processes become similar to those undertaken within "boardrooms," often without the necessary expertise to manage process-oriented regimes.

2. Regulatory governance networks

Regulatory governance networks can be defined as the relatively stable patterns of coordinated action and resource exchanges undertaken by public, private, and nonprofit actors that interact through a variety of government-centered, cooperative, and voluntary agreements to provide regulatory oversight, guidance, and compliance with rules and industry best practices (Koliba *et al.* 2010). The emergence of regulatory governance networks is largely a result of an increase in the complexity of the regulatory environment. The regulatory environment becomes more complex when multiple actors are added to the regulatory mix (e.g. industry actions are carried out not through a single firm, but through a strategic alliance or supply chain of firms); when the transaction costs of extracting compliance are too financially or politically costly; and when the technical complexity of industry actions are so great as to require more of an "operating room" (Gormley 1986) approach to regulation. These trends have all contributed to more networked approaches to regulatory systems.

The literature on regulatory regimes has illustrated the increase in complexity of the regulatory environment by focusing on the shift from government-centered oversight to process-oriented regulatory regimes (Ayres & Braithwaite 1991; Parker 2002; May 2007; Gilad 2010). Prescriptive tools, such as inspections and direct monitoring, were viewed as too rigid and as ill-suited to adjust to a rapidly changing or heterogeneous business environment that requires individualized treatment and constant learning on the part of both industry and regulators (Ayres & Braithwaite 1991; Potoski & Prakash 2004; Gilad 2010). The lack of flexibility inherent in prescriptive tools, coupled with shrinking inspector resources, led many regulatory agencies to complement their government-centered tools with process-oriented regimes (Parker 2002; Gilad 2010). Process-oriented regimes focus on creating mandates and incentives for industry to design and implement (often in collaboration with the regulatory agency) self-reporting, self-auditing, and quality control processes. While these internal monitoring processes shift some of the responsibility for oversight from the regulator to industry, the regulatory agency retains the responsibility for inspecting and verifying the effectiveness of industry's self-monitoring processes (Gilad 2010). Importantly, process-oriented regimes range from entirely voluntary to mandatory to begin or continue operations (Coglianese & Lazer 2003). In countries such as the United Kingdom (UK), Norway, and Canada, high-risk industries, such as deepwater oil drilling, are regulated using a process-oriented approach that mandates firms to develop a "safety case" with items

such as risk assessments and hazard mitigation plans (Bennear 2012). The benefit to regulatory agencies of using process-oriented tools to complement their prescriptive, government-centered regimes is that they often provide agencies with access to information on the internal operation of the firm that would otherwise be costly to obtain through traditional inspections. This information can provide regulators with insights into the costs and benefits of regulations, allow for the comparison of compliance and safety cultures among firms, and allow for the targeting of traditional inspection activities (Bennear 2012; Mills & Reiss 2013). Importantly, scholars have noted that regulators must look to acquire personnel with audit oversight and data analysis skills to effectively oversee a process-oriented regulatory regime (Mills 2010, 2013).

The effect of the shift from prescriptive regulatory regimes to process-oriented approaches (Parker 2002; Gilad 2010) has been the proliferation of actors involved in oversight functions previously reserved for government agencies. This proliferation of actors has drastically altered the previously vertical or "principal–agent" relationship between regulator and regulated firm to one that is horizontal and built upon the sharing of information related to the internal operation of the firm. Inherent in the shift from the coerced provision of information to the voluntary sharing of information with regulators is the shift from purely vertical ties between regulated and regulator, to a structure with both vertical and horizontal ties. A greater emphasis has been placed on fostering trust between regulator and the regulated entity to ensure compliance when horizontal ties are emphasized (Murphy 2004; Gunningham & Sinclair 2009; Carrigan & Coglianese 2011). The close relationship and trust necessary to operate a process-oriented or performance-based regulatory regime has led some scholars to fear that the agency responsible for ensuring public accountability has become "captured" (Peltzman 1976) by the regulated industry. Ayres and Braithwaite (1991) and Gunningham (2011) have noted that the line between a collaborative relationship and a situation where an agency is "captured" by industry is hard to draw. This is particularly true in complex industries where agencies work to overcome information asymmetries through collaborative processes, while fulfilling their legal and professional mandate to oversee industry. This paper will explore how regulators and firms in a process-oriented regulatory regime failed to balance multiple accountability regimes.

3. Accountability in regulatory governance networks

The most thorough treatment of accountability within regulatory governance networks was conducted by May (2007), who used an accountability framework developed by Romzek and Dubnick (1987) to show how political, legal, bureaucratic, and professional accountability structures vary across prescriptive, process-based, and performance-based regulatory regimes (May 2007). In his examination of regulation in building and fire safety, food safety, and nuclear power plant safety, May (2007) found that a shift from prescriptive to process-based and performance-based regulatory regimes has led to a substitution of professional accountability for bureaucratic accountability structures. While this finding is a significant contribution, it does not address the question of how the shift from a government-centered regulatory approach to one based more on self-regulatory techniques that are contingent upon certain comfort levels among regulators, elected officials, and to some degree, citizens, for more market-driven and collaborative regulatory mechanisms, occurs. A framework that encompasses the role of markets and collaborative ties is needed. A more nuanced governance network accountability framework (Koliba *et al.* 2011) allows for a more in-depth analysis of the role that salience and complexity play in determining the dominant accountability structures within regulatory governance networks by juxtaposing market, democratic, and vertical and horizontal accountability structures. This broadened view of accountability allows for a more heterogeneous mixture of complementary and competing factors.

Table 1 outlines the application of the governance network accountability framework to regulatory governance networks at the federal level. The framework addresses the explicit standards and implicit norms that guide the relationship between those rendering the account and those to whom accounts are rendered. Of particular interest is the market accountability frame, which is divided into two distinct, but interrelated, components: *shareholder accountability* and *consumer accountability* (Scott 2006). *Shareholder accountability* usually calls for the maximization of profit as the driving, explicit performance standard. As such, the services, products, and information of privately owned firms often are viewed as proprietary objects. Within regulatory governance networks, shareholder accountability takes the form of strategic decisions within firms of how, when, and what information to share with regulators. Importantly, shareholder accountability is often achieved through a vertical power structure with boards

Table 1 Governance network accountability framework

Accountability frame	Accountability type (to whom is account rendered?)	Relational power	Explicit standards	Implicit norms	Specific applications to regulatory networks
Democratic	Elected representatives	Vertical over public sector	Laws, statutes, regulations	Representation of collective interests; policy goals	Congressional authorizations and appropriations processes
	Citizens (and interests groups)	Horizontal accesses to public sector organizations/ elected officials	Maximum feasible participation; sunshine laws; deliberative forums	Deliberation; consensus; majority rule	Public comment process under the administrative procedures act
	Legal (courts)	Vertical	Laws; statutes; contracts	Precedence; reasonableness; due process; substantive rights	Fines, civil penalties, and in some cases, the ceasing of operations. Judicial review of rulemaking
Market	Shareholder/owner	Vertical over management/ labor	Profit; reputation	Efficiency; social norms	Regulatory decisions (such as sharing of incident reports, standard setting, internal tests, etc.) that are driven by profit maximization, reputation, and social norms
	Consumer	Horizontal with owners	Consumer law; industry standards	Affordability; quality; satisfaction	Ability of consumer to make informed decision based on firm's ability and willingness to comply (or exceed as in the case of ISO) with regulatory standards
Administrative	Bureaucratic (principals, supervisors, bosses)	Vertical over agents; subordinates; contractees	Performance measures; administrative procedures; organizational charts	Deference to positional authority; unity of command; span of control	Inspector checklists for enforcement actions, detailed reporting requirements, reviews of enforcement decisions, and ratings of inspectors
	Professional (experts)	Vertical over lay persons; horizontal within profession	Codes of ethics; licensure; performance standards	Professional norms; expertise; competence	Designing and enforcement of internal compliance processes or performance-based regulatory standards based on profession or industry best practices, rules, or codes of ethics
	Collaborative (peers, partners)	Horizontal with peers	Written agreements; decisionmaking procedures; negotiation regimes	Trust; reciprocity; durability of relationships	Sharing of regulatory information (processes, internal firm operations, etc.) and cooperation in designing corrective action to remedy noncompliance

Source: Koliba *et al.* (2011).

of directors directing firm management to take specific actions. While the field of economics would predict that firms would look to design process-oriented or performance-based internal oversight or audit programs that minimize cost while providing an acceptable level of compliance, scholars have identified several instances where firms have gone "beyond compliance" standards established by regulators because of societal pressures, as well as a desire to maintain the organization's reputational capital (Ayres & Braithwaite 1992; May 2005; Thornton *et al*. 2005, 2009; van Erp 2011). This body of literature suggests that shareholder accountability is more than a blind focus on profitability and stock price, but rather a multidimensional concept built not only on fear of fines for noncompliance, but also the desire to maintain and enhance the firm's reputation for compliance.

Consumerist accountability is a market-based accountability predicated on the ability of consumers to choose between alternative competing goods or services. Through a consumer's choice or refusal to purchase, the consumer may be understood as holding a corporation accountable. Within regulatory governance networks, consumer accountability is manifested through the ability of consumers to alter purchasing behaviors given a firm's capacity to meet regulatory compliance. Traditionally, the ability of consumers to examine the firm's capacity to meet regulatory compliance would be centered on incidents of noncompliance reported by regulators. However, scholars have examined cases, particularly in the area of environmental compliance, where firms will participate in voluntary programs that design and set industry standards that are above the minimum levels, such as the International Organization for Standardization (ISO) standards (Prakash & Potoski 2006; Darnall *et al*. 2010). By enacting these costly standards, firms can differentiate themselves either as good corporate citizens or safe operators in the eyes of their consumers. These government and industry-centered voluntary programs provide more information to consumers to make an informed decision about the comparative level of compliance of firms in the marketplace.

The administrative frame of governance network accountability focuses on the processes, procedures, and practices that are employed in the administration and management of formally organized regulatory governance networks. *Bureaucratic accountability* structures are characterized by hierarchical arrangements through which there are clear relationships between subordinates and superiors who rely on tools, such as inspector checklists for enforcement actions, detailed reporting requirements, reviews of enforcement decisions, and ratings of inspectors (May 2007). As many federal agencies have shifted from government-centered to process-oriented regulatory regimes, the structure of bureaucratic accountability controls has shifted from inspections of equipment and actions to inspections of systems and processes designed to identify and report errors (Parker 2002; May 2007; Gilad 2010). The evolution in the nature of bureaucratic accountability has placed more emphasis on professional accountability structures. *Professional accountability* is characterized by placement of control over organizational activities into the hands of the employee with the expertise or special skills to get the job done (Romzek & Dubnick 1987). Professional accountability may also be maintained through compliance with profession or industry best practices, rules, or codes of ethics.

When two actors enter into a horizontal relationship in a regulatory governance network, they are not beholden to the traditional principal–agent dynamics of vertically arranged relationships marked by conflict or competition, where the principal holds some control (political, funding, etc.) over the agent who holds some informational advantage (expertise, etc.) over the principal. Instead, social network theorists have equated horizontal relationships with cooperative behaviors and norms of trust and reciprocity (Thompson 2003). *Collaborative accountability* binds actors as peers or partners (Mashaw 2006). The "reputational capital" of network actors becomes a key element within the establishment of durable, horizontally aligned relationships (Kreps & Wilson 1982). Although Carpenter (2010) has found that reputational cues can be used by agencies to make decisions at the national level, the importance of reputation and collaborative accountability is most evident in regulatory governance networks at the local or field level and also through collaborative organizations that foster the sharing of best practices and de-identified information regarding regulatory successes (Mills & Reiss 2013). The shift to process-oriented and performance-based regulatory regimes has made collaboration and the exchange of information between inspectors and representatives from firms necessary to ensure effective compliance. A key factor in the effectiveness of regulatory governance networks is the ability of both the regulatory and the regulated firm to have a reputation as a trustworthy partner to foster a free exchange of secondary information between the parties (Mills & Reiss 2013). That said, the collaborative accountability that may persist in a regulatory governance network might also be built on the revolving door of regulator–regulated ties. In these instances, the trust between principal and agent may undermine citizen confidence.

The Koliba, Mills, and Zia framework provides a theoretical lens to examine the shift from government-centered regulation to process-oriented regulatory regimes and the trade-offs that arise during the evolution of a regulatory governance network. Because the framework simultaneously considers market and administrative accountability regimes, it can be used to analyze when regulatory networks have shifted from government-centered to process-oriented regulatory regimes. More importantly, the framework can help to explain why both government-centered and process-oriented regulatory regimes fail and the degree to which this failure is a result of the incomplete implementation, perverse incentives, or a lack of oversight capacity in regulators and firms. In this paper, we use the Koliba, Mills, and Zia framework to examine the failure of the regulatory network charged with overseeing deep-water oil exploration in the Gulf of Mexico that led to the explosion of the *Deepwater Horizon* rig.

4. Data and methods

This paper employs a critical case (Yin 2013) design to build upon existing literature and theory on accountability in regulatory regimes. Our selection of the *Deepwater Horizon* case to examine market, democratic, and administrative accountability frames was driven by several factors, including the presence of a transition from a government-centered to a process-oriented regulatory regime by the main regulatory actor in the network: the Minerals Management Service (MMS). Additionally, the case was selected because of the complexity of the regulatory environment within which the network operates, as well as the evolution of the MMS's approach to regulatory oversight and its use of a voluntary process-oriented regime, the Safety and Environmental Management Plan (SEMP). Finally, we selected the *Deepwater Horizon* case because of the unique interaction of technical, decisionmaking, and regulatory agency failures that led to the disaster. While the analysis in this paper explores only a voluntary process-oriented regime, we feel that the conclusions drawn from the *Deepwater Horizon* case could be generalized to more mandatory process-oriented regimes. While outside the scope of this paper, the Koliba, Mills, and Zia framework allows for comparisons across the spectrum of process-oriented regimes, which would provide insights into how different regimes prioritize different accountability mechanisms depending upon whether the program is mandatory or voluntary. We feel the conclusions from this study provide an important first step in answering the vital public management question of the degree to which the voluntary nature of some process-oriented regulatory regimes increases or decreases accountability and compliance.

To construct our case study (and the integrated analysis), we synthesized and analyzed reports and working papers from the National Commission on the BP *Deepwater Horizon* Oil Spill and Offshore Drilling, including the Chief Counsel's Report that formed the basis for the report of the National Commission (2011), the Government Accountability Office (US GAO 2010), the United States Department of the Interior Inspector General's office (2010), the Congressional Research Service (CRS), and the University of California at Berkeley's Deepwater Horizon Study Group, along with internal investigations from BP and Transocean. In an attempt to increase the internal validity while reducing potential biases in each type of report (government, corporate, and academic) of our case study, we triangulated the data from government and corporate reports on the disaster with news and academic accounts of the disaster to provide a full account of the environment that led to the *Deepwater Horizon* oil spill. Our case is divided into two main sections: the failure of the regulatory agency (MMS) that led to the accident, and the industry decisionmaking factors that led to the accident. In each section, we present an in-depth examination of the environmental factors leading up to the accident followed by analysis of the accountability breakdowns and trade-offs that led to the disaster using the Koliba, Mills, and Zia accountability framework presented above.

5. Anatomy of a disaster

The explosion of the *Deepwater Horizon* rig on 20 April 2010 and the subsequent oil spill resulted in one of the worst ecological disasters in the history of the US. Following the explosion and subsequent spill, President Barack Obama commissioned the National Commission on the BP Deepwater Horizon Oil Spill and Offshore Drilling through Executive Order 13543 on 21 May 2010. The Commission examined the relevant facts and circumstances concerning the root causes of the *Deepwater Horizon* explosion and developed options to guard against, and mitigate the impact of, any oil spills associated with offshore drilling in the future (National Commission 2011). Additionally, the GAO, Department of Interior Inspector General, BP, Macondo, and others released reports following the explosion that

produced findings on the technical, communications, and regulatory breakdowns that led to the largest oil spill in US history.

The National Commission along with BP and Transocean's internal investigations identified three technical root causes that led to the build-up of methane gas and the subsequent explosion: BP's choice to use a single tube rather than a tie-back tube casing for the well; an inadequate cementing job by Halliburton that allowed gas to flow into the wellbore; and a deficient BOP that did not operate properly during the initial stages of the blowout, resulting in part from a lack of maintenance and testing by Transocean. While each of these root causes appears to be technical in nature, there were a series of regulatory and industry accountability breakdowns that led to each technical failure on the *Deepwater Horizon* rig. These root causes may be broken down into two groups: failures of the regulatory system accountable for overseeing offshore deep well drilling operations and industry decisionmaking and communication errors.

5.1. Failures of regulatory oversight leading to the *Deepwater Horizon* disaster

The MMS was created in 1982 as a result of the recommendations of the Commission on Fiscal Accountability of the Nation's Energy Resources, or the Linowes Commission. The Commission was tasked with reviewing the ability of the US Geological Survey (USGS) to collect revenues from mineral extraction. The USGS's scientific mission did not lend itself to revenue collection, which the GAO estimated cost the US treasury hundreds of millions of dollars in lost revenue. Therefore in 1982, Secretary of the Interior Melvin Watt created the MMS by incorporating the revenue collection charge called for by the Linowes Commission and the Federal Oil and Gas Royalty Management Act (FOGRMA) with the responsibility for offshore development, leasing, and regulation, formerly the domain of the Bureau of Land Management (BLM). The agency was divided into two components: the office of Mineral Revenue Management implemented FOGRMA by collecting royalties, while the office of Offshore Energy and Minerals Management was responsible for implementing the Outer Continental Shelf Lands Act of 1953, which now directed the MMS to both develop and lease offshore properties for oil and gas exploration while also providing for the protection of human, marine, and coastal environments (Carrigan 2014).

Throughout its history, the MMS has attempted to balance the economic interests of developing new offshore properties for oil exploration with its charge to regulate offshore drilling activities. In the 1980s and early 1990s, MMS subjected oil and gas activities to an array of prescriptive safety regulations, including hundreds of pages of technical requirements for pollution prevention and control, drilling, well-completion operations, oil and gas well workovers (major well maintenance), production safety systems, platforms and structures, pipelines, well production, and well control and production safety training (National Commission 2011). The agency conducted announced and unannounced inspections to ensure compliance with a "national checklist" of safety and environmental regulations. However, the MMS increasingly failed to keep pace with industry, as offshore drilling processes became more complex as oil companies moved into deeper waters (Carrigan 2014). The lack of understanding of the nascent deepwater drilling technology by both industry and the MMS led to a more collaborative and process-oriented regulatory regime.

Under the new safety-management model being explored in regulatory agencies in other countries, minimum standards for structural and operational integrity (well control, prevention of fires and explosions, and worker safety) remained in place, but the burden now rested on industry to assess the risks associated with offshore activities and demonstrate that each facility had the policies, plans, and systems in place to manage those risks (National Commission 2011). Career officials in the MMS were supportive of the changes implemented initially by Norway, the UK, and Canada. In 1991, the MMS published a Federal Register notice requesting comments on the agency's plan to shift to a SEMP. In late 1991, the American Petroleum Institute (API) asked the MMS to postpone action and to work with API to collaboratively develop a set of "recommended practices" (RP) for offshore oil drilling operations. The MMS felt that the recommended practices developed by API were incomplete and did little to ensure the safety of oil drilling. By the mid-1990s, there was a growing consensus within the MMS that the technology of new deepwater equipment was so advanced that the chance of a major safety incident was slim. The agency, instead of attempting to fight the political battle of mandating SEMP for all operators, encouraged voluntary compliance with the SEMP contained in the API recommended practices. As one MMS official put it, "We want to approach our relationship with the offshore industry as more of a partner than a policeman" (National Commission 2011 pp. 71–72).

At the same time it was trying to evolve its regulatory process, the MMS was under increasing pressure from Congress to focus more of its attention developing deepwater leases for oil exploration. In 1995, Congress passed the Deep Water Royalty Relief Act, which suspended royalty payments on Gulf deepwater leases through 2000, until significant amounts of oil and gas had been produced on those leases. This incentive had a drastic impact on the complexity of oil exploration in the Gulf. Prior to 1995, the average water depth of oil production increased by less than four feet. Following passage of the law, the average depth of oil exploration increased to 18 feet, a fourfold increase (Carrigan 2014). This increase in the depth of oil exploration and production put a strain on the resources of the MMS as they lacked the personnel and the capacity to effectively regulate a largely unknown technology.

Because of the increase in the depth of drilling and the agency's lack of information on deepwater technology, the MMS again resurrected the effort to mandate the implementation of SEMPs for all offshore operators. In 2004, the API updated RP-75, which contained industry best practices for the voluntary implementation of SEMPs. RP-75 contained 12 elements, including the collecting of safety information, hazard analysis, incident investigation, and auditing of program elements (Sutton 2011). As the MMS went through the rulemaking process, the agency encountered resistance to mandating the reporting of safety incidents from industry and the Office of Management and Budget (OMB), who both argued that the requirement to report all gas leaks, large and small, would be overly burdensome. As one MMS official recalled, "It was like pulling teeth. We could never get cooperation from industry or OMB" (National Commission 2011, p. 72). The Advanced Notice of Proposed Rulemaking for SEMP issued in 2006 mandated only four of the 12 API recommended practices. At the time of the Macondo blowout, 20 years after its original proposal, the MMS had still not published a final rule mandating that all operators have plans to manage safety and environmental risks (National Commission 2011).

The inability of the MMS to acquire professional expertise to provide effective safety and environmental oversight of deepwater drilling remained a problem for the agency. The MMS was unable to produce regulations or safety requirements that addressed advances in industry drilling technologies. Much of the inability to produce regulations and conduct meaningful inspections of deepwater oil drilling operations was the result of the agency's trouble recruiting, retaining, and training inspectors. In March 2010, the GAO reported that the MMS experienced high turnover rates in key oil and gas inspection and engineering positions responsible for production verification activities (US GAO 2010). The National Commission Report found that almost half of the MMS inspectors surveyed did not believe they had received sufficient training. Additionally, the MMS does not provide formal training specific to the inspections process and does not keep up with changing technology. Some inspectors noted that they rely on industry representatives to explain the technology at a facility (National Commission 2011). Some have speculated that the lack of emphasis on training for inspectors was related to the MMS's dual mandate and pressure from Congress to focus its attention on developing and leasing new offshore properties, rather than regulatory oversight (Carrigan 2014).

When industry representatives contended that BOPs were much safer than previously thought and that MMS regulations required too many inspections of the critical piece, the agency reduced the number of BOP inspections by half (National Commission 2011). Even as third party analysis of the BOPs showed that the blind sheer rams were an unreliable last resort under most conditions, the MMS never revised its BOP regulations or required an inspection of these components. Adding to the complexity of regulating the BOP was the fact that many companies, including BP, were regularly contracting out the maintenance and inspection of the BOP to other firms, including Transocean and Halliburton. However, the MMS took no action to require audits or inspections by the contracting entity to ensure the reliability of the BOP (National Commission 2011).

The environment described here illustrates several breakdowns and trade-offs between accountability frames that led to conditions that were conducive for a major regulatory failure. First, *there was a significant breakdown in administrative accountability structures*. The decision by the MMS to pursue a process-oriented regulatory regime through the SEMP, rather than a government-centered regime, illustrates the agency's willingness to defer to the expertise of industry, which had developed increasingly complex processes for deepwater oil drilling. It appears that, faced with the reality that it could no longer sustain effective inspection techniques, the MMS decided to act as an "accountability entrepreneur" (Reiss 2011) by trying to shift the risk and responsibility for oversight from the agency to industry through the creation of the SEMP. However, the MMS encountered stiff resistance from both industry and political appointees within OMB that watered down the SEMP and left the agency and industry in a state of

regulatory limbo. Therefore, the bureaucratic accountability that the MMS could have had in a more traditional regulatory arrangement, or with a fully implemented process-oriented regime, became watered down.

Second, *the lack of professional accountability in the MMS* led to the inability of the regulators to effectively oversee the nascent deepwater oil exploration industry. The lack of professional capacity was evident both in the agency's lack of specialized training and the high turnover rate of inspectors. Importantly, because the provisions of the SEMP that encouraged voluntary reporting and auditing were not fully implemented, the inspectors at the MMS were at a severe information disadvantage vis-à-vis the drilling companies they were charged with regulating. By placing a greater onus on industry professionals to regulate themselves, this case also brings to bear the failure in the professional accountability of the engineers from BP and its subcontractors to adequately follow the RPs determined by the profession.

An interesting feature of the *Deepwater Horizon* regulatory network was the *lack of democratic accountability for regulatory oversight* (involvement by elected officials, citizens, and courts) present in the network prior to the explosion aboard the rig. While senior career officials at the MMS wanted to move forward on implementing a mandatory SEMP to regulate deepwater oil exploration, political appointees at OMB and Congress were not responsive to requests to fully implement a process-oriented regime. Specifically, Congress's passage of the 1995 Deep Water Royalty Relief Act sent a clear message to the MMS to focus its attention on helping industry develop new deepwater oil fields while reducing its overall budget for regulatory activities. This illustrates deference for the importance of safety by elected officials and by political appointees, which affected the ability of the MMS to implement its mandate.

Finally, the unwillingness of OMB and industry to include all of the recommended practices in the MMS's SEMP illustrates *the trade-off between administrative and market accountability frames*. While the 2006 rule implemented four of the 12 recommended practices from the API's RP-75, some key elements to successful process-oriented regulatory regimes not included in API's recommendation, such as information sharing between regulator and industry, were not implemented voluntarily in industry SEMPs. These elements would have fostered an exchange of information and the building of trust and a sense of durability between the MMS and the deepwater oil operators that could have resulted in an increased reliance on horizontal collaborative accountability structures within the network. However, the unwillingness of industry to voluntarily implement these elements into their SEMPs suggests that in this case the oligopolistic oil industry was driven more by traditional perceptions of shareholder accountability such as profit motive and less by reputational enhancement or social norms. Also, the lack of full implementation of API's recommended practices illustrates a potential issue with industry compliance with voluntary standards as a signal of consumer accountability regarding the relative level of compliance of firms. While BP was in compliance with the recommended practices contained in the government-sponsored SEMP, it was clear that the SEMP was inadequate by the industry-sponsored API's standards. This raises questions about the ability to ensure consumer accountability through the use of both government and industry sponsored voluntary compliance programs, particularly when the government lacks the resources to effectively oversee such programs or when the government (in this case OMB) is swayed by political, rather than professional, arguments for the implementation of standards that comprise voluntary certifications.

From the preceding analysis, it is clear that there was a lack of regulatory oversight by the MMS of the offshore oil drilling industry. The MMS was hampered in its efforts to implement a fully functioning SEMP, which led to the lack of a consistent risk and hazard analysis in decisionmaking within companies, such as BP. Importantly, the lack of a well-structured safety and environmental reporting system as part of the SEMP rule hampered the building of a trustful and honest exchange between the MMS and industry, which ultimately led to the hiding of violations and inspection results. Additionally, the increasingly complex nature of deepwater drilling operations, coupled with a lack of resources for MMS inspection and training functions, left the agency at a severe informational disadvantage vis-à-vis the drilling companies they were charged with regulating. These factors, along with a lack of a clear accountability framework, set the groundwork for BP, Transocean, and Halliburton's mismanagement aboard the *Deepwater Horizon* rig.

5.2. Industry decisionmaking and communication errors

One of the contributing factors that led to the *Deepwater Horizon* disaster was BP's decision to use a single tube rather than a series of shorter tie-back tubes in the wellbore. Industry best practice for a well as deep as the Macando

prospect (over 20,000 feet) was to use a series of tie-back tubes, rather than one long single tube. The tie-back tube serves as a secondary barrier to gas kicks that can cause blowouts similar to the one that caused the *Deepwater Horizon* rig's blowout. BP, however, constructed a single tube running the full span of the wellbore. While BP's internal computer simulations and engineering experts raised concerns that the well's design allowed a significant amount of gas to escape to the top of the well, BP project managers responded that "not running the tie-back saves a good deal of time/money" (Bush 2012, p. 540). The National Commission noted that BP's choice to use a single tube design was not an unprecedented decision and itself did not lead to the blowout. However, the single tube design increased the difficulty of obtaining a reliable primary cement job in several respects, which was a direct cause of the blowout. The single tube design made cementing, the process of pouring cement slurry into the casting channel to stop the flow of oil from the well, a much more complex process than would have been the case with a tie-back casing. Specifically, a single tube design places more importance on making sure that the flow of cement into the well is centered. If the cement job is not centered, it can leave channels of drilling mud that can severely compromise a primary cement job by creating paths and gaps through which pressurized hydrocarbons can flow (National Commission 2011, p. 96).

BP's initial design called for 16 centralizers (used to center the flow of cement into the well) to be used to cement the well, but that number had been increased to 21 based on internal testing done by cement contractor Halliburton. However, BP's main supplier, Weatherford, only had six centralizers available during the cementing process. Halliburton's internal modeling found that given BP's decision to use the single tube design, the cementing job would require the full 21 centralizers to prevent gas from escaping into the well. However, BP's leadership on the rig was uncertain if they could get 15 of the correct type of centralizers to the rig via helicopter and also lamented the extra "10 hours" that would be needed to install the extra pieces. The decision was made by BP's off-rig team to use only the six centralizers for the cementing process. Also, it appears that the decision to move forward with only six centralizers was not communicated to the primary Halliburton cementing team (National Commission 2011).

During the cementing process, BP was very concerned that Halliburton's best practices for pumping mud and cement into the well would lead to lost returns of oil. In order to limit this risk, BP made two critical decisions that increased the risk of gas build-up in the well. First, BP limited the amount of mud circulated through the well to approximately 350 barrels of mud before cementing, rather than the 2,760 barrels needed to do a full bottom-up circulation. Second, BP compromised by deciding to pump cement down the well at the relatively low rate of four barrels or less per minute, which decreased the risk of a loss of oil returns, but also decreased the effectiveness of the cement job. Third, BP limited the volume of cement that Halliburton would pump down the well. This is contrary to best management practice in this area as, "Pumping more cement is a standard industry practice to insure against uncertain cementing conditions: more cement means less risk of contamination and less risk that the cement job will be compromised by slight errors in placement" (National Commission 2011, p. 100). A final area of concern related to the cement job was the type of cement slurry used by Halliburton. Halliburton's initial tests of the nitrogen-infused slurry found that it posed a slight risk for becoming porous and allowing gas to escape into the well. Halliburton sent these findings to BP, but it is not clear whether they examined the findings prior to cementing the well. Additionally, Halliburton conducted further testing of the slurry and found a much higher failure rate, which was not reported to BP (BP 2010; National Commission 2011). These shortcomings led to an ineffective cement job, which was the primary cause of the build-up of gas in the wellbore.

As gas began to flow into the well, the team on the rig should have noticed increased pressure readings from both the Transocean "Hitec" system and the Sperry Sun system (which transmitted real-time pressure readings to BP's onshore team). However, the pumps were shut down during this time, which meant that there was no one monitoring the rising pressure from below. This is exceptional given the number of different actors who had access to this data. At 9:40pm on 20 April 20, drilling mud began spewing onto the rig floor. It was at this moment that the crew aboard *Deepwater Horizon* realized that a kick had occurred. The crew took immediate action by diverting the flow into the mud–oil separator and closed one of the preventers on the BOP. However, their actions were too late as there was a significant amount of gas above the BOP and too high of a flow rate for the BOP to withstand. The gas above the BOP ignited resulting in what one Transocean employee likened to "a 550-ton freight train hitting the rig floor," followed by what he described as "a jet engine's worth of gas coming out of the rotary (National Commission 2011, p. 114).

Much of the investigation following the *Deepwater Horizon* explosion has focused on the inability of the BOP to seal the Macando well. A critical component of the BOP is the blind sheer ram, which is designed to cut the drill pipe in the well and to shut off the well following an emergency release of oil. However, both Transocean and the MMS know that oftentimes in deepwater operations, the blind sheer ram is unable to cut through the drill pipe. Adding to the concern around the blind sheer ram is that Transocean's BOP had not been recertified since 2000. The problem was also exacerbated by Transocean's "condition-based maintenance" approach, which stated that the condition of the equipment would dictate repair, rather than set timetables for regular inspections. This allowed Transocean to forgo regular disassembly and inspection of the BOP and may have led to the blind sheer ram not engaging following the explosion aboard the *Deepwater Horizon* rig (Chief Counsel's 2011).

It is clear that management at BP, Transocean, and Halliburton did not communicate to its personnel on the rig how to properly evaluate the trade-offs between risk and time/money savings when making operational decisions. Table 2 lays out some of the key decisions that led to the explosion. A report by the Chief Counsel analyzed these decisions by looking at the availability of less risky alternatives and whether or not those decisions saved time. It is clear that the focus aboard the *Deepwater Horizon* was squarely on saving time and money, rather than reducing risk. The lack of effective information sharing and communication among the companies aboard the *Deepwater Horizon* was another systemic root cause of the disaster. Information was extremely compartmentalized aboard the *Deepwater Horizon* as a result of poor communication. BP routinely did not share information with its contractors or internally with members of its own team. Contractors did not share information generated from "proprietary systems" with BP or other contractors. As a result, actors often found themselves making decisions without full information regarding the context or critical nature of those decisions. Additionally, Transocean and BP lacked procedures to share information from experiences on other rigs that may have helped to inform decisionmaking on the *Deepwater Horizon*. The technical causes of the disaster were the results of a series of decisions made by the onshore and offshore operations teams. As Table 2 demonstrates, these decisionmakers consistently opted for the least cost, highest profit option. It should be noted, however, that no laws were broken. In most cases industry-wide best management practices were not followed, however, these practices were most often classified as voluntary.

The decisions made by BP and its contractors illustrate several breakdowns and trade-offs in accountability structures. First, while many of the decisions made by BP and its contractors were market driven, it is clear that *there was a breakdown in market accountability* in the *Deepwater Horizon* incident. Specifically, while BP and its contractors made decisions that reduced time and led to short-term operational efficiencies, the decisionmakers failed to consider the long-term reputational and profitability implications of not conducting risk analysis of its decisions. The *Deepwater Horizon* incident did great damage to BP's organizational reputation around the world, which, at least initially, negatively impacted shareholders by costing the company $5 billion (USD) and a reduction in the stock price of over 20 percent (Krauss 2010). This indicates that the profit maximization component of shareholder accountability was so prevalent in the rush to develop the Macando well that the reputation of BP and

Table 2 Evaluating decisionmaking aboard the *Deepwater Horizon*

Decision	Less risky alternative available?	Less time than alternative?	Final decisionmaker(s)
Not waiting for more centralizers of preferred design	Yes	Saved time	BP Onshore
Not waiting for foam stability test results or redesigning slurry	Yes	Saved time	Halliburton and BP Onshore
Using spacer made from combined lost circulation materials to avoid disposal issues	Yes	Saved time	BP Onshore
Displacing mud from riser before setting cement plug	Yes	Unclear	BP Onshore
Not installing additional physical barriers during temporary abandonment procedures	Yes	Saved time	BP Onshore
Not performing additional diagnostics in light of troubling negative pressure test results	Yes	Saved time	BP and Transocean on rig

Source: Chief Counsel (2011).

the norms of industry were relegated to the background. There was also a breakdown of consumer accountability evident in the decisionmaking practices of BP and its contractors. The failure of BP to fully integrate all of the recommended practices into its voluntary SEMP led to a misguided perception of the company among consumers as a safe and responsible corporate entity. Finally, BP's SEMP gave them the ability to brand themselves to consumers as a "beyond compliance" organization, which, given the incomplete implementation of the SEMP, was a distorted market signal.

The decisionmaking process also illustrates the *trade-off between administrative and market accountability*. The lack of professional accountability exercised by the MMS coupled with the lack of a fully implemented SEMP allowed BP and its contractors to make decisions without regard to risk, and with full regard to increased efficiency through reduced time and lost returns of oil. The decisions made by BP, Transocean, and Halliburton, from the decision to use a single tube well to the decision to proceed using only six centralizers to cement the well, were made with full consideration of accountability to the shareholders of the respective companies. As the MMS had promulgated no rules or regulations for the number of centralizers to be used for the well, the threat for legal or administrative accountability to BP was weak at best. Although engineers aboard the *Deepwater Horizon* would occasionally raise potential issues regarding the structural integrity of the well, management deferred exclusively to options that would ensure time or cost savings. The dominant decision architecture in the *Deepwater Horizon* governance network was one that focused on centralized decisionmaking by BP's onshore team, akin to Gormley's boardroom regulatory environment, in which a distorted short-term vision of accountability (i.e. micro-level profitability rather than overall organizational reputation) to shareholders' bottom line prevailed.

The National Commission Report's finding that BP lacked a process for incorporating risk or hazards into its decisionmaking illustrates *that a lack of professional accountability on the part of regulators and industry can lead to complete deference to shareholder accountability within the regulatory governance network*. Without an expert from the MMS to conduct effective inspections (note that the *Deepwater Horizon*'s BOP was inspected less than a month before it failed), BP and Transocean were able to implement safety processes, such as the "condition-based maintenance" program of its BOP, which were designed to reduce the costly process of disassembling the BOP. Because the process-oriented SEMP had not been fully implemented, the MMS lacked the information it needed to assess the risk and hazards of the *Deepwater Horizon* operation. Had the MMS been staffed with experts in risk and hazard analysis to implement a full SEMP, these types of cost-cutting measures may have been curbed. This lack of professional capacity led to the deference to the decisionmaking of industry, which failed to rely on its own professional standards as a result of reducing the pressure to increase the profitability of the well by reducing the time it would take to make the well operational.

Finally, the *Deepwater Horizon* regulatory governance network illustrates the *trade-off between collaborative and shareholder accountability*. The proprietary nature of much of the equipment, information, and processes aboard the *Deepwater Horizon* precluded full collaboration between BP, Transocean, and Halliburton. For example, after Halliburton had tested the cement slurry for its porousness, the company did not disclose the findings of its report to BP for fear that the results might cause problems, including delays and cost overruns. Also, both Transocean and BP were not able to share information from experiences drilling other deepwater oil reserves to help guide decisionmaking on the *Deepwater Horizon* rig. This lack of information sharing and communication precluded the development of trust and transparency between the management teams involved in operating the rig. Additionally, the lack of coordination by the contractors used by BP is consistent with Romzek and Dubnick's (1987) work on the use of contractors by NASA prior to the Challenger disaster.

6. Discussion and conclusions

The *Deepwater Horizon* disaster illustrates the importance of having multiple accountability frames in a complex regulatory regime. Specifically, the inability of actors to effectively balance democratic, administrative, and market accountability mechanisms led to the full implementation of a process-oriented regulatory regime that resulted in ineffective oversight and decisionmaking. The process-oriented SEMP was not effective in ensuring compliance and preventing the disaster because of a lack of democratic accountability on the part of Congress and OMB that resulted in the incomplete implementation of a process-oriented regulatory regime that limited the informational tools at the disposal of the MMS to build its professional capacity for oversight. This lack of capacity resulted in the MMS relying

on industry to self-regulate its operations, however, BP and its contractors relied on a narrow focus on profit maximization through time and cost reduction at the expense of professional best practices.

Our analysis identifies several key insights for regulators and policymakers who may be looking to transition to, or restructure existing, process-oriented regulatory regimes. First, our findings place an important caveat on Darnall *et al*.'s (2010) study of government and industry centered voluntary programs. In order to hold firms accountable for their commitment to go "beyond compliance" in government-centered voluntary programs, it is necessary for the regulatory agency to have enough professional capacity to effectively oversee the complex processes of industry. Without this capacity, agencies will be forced to rely on the analysis and processes of industry, which may or may not be in full compliance with all of the professional standards of the regulated industry. Ironically, the lack of professional capacity at the MMS was largely the result of a lack of democratic accountability from OMB and Congress who failed to clarify the mission of the agency and to allow it to fully implement a process-oriented regulatory regime through SEMP.

Importantly, a lack of professional capacity on the part of the regulator may also have another unintended consequence: a singular focus on profit-maximization in the area of shareholder accountability. It is clear from the *Deepwater Horizon* case that decisions both on and off the rig were made with the singular goal of profit maximization and without consideration of the potential damage to shareholder accountability vis-à-vis the damage to the organizational reputation that a large-scale incident would have on the shareholders. Our findings support the conclusions of Gormley (1986), who noted that as processes become increasingly complex, agencies often defer to the professional expertise of industry while decisionmaking processes become similar to those in "boardrooms." In the case of the *Deepwater Horizon*, boardroom decisionmaking materialized in the inability of BP to evaluate its operational decisions in terms of not only its desire to save time and money, but in the inability to assess the risk involved with each decision. A key insight from van Erp (2011) is that the ability of the regulator to effectively oversee complex industries through publicizing incidents of noncompliance can be an effective way to shift the focus of firms from profit maximization to the maintenance of organizational reputation. Without capacity for oversight because of the lack of a fully implemented SEMP, this key regulatory tool was not available to MMS regulators.

Another key finding from our examination of the *Deepwater Horizon* incident is that as agencies shift from government-centered to process-oriented regulatory regimes, it is vital that congressional authorizers and appropriators to clarify and remove conflicts from the mission of regulatory agencies. The conflicting mission of the MMS led to uncertainty about how to address key disagreements, such as the implementation of recommended practices within SEMP. In the three years following the *Deepwater Horizon* disaster, the MMS has undergone a major reorganization. Although the MMS was renamed the Bureau of Ocean Energy Management, Regulation and Enforcement (BOEMRE) immediately following the explosion, the agency's structure remained the same until 1 October 2010, when the Department of the Interior created two distinct bureaus: the Bureau of Ocean Energy Management (BOEE, responsible for managing environmentally and economically responsible development of the nation's offshore resources through the issuing of leases) and the Bureau of Safety and Environmental Enforcement (BSEE, responsible for safety and environmental oversight of offshore oil and gas operations, including permitting and inspections of offshore oil and gas operations). The separation of the leasing and safety oversight functions of the MMS is designed to remove a large degree of the internal conflict of interest in promotion and regulation of deepwater oil exploration identified by Carrigan (2014).

Finally, our findings illustrate that in order to realize the benefit of process-oriented regimes that rely on collaborative accountability such as SEMP, there must be mechanisms in place that force both the regulatory agency and the firm to share information. One such mechanism that was not initially included in the SEMP for the *Deepwater Horizon* is incident reporting systems that allow employees to disclose violations to the regulator in exchange for confidentiality and immunity from regulatory enforcement action. These programs go beyond traditional voluntary compliance programs by relying on repeated interactions between firms and regulators to develop a working relationship rooted in trust that can lead to higher levels of compliance (Mills & Reiss 2013). Recently, BSEE has issued a final rule that implements key parts of SEMP that were not present prior to the *Deepwater Horizon* incident, including the establishment of voluntary safety reporting programs, clear identification of final decisionmaking authority in written policies and procedures, and mandatory audits of rig operations every two years (BSEE Fact Sheet on SEMS rule). This suggests that the agency is looking to adjust its regulatory regime to provide more effective oversight of a complex industry that is operating in a process-oriented regime.

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