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Abstract

How is it that some organizations can maintain nearly error-free performance, despite trying conditions? Within research on such high-reliability organizations, mindful organizing has been offered as a key explanation. It entails interaction patterns among front-line operators that keep them attentive to potential failures—and relies on them having the expertise and autonomy to address any such failures. In this study, we extend the mindful organizing literature, which emphasizes local interactions among operators, by considering the broader institutional context in which it occurs. Through interview, observational, and archival data of a high-reliability explosive demolitions firm in China, we find that external regulators can crucially enhance the mindful organizing of front-line operators as regulators and operators interact around safety rules. Regulators go beyond the interactions emphasized in institutional theory, whereby regulators help operators internalize the content of rules and follow the rules in practice. Rather, regulator interactions also help ensure the salience of rules, which enriches and distributes operator attention throughout the firm. We also find evidence of regulator learning, as interactions with operators help regulators improve rule content and the techniques by which rules remain salient. These findings expand our understanding of mindful organizing and the interactional dynamics of institutions. They also particularly speak to the debate over whether and how rules can enhance safety. Namely, through distinct practices that impact the content and salience of rules, regulators can increase standardization without diminishing operator autonomy.

1. Introduction

As a topic of scholarly inquiry, safety has undergone periodic and substantial shifts in how it is conceptualized (see Hollnagel, 2014). One such shift has been from case studies of safety failures to studies of systems where failures are to be expected, but do not occur. The former approach, as exemplified by Perrow's (1984) influential treatment of the Three Mile Island accident, made a crucial point about how systems are designed: as the activities in a system become more complex and interdependent, the knowledge required to control the system begins to exceed the capacity of any of its regulators, managers, or operators, and the odds of safety failures necessarily increase as a consequence. The latter approach, therefore, has studied *high-reliability organizations*, a subset of complex and interdependent systems that attain nearly failure-free performance despite these trying conditions (LaPorte, 1996).

What became increasingly clear to scholars of high-reliability organizations was that the knowledge required to control such systems indeed cannot be completely encoded in rules formulated by managers or regulators, but that this need not necessarily increase the odds of safety failures. The knowledge required to control systems instead inheres within specific patterns of interactions among front-line operators and a shared concern for reliability that underlies and motivates these interactions (Weick, 1987; Weick, et al., 1999). These patterns of interactions, known as *mindful organizing*, serve a common purpose: they help operators direct their attention toward current activities and the potential failures lurking in them, rather than allowing past successes or previously determined strategies to lull attention away from current activities. These patterns, in turn, rely on operators having the expertise and autonomy to interpret the causes of any lurking failures they notice and address them accordingly (Vogus and Rerup, 2018; Weick and Sutcliffe, 2006). In particular, mindful organizing entails five specific

patterns of interaction in which people demonstrate a *preoccupation* with potential sources of failure, a *reluctance* to accept simplified interpretations of ongoing events, a *sensitivity* to current operations, and, when faced with problems, a *commitment* to resilience and a *deference* to the person with the most relevant expertise, rather than the most power (Weick et al., 1999).

From this perspective, safety is not conceptualized as an abstract system-level outcome (i.e., the absence of major failures), but as a set of concrete interactions that occur at the level of front-line operations (e.g., Hollnagel, 2014; Rochlin, 1999). A key benefit of conceptualizing safety in line with mindful organizing is that practitioners who value safety can more readily influence the patterns of interactions that operators enact during their activities than they can influence the complexity and interdependence of those activities (Perrow, 1984). The complexity and interdependence of operator activities has become less influenceable in part due to external technological advances increasing the complexity of activities (Hollnagel, 2014) and the inability of organizations to buffer their activities from external regulatory influence (Weick et al., 1999). In contrast, the operator interactions that constitute mindful organizing can be enhanced by leader actions (Madsen et al., 2006) and organizational practices like socialization (Weick and Roberts, 1993), training (Vogus and Welbourne, 2003), and technology use (Valorinta, 2009), among others (see Sutcliffe et al., 2016). In this way, mindful organizing may be a particularly promising pathway to safety because practitioners can directly enhance mindful organizing at the level of front-line operators, who are typically closest to any potential lurking failures.

Mindful organizing certainly captures an important aspect of safety. However, the singular focus on social interactions among front-line operators in the relevant research may entail limitations in its explanatory power and recommendations for practitioners. For instance, although these front-line operators will have local expertise, they may lack the broader system-

level understanding to optimally use whatever authority is granted to them (Leveson et al., 2009). Empowering operators in the manner recommended in mindful organizing research could therefore increase the risk of safety failures in some cases, rather than reduce it. Research on mindful organizing can thus be characterized by a degree of "interactional reductionism" (Levinson, 2005), whereby phenomena that are better understood at the system level are reduced to local interactions. Unless the interactions among front-line operators are contextualized more fully within system-level features, the recommendations made in mindful organizing research may be systematically limited in ways that increase the risk of safety failures.

To this end, mindful organizing researchers have recently started to contextualize these front-line interactions through theoretical work. Some have theoretically emphasized interactions between front-line operators and top managers within an organization (Vogus and Rerup, 2018). Others have emphasized how any such interactions occur within the broader organizational context, including the structures that provide people with institutionalized concepts for sensemaking, the resources that enable them to enact routines, and the information flows that guide which routines they enact and which concepts they use to make sense of events (see Kudesia, 2019; Kudesia and Reb, 2018). However, our understanding of how mindful organizing is embedded within broader system-level features still remains exceedingly limited, particularly given the absence of relevant empirical research.

1.1. Aim and Scope of the Present Study

In the present empirical study, we therefore focus simultaneously on global system-level features and local interaction patterns within a high-reliability explosive demolitions firm in China in order to expand the explanatory power of mindful organizing for safety. In particular, we focus not merely on the interactions among front-line operators, but on the interactions

between front-line operators and their external regulators, as they occur over time (cf. Shrivastava et al., 2009). Through an inductive analysis of interview, observational, and archival data, we generate a novel theoretical model that broadens our understanding of mindful organizing by considering interactions between two groups, rather than merely within a single group of front-line operators, and by highlighting how these interactions both draw from and contribute to system-level institutionalization processes (see Figure 2). In particular, we find that four specific types of interactions between external regulators and front-line operators related to safety rules are crucial in enabling and sustaining mindful organizing in ways that, in turn, improve organizational safety. It is, at least partially, through these four interactions that operators and regulators jointly maintain the content and the salience of rules during activities.

A central topic of importance to emerge inductively from our data concerns rules. Rules or formal written-down representations of standard operating procedures, are known to play an important role in safety, albeit a role that remains poorly understood (see Hale and Borys, 2013a, 2013b). On one hand, violations of rules are typically associated with reduced safety (Dekker, 2005; Hopkins, 2011). On the other, operators often report that rules have little to no relevance to their actual activities (Hale and Borys, 2013a, pp. 208–209). People can further violate rules intentionally or unintentionally in ways that enhance or reduce safety, and for varied reasons including that violation has become normalized or that current activities fall outside the scope of the available rules (Reason et al., 1998). All of these complications make the function of rules for safety difficult to understand and in need of further clarification.

One way to help clarify the function of rules for safety is to consider how global system-level features shape local interaction patterns. In one way of thinking, the global system-level features strongly determine local interaction patterns. Dekker (2005), for instance, suggested that

institutions can endorse one of two competing approaches to rules—and whichever approach the institution endorses will shape operator activities. In the first approach, rules are treated as strict bureaucratic controls that institutions encode into operators through socialization and training. Front-line operators thus violate rules at great peril, as rules standardize the knowledge of the experts who formulated them. In the second approach, rules need not be strict and controlling. Instead, properly enacting a rule requires the expertise of operators in their specific contexts (Dreyfus and Dreyfus, 2005). This suggests a need to grant greater autonomy to operators.

In another way of thinking, however, an institution need not exclusively endorse either a standardization approach or an autonomy approach to rules at the global level (Hale and Borys, 2013a). Rather, in line with the principle of loose coupling (Orton and Weick, 1990), an institution can retain aspects of both standardization and autonomy through "flexible rules" (Grote, 2004; Grote et al., 2009). Flexible rules, for instance, are written in a manner that does less to specify the precise actions operators must undertake and does more to emphasize the goals for operators to achieve or the processes by which they can make effective decisions (Hale and Swuste, 1998). As a result, flexible rules can be standardized globally throughout an institution, while still allowing for local autonomy among operators.

But flexible rules cannot be defined merely by their content. An understudied but "crucial" question regarding flexible rules concerns "the process of generating and modifying rules" (Grote et al., 2009, p. 22). Institutions must engage in a process that not only generates safety rules, but also modifies these rules based on feedback from operator activities (cf. Barley and Tolbert, 1997). We can thus reconceptualize mindful organizing on the front lines not as an isolated group activity, but as an important local sensemaking process that draws on, contributes to, and interfaces with the broader system-level process by which institutions manage their safety

rules (Kudesia, 2017; Weber and Glynn, 2006).

The present study adopts this reconceptualization of mindful organizing to help clarify the function of rules for safety. In particular, our model addresses the vastly understudied interactions between global and local levels: how institutional and operational actors come to support each other toward mindful organizing and thus safety (Barbour and Gill, 2017; Hale and Borys, 2013b). Our research clarifies how the four specific interactions of encoding, reinforcing, reinstating, and learning that we discover can enhance the management of rules for safety. In so doing, complementing past research that has largely focused on the content of rules, our findings surface the importance of rule salience. Even rules that are well-encoded through training and assessment practices are of little practical value if they are not salient in operators' minds during their everyday activities. We find that regulators engage in a number of specific practices that reinforce and reinstate the salience of safety rules. Our introduction of this distinction between rule content and rule salience further develops the important question of how flexible rules function in practice (Grote et al., 2009) by identifying how salience and content functions of rules enable loose coupling. In particular, regulators can interact with operators in a manner that keeps the goals of rules salient in the minds of operators, which allows regulators to improve the content of the rules as they learn over time. As a result, regulators can modify the rules without undermining their legitimacy in the eyes of the operators (which would entail a dysfunction of excessive autonomy) and without letting safety decay because the regulators are reinforcing rules that contain irrelevant content (which would entail a dysfunction of excessive standardization). Taken in sum, our study thus sheds light on the broader context in which mindful organizing occurs, by considering the interactions around rules between institutional and operational realms.

2. Method

2.1. Study Context

Our study concerns interactions between front-line operators and external institutional actors within the explosive demolitions industry. Safety is a serious concern for the explosive demolitions industry given the nontrivial risk of fatality (Chen et al., 2012) and how human errors account for a majority of safety failures (Yin et al., 2017). As such, we purposively sampled from within this industry. Purposive sampling entails the methodological process of selecting a study context where the dynamics of interest are likely to manifest transparently (Patton, 2002).

In particular, operators in our study work for a large Chinese firm, which we refer to by the pseudonym Monkey King Blasting Company (MKBC). Founded in 2007, MKBC operates blasting projects for civil uses in mining and quarrying, as well as other civil engineering uses like dam and road construction. MKBC has earned a "first class" operation certificate from the government for its excellent operational record, which qualifies it as a high-reliability organization within its industry. The explosive demolitions industry is externally regulated by the police, who manage the operation certificates of organizations as well as the licenses of individual operators and maintain an on-site presence where blasting activities are occurring.

During data collection for this study, we recognized that even front-line operators in high-reliability organizations can engage in mindless and unsafe activities for several reasons (e.g., Choudhry and Fang, 2008). But we were surprised to find that these external regulators played an important role in proactively maintaining and reactively restoring mindful organizing, thereby limiting the unsafe activities of operators. Because such interactions between regulators and operators were frequent and revelatory in this context, we chose to explore them in greater depth as our theoretical contribution for the present study. The focal institutional actors in our

study are former operators employed by MKBC who, due to their extensive experience in the industry, have been deputized by the police as on-site regulators for the blasting activities of other firms. Their dual perspective as former operators and current regulators gives them vivid and unique insight into the nature of regulator-operator interactions.

Insert Table 1 about here

2.2. Data Collection

We conducted interviews as our primary data source, which we supplemented with observation, informal conversations, and archival data. The data reported in this study include fifteen interviews, selected from a broader data collection based on their relevance to our current research question (see Table 1). We selected these interviews because they contained data about the interactions between regulators and operators from the perspectives of both the operators in the blasting site and their external regulators. The interviews lasted 30 to 90 minutes. They were audiotaped and both transcribed and translated by the author who conducted them, following best practices for cross-cultural qualitative research (Poland, 1995; Xian, 2008). We staggered the interviews over two time periods to allow insights from our first data collection to guide our subsequent data collection, in line with the principle of theoretical sampling (Charmaz, 2006).

We began with phone interviews with the top managers of 4 of the 6 active blasting projects. Because these managers take the lead role of interacting with the police regulators, we felt that they could therefore provide a valuable initial overview. These initial interviews gave us rich insights into the organization's relationship with regulators, how regulatory actions impact organizational safety, and its various interactions with regulators. To deepen our insight into how

interactions with regulators influence organizing at the operational level, one of us travelled to the blasting sites and, once there, carried out a second round of interviews with managers, operators, and regulators on the front-lines. Based on emerging theoretical insights, and in line with the principle of tracer studies (Hornby and Symon, 1994), our interview questions traced the various functions and transformations of safety rules over time to better understand how they were enacted in context. We selected blasting sites for visits that were described by top managers in phone interviews, which allowed us to triangulate across sources in the organizational hierarchy (Lincoln and Guba, 1985). Because top managers interact with city-level police and front-line operators interact with town-level police, over whom city-level police have jurisdiction, our informants collectively cover the spectrum of interactions across different levels of the hierarchy.

These formal interviews were supplemented with observations, informal conversations, and archival data collected at the blasting sites. Specifically, the author attended group field meetings, jotted notes during observations in the blasting sites, had informal conversations with informants during breaks, collected photos and videos to capture important observations, and shadowed a key informant during his everyday activities (Czarniawska-Joerges, 2007; Emerson et al., 2011; Spradley, 1980). Archival data served a complementary function that helped us better understand and contextualize our interviews and observational data. For instance, in explaining how they manage safety concerns, the Guard Man and Site Regulator 2 both showed us physical records they used to document everyday explosive use and operational problems, respectively. We treated copies of these physical records as archival data that enriched our understanding of how safety was managed on the operational level. We also collected archival data such as organizational brochures and training materials from the CEO's office, as it is the

department in charge of collecting and managing firm-level data. Because much of these archival data are confidential, they were used in analysis but are not reproduced here.

2.3. Data Analysis

We imported transcribed interviews, field notes, and photos into ATLAS.ti to conduct our data analysis (Friese, 2014). Following an inductive approach to coding, we treated our informants as knowledgeable agents and therefore sought to foreground their interpretations (Gioia et al., 2013; Van Maanen, 1979). Guided by our growing interest in the interactions between operators and regulators, in our first round of coding we sought to describe what regulators do, why the regulators do what they do, how operators react to regulator activities, and how regulator activities affect operations, using in-vivo codes that captured informant language (Charmaz, 2006). For example, we coded "*If the company has even one safety accident, the police will punish us immediately, by degrading the company. Now our company is first class, the highest national class. We would be degraded [to a lower class] if an accident happens. Based on the severity of the accidents, we might even get our blasting certificate cancelled or withdrawn. This would mean that we could never do blasting projects anymore*" (Project Director 1) as "police punish accidents by degrading or withdrawing organizational certificates."

After the first round of descriptive coding, we moved to a second round of coding, in which we identified open codes within the initial codes. The open coding process remained at the level of informant language, but started to identify concepts that could serve as building blocks for a grounded theory (Charmaz, 2006). Examples of open codes include "teaching operation knowledge and procedures," "monitoring operators to conduct tasks by regulations, rules, and procedures," and "stopping wrongdoings." After open coding, when we noticed higher-order themes starting to emerge, we began axial coding by grouping similar open codes into categories

(Charmaz, 2006). For example, the open codes of "teaching operation knowledge and procedures" and "lecturing safety regulations and rules" were grouped into the category of "training rule content," as they showed what content the regulators trained the operators in.

During the axial coding process, we observed that the interactions between regulators and operators influenced one of two aspects of rules—namely, the content of rules (what activities the rules promote or prohibit) and the salience of rules (the extent to which rules are cognitively activated during operations)—and that these interactions proceeded differently across different stages over time. This insight led us to iterate back to the literature (Orton, 1997), seeking insight into the stages across which interactions occur between institutional and operational realms. We found that Barley and Tolbert's (1997) four-stage model helped to explain the interactions between institutional and operational realms present in our data—and, in doing so, highlighted the unique ways in which these interactions relate to mindful organizing. The third, and final, round of selective coding allowed us to arrange our findings into a single theoretical model (Charmaz, 2006), where the interactions between regulators and front-line operators occurred across the four stages identified by Barley and Tolbert. The data structure resulting from our iterative coding process (Gioia et al., 2013) appears in Figure 1, where the stages and regulator-operator interactions are displayed. These themes are subsequently arranged into our full process model in Figure 2 and organized by rule content and rule salience in Table 3.

Insert Figure 1 about here

2.4. Development of Theoretical Model

To develop our theory, we drew on and extended Barley and Tolbert's (1997) model. Their model was designed to better clarify how features of institutions, such as rules, can both constrain and enable practical human activities, such as operator safety, making it an ideal basis to arrange and organize our findings. Whereas their intent was general, to explain how features of institutions are reproduced or transformed through human activities, our intent here is more specific. Our intent is to understand how the various stages of this process implicate safety—and the specific interactions between actors associated primarily with the institutional realm (the regulators in charge of rules) and actors associated primarily with the operational realm (the blasters whose activities the rules are meant to guide). We use the imagery of rules "circulating" between the institutional and operational realms to capture how these rules are dynamic, active, and negotiated through social interactions rather than existing passively as cognitive knowledge to be passed from one person's mind to another (cf. Gherardi and Nicolini, 2000), although the term "rule management" certainly could apply equally well to our data (Hale and Borys, 2013b).

In line with Barley and Tolbert (1997), we trace four stages of rules circulating between regulators and operators: encoding, enacting, following/violating, and learning (see Figure 2). *Encoding* refers to the first stage in which institutional safety rules are introduced to and internalized within operators, largely by training and certification processes. *Enacting* is the next stage in which operators apply these general rules to their specific current activities. *Following/ violating* refers to the subsequent stage at which the operators, as a result of their actions, either faithfully follow the rule or violate it. Finally, the operator action of rule following or violating

can facilitate *learning* within the institutional agents, which, in turn, impacts their subsequent interactions with operators.

In this model of institutional rule circulation, institutional actors perform the encoding and learning stages, whereas operational actors perform the enacting and following/violating stages. We move beyond this model to identify two additional interaction processes, by which institutional actors, the external police regulators in this case, influence how operators use rules—processes that directly map on to the enacting and following/violating stages performed by operational actors. First, whereas institutions are typically seen as only influencing the content of rules through encoding, the on-site external regulators also influence the salience of rules during the enacting stage, through various *reinforcing* interactions that proactively keep operators attentive toward current activities. Second, institutional actors also engage in more reactive *reinstating* interactions that help ensure the integrity of rule content and the constancy of rule salience during the rule following/violating stage. These processes reveal that institutional actors do not merely influence the content of rules, but their salience as well—suggesting that these interactions have greater effects on operator cognition, particularly attention, than has been noted to date.

Insert Figure 2 and Table 3 about here

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3. Presentation of Grounded Research Findings

We now turn to a deeper examination of the four regulator-operator interactions as they

occur over the aforementioned stages of rule circulation. For each of these interactions, we provide quotes from our informants in the main text that eloquently describe the interaction and supplementary quotes in Table 2 that offer additional evidence that these interactions are indeed grounded in our interviews with informants (see Pratt, 2007). In the following section, we detail how these regulator-operator interactions enhance mindful organizing and safety.

Insert Table 2 about here

3.1. Encoding of Safety Rules

Beginning at the first stage, the first regulator-operator interaction relates to encoding. Encoding entails to the set of interactions through which operators first become exposed to and begin to internalize the content of institutionalized safety rules. Examples of rule content within the explosive demolitions industry include that operators must carry certificates of exam completion with them, follow procedures to properly connect wires, wear electrostatic clothing and not carry cigarettes or cellphones, evacuate from the blasting area behind a prespecified safety diameter before blasting occurs, and that the organization must report the explosives used in each blast by a deadline after use. These safety rules specify both the processes by which operator activities must proceed, if safety is to be maintained, as well as the specific and concrete steps by which these processes are accomplished on the front lines (Hale and Borys, 2013a).

3.1.1. Practices Associated with Encoding

Two specific practices were used to enhance the encoding of rules through regulator-operator interactions: training and assessing. These two practices serve as the initial foundation for operators to competently enact the content of safety rules during their everyday activities.

Training. Regulators formulate the content of the safety rules that operators must know before operating—and training serves as the primary means by which regulators educate the operators on these safety rules. Rather than relegating training to the self-study of individual blasters, the internal education processes of the various distinct explosive demolition firms, or a third-party contractor, the regulators themselves host a large training to help potential operators encode the rules. As the CTO of MKBC explained, "*the police in our city organize a large blasting operation training every year … It is mandatory. The [operators] must pass this training, which takes 72 hours in total.*"

For all front-line operators, including even the security and guards, the content discussed during training is the requisite first step to entering the blasting industry. Some of this content thus concerns the basic activities of blasting, including "*how to claim and distribute explosives, how to load powder, and how to connect wires*" (Junior Blaster 1). Other content is more advanced and focused on safety as a topic in itself, in which case, experts are brought in to discuss cases where failures occurred. As Project Director 1 explained, "*The police invite experts to give us lectures using cases. The experts teach us cases, tell us about accidents, and show us operation procedures.*"

Assessing. After training the content of the rules, regulators possess the power to issue or withhold a license to any would-be operator (or a renewal to an existing operator) based on their assessment of that person's performance during training. If denied a license, operators are effectively excluded from the industry: "*To work in the blasting sector, we need to obtain a license from police*" (Junior Blaster 1). As a result, assessment of operators' knowledge of the rules is an important step in the process, one that is tightly monitored and controlled. As Site Regulator 2 explained, "*Because the blasting industry is related to civil explosives, the exam is*

very strict. The questions on each computer are different. It's impossible to cheat." The strictness of assessment, with randomized presentation of questions on computers, attests to the dangers of granting licenses to operators with limited or faulty knowledge of safety rules.

3.2. Reinforcing of Rule Enactment

Whereas the first stage of rule circulation, encoding, occurred within the institutional realm (i.e., police-sponsored training and assessments), the second stage occurs at the operational realm (i.e., where operators enact the rules on the front lines). The second type of regulator-operator interaction, *reinforcing*, occurs here on the front lines, as regulators stationed at active blasting sites proactively ensure that rules are properly enacted through their interactions with operators. On the most basic level, Project Director 1 noted that the on-site regulators ensure that the operators have received training and demonstrated basic competence by "*requiring that all operators have licenses*," as the regulators manually check that "*all people [present at the blasting site] are properly licensed operators.*" But having a license signifying knowledge of the content of rules does not ensure that the rules will be enacted, which is why a need exists for regulators to engage in reinforcing interactions with operators.

3.2.1. Practices Associated with Reinforcing

To ensure that rules are actually being enacted, regulators use two specific practices during their reinforcing interactions with operators: ensuring compliance (increasing the extent to which operators behave in compliance with the rules) and vigilance maintaining (increasing the attentiveness of operators during their everyday activities).

Ensuring compliance. On the front lines, although operators may know the content of the safety rules, they are not uniformly motivated to follow these rules. Despite acknowledging that these safety rules will, in most cases, improve safety, operators note that safety rules also

entail tradeoffs with other operational goals, such as productivity. These tradeoffs can limit the degree to which operators actually enact the rule content during their everyday activities. One of the regulators we spoke to was formerly a front-line operator. He described how operators felt about safety rules: "*To be honest, if we do everything according to the rules, our operations would become very slow. [Following rules] delays progress. Sometimes if we follow rules, our work will be impacted. For example, the rule says that all operators must evacuate outside 200 meters. But it's impossible when operating inside a tunnel. We can only ask the teams following [the blasting team] to go back about 50 meters. [If they evacuated 200 meters like the rule mandates], the progress of the other teams would be delayed*" (Site Regulator 1).

Further, safety rules pertain to different types of operational activities, and thus require some degree of coordination across the various front-line operators. For instance, in a mining blasting project, the safety rules for evacuation are meant to protect the blasting team from injuries. But there are also miners, constructors, and transporters on site, each of whom may be from different organizations. As Site Regulator 2 explained, even if the blasting team follows the relevant safety rule, they have no formal mechanism to ensure that the other teams do so as well: "*Sometimes when asking operators on other teams to evacuate [before the blasting team detonates an explosive], they just want to finish up their tasks, and don't evacuate. This causes the evacuation to be delayed.*"

The presence of on-site regulators helps overcome both of these common reasons why rules are not actually enacted in practice: the tradeoffs between safety and productivity and the inability of any one team to ensure that other teams follow the content of safety rules. We refer to this practice as ensuring compliance, as here the regulators interact with all the operators to ensure behavior is compliant with the rules. Primarily, ensuring compliance takes the form of

regulators inspecting the ongoing operator activities. As one of the regulators explained, "*Police come here [to the blasting site] to count: counting the quantity of explosive powder and the number of operators. They also check the operation site, whether there are hidden dangers, whether the safety warning zone is [clearly and properly set]*" (Site Regulator 1). The Guard Man similarly described the process of checking: "*Police usually check if we work by the rules when operating. For example, the police check whether the blasters wear electrostatic clothing, bring smokes and lighters to the blasting site, bring phones or not, how we set up the safety warning zone, whether we turn on the warning alarm or not before a blast. Also, the police check if each operator is in charge of their own tasks.*" In this way, regulators interact with operators in ways that help proactively ensure that the content of safety rules is enacted, despite any productivity tradeoffs or coordination challenges that accompany multiple teams from different organizations.

As the following conversation reveals, regulators engage in these ensuring compliance interactions with operators specifically with safety in mind:

> Interviewer: "*What do you pay attention to during your daily work?*"
>
> Site Regulator 2: "*Safety! Safety is the most important thing!*"
>
> Interviewer: "*Could you specify what you mean by 'safety'?*"
>
> Site Regulator 2: "*For example, [how operators set up] the safety warning zone when they load powder, [how they] use detonators and explosive powder, and when the blasters are about to blast, all people at the blasting site must be evacuated 200 meters away from blasting zone, where there might be dangers, all people must evacuate, to a safer place, etc.*"

And such interventions lead to concrete improvements in rule enactment:

Site Regulator 2: "*Now our regulating has become stricter. Our communication [with the operators] works: the [operators] will execute once we tell them to do anything.*"

Interviewer: "*How about the issue of lost explosives?*"

Site Regulator 2: "*Basically there are no lost explosives now. Before they start to work, I told them to claim explosives based on how many they plan to use. The leftover explosives need to be returned to the warehouse. After power loading, all leftover explosives should be returned to the warehouse. So now our regulating is stricter. Normally there is no accident.*"

Vigilance maintaining. In addition to the more direct practice whereby regulators check and inspect operators, the mere presence of on-site regulators has a further indirect effect on the vigilance of operators. Namely, the very presence of regulators at the operational realm enhances operator alertness towards safety in general. The regulators and operators alike that we spoke to consistently suggested—in comparing the frequent supervision of local police in their blasting site relative to other, laxer, blasting sites—that the more often regulators visited the site, the greater the effect it had on maintaining vigilance, ultimately helping to "*prevent accidents*" (Site Regulator 2). The effect was summarized in one particularly revealing conversation:

Interviewer: "*How often do police check the blasting sites?*"

Project Director 1: "*Very frequently! For example, here, the police come to monitor our operations every day.*"

Interviewer: "*Really, local police?*"

Project Director 1: "*Yes. For example, if we plan to blast today, we report to the police that we're going to blast at a certain time, either via WeChat [a messaging program] or just calling them. Then our office needs to send a person to pick the police up and come*

to our site. Then the police watch over the whole process of blasting."

Interviewer: "*So the police are at the site every day.*"

Project Director 1: "*So you see, the supervision of the police here is very strict and adequate, in terms of detecting hidden dangers. They did good supervision, helping us to eliminate many hidden dangers. For us, we hope that police are strict in regulating. Why? Because it's beneficial for our own safety.*"

Interestingly, some informants even suggested that the presence of on-site external regulators offered greater benefit for safety than internal safety processes. As Project Director 1 explained, "*In terms of inspecting the operations, police supervision has better effects than our own*" (Project Director 1). Site Regulator 1, similarly, noted how "*external regulation is the most effective. External supervision is stronger. If there is any accident, the external regulation must have been lax [at that site]*." But it is further likely that the external and internal processes work together, rather than functioning as substitutes. Speaking with the Guard Man, who is the primary person tasked with coordinating with the on-site regulators, he explained the many internal processes he engages in to ensure that rules are followed: "*I'm in charge of coordinating with police at the blasting sites … After I claim the explosives for operators from the warehouse, I transfer the explosives to operators at sites and make records. Then I need to supervise whether every party signed on the records. I need to make sure that every operation is by the rule. [For example,] I need to make sure that the blasters use boxes to store explosives. [I need to check] the distance between detonators and powder. These operations must follow the specific procedures and rules.*" He then went on to explain that the presence of external regulators strengthens his internal safety processes, allowing operators to remain more vigilant.

Interviewer: "*Does the internal [process] become stricter if the external regulation*

becomes stricter?"

Guard Man: "*Yes. The external supervision is strict. Our internal [processes] must definitely keep up with their steps. Otherwise, we will be eliminated by the industry. Because we can't afford any accident. As our project director said, your performance may be good, like you earn 4 or 5 million for the company today, but your whole work will be in vain once you have a single accident. So, we can't afford any accidents.*"

3.3. Reinstating after Rule Violations

The prior stage of rule circulation, reinforcing, describes an ongoing set of regulator-operator interactions, whereby the frequent on-site presence of regulators helps proactively facilitate rule-compliant behavior in operators and maintain their vigilance. During their ongoing interactions, however, regulators might notice violations of rules from operators. Site Regulators notice such rule violations as they "*enter into and get out of the sites together with operators*" (Site Regulator 2). By maintaining a frequent on-site presence, the likelihood of noticing such rule violations substantially increases. As one informant explained, this presence allows them to detect a host of rule violations:

Site Regulator 2: "*Sometimes they [operators in the basting team] violate the rules.*"

Interviewer: "*Could you give some examples of the rule-violating behaviors that you noticed?*"

Site Regulator 2: "*Sometimes when the operators were loading powder, there were still workers at the site who hadn't evacuated. They should cut off the electricity. If not, the detonators might cause premature detonation when loading powder, which might cause accidents. And when distributing explosives, they should've clearly counted the number of explosives, because if they missed counting one detonator while distributing, the*

detonator might be lost somewhere outside."

Upon noticing such rule violations, the external regulators engage in a separate set of reactive social interactions with operators, which we call *reinstating* interactions. These reinstating interactions differ from reinforcing interactions in that they only occur when regulators notice that operators violate rules. These interactions serve the overall function of addressing the violation both immediately with the offending operator, and more broadly on the front lines.

3.3.1. Practices Associated with Reinstating

In response to rule violations, regulators use three practices during their reinstating interactions with operators: correcting the immediate violation behavior, reasserting the content of the rules, and escalating so that operators more broadly keep the rules salient in their minds.

Correcting. After noticing violations during the front-line operations, regulators quickly react to these problems, intervening to promote problem solving, which we refer to as correcting. For example, Site Regulator 2, who supervises a blasting team, explained how he undertakes correcting actions after noticing operators engage in rule violations:

> "*Sometimes, some operators do a very messy job. The tubes and powders are too messy. If I was operating, I would clean my area after finishing loading powder into one hole, then I would start the next hole. I would put the tubes which I don't use aside. However, some operators work on 20 to 30 holes altogether. And [I saw that] the wires were all mixed on the ground … When I notice that some blasters step over the tubes, I warn them not to step on the tubes, and ask them to check if the tubes were broken. If there are any small holes on the tubes, I ask them to change to new tubes … When we were supervising on the ground, we stop problems once noticing. We have two regulators in this blasting*

site. We both follow these blasters [around]. When we saw that their tubes were messy, we helped them to clear up…"

"*When I first came to supervise this team, I noticed that most blasters tied detonators and igniters from the forward direction. I told them, 'You should tie from the reverse direction.' But they told me, 'It's okay, as long as the detonator can explode [it doesn't matter how you tie the detonators and igniters]'. Then I explained to them, 'I saw incidents happen twice in your operation … I noticed that there were two holes that didn't explode [because you incorrectly tied detonators and igniters].*"

These immediate correcting actions by regulators are helpful for solving problems emerging on site. For instance, speaking about the effectiveness of his correcting actions, Site Regulator 2 explained: "*Now [these violations] have been corrected. They all tie from the reverse direction.*" However, the immediate correcting of a single operator's behavior may not be the only, or most effective, way of ensuring that safety rules are properly followed.

Reasserting. Indeed, some problems might emerge repeatedly across operators on a site. During field observations across blasting sites, and several of our interviews, we found that some problems occur repeatedly over time within a site or across operation sites. For instance, many of our informants also discussed the problem of operators tying wires in the opposite direction (CTO, Site Manager 1, Senior Blaster, Safety Man, Site Manager 2). Another common problem mentioned by several informants was flyrock, where explosions send rocks airborne in ways that can lead to serious injury, particularly if all operators have not evacuated to the proper distance (CTO, Project Director 1, Site Manager 1, Site Regulator 1, Safety Man). In such cases, regulators may adopt more forceful practices when faced with frequent violations of rules, so that these common problems cease. We refer to such practices as reasserting, as these practices

help reassert the content of rules that are often violated. One common reasserting action taken by regulators is to force the entire project to pause, require the operation team to solve the problems during the pausing period, and supervise them consistently until the problems are solved. One informant, Site Regulator 2, told us how regulators take action to reassert the violated rules:

> "*Police notice a problem. They just [ask the company to] stop the project for several days and correct their violations. After correcting, police come to supervise you [the blasting team]. They examine and supervise you to blast. And they check all of your operation records. [After this] they allow you to start the operations again. So, there must be actions to make changes and reforms. Afterward, the operation team conducts blasts for another several times. And police keep coming to supervise these operations [after the correcting] until [they are confident that] you are qualified.*"

Although these reasserting practices are more forceful than the more minor correcting practices, even reasserting may not be sufficient to ensure proper enactment of safety rules.

Escalating. Indeed, one reason why *"external regulation is the most effective"* (Site Regulator 1) is that external regulators possess the power to escalate the repercussions of rule violations in ways that enhance the salience of the rule throughout the entire organization. We refer to these practices as escalating. One escalating practice by which regulators enhance rule salience is to expand the realm of awareness of violations beyond the immediate operators. As our informant, Guard Man, shared with us, "*Police noticed one small problem by one operator. They tended to assume that the entire operation team has such problem. So, [the problem] is exaggerated.*" Escalation, in such cases, is made possible through tactics such as asking the blasting company to "*hold meetings for all operators in the team, let them know about the mistake (one blaster carrying smokes into the blasting site)*" (Guard Man) and "*turn the mistake*

into a case study and tell it to the whole team" (Site Regulator 2). By escalating a single violation into a set of meetings or a case study, regulators can dramatically increase the salience of that rule throughout the broader organization.

The more effective tactic to make rules salient on the ground, however, appears to be punishment. As the legitimate external regulator, police have the power to punish violations from operators. Punishments enhance the salience of rules because the severity of the punishments are coupled with the severity of the violation. On the less severe side, the CTO explained, "*police lock the explosives management system if we forget to upload records.*" Even this punishment of locking the explosives management system, however, has organization-wide consequences: "*It's one system for the whole company. You see, there are so many projects in the company. So, if the company's explosives system gets locked, all projects come to a halt, not just one single project*" (Site Regulator 1). This punishment is effective in terms of managing explosives and preventing the loss of explosives, as the operation team now "*doesn't dare forget to report records. As long as we finish the explosives claiming, after the blast per day, we return the left-over explosives to the warehouse, and report how much we used today right away*" (Site Regulator 2).

For more severe accidents, regulators may "*downgrade or withdraw the company's operation certificate*" altogether (Informants: Site Regulator 1, CTO, Project Director 1). As one informant, Project Director 1, told us, "*Police supervision is very strict. If you have any accidents, the police punish you immediately by downgrading your class. For example, now our company is first class, the highest. We could be downgraded [to a lower class], depending on the severity of the accident. Or our operator certificate would be withdrawn, so that we cannot conduct blasting projects in the industry anymore.*" Such punishments escalate the impact of single violations throughout the organization in order to ensure the salience of rules.

3.4. Learning from Rule Following / Violating

The fourth stage of rule circulation, learning, turns from the operational realm back to the institutional realm. Whereas the reinstating behaviors concerned how regulators could respond to rule violations in ways that impact the operators, the way regulators respond to rule following or rule violations also impacts the regulators as well. To the extent that regulators change their behavior over time based on interactions with operators, this indicates learning, and will have consequences for how the regulators subsequently encode, reinforce, and reinstate rules.

3.4.1. Practices Associated with Learning

Learning occurs in the way that regulators refine the content of their rules and heighten their ability to enhance the salience of rules over time.

Refining. Given that regulator interactions largely function to ensure that operators are following safety rules, both proactively and reactively, it is essential that these rules actually help operators maintain safety. To the extent that operators frequently describe rules as "not always realistic," "too complicated," "sometimes contradictory," or "unworkable in practice" (Hale and Borys, 2013a, p. 208), it becomes clear that regulators do not always formulate useful rules on their own. One important way that regulators formulate more useful rules relevant to front-line operations is through their interactions on the operational realm. These interactions allow them to refine the content of their rules. As one of our informants explained, "*Police may not have much experience in blasting. But they do learn. Otherwise, they would fall behind. Now, police read books on blasting and ask us questions while referring to the books. If we can't answer their questions, they know it immediately. Police are learning every day, particularly about how to regulate. They learn Regulations to Manage Warehouse and Operation Regulations at Sites [two books about regulations in the explosive demolitions industry]. Police learn every day, to inspect*

problems" (Site Regulator 2). Such interactions allow the regulators to reconcile the theoretical knowledge contained in their books with the practical knowledge possessed by the operators, and thereby learn how to better regulate the operators. For instance, they become able to design and enact more comprehensive rules. As the Guard Man explained, "*Before, there were not so many regulations and rules. The control and regulation of explosives was not as strict as it is now. The regulations and rules became more comprehensive as [regulators] went through the accidents.*" This aspect of learning shows how the rule content can improve by becoming more refined and precise through experience conversing with operators and understanding cases of accidents.

Heightening. Similarly, regulators can learn to heighten the salience of rules. As the Guard Man explained, "*They gained experiences from accidents, the lessons of blood. Then the regulations became stricter*" (Guard Man) and "*the regulating here is much stricter than the other places*" (Project Director 1). As various informants explained in relation to reinforcing interactions, the strictness of regulators directly heightens the salience of rules in the cognition of operators. Thus, practices that enhance rule salience are not completely uniform across all the regulators, but these practices instead accumulate based on learning from their own idiosyncratic experience. For instance, one of the informants explained how unique learned practices made the regulations stricter on one site than others: "*Let me tell you something. I've worked in different places. The police here are the only ones I know who ask blasting teams to report storage of explosives at the end of each year. The police in other places are not so strict. For example, during [important dates like] Chinese New Year and national meetings, police at other places would just go to the blasting sites and paste a strip seal on the warehouse. But our police here stop all the blasting projects. They don't seal the warehouse. But they take all explosives away and put them in the main warehouse … So, we [the blasting teams] have nothing to blast! How*

strict it is!" (Site Regulator 1). In this way, regulators can also learn how to effectively increase the salience of rules over time, leading to more effective regulating.

4. Implications of Rules for Mindful Organizing and Safety

The grounded findings presented in the previous section illustrate how safety rules serve different functions as they circulate back-and-forth from the institutional to the operational realm and afford four distinct stages of regulator-operator interactions. Operator activities are therefore guided by rules, but not entirely governed by them. To even enter the operational realm, both literally through certification checking and more abstractly in terms of their competence, initially operators must learn and follow the rules. But to function effectively as operators, they cannot mindlessly follow the rules because the rules are sometimes irrelevant or unhelpful, leading to necessary violations. But not all violations are of this type. Because of the physical intensity of this work, some violations reflect failures in self-regulation and dangerous shortcuts. This reveals a system in which regulators neither possess the wisdom to craft perfect rules nor do operators possess the expertise and single-minded dedication to safety to not need rules. In the current section, we explore how in such a system, interactions between regulators and operators around these rules can nonetheless enhance mindful organizing and thus safety. Where appropriate, we identify which of the five interaction patterns that collectively constitute mindful organizing (i.e., preoccupation with failure, reluctance to simplify, sensitivity to operations, commitment to resilience, and deference to expertise) are implicated in this rule circulation (Weick et al., 1999).

4.1. How Encoding Influences Mindful Organizing and Safety

In encoding, the first stage of rule circulation, we see that regulators take an active role of formulating and passing on the content of rules to operators, who take a more passive role of internalizing the rules through training practices and demonstrating competence through

assessment practices. Both of these practices, further, occur before operators are licensed to enter active blasting sites and perform any activities on the front lines. Although at this stage of rule circulation, the rules seem to be used in a rigid, bureaucratic manner (Dekker, 2005), such a use of rules is not necessarily at odds with mindful organizing. To be sure, mindful organizing research emphasizes that organizations should defer to operator expertise, rather than over-specifying their activities (Weick et al., 1999). But its focus on local front-line interactions leaves open the question of where operators gain the requisite expertise in the first place. As recent models suggest, when operators lack expertise, they can best facilitate mindful organizing by internalizing institutional concepts, like rule content (Kudesia, 2019). Junior blasters may lack sufficient personal experience, but they know at minimum the rules to follow from the training. For instance, Junior Blaster 1 recalled how he internalized the rule not to throw detonators to avoid creating sparks. He would "*definitely walk up to the higher channel and pass the detonator to my colleagues [operating in the higher channel]*" because throwing detonators "*is dangerous even in imagination.*" Rules thus serve as an essential artifact that provides operators with an initial conceptual understanding of their activities (Grote et al., 2009). This initial process of internalizing rule content need not be constraining provided that operators continue to refine their understanding of this content as they enact rules during their everyday activities (Dreyfus and Dreyfus, 2005).

One benefit of encoding rule content for mindful organizing is that operators develop a "mental model" of the correct operations, which helps them better identify who possesses the relevant expertise to get tasks done (Weick, 1989; Weick and Roberts, 1993). Encoding rule content thus serves as a precondition to keep the front lines sensitive to operations, in that it helps them create and maintain a current and integrated understanding of how tasks and expertise

are distributed across their members (Weick et al., 1999). Rules constitute a baseline model that helps junior operators understand how operations are currently proceeding—and a shared basis from which senior operators can enrich the understanding of junior operators. As Junior Blaster 1 shared, "*The senior blasters have been working in many different projects before. They saw more and experienced more. And they heard more. So, we [juniors] can ask them.*" In one case, a senior blaster explained how to go beyond the basic rules about powder loading by "*making an interlayer between two layers of powder,*" which can prevent overloading.

Thus, encoding rule content through training and assessment practices need not prohibit necessary flexibility when operators enact the rules on the front lines. These practices can instead form the very basis of shared competence and expertise that make doing so possible. This makes the strictness and highly controlled nature of encoding a likely strength for safety, rather than a danger. In fact, when asked about instances where front-line operators and management lacked agreement about the importance of a lurking failure for safety, Site Regulator 2 emphasized the value of these trainings. He noted how in the three to four years since the police trainings have become stricter, "*operations have become more standardized than before,*" because operators across the organization now have a shared understanding of what constitutes a lurking failure, and how to respond to it.

4.2. How Reinforcing Influences Mindful Organizing and Safety

Regulator actions, such as those that reinforce rule enactment, are often conceptualized on an abstract level. But, at the front lines, regulators and operators interacted frequently and in very concrete ways that served a reinforcing function for rules. At this second stage of the rule circulation process, it becomes clear that regulators and operators can have different, and even conflicting, priorities (e.g., Bruns, 2009). Whereas regulators are concerned solely with safety,

operators must manage the tradeoff between safety and productivity. Operators can further be pressured by clients to sacrifice safety for productivity. A technician described one such situation which he had encountered just days prior. His operation team wanted to reinforce the blasting site, calling in the next team to perform follow-up tasks (e.g., cleaning residue from the blast, reinforcing the supportive arch around the blasting area) prior to starting the next blast, as stones can come loose during blasting and fall down to cause accidents. The client, however, did not take this potential danger seriously and insisted on proceeding to the next blast without reinforcing the site in order to catch up with the project schedule. As the Technician expected, in the absence of a reinforced arch, stones from the roof of the blasting area fell down, causing a major safety risk.

These concrete differences in priorities on the ground cannot be addressed by the more abstract interactions related to encoding (i.e., training and assessing). Rather, it was the presence of on-site regulators that helped ensure that safety rules were not circumvented in favor of productivity goals, through both direct and indirect means. As the Project Director 1 said, "*In this case [when the client asked the operation team to catch up with project schedule], the police play an essential role [to ensure safety]*." Directly, on-site regulators increase the compliance of operators with the content of rules by strictly checking their activities—and their formal power allows them to ensure compliance across the various teams and organizations in a way that no other actor could, and no amount of abstract training would address. Given that mindful organizing research has seldom explored how multiple operation teams in different organizations work together, these more direct ensuring compliance practices of regulators highlight an important, but understudied, political dimension to mindful organizing and the maintenance of safety on the front lines: sometimes it may require formal power to ensure compliance with

safety rules. Otherwise potential failures may be neglected. Maintaining a preoccupation with failure is thus not only a cognitive accomplishment, but a political one as well (Weick et al., 1999).

Indirectly, the mere presence of on-site regulators served as a visual reminder to keep safety rules salient in the mind of operators. This "priming" effect, whereby concrete cues serve as a reminder of institutionalized rules, also remains a vastly understudied aspect of mindful organizing (see Weber and Glynn, 2006). In the case of the blasters, this priming effect highlights that rules are not just merely content that is encoded in memory and enacted in behavior, as the existing literature largely treats them. Rather, rules also implicate attentional processes of vigilance related to maintaining the salience of rules in the minds of operators. As Site Regulator 1 explained, his presence encourages operators to "*report and solve the problem you discover in your own work*" and keeps individual operators feeling responsible for safety by "*watching themselves.*" Namely, "*the key thing in the company is to ask each worker to watch themselves. Because, if every worker is good in their work, if every worker can watch [take care of] their own problem, there would be no problem.*" In this way, the on-site regulators promote the operation team's preoccupation with failure by encouraging operators to report their problems (Bourrier, 1996; Weick et al., 1999) and their commitment to resilience by encouraging operators to take care of the small problems emerging from their individual work, lest those small problems amplify into large ones (Van Dyck et al., 2005).

Given that the priming effect of social interactions has also not been addressed in the relevant work on vigilance (Grier et al., 2003), the way rule salience is maintained through frequent and strict regulator-operator interactions is an important finding for safety. In sum, by directly reinforcing the content of rules and indirectly reinforcing the salience of rules, regulators

can promote mindful organizing in the front-line operators, and thereby enhance safety.

4.3. How Reinstating Influences Mindful Organizing and Safety

At this third stage of rule circulation, we can see how regulators both act in a manner similar to, and distinct from, that of front-line operators. Through these reactive interactions, the regulators play an "editing" role in mindful organizing that continually reinstates the salience of safety rules in operator activities (Weber and Glynn, 2006). At its least severe, regulators engage in correcting practices that are indistinguishable from how two fellow operators would interact with each other to organize mindfully: engaging in mentoring conversations that help operators better understand and improve their activities (Engemann and Scott, 2018).

But, as violations become increasingly severe, the regulators utilize more of their formal power to reinstate rules, first by pausing ongoing operations to reassert the content of rules, and eventually by escalating the consequences of rule violation beyond the immediate operator to enhance rule salience throughout the organization. However, even these escalation practices are not inconsistent with the principles of mindful organizing. Namely, in mindful organizing, "any failure, regardless of its location, is treated as a window on the reliability of the system as a whole" (Weick et al., 1999, p. 92). Escalating embodies this very principle, as single violations are used to increase the salience of rules across the entire organization through meetings, case studies, and eventually punishments of increasing severity.

These escalating practices from regulators help encourage a preoccupation with failures among operators, such that they treat small failures or near misses as potential indicators of larger threats (LaPorte and Consolini, 1991). The Guard Man described such an example when the police found a blaster who "*took smokes and a lighter with him when he went into the tunnel*." After, the Guard Man convened a meeting with not only the responsible blaster and the

leader of that blast site, but with every person working in the site to ensure that they follow the rules "strictly" once again. As a result, the responsible blaster was named publicly and had to pay a fine and write a letter of self-criticism. The Guard Man explained how the regulators enhance their preoccupation with failures, "*The police noticed a small problem, but they might think the whole project had the same problem, then upgrade the small problem. Actually, it is not wrong that the police make strict requirements and supervision. Because it is the police's job [to ensure safety]. We are working in blasting sector. We need to be responsible for our own safety.*"

Interactions with regulators who have the legitimate power to punish rule violations thus encourage operators not merely to follow the rules, but to use small rule violations as a mechanism for enhancing salience of safety throughout the entire firm. In this case, whereas the regulators required reforms and a written notice attesting to these reforms, the firm proactively went several steps further in responding to the violation with the internal site-wide meeting and punishments. What appears essential to the efficacy of such reinforcing regulator-operator interactions is that their forcefulness scales with the severity of the violations to which they respond. Minor violations of rules merit communication, whereas even a single major violation can merit withdrawal of the organization's certificate to operate in the blasting industry.

4.4. How Learning Influences Mindful Organizing and Safety

At this final stage of rule circulation, we can see that to facilitate mindful organizing, regulators cannot merely impose rules from the institutional realm onto the operational realm in a top-down manner. The rules may be poorly formulated—and encoding and reinforcing poorly formulated rules would erode safety, rather than enhance it. Rather, through social interactions with operators on the front-lines, where rules were followed, violated, or clarified through conversations, regulators learn to improve their rules in a more bottom-up manner. As Site

Regulator 1 explained, "*The most important thing is to communicate [with operators]. The police cannot 'kill all in one palm' [use one rule for all operations].*" Regulators are only capable of learning—that is, modifying rules over time to make them more adaptive—to the extent that they also defer to the expertise of operators (Roberts et al., 1994). The net effect of this learning over time is that the system overall increases its commitment to resilience, in remaining flexible for adapting expertise to changing conditions (Wildavsky, 1991). Unless regulators acknowledge and absorb the expertise elicited by their interactions with operators in the form of learning, the system overall will gradually degrade its resilience in adapting the expertise contained within it.

Although this capacity for regulators learning to improve their rules has been discussed in theoretical terms as a potential contributor to safety (Hale and Borys, 2013b), to our knowledge, it has not yet been observed in an empirical context. This finding, along with the insight that effective reinstating scales the severity of the violation with the severity of the punishment, suggest that part of a mindful organizing system requires not only that the front-line operators bring attention toward current activities and make adjustments to avoid potential lurking failures, but that regulators do the same. For rules to function in a manner that enhances mindful organizing, the regulators who formulate the rules must actively learn from operators.

5. Discussion

How can organizations avoid failures in the face of complexity and interdependence? Past research has found that high-reliability organizations do so through mindful organizing among front-line operators (Weick, 1987; Weick et al., 1999). The present research extends this research by highlighting the importance of the interactions between front-line operators and external regulators. Drawing on recent theories of mindful organizing that seek to unite local

interaction patterns and global system-level features (Kudesia, 2019; Kudesia and Reb, 2018), we show that institutional safety rules of external regulators can actually enhance mindful organizing through four specific types of social interactions—a finding in stark contrast to the common idea that rules are simply bureaucratic tools of control (Dekker, 2005).

Even though the front-line activities of blasters in our study were nowhere near as complex as those in some other high-reliability organizations such as nuclear power plants or aircraft carriers (e.g., Weick et al., 1999), a variety of cognitive and social interaction processes still were implicated in their organizing process. Most tellingly, it was only by tracing the rules across the stages of encoding, enacting, following/violating, and learning, and then further specifying how institutional actors work to reinforce and reinstate the content and salience of rules, and learn along the way, that the full variety of processes was revealed. In this way, our joint examination of local and global aspects of rules approaches a long-held ideal of high-reliability organization research to not take core concepts for granted, but to understand them within their full context (Rochlin, 1999).

As a key takeaway, we identify how each of these four regulator-operator interactions around rules enhance mindful organizing, and thus improve safety.

1. *Encoding*. Rules provide an initial understanding that operators can develop as they gain experience as well as a socially shared understanding that helps them learn from others. Rules also help operators mentally represent the broader operation and thus how their activities interface with the activities of others.

2. *Reinforcing*. Rules carry a weight that allows regulators to directly override goals that compete with safety, such as productivity. This weight also indirectly keeps operators attentive toward their tasks, making them more likely to report and quickly address problems.

3. *Reinstating*. Rules allow regulators to treat small violations as windows into lurking failures in the broader system and encourage operators to do the same within their firm.

4. *Learning*. Rules can be modified to absorb the expertise of operators through their interactions with regulators. Further, these regulator-operator interactions model the type of flexibility that underlies organizational resilience and help enhance it over time.

5.1. Theoretical Implications

Although our inductively generated theoretical model (Figure 2) is relatively simple, it nonetheless distills several crucial insights. First, in contrast to common theories that only model institutions as an abstract set of rules that people internalize in a passive manner, we show that institutional rules are taken up in concrete interactions between regulators and front-line operators, such that the rules are used to prime important operational activities and hold people accountable for failures to enact these activities (Weber and Glynn, 2006). Second, and relatedly, these interactions between regulators and operators can increase the salience of rules on the front-lines, essentially serving a function analogous to the interaction patterns that characterize mindful organizing among operators (Weick and Sutcliffe, 2006). These interactions around rule salience, further, have not been as adequately addressed in the safety literature, which has thus far focused more on rule content. Third, we highlight the possibility that institutions, through local interactions with operators, are capable of learning. Although this idea has been noted in theoretical terms (Hale and Borys, 2013b), we show it empirically, and further identify two particular forms of learning. Not only can specific episodes of rule following or violating provide cause for institutional actors to refine rule content, they can also facilitate learning about how to best ensure heightened rule salience.

More broadly, we speak to the debate on how rules influence safety (Dekker, 2005; Grote

et al., 2009; Hale and Borys, 2013a). High-reliability organizations must balance standardization and autonomy, as standardization minimizes lurking failures in the system, whereas autonomy prevents these failures from manifesting. Rules are typically seen as increasing standardization and diminishing autonomy. But rules need not function in this manner. Instead, drawing on the principle of loose coupling (Orton and Weick, 1990), flexible rules have been discussed as a promising way to retain aspects of both standardization and autonomy (Grote et al., 2009). Prior work on flexible rules has considered how specific content of rules may simultaneously promote both standardization and autonomy (Hale and Swuste, 1998). By exploring the understudied processes by which rules are generated and modified through regulator-operator interactions, we identify a further dimension of rules beyond content, namely their salience. Importantly, rule content and rule salience are enhanced by distinct practices (see Table 3).

It is therefore possible that loose coupling of standardization and autonomy can be further achieved by allowing these distinct practices to complement each other. Even if the content of rules is modified over time to address points of irrelevance, rules can still maintain their salience in influencing the vigilance and goals of operators. As a result, regulators can modify the rules without undermining their legitimacy in the eyes of the operators (a dysfunction of excessive autonomy) and without harming safety because they reinforce rules that contain irrelevant content (a dysfunction of excessive standardization). These findings provide new insight into how standardization and autonomy can be loosely coupled through flexible rules. Whereas prior work identifies features of rule content that enhance loose coupling at a single point in time (e.g., whether they emphasize goals to pursue or specify concrete actions), our work focuses on how loose coupling can be dynamically enhanced over time. Rule salience practices can keep safety goals salient at the same time as rule content is adjusted through a distinct set of learning

practices. To the extent that theorists of rules, safety, and high-reliability organizations consider both rule content and rule salience as rules circulate between the institutional and operational realms, we may better understand how loose coupling functions in practice.

5.2. Practical Implications

Our study has several practical implications. First, our findings highlight the important role of external regulators in enabling and maintaining mindful organizing for safety. Importantly, our study shows that external regulators' role is not limited to rule content, but also extends to activities that heighten rule salience in situations such as when vigilance has declined. Thus, a focus on both rule content and salience can help guide regulators in the blasting industry and beyond to implement effective regulations (see Table 3). Regulators should be aware that they do not merely help operators encode the rules they devise. They also need to engage in processes of reinforcing and reinstating both rule content and salience, especially when violations occur. Further, regulators should make time to integrate lessons learned to further improve rule content and processes to raise rule salience as needed.

On the other hand, the present findings may help organizations and their operators gain a deeper appreciation of the value of external regulators. While their actions can seem strict and bothersome, when done effectively, they appear crucial for mindful organizing. A better understanding of the role of external regulators may also lead to greater cooperation. Given that our findings emphasize the interaction between regulators and operators, such cooperation can further enhance mindful organizing and improve organizational safety. Indeed, without cooperation, it may be difficult for regulators to conduct effective regulating. Importantly, the specific interaction processes which we found inductively in our data can serve as vivid examples for operators to mirror in their daily work. A deeper understanding from both

regulators and operators is important for practitioners in industries where accidents can have severe consequences. Employee safety will be protected, and even human lives can be saved.

5.3. Strengths, Limitations, and Future Research Directions

As with any study, ours has both strengths and limitations. Arguably, the qualitative approach we took is particularly suitable for our interest in inductively addressing how questions and for understanding processes (Pratt, 2007). By shedding light on their interactions, our study provides novel insight into how regulators and operators interact effectively to promote organizational safety. However, although our final theoretical model was derived from empirical data, it is important to keep in mind that the current study is best viewed in the context of theory development, rather than theory testing. As such, scholars and practitioners alike must exercise caution and judgment in transferring the present model to their safety contexts (Firestone, 1993).

In future research, an effort should be made to get more first-hand data from regulators. In our study, we had wide access to operators and other organization members; however, our access was to regulators who were deputized by the police to supervise operations, rather than police officers themselves. While our findings suggest that these regulators play a crucial role in enabling mindful organizing, including a more diverse set of external regulators would go a long way toward testing the robustness of the present model and deepening our understanding of the relation among the organization, its operators, its external regulators, and their safety outcomes.

We should also note that our theorizing concerns how and under what conditions regulators and their safety rules can benefit safety. We do not in any way suggest that regulators necessarily must be beneficial. Rules can be poorly designed, managed by regulators with insufficient expertise, and thereby function to impair safety. It is even possible that some of the regulator practices we identify may hamper, rather than foster, mindful organizing among front-

line operators. We simply did not have data describing any such negative impact. This is likely due to the nature of our high-reliability context, where major accidents seldom occur, providing little empirical possibility for observing whether regulators may play a role in them.

We also focused theoretically on the everyday activities and interactions by which safety is accomplished, rather than the more exceptional circumstances in which accidents occur (see Hollnagel, 2014). Our focus therefore was not on identifying helpful properties of operators, regulators, or rules as independent actors, but on discovering how regulators and operators jointly interacted around rules (Gherardi and Nicolini, 2000; Weber and Glynn, 2006). It is easy to imagine how these interactions are fragile and could become counterproductive in the absence of motivation and goodwill from either regulators or operators. It is also the case that "national, regional, or political cultures" affect how regulators and operators interact around rules (Hale and Borys, 2013a, p. 212). For instance, China has centralized political power in its government, but allows police to regulate operators at more local levels (Blanchard and Shleifer, 2001; Ma and Zhao, 2018). The level of authority that local police possess (e.g., stopping work on an entire blasting site, withdrawing blasting certificates, removing unused explosives) and the flexibility granted to them (e.g., modifying rules with learning over time) seem to be important conditions for such interactions. Future work could shed further light on these observations by comparing regulatory practices across countries (e.g., Bourrier, 2005; Jiao, 2001).

What we suggest is thus that the dynamics whereby rules circulate between regulators and operators have the *potential* to enhance the expertise and attention of operators, as well as the quality of learning that informs the rules formulated by regulators. Given these dynamics, it becomes possible to reconceptualize mindful organizing not as something that happens on the front-lines and which is entirely internal to the organization but instead as emerging from the

alignment between front-line operators and their broader institutional context. Indeed, by integrating the perspectives of both regulators and operators, our findings suggest that mindful organizing is not necessarily contained within a single team, but emerges from interactions between teams (i.e., operators and regulators). This raises the possibility of further research on mindful organizing among multiple parties. This research could examine multiple levels. For example, does the individual-level mindfulness of regulators and operators play a role in attaining collective-level mindful organizing, such as by more effectively carrying out encoding, reinforcing, reinstating, and learning practices? Ideally, such research would study the interactions between regulators and operators over a longer time period to arrive at a fuller picture of their dynamic interplay. Future research could also examine the role of emotions in this process, complementing the more cognition-based view of our current study, as both features certainly play a role (Weick, 1989).

In sum, the present study affirms that mindful organizing is, indeed, an important source of safety in high-reliability organizations. Our findings uniquely illustrate how external parties, such as regulators, can be integral parts of a mindful organizing system. Mindful organizing becomes possible only to the extent that institutions, through regulators, effectively formulate and encode safety rules within operators—and these operators enact these rules, scaffolded by reinforcing and reinstating interactions with regulators, who are themselves willing to learn. Mindful organizing thus cannot be reduced to a set of local interactions. It requires interactions between local and global levels, both within and across teams, to enhance safety.

References

Barbour, J.B., Gill, R., 2017. Questioning as regulatory work practice: The communicative accomplishment of reliability and safety in the oversight of nuclear power plants. Commun. Monogr. 84, 466–487. https://doi.org/10.1080/03637751.2017.1322212

Barley, S.R., Tolbert, P.S., 1997. Institutionalization and structuration: Studying the links between action and institution. Organ. Stud. 18, 93–117. https://doi.org/10.1177/017084069701800106

Blanchard, O., Shleifer, A., 2001. Federalism with and without political centralization: China versus Russia. IMF Staff Pap. 48, 171–179.

Bourrier, M., 2005. The contribution of organizational design to safety. Eur. Manag. J. 23, 98–104. https://doi.org/10.1016/j.emj.2004.12.014

Bourrier, M., 1996. Organizing maintenance work at two American nuclear power plants. J. Contingencies Crisis Manag. 4, 104–112. https://doi.org/10.1111/j.1468-5973.1996.tb00082.x

Bruns, H.C., 2009. Leveraging functionality in safety routines: Examining the divergence of rules and performance. Hum. Relat. 62, 1399–1426. https://doi.org/10.1177/0018726709339130

Charmaz, K., 2006. Constructing grounded theory: A practical guide through qualitative analysis. SAGE Publications, Thousand Oaks, CA.

Chen, H., Qi, H., Long, R., Zhang, M., 2012. Research on 10-year tendency of China coal mine accidents and the characteristics of human factors. Saf. Sci. 50, 745–750. https://doi.org/10.1016/j.ssci.2011.08.040

Choudhry, R.M., Fang, D., 2008. Why operatives engage in unsafe work behavior: Investigating factors on construction sites. Saf. Sci. 46, 566–584. https://doi.org/10.1016/j.ssci.2007.06.027

Czarniawska-Joerges, B., 2007. Shadowing: and other techniques for doing fieldwork in modern societies. Copenhagen Business School Press, Malmö, SE.

Dekker, S., 2005. Ten questions about human error: A new view of human factors and system safety, Human factors in transportation. Lawrence Erlbaum Associates, Mahwah, NJ.

Dreyfus, H.L., Dreyfus, S.E., 2005. Expertise in real world contexts. Organ. Stud. 26, 779–792. https://doi.org/10.1177/0170840605053102

Emerson, R.M., Fretz, R.I., Shaw, L.L., 2011. Writing ethnographic fieldnotes. University of Chicago Press, Chicago, IL.

Engemann, K.N., Scott, C.W., 2018. Voice in safety-oriented organizations: Examining the intersection of hierarchical and mindful social contexts. Hum. Resour. Manag. Rev. https://doi.org/10.1016/j.hrmr.2018.05.002

Firestone, W.A., 1993. Alternative arguments for generalizing from data as applied to qualitative research. Educ. Res. 22, 16–23. https://doi.org/10.3102/0013189X022004016

Friese, S., 2014. Qualitative data analysis with ATLAS.ti. SAGE Publications, Los Angeles, CA.

Gherardi, S., Nicolini, D., 2000. To transfer is to transform: The circulation of safety knowledge. Organization 7, 329–348. https://doi.org/10.1177/135050840072008

Gioia, D.A., Corley, K.G., Hamilton, A.L., 2013. Seeking qualitative rigor in inductive research: Notes on the Gioia methodology. Organ. Res. Methods 16, 15–31. https://doi.org/10.1177/1094428112452151

Grier, R.A., Warm, J.S., Dember, W.N., Matthews, G., Galinsky, T.L., Szalma, J.L.,

Parasuraman, R., 2003. The vigilance decrement reflects limitations in effortful attention, not mindlessness. Hum. Factors 45, 349–359. https://doi.org/10.1518/hfes.45.3.349.27253
Grote, G., 2004. Uncertainty management at the core of system design. Annu. Rev. Control 28, 267–274. https://doi.org/10.1016/j.arcontrol.2004.03.001
Grote, G., Weichbrodt, J.C., Günter, H., Zala-Mezö, E., Künzle, B., 2009. Coordination in high-risk organizations: The need for flexible routines. Cogn. Technol. Work 11, 17–27. https://doi.org/10.1007/s10111-008-0119-y
Hale, A., Borys, D., 2013a. Working to rule, or working safely? Part 1: A state of the art review. Saf. Sci. 55, 207–221. https://doi.org/10.1016/j.ssci.2012.05.011
Hale, A., Borys, D., 2013b. Working to rule or working safely? Part 2: The management of safety rules and procedures. Saf. Sci. 55, 222–231. https://doi.org/10.1016/j.ssci.2012.05.013
Hale, A.R., Swuste, P., 1998. Safety rules: Procedural freedom or action constraint? Saf. Sci. 29, 163–177. https://doi.org/10.1016/S0925-7535(98)00020-4
Hollnagel, E., 2014. Is safety a subject for science? Saf. Sci. 67, 21–24. https://doi.org/10.1016/j.ssci.2013.07.025
Hopkins, A., 2011. Risk-management and rule-compliance: Decision-making in hazardous industries. Saf. Sci. 49, 110–120. https://doi.org/10.1016/j.ssci.2010.07.014
Hornby, P., Symon, G., 1994. Tracer studies, in: Cassell, C., Symon, G. (Eds.), Qualitative methods in organizational research: A practical guide. SAGE Publications, Thousand Oaks, CA, pp. 167–186.
Jiao, A.Y., 2001. Police and culture: A comparison between China and the United States. Police Q. 4, 156–185. https://doi.org/10.1177/109861101129197789
Kudesia, R.S., 2019. Mindfulness as metacognitive practice. Acad. Manage. Rev. 44, 405–423. https://doi.org/10.5465/amr.2015.0333
Kudesia, R.S., 2017. Organizational sensemaking, in: Braddick, O. (Ed.), Oxford Research Encyclopedia of Psychology. Oxford University Press, Oxford, UK, pp. 1–47. https://doi.org/10.1093/acrefore/9780190236557.013.78
Kudesia, R.S., Reb, J., 2018. Mindfulness and the risk-resilience tradeoff in organizations, in: Trump, B.D., Florin, M.-V., Linkov, I. (Eds.), IRGC Resource Guide on Resilience (Vol. 2): Domains of Resilience for Complex Interconnected Systems. EPFL International Risk Governance Center, Lausanne, CH, pp. 94–101.
LaPorte, T.R., 1996. High reliability organizations: Unlikely, demanding and at risk. J. Contingencies Crisis Manag. 4, 60–71. https://doi.org/10.1111/j.1468-5973.1996.tb00078.x
LaPorte, T.R., Consolini, P.M., 1991. Working in practice but not in theory: Theoretical challenges of "high-reliability organizations." J. Public Adm. Res. Theory 1, 19–48.
Leveson, N., Dulac, N., Marais, K., Carroll, J., 2009. Moving beyond Normal Accidents and High Reliability Organizations: A systems approach to safety in complex systems. Organ. Stud. 30, 227–249. https://doi.org/10.1177/0170840608101478
Levinson, S.C., 2005. Living with Manny's dangerous idea. Discourse Stud. 7, 431–453. https://doi.org/10.1177/1461445605054401
Lincoln, Y.S., Guba, E.G., 1985. Establishing trustworthiness, in: Naturalistic Inquiry. SAGE Publications, Newbury Park, CA, pp. 289–331.
Ma, Y., Zhao, Q., 2018. Decision-making in safety efforts: Role of the government in reducing the probability of workplace accidents in China. Saf. Sci. 104, 81–90. https://doi.org/10.1016/j.ssci.2017.12.038
Madsen, P., Desai, V., Roberts, K., Wong, D., 2006. Mitigating hazards through continuing

design: The birth and evolution of a pediatric intensive care unit. Organ. Sci. 17, 239–248. https://doi.org/10.1287/orsc.1060.0185
Orton, J.D., 1997. From inductive to iterative grounded theory: Zipping the gap between process theory and process data. Scand. J. Manag. 13, 419–438. https://doi.org/10.1016/S0956-5221(97)00027-4
Orton, J.D., Weick, K.E., 1990. Loosely coupled systems: A reconceptualization. Acad. Manage. Rev. 15, 203–223.
Patton, M.Q., 2002. Qualitative evaluation and research methods. SAGE Publications, Beverly Hills, CA.
Perrow, C., 1984. Normal accidents: Living with high-risk technologies. Basic Books, New York, NY.
Poland, B.D., 1995. Transcription quality as an aspect of rigor in qualitative research. Qual. Inq. 1, 290–310. https://doi.org/10.1177/107780049500100302
Pratt, M.G., 2007. Fitting oval pegs into round holes: Tensions in evaluating and publishing qualitative research in top-tier North American journals. Organ. Res. Methods 11, 481–509. https://doi.org/10.1177/1094428107303349
Reason, J., Parker, D., Lawton, R., 1998. Organizational controls and safety: The varieties of rule-related behaviour. J. Occup. Organ. Psychol. 71, 289–304. https://doi.org/10.1111/j.2044-8325.1998.tb00678.x
Roberts, K.H., Stout, S.K., Halpern, J.J., 1994. Decision dynamics in two high reliability military organizations. Manag. Sci. 40, 614–624. https://doi.org/10.1287/mnsc.40.5.614
Rochlin, G.I., 1999. Safe operation as a social construct. Ergonomics 42, 1549–1560. https://doi.org/10.1080/001401399184884
Shrivastava, S., Sonpar, K., Pazzaglia, F., 2009. Normal Accident Theory versus High Reliability Theory: A resolution and call for an open systems view of accidents. Hum. Relat. 62, 1357–1390. https://doi.org/10.1177/0018726709339117
Spradley, J.P., 1980. Participant observation. Holt, Rinehart and Winston, New York, NY.
Sutcliffe, K.M., Vogus, T.J., Dane, E., 2016. Mindfulness in organizations. Annu. Rev. Organ. Psychol. Organ. Behav. 3, 55–81. https://doi.org/10.1146/annurev-orgpsych-041015-062531
Valorinta, M., 2009. Information technology and mindfulness in organizations. Ind. Corp. Change 18, 963–997. https://doi.org/10.1093/icc/dtp027
Van Dyck, C., Frese, M., Baer, M., Sonnentag, S., 2005. Organizational error management culture and its impact on performance: A two-study replication. J. Appl. Psychol. 90, 1228.
Van Maanen, J., 1979. The fact of fiction in organizational ethnography. Adm. Sci. Q. 24, 539–550. https://doi.org/10.2307/2392360
Vogus, T.J., Rerup, C., 2018. Sweating the “small stuff”: High-reliability organizing as a foundation for sustained superior performance. Strateg. Organ. 16, 227–238. https://doi.org/10.1177/1476127017739535
Vogus, T.J., Welbourne, T.M., 2003. Structuring for high reliability: HR practices and mindful processes in reliability-seeking organizations. J. Organ. Behav. 24, 877–903. https://doi.org/10.1002/job.221
Weber, K., Glynn, M.A., 2006. Making sense with institutions: Context, thought and action in Karl Weick’s theory. Organ. Stud. 27, 1639–1660. https://doi.org/10.1177/0170840606068343
Weick, K.E., 1989. Mental models of high reliability systems. Ind. Crisis Q. 3, 127–142. https://doi.org/10.1177/108602668900300203

Weick, K.E., 1987. Organizational culture as a source of high reliability. Calif. Manage. Rev. 29, 112–127.
Weick, K.E., Roberts, K.H., 1993. Collective mind in organizations: Heedful interrelating on flight decks. Adm. Sci. Q. 38, 357–381. https://doi.org/10.2307/2393372
Weick, K.E., Sutcliffe, K.M., 2006. Mindfulness and the quality of organizational attention. Organ. Sci. 17, 514–524. https://doi.org/10.1287/orsc.1060.0196
Weick, K.E., Sutcliffe, K.M., Obstfeld, D., 1999. Organizing for high reliability: Processes of collective mindfulness, in: Sutton, R.I., Staw, B.M. (Eds.), Research in Organizational Behavior. JAI Press, Stanford, CA, pp. 81–123.
Wildavsky, A.B., 1991. Searching for safety. Transaction Books, New Brunswick, NJ.
Xian, H., 2008. Lost in translation? Language, culture and the roles of translator in cross-cultural management research. Qual. Res. Organ. Manag. Int. J. 3, 231–245. https://doi.org/10.1108/17465640810920304
Yin, W., Fu, G., Yang, C., Jiang, Z., Zhu, K., Gao, Y., 2017. Fatal gas explosion accidents on Chinese coal mines and the characteristics of unsafe behaviors: 2000–2014. Saf. Sci. 92, 173–179. https://doi.org/10.1016/j.ssci.2016.09.018

Table 1

Data Sources and Informant Descriptions

Informant	1st Round Phone Interview	2nd Round Field Investigating
Regulation		
Site Regulator 1		1 Interview
Site Regulator 2		1 Interview
Operation		
Top management		
Chief Technology Officer (CTO)	2 Interviews	1 Interview
Project Director 1	1 Interview	
Project Director 2		1 Interview and informal conversations
Upper management		
Deputy Project Director 1	1 Interview	1 Interview
Deputy Project Director 2	1 Interview	
Site management		
Site Manager 1		1 Interview and informal conversations
Site Manager 2		1 Interview
Technician		1 Interview
Guard Man		1 Interview and informal conversations
Safety Man		1 Interview and informal conversations
Ground level		
Senior Blaster		1 Interview and informal conversations
Junior Blaster 1		1 Interview and informal conversations
Junior Blaster 2		1 Interview and informal conversations

Table 2

Supporting Data

Theme	Representative Quotations
	Encoding content of rules
Training	"There is a 6-day training for all blasting operators by Police, besides internal trainings by me and CTO." (Deputy Project Director 1) "In the beginning, there was a training for the blasting license... (I attended) a 9-day training by Police." (Junior Blaster 1)
Assessing	"After passing the written test and interview, the blasting operators can renew their license. And the license is renewed every year." (CTO) "We take the computer-based exam. After passing the computer-based exam, there is a simple face-to-face interview. Then we could obtain the license." (Junior Blaster 1)
	Reinforcing content of rules
Ensuring Compliance	"Police coordinate with us, mainly about how we set the safety warnings. And supervise us. They check if the number of detonators and explosive powder is correct (as the record we reported), to see if we hide any explosives by ourselves." (Deputy Project Director 1) "Police check if operators bring smokes and lighters to the blasting sites." (Project Director 1) "Police supervise on-site operations, checking the account books. They keep records of the powder quantity, and the code of each detonator, how many detonators are used today, and the code of each detonator. The police record all of these things. Then they also check the account book to see if there are any discrepancies." (Site Regulator 2)
	Reinforcing salience of rules
Vigilance Maintaining	"Now it has become a rule here. We must call police every time we blast. [The police come for every blast] unless they are too busy to come to the site. For example, they might have to deal with some [legal or criminal] cases. If so, the police will reply and ask us to blast under the condition that safety is ensured. Then we will blast as planned. After blasting, we need to take photos of the site and send them to police [for their records]." (Project Director 1)

	Interviewer: "Later the police asked you to supervise this blasting team on their behalf, to share their workload?" Site Regulator 1: "Yes, they were quite tired [before assigning us to supervise the site]. This team blasts about three times a day and a single blast lasts about 2 hours, so the police had to remain on-site during the whole process [about 6 hours per day] … So, police assigned us to supervise the site [on their behalf]." "We represent the police, to supervise the operations here … If the blasting team supervises themselves, they might not point out the violations timely upon noticing. So police need to supervise the operations. Normally, police should stay and supervise operations at the blasting sites. But police have few people to send to the sites. So they assign us [our blasting company], who have a higher class of operation certificate than the current blasting team to supervise the operations on their behalf." (Site Regulator 2)
	Reinstating content of rules
Correcting	"I stopped the blasters from loading powder. After making sure that everyone was evacuated, I asked them [the blasters] to start blasting." (Site Regulator 2) Interviewer: "Does the client make any inappropriate suggestions, which might violate some operation regulation?" Project Director 1: "Sure. It happens. For the client, the most important thing is productivity, and then safety. Without making progress and ensuring safety, the client cannot make profits. But if the schedule of project is too tight, there will be conflicts between productivity and safety. Sure will there be many conflicts. Under this circumstance, the police play an essential role." Interviewer: "To ensure safety?" Project Director 1: "Exactly."
Reasserting	"They perform surprise checks. They won't tell you when they're coming, to prevent you from taking action beforehand. They will come to check your operations at random intervals, to see if you are still repeating the violations that you did before." (Site Regulator 2)
	Reinstating salience of rules
Escalating	"For small issues, police would ask us to write criticism letter, and pay for fines." (Site Regulator 1) "If detecting who lost the explosives, police would charge criminal detention to the person." (Guard Man)
	Learning content of rules
Refining	"The local police regulate the blasting projects very strictly. For example, we have a strict regulation here called '1322' … It means there must be 1 technician, 3 blasters, 2 safety men, and 2 guard men [under one project]." (Site Regulator 1)

	Learning salience of rules
Heightening	"There were many coal mines in our province. It was so easy to have accidents. Too many. So, now our province is very strict in regulating." (Site Regulator 2) "We're very strict. It's strict here. Much stricter than other places … [There was] an accident happened in a railway project. Tunnel. Railway. Honestly speaking, the reason why that accident happened was that the regulation there was not as strict as [how we're regulating] here." (Site Regulator 1)

Table 3

Regulator-Operator Interactions Enhancing Rule Content and Rule Salience

	Rule Content	**Rule Salience**
Encoding	• Training • Assessing	
Reinforcing	• Ensuring Compliance	• Vigilance Maintaining
Reinstating	• Correcting Violations • Reasserting Content	• Escalating
Learning	• Refining Content	• Heightening

Figure 1.

Data Structure

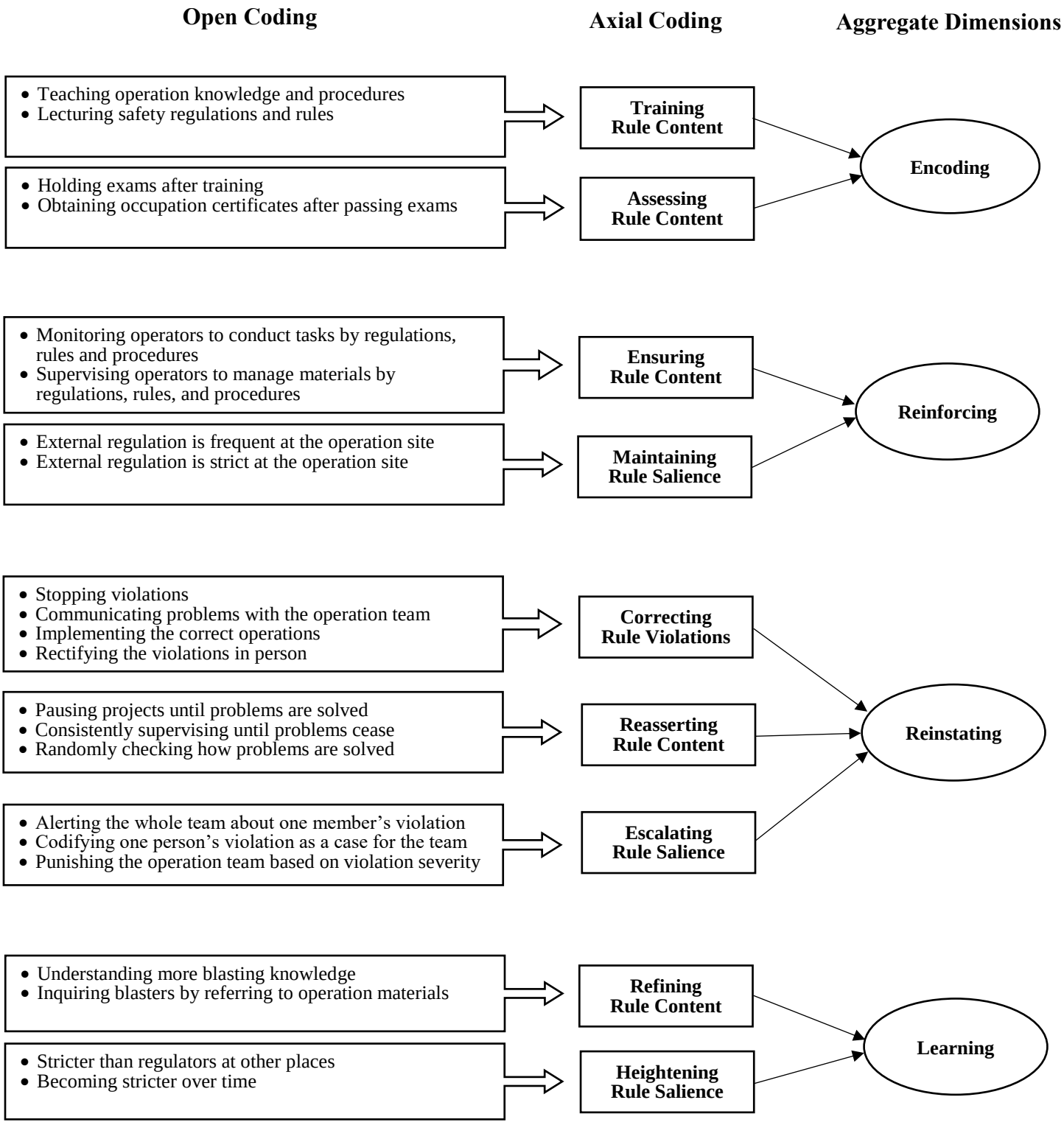

Figure 2.

Theoretical Model of Regulator-Operator Interactions