Safety and Organizational Design Factors: Decentralization and Alignment

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This study examines the relationship between two key organization design factors—decentralization and alignment—and organizational-level safety outcomes. Safety-related practices embedded in organizational design at 54 United States-based organizations through a survey of top-level managers and used injury reports provided to the Occupational Safety and Health Administration (OSHA) to measure each organization's safety record are assessed. Results extend the organizational design and occupational safety literature by providing evidence that decentralization and alignment help reduce overall organizational injuries, and lending additional support for increased worker control of safety practices, along with a need for congruency across the broader company policies and practices.

Safety remains one of the most important issues in the workplace for many reasons. First, the human imperative exists, stemming from millions of disabling injuries and deaths that occur each year at work. Second, the financial cost to organizations and individuals resulting from safety failures is significant, including millions of days lost from work, costing employers and employees billions of dollars each year (National Safety Council, 2008). Third, safety requirements and enforcement routines enacted by safety regulators represent a significant policy obligation for organizations. Further, the efficacy of government policy is often contingent on the actions of organizations to secure worker safety. Although workplace accidents occur all too often, there is growing evidence that managerial practices can have a significant effect on safety (Zohar & Luria, 2004; Zohar, 2002).

Continuing the search for practices that will have the greatest impact on safety outcomes is critical to improving the effectiveness of policy and to protecting people

in the workplace. Recent industrial and mining accidents such as the Deepwater Horizon explosion and oil spill in the Gulf of Mexico have put the importance of safety for organizations and the need for effective practices in sharp relief. In post-incident analyses, organizational design issues have often been found to be especially important as causal to the accidents. The report of the National Commission on the BP Deepwater Horizon (Chief Counsel's Report, 2011), for example, showed that reorganization prior to the spill changed well management to a functional structure from a project-based model in which responsibility for individual wells was localized. In the commission's report, confusion over responsibility for safety and slowed decision making were argued to be at the heart of many of the failures leading to the disaster. In another example, NASA has experienced a number of high-profile safety failures in its history. In each of the space shuttle explosions in which all crew members were killed, analysts identified structural issues as key. Although there were immediate, technical causes to these accidents (the O-ring on the Challenger and the heat tiles on the Columbia) broader structural factors in the organization proved to be the enabling—and sometimes causal—factors that led to disaster (Columbia Accident Investigation Report, 2003; Vaughan, 1997).

Even as the awareness of the role of structure in the lead-up to accidents has increased, relatively little research examining the efficacy of various structural interventions is available for practitioners. Although a number of case studies have examined the structural issues associated with major safety failures, more multi-organization research that examines the relationship between design factors and safety outcomes is needed in order for managers and policy makers to make evidence-based design decisions. The purpose of this study is to extend the current safety literature by examining how the design of organization-level safety practices impacts organization-level safety outcomes.

Organizational design involves a series of decisions about structures that define accountability and responsibility and enable execution of an organization's goals (Miller & Friesen, 1984). We will examine two design factors and their relationship to safety performance goals. First, decentralization should affect safety by moving responsibility for decision-making and implementation to operational levels of the organization. This brings decisions about safety to the level where knowledge of safety problems and awareness of relevant solutions actually reside and where employee behaviors occur. Decentralization of safety decision making is consistent with calls to increase worker control over work processes, particularly with regard to work environment reforms (Deutsch, 1981).

Decentralization with regard to safety is not uncontroversial, however. Centralization of safety accountability in a single department offers the advantages of standardization of safety routines throughout an organization as well as more intensive specialization in safety. Nevertheless, evidence from case research on accidents seems to lend support to the notion that one of the most significant problems in organizations has been the movement of critical information upward in organizations (Vaughan, 1997; Weick, 1990). When critical safety problems occur, communication flow is interrupted and "structural secrecy" impedes the movement of information that would inform decisions (Vaughan, 1997). Information accuracy also is affected

by "hierarchical distortion" in which such macrostructures as centralization affect communication processes. The weight of evidence from this case research suggests that decentralization offers benefits with regard to communication and responsiveness to safety issues.

Decentralization, however, cannot be effective unless organizational processes related to performance evaluation and rewards reinforce safety as a critical imperative. Often pressures to meet deadlines or meet operating cost targets (and performance evaluations and rewards linked to their achievement) can push safety concerns to the background. These effects can be overt or subtle, as the report of National Commission on the Deepwater Horizon Oil Spill (Chief Counsel's Report, 2011, p. 247) concluded:

> "Cost accounting is a necessary and reasonable part of running a business. Nonetheless, given the many decisions that increased risk but saved time and money, it is a reasonable inference that cost and time overruns had an effect, conscious or unconscious, on decision making."

Thus, the second design factor is the alignment of important practices, particularly those associated with the systems of evaluation and rewards. Decentralizing decision making on safety when operational pressures on which employees are evaluated and rewarded are also present can result in decreased attention to safety. In the following sections, will be a brief review on the safety literature, and then introduce the literature on organizational design and the hypotheses about their relationship to safety performance. Following the description of methods and results, the implications of the study to research and practice, the study's limitations, and directions for future research will be discussed.

Safety Research

Safety outcomes have been studied at multiple levels of analysis and from multiple perspectives. The earliest safety studies took an ergonomic approach, focusing on how organizations should arrange the physical working environment to minimize injury. This research, particularly in the field of industrial engineering and operations management, remains a significant focus of safety research (e.g., Colombo & Cugini, 2005; Paquet, Mathiassen & Dempsey, 2006; Li, Yu & Han, 2007). Another stream of research, which has yielded little in the way of consistent results, examines individual differences that might identify those who would be "accident prone" (Hale & Hale, 1972). More recently, Hale and Hayden (1998) suggested a third phase of safety research has begun, one that seeks to identify factors from organization theory that may inform safety theory and practice.

The third phase of safety research has been dominated by research and theory focusing on the idea that a "safety climate" influences safety outcomes (Hofmann & Stetzer, 1996; Zohar, 1980). Safety climate has been described as a combination of employee perceptions of management's commitment to safety, the importance of safety to coworkers, self-beliefs about safety, and general perceptions of worker involvement in safety-related activities (Dedobbeleer & Beland, 1991). Although measures associated

with safety climate vary considerably across studies in terms of scale length and content, they share the focus on employee perceptions of organizational policies and practices. This is consistent with the general assumptions behind the idea of climate—that employee perception is assumed to be the consequence of the policies, procedures, and rewards within an organization. Employees apprehend these organizational practices and use them to help make sense of their work world (Schneider, 1975; Schneider & Reichers, 1983).

Although research has shown a relationship between safety climate and safety outcomes, employee perceptions can be based on a range of practices as well as overall attitudes toward the organization (Schneider, 1975), and it can be difficult to tease out which specific practices affect climate. Climate has been described as a "Gestalt" (Schneider, 1975) or a "feeling in the air" about a company (Schneider, Gunnarson & Niles-Jully, 1994). It is critical, therefore that research in the field of climate is seeking to unpack practices subsumed within various characterizations of climate (c.f. Schneider and colleagues' work on service climate; Schneider et al., 1994; Schneider et al., 2005). Research on safety climate has also moved in this direction, examining leadership and its effects on safety climate (Zohar, 2002) and safety outcomes (Barling, Loughlin & Kelloway, 2002). This study extends this research by specifically examining organizational design factors and their impact on safety performance.

Organizational Design Literature

A wide range of literatures have examined the effects of organizational design on organizational outcomes, including such disparate topics as innovation (Damanpour, 1991), effective strategy implementation (Love, Priem & Lumpkin, 2002), and procedural justice (Schminke, Ambrose & Cropanzano, 2000). The field of human resources (HR) and high performance work systems (HPWS) employ many of the classic design elements in determining which policies, procedures, and practices will have the greatest effect on employee and firm performance. Research in HPWS found considerable support for the impact of these design-related factors on important organizational outcomes, including turnover (Huselid, 1995; McEvoy & Cascio, 1985), productivity (Katz, Kochan & Keefe, 1987), sales, and return on average assets (Huselid, 1995). These studies attempt to capture organization-level design factors in order to uncover connections to organization-level results, with a consensus that certain "good" practices led to positive organizational outcomes (Delaney & Huselid, 1996; Becker & Gerhart, 1996). Although most of this literature does not focus on safety, components of organizational work systems such as participative decision-making and information sharing have been linked to overall improved organizational performance (Huselid, 1995; Pfeffer, 1998).

These literatures differ from much of the prior research on safety because they have organization-level performance outcomes as their unit of analysis, rather than the group or sub-unit level outcomes. Although leading scholars in the safety climate research stream (Zohar 2000, 2004) have called for studies to examine climate at the organization level as well as the group level, much of the climate research remains focused on the group level (Hofmann & Stetzer, 1996; Zohar, 2002), making potential

organization-level and policy-level interventions difficult to specify. In this study we follow the model used most often in organizational design and HPWS literature and focus on organization-level independent variables and outcomes.

Classic work in organizational design has sought to identify the major structural factors that describe organizations and the appropriate arrangements of structure that maximize various types of performance (Pugh et al., 1969). Several organizational design constructs and their measures have been developed including: specialization, functional differentiation, professionalism, formalization, authority, administrative intensity, centralization, internal communication, vertical differentiation, and alignment of policies and procedures (Galbraith, 2005; Price & Mueller, 1986b). The safety climate literature provides a useful starting point for developing a theoretical rationale for focusing on a more limited subset of structural factors. Since many of the factors within the safety climate literature focus on employee perceptions of how supportive day-to-day practices are of safety (DeJoy, 1985; Zohar, 1980), it was useful to focus on those factors that might be most salient, or meaningful (see Schneider, 1975) to employees. For this reason, we narrowed our focus to two specific organizational design factors: decentralization and alignment.

Henry Mintzberg (1993, p. 2) argued that "every organized activity….gives rise to two fundamental and opposing requirements: the division of labor into tasks, and the coordination of these tasks to accomplish the activity. The structure of the organization can be defined simply as the ways in which labor is divided into distinct tasks and coordination is achieved among these tasks." This simple statement accurately describes the issues associated with organizational design, but masks considerable complexity. Organizations are a nexus of multiple, sometimes conflicting, tasks and functions (Gresov & Drazin, 1997), and designers must determine what structure will best secure the performance of each of these functions separately; how coordination across functions will occur; and how tradeoff decisions will be made when conflicts occur between tasks (Lawrence & Lorsch, 1969). Safety is one of the many functions that designers must accommodate within the structure. Is the safety function best centralized at the top levels of the organization, or decentralized to the operations level? If decentralized, how will coordination with other key functions such as performance appraisal and compensation occur when those processes are also used to support other functions associated with productivity? These are questions we examine using the organizational design factors of decentralization and alignment of organizational practices, both of which are hypothesized below to be associated with effective safety outcomes.

Decentralization

Organizational design options that enable responsiveness to contingencies and influence both perceptions and behaviors of employees have long focused on the issue of centralized vs. decentralized decision-making (Child, 1973; Damonpour, 1991). Decentralization is defined as the extent to which decision making and authority are distributed throughout the organization and employees are able to make independent decisions about their work (Aiken & Hage, 1971; Corwin, 1975). Decentralization has been a focus of attention in organizational design because of its practical utility in achieving organizational goals in the face of complexity and change in the environment

and because of its psychological effect on employees.

Although much of the focus on decentralization has been on issues of responsiveness to external environmental pressures (Lawrence & Lorsch, 1969) there are several other factors within the organization that can be affected by decentralization. Decentralization recognizes that the exigencies of practice may be quite different in various units of the organization, as each experiences different types of performance pressures, resulting in different time horizons, different goals, and different levels of informality (Galbraith, 2002; Lawrence & Lorsh, 1969). A single, centralized authority is unlikely to have the knowledge, flexibility or expert authority to make decisions in these very different environments (Lawrence & Lorsch, 1969). Further, from the organizational behavior literature we understand that decentralization can increase feelings of autonomy in the workplace (Iverson & Roy, 1994; Price & Mueller, 1986a), thus improving overall work behaviors. An example of this was found by Dwyer and Fox (2006) when they noted that the more control employees viewed themselves as having over their work, the more likely they were to spend additional time helping customers and achieving customer satisfaction (rather than rushing to meet number of customers-served expectations).

Each of these outcomes resulting from decentralization (acknowledgement of differences between units across the organization and increased feelings of autonomy) may positively impact safety outcomes. Increased knowledge of unit-specific differences, could affect organization-level outcomes as safety processes at lower organization levels reflect the immediate environment of a work group and allow responsiveness to work-centered contingencies. The second – increased feelings of autonomy – may impact safety through an improved individual responsiveness due to an increased sense of control over one's own work. In a study of miners, for example, Fitzpatrick (1980) found that workers engaged in social interaction and created a subculture that helped the miners cope with the dangers they faced. Similarly, steel workers collectively constructed processes that allowed them to maintain a sense of control over the dangers in their work (Haas, 1977). Thus, decentralization would seem to be an important design mechanism that may support the function of safety by enabling worker control.

Decentralization of safety is a controversial strategy. Many organizations place the responsibility for safety within the HR function, some place it within engineering departments, and still others have a separate safety department, often associated with production. The determination of the relative effectiveness of the decentralization decision is, as a result, an important practical question as well as a theoretical one. Centralization can signal importance and in the case of implementation of standardized practices, can be an efficient means of diffusion (Damanpour, 1991). Yet, the perception of how likely a crisis is to occur in an organization is perceived differently depending on the hierarchical level of the individual in the organization (Larson & Fowler, 2009). Specifically, the likelihood of an accidental crisis occurring is viewed as much higher at the lowest level (entry-level) of managers in organizations due to their day-to-day exposure to the possibility, indicating an importance of decentralizing due to more direct exposure and familiarity with safety situations. In addition to the importance of familiarity in responding to safety situations, the importance of worker control

with regard to safety (Deutsch, 1981) would also seem to favor decentralization. The American Society of Safety Engineers seems to support decentralization as well, asserting in their guidelines that safety is "learned from others," and everyday experiences either reinforce or weaken the strength of safety (Cooper, 2001). This implies that if organizations want to reinforce safety, they should decentralize the enforcement of safety practices to all employees. Organizations convey the importance of safety through continual reinforcement at the operational level (Hofmann, Morgeson & Gerras, 2003), and immediate reinforcement is more likely to be possible when organizations deploy the responsibility for safety practices to lower levels of the organization.

Thus, the design decision to decentralize safety should be associated with a reduced number of injuries for an organization. Specifically, decentralization is defined as the deployment of responsibility and authority to lower levels of the organization so that the safety function is enacted closest to its operational base. It is at this level that employees are affected by unsafe situations, and at this level that employees need to be able to immediately react.

Hypothesis 1: Decentralization of safety responsibility will lead to lower numbers of injuries.

Decentralization deals with the first important requirement of organizational design, the best structure to support the functions of the organization. The next hypothesis examines the other important aspect of design; that of coordination across functions.

Alignment of Practices

Lawrence and Lorsch emphasize the importance of integration, defined as collaboration across functions in order for "unity of effort" to be achieved (1969, p.11). As a nexus of multiple tasks and goals, organizations, especially decentralized organizations, run the risk of sub-optimizing performance on some tasks when there are multiple goals (Gresov & Drazin, 1997). Thus, for the function of safety to be sustained within an organization, the organization's design needs to include mechanisms of coordination among tasks and goals so that sub-optimization of performance on safety does not occur.

One way to achieve coordination is by creating multiple, reinforcing practices within an organization. This coordination is often quite difficult when tasks and goals vary widely, but a range of activities and structures can assure a level of internal consistency of practices within a work group, while assuring that these practices are at least neutral with regard to other tasks and functions (Grazin & Dresov, 1997). These concepts indicate that safety policies, procedures, and reward systems must be both internally consistent, as well as integrated with the other organizational or functional imperatives.

Probably the most significant research on the importance of consistency or alignment of practices can be found in the literature on high performance work systems (Becker & Gerhardt, 1996; Huselid, 1995; Pfeffer, 1998). In order for congruence or

alignment between the practices to exist, each of the practices must work toward the same end simultaneously, and each practice must provide reinforcement for the others, as well as coherence to the practices. The consistency of practices can be expected to lead to more positive organizational outcomes (Beer et al., 1985) as clarity of purpose is continuously reinforced across activities. This indicates that safety practices must be aligned internally, as well as with practices in other functional areas.

Empirical studies in HR strategy support the positive effect of the alignment of practices (Arthur, 1994; MacDuffie, 1995; Delaney & Huselid, 1996). MacDuffie (1995) argues that not only does a group of coherent practices provide several ways for workers to acquire skills, but they also more strongly shape the pattern of interactions among employees and managers within an organization. Dwyer and Fox (2006) address the alignment issue as well, noting that time spent on customer satisfaction is typically reduced in call centers as they are rewarded for volume of calls, not for solving issues. The need for internally consistent practices would also be seen as important in impacting a range of other outcomes, including safety. The idea that internal consistency re-emphasizes organizational values is addressed most directly in the training literature. Heinrich (1950) indicated that injury prevention campaigns often fail because organizations continue to emphasize other types of organizational goals besides safety. The transfer of training literature (e.g. Baldwin & Ford, 1988) suggests that if organizational practices are contradictory (e.g., employees are trained on safety, but evaluations emphasize something else such as productivity), then employees are less likely to transfer what they have learned to their job. Lehto and Salvendy (1995) describe four practices—selection, training, job design, and supervision, as working synergistically to maximize safe procedures in an organization.

The safety climate literature also reflects the importance of alignment, since climate scales ask employees whether or not safety is prioritized higher than production and meeting deadlines (Zohar, 1980; Hofmann & Stetzer, 1996). In general, for employees to grasp the importance of safety, they need to see the presence of company-wide support and formal reinforcement that affects everyday practice. This is supported by climate research that describes climate as something developed on a "day-to-day basis" by organizational "practices, procedures, and rewards" (Schneider et al., 1994, p. 17). Thus, the formal coordination mechanism of alignment will help the various tasks and functions work together toward common goals.

Hypothesis 2: Organization-level alignment of practices supporting safety will lead to lower numbers of injuries.

Method

Survey Distribution/Sample

Sampling procedure. To obtain a sample, advertisements were placed at associations of business and industry and safety councils throughout a state in the Midwest United States. Interested members were asked to contact the researchers directly for additional information. This voluntary method was used because of the sensitivity of the information being requested. Although a self-selection bias was of concern, no

major differences existed between the average number of injuries in the responding organizations and overall population averages (obtained from Occupational Safety and Health Association [OSHA] statistics). Further, this method overcomes the biases in previous research that has tended to focus on individual injury self-reports or perceptions of safety risk (Huang et al., 2004). In exchange for their participation in the study, each organization received a benchmarking report of safety practices across participating organizations, as well as an executive summary of the research findings.

Respondents. Of the 112 organizations that originally responded to the advertisements, 54 organizations completed the survey, with 48 of these organizations providing complete, usable data (including OSHA logs of reportable injuries and/or safety records). Most of the organizations that chose not to participate (or that did not provide complete data) opted out because of time constraints and organizational policies restricting the amount of injury information they could provide. Instructions asked organizations to have their top safety officer, CEO, HR Manager, or whoever would be most knowledgeable of the organization's safety practices, to complete the survey, along with two other top managers with similar familiarity of safety practices (if possible). Using senior executives as informants concerning issues of strategy and organizational design, along with organization-level outcomes is common practice in a range of literatures (e.g., Aiken & Hage, 1971; Huselid, 1995; Becker & Gerhardt, 1996). Of the organizations responding to the survey over half (51.9%) had multiple respondents return the survey. Typically, the organizations with multiple respondents were larger organizations where multiple upper level managers responded (i.e. CEO and safety officer, HR Manager, and unit managers). The majority of the responding organizations were from the manufacturing (61.1%), services (16.7%), and transportation and public utilities (11.1%) industries. Agriculture, mining, finance, wholesale and retail trade, and construction each had two or less organizations respond. (Organizations were classified into eight broad categories as identified in OSHA's yearly reports.)

Measures

Independent variables. The survey focused on decentralization of safety and alignment of the safety practices within the organization. The survey asked that respondents answer Likert-type items based on a 1-5 scale (not at all = 1, great extent = 5). Cronbach's alpha was estimated for each scale to determine the internal consistency of the scales. These reliability coefficients were used to correct for measurement error in the observed correlations. The resulting disattenuated correlations were then used in the regression models to estimate the relationships between independent variables and organizational safety (Schmidt & Hunter, 1996).

Decentralization. The five-item scale asked respondents the extent to which the responsibility of safety is decentralized throughout the organization; each department is responsible for their own safety procedures; safety is viewed as everyone's concern (not just the safety department's concern) within the organization; decisions on safety policies/procedures are determined with input from all departments; and various departments participate in safety enforcement across the organization. These five

items were combined for the decentralization scale. Cronbach's alpha for this scale was estimated to be .81, indicating the scale to be reliable.

Alignment. The six-item scale asked respondents the extent to which the safety practices in place at the organization were supportive of each other; multiple safety practices were used to enforce safety; various safety practices within the organization contradicted each other (reverse coded); HR practices (selection, training, evaluations, compensation) were all used to reinforce organizational safety outcomes; safety practices send mixed messages to employees (reverse coded), management emphasizes other outcomes (i.e. placing productivity above safety) causing the importance of safety to be decreased (reverse coded). These six items were combined for the alignment scale. Cronbach's alpha for this scale was estimated to be .76, indicating the scale to be fairly reliable.

Dependent variables. Because the present study examines organization-level practices, the dependent variable of interest is overall organizational safety outcomes. Since the study examines measures across several organizations, it uses recorded safety measures (rather than observed) due to practicality. Furthermore, because the study includes multiple organizations, it is necessary to obtain recorded injuries reported in a consistent, standardized form. Thus, as the organizations surveyed were US-based, the organizational safety measures were obtained from OSHA 300 logs since these are required injury reports of all US companies. The safety officers were asked to provide copies of the actual logs they had used to report their injuries to OSHA (or to complete an injury reporting sheet if the logs were unavailable) for their organization over the past five years. Table 1 shows the injuries in each OSHA category, by year, for the organizations in the study as well as total injuries for each category and the percentage of total injuries that each category represents. Sprains and strains were the most common type of injury reported.

Table 1: *Summary of Injuries for Each OSHA Category (All Companies Combined)*

Type of Injury	*(1) Fracture*	*(2) Eye*	*(3) Contusion*	*(4) Diseases*	*(5) Toxics*	*(6) Cuts*	*(7) Needles*	*(8) Abrasions*	*(9) Sprains/ Strains*	*(10) Bites*	*(11) Skin*	*(12) Cumulative Trauma*	*(13) Mental Stress*	*(14) Burns*	*(15) Other*
Year 1	301	74	157	3	7	201	68	6	536	2	51	249	3	37	13
Year 2	375	148	212	7	17	229	301	96	848	6	24	309	3	51	19
Year 3	353	131	271	9	5	251	232	73	773	5	25	349	0	73	26
Year 4	320	166	214	3	6	181	119	130	609	4	32	378	2	38	32
Year 5	258	176	219	16	54	260	165	143	694	9	31	257	2	38	25
Total Injuries	1140	517	718	635	82	722	912	247	2116	49	364	991	227	142	111
Percent of Total Injuries	12.7	5.8	8.0	7.1	0.9	8.0	10.2	2.8	23.6	.5	4.1	11	2.5	1.6	1.2

In addition, because it is important to capture as many dimensions of safety as possible in order to determine the overall safety of an organization, this study weighted injuries from the OSHA 300 logs according to seriousness. Organizational safety outcomes were measured as the average number of injuries, weighted for seriousness (based on type of injury and type of medical treatment required) (Vreedenburgh, 1998), over five years. Incident types on OSHA logs are broken down into fractures, eye injuries, contusions, infectious diseases, lacerations, needle punctures, abrasions, sprains/strains/fractures, bites, occupational skin disease, disorders, mental stress, thermal burns, and other. These types of injuries as well as what type of medical treatment was required (medical treatment only, or lost days from work) were used to rate the injuries incurred for seriousness.

OSHA logs for the past five years were obtained from the organizations in order to have a more consistent report of employee injuries, allowing for the control of random fluctuations in reported injuries. To do this, the correlation of injuries across five years was determined and the average calculated. The resultant mean correlation (.78) was the reliability of injuries reported for one year. The reliability of the average injuries across five years was then determined by using the Spearman-Brown prophecy formula to adjust the one-year reliability. This procedure yielded the estimated reliability of .95 which was then used to correct the correlations between the dependent variables and independent variables for measurement error. This correction helps account for random fluctuation of responses over time (Schmidt & Hunter, 1996).

Control variables. In order to determine whether it is the hypothesized design practices that are influencing organizational safety additional factors needed to be considered and used as control variables. When examining the human resources literature, the most common variables controlled for were type of industry (Bae & Lawler, 2000; Huselid, 1995) and firm size (Huselid, 1995; Huselid, Jackson & Schuler, 1997; Jackson, Schuler & Rivero, 1989; Delaney & Huselid, 1996). One study that looked specifically at organizational characteristics found that industry actually influenced the type of HR practices put in place (Jackson et al., 1989). The National Safety Council (2008) also makes distinctions across industries in its yearly reports, and has found a definite distinction in the number of injuries by industry. There also may be an indirect link with firm size and injuries, because larger firms have been found to have additional practices such as drug testing (Borg, 2000), developmental initiatives (Douglas & McCauley, 1999), and training (Colarelli & Montei, 1996) which may influence an organization's safety outcomes. Thus, this study controlled for both industry and organizational size.

Size of the organization was measured with a single, open-ended item asking "Approximately how many people are in your organization?" (Min = 4, Max = 6,000, Mean = 489). Type of industry was measured with a single open-ended item asking "Type of industry." The responses were used to classify the organizations using OSHA's classification system: agriculture, forestry and fishing, mining, construction, manufacturing, transportation and public utilities, wholesale and retail trade, finance, insurance, real estate, and services. These eight industries were then broken down into two classifications – high risk and low risk – based on the incidence rates per industry provided by OSHA records.

Analyses

Examining informant agreement. Because there were multiple respondents from organizations on the survey, the intraclass correlations (ICC) of the responses were determined (Bliese, 2000). The mean ICC(2) was found to be .83 (Minimum = .64, Maximum = .96). Because the ICCs were fairly high, multiple responses from within organizations were averaged, and the means were used for the rest of the analyses.

Hypothesis testing. The proposed relationships were tested by regressing organizational safety on the predictor variables (decentralization and alignment) and control variables (industry type and organizational size). Support for the hypotheses was found if the beta weight was negative and the confidence interval around the beta weight did not include zero.

Results

Findings

Correlations and descriptives. Descriptive statistics, reliability estimates, and correlations for all measures are reported in Table 2. Because the sample size was small, a 90% confidence interval was used to examine correlations and test hypotheses. When examining the corrected correlations between the perceived organizational safety practices and numbers of injuries, decentralization (r = -.37) had a negative value and a confidence interval not including zero (CI = -.60, -.15). This indicated that decentralization was associated with fewer injuries. Alignment (r = -.18) is also negatively correlated with injuries, indicating that they may be associated with fewer numbers of injuries; however, their confidence interval included zero.

Table 2: *Means, Standard Deviations, and Correlations between Organization Design Variables, Control Variables, and Safety Outcomes*

Variable	Mean	N	SD	1	2	3	4	5
1. Decentralization	3.51	54	.81	(.81)	.73*	-.02	.16	-.37*
2. Alignment	3.52	53	.65	.66*	(.79)	.12	.13	-.18
3. Industry (by high or low risk)	.80	54	.41	-.02	.11	(---)	-.18	-.32
4. Organizational Size	530.43	53	1044	.12	.15	-.18	(---)	-.05
5. Injuries per 100 employees	26.86	48	24.08	-.21	-.33*	-.31*	-.05	(.95)

**Indicates correlations with 90% confidence intervals which do not include zero*
Upper diagonal correlations are corrected for measurement error
Diagonal cells are Cronbach's alpha

Hypotheses. The first proposed hypothesis was tested by regressing injuries on the decentralization predictor variable and control variables (industry type and organizational size). The relationship of decentralization with injuries (r = -.37) was negative, indicating that decentralization of safety practices was associated with fewer injuries. Further, the confidence intervals around this beta-weight did not include zero (CI = -.59, -.15), providing support for the hypothesis that decentralization of safety practices has a relationship with organization-level safety outcomes (see Table 3).

Table 3: *Regression of Injuries on Decentralization*

Injuries (per 100 employees)						
Variable	β	R^2 (Shrunken R^2)	R (Shrunken R)	ΔR^2	90% CI	
					L	H
Step 1						
Industry Type	.36	.11	.33	.11	.13	.59
		(.07)	(.26)			
Organizational Size	.08				-.16	.32
Step 2						
Decentralization	-.37	.24	.49	.13	-.59	-.15
		(.19)	(.43)			

The second proposed hypothesis was tested by regressing injuries on the alignment predictor variable and control variables (industry type and organizational size). The relationship of alignment with injuries (β = -.29) was negative and the confidence intervals did not include zero (CI = -.52, -.05). This provided support for the hypothesis that alignment of safety practices is related to organization-level safety outcomes (see Table 4).

Table 4: *Regression of Injuries on Alignment*

Injuries (per 100 employees)						
Variable	β	R^2 (Shrunken R^2)	R (Shrunken R)	ΔR^2	90% CI	
					L	H
Step 1						
Industry Type	.40	.11	.33	.11	.16	.64
		(.07)	(.26)			
Organizational Size	.08				-.16	.32
Step 2						
Alignment	-.29	.19	.44	.08	-.52	-.05
		(.13)	(.36)			

Discussion

This study lends support for the prospect of using organizational design as a means to manage safety practices in an organization and to affect safety performance. We identified two organizational design constructs – decentralization and alignment – that were associated with reduced reported injuries. The indication that decentralization of safety practices may reduce injuries demonstrates the potential importance of continual, day-to-day reinforcement of safety (Hofmann et al., 2003) through distribution of safety authority and responsibility to all employees. By locating the decisions about safety at the place where the greatest understanding of processes exists, and enabling greater worker control, safety outcomes improve. The result that the alignment of practices may be associated with fewer injuries for the organization supports the argument that practices should be consistent within an organization (MacDuffie, 1995; Delaney & Huselid, 1996).

The finding that both decentralization and alignment may have a relationship with reduced injuries, suggests that safety is considerably more than the implementation of particular, isolated safety practices or rules. Rather, the results suggest safety should be explicitly included in organizations' fundamental design decisions. When determining structures that may best implement overall strategy, safety must enter into the design calculus. Safety performance depends on worker control and coherence of practices.
Perhaps the most important implication of this study is that focusing on organizational factors rather than individual factors will go a long way toward improving safety and improving an organization's capacity to problem solve. There is a strong tendency in the United States to seek individual accountability when safety issues arise. In many cases, post-accident reviews focus on proximal causes—on individuals and individual actions. In her exhaustive analysis of the Challenger launch decision, sociologist Diane Vaughan (1997, p. 392) argued that the tendency to look at immediate cause, rather

than the organizational context in which the immediate cause became possible stems from the desire for quick action, playing the "politics of blame":

> "Responsible individuals can be fired, transferred, or retired. New rules that regulate decision making can be instituted. Having made these changes, the slate is clean. Organizations can go on… The myth of managerial wrongdoing made the strategy for control straightforward: fix the technology and change the managerial cast of characters, implement decision controls, and proceed with shuttle launches."

In other words, safety approaches that do not look at the design of the organization run the risk of appearing to respond to calls for accountability, but in the end, safety problems were not addressed. Thus, in spite of actions to hold individuals accountable and implement new decision controls after Challenger, the review of the Columbia accident more than a decade later showed that NASA's "fix" after the Challenger did nothing to change the safety environment. In fact, most of the antecedents to Columbia's failure were the same as those that led to the Challenger disaster (Columbia Accident Investigation Board, 2003).

The results lend further empirical support to the conclusions of prior case studies and to reports on major safety failures. Although there are arguments for centralization—accountability can be pinpointed, specialization is possible, and standardized practices can be diffused—this research would seem to suggest that the counterarguments associated with decentralization are instead supported. Local information, knowledge, and responsiveness, as well as more accurate and frequent communication about safety are associated with better safety outcomes. Alignment of a range of practices around safety is also critical. Given that prior research has shown that declining and misallocated resources lead to "drift" toward the possibility of more serious accidents as attention turns from safety to cost (Marcus & Nichols, 1999), the findings indicate that one way to avoid drift is to maintain alignment of rewards and performance management systems around safety. Both decentralization and alignment may offset tendencies at higher levels of the organization to make decisions that sub-optimize safety goals.

Limitations

There are a number of limitations to this study. One of the most notable is the sample size. This study took a complex format asking organizations not only to complete a survey, but also to provide multiple respondents, as well as provide sensitive safety information over multiple years. Thus, though the sample size was small, when looking at the required time and willingness to disclose safety information for participating organizations, the response rate and amount of in-depth information provided by each organization was actually quite good. Given that many safety studies look at practices within a single organization, this sample represents a significant departure from the norm, and gives us much needed cross-organizational information. However, because of the small sample size, there could be a problem of capitalization on chance, and results are likely not completely representative of the population value.

Further, because of reduced power due to the smaller sample-size, it may be difficult to detect a relationship when there is one. There were also limitations with the measures of this study. Measures were all collected from upper management, which may have caused some information on what actually occurred (versus what policies say should have occurred) to be lost. Further, full correction for transient error was not possible in the measures of the independent variable (only random response error and specific factor error were accounted for by alpha coefficient) (Schmidt, Le & Illies, 2003). Therefore, the correlation and regression estimates are most likely conservative, reducing the probability of detecting an impact of design factors.

The dependent variable measures were also a limitation. In order to get the most consistent information across companies possible, OSHA log information was used. However, this information provides only injuries serious enough to report, resulting in a low base rate of the injury criterion. Consequently, the magnitudes of estimated correlations between this criterion and the independent variables were potentially affected (reduced). Yet despite the small sample size and conservative estimates, this study still supports the relationship between structural decentralization and alignment and organizational safety.

Future Research

This study represents a first step toward expanding current research in safety from employee perceptions of safety climate to identifying potential design factors that may affect safety outcomes. Multiple overlaps were identified in the theoretical portions of this paper between the safety climate, the HR literature, HPWS and the organizational design literature. Because of the complementary findings that each area of research contributes, it is important that additional consideration and theoretical development between them continues.

Decentralization should be explored further to see if there is an appropriate degree of decentralization necessary in developing practices and responsibility. Whether the type of job, management, industry, or size of organization makes a difference on the impact of decentralization is also important. Research should also examine the possibility that some aspects of safety might be best centralized (dissemination of safety information and practices or training), but others, such as response to safety incidents, should be decentralized. Perhaps most important is a replication study with a larger sample and a research design that limits the sample to just one or two particular industries so that potential noise from cross-industry differences can be controlled. A larger sample also would enable examination of interactions between independent variables. For example, alignment may actually increase the importance of decentralization. Although decentralization is associated with safety on its own, it may have a greater impact on safety when alignment of practices is present. The study could not test that possibility with a sample this small, but it certainly merits attention in future studies. A replication study in organizations in other countries would also be of interest to see if the same design factors hold importance across cultures.

Conclusion

This study extended the safety research by providing evidence for a relationship between organizational design factors and safety outcomes. Specifically, two organizational design constructs, decentralization and alignment, were identified as related to reduced injuries. These findings opened the door to new avenues of research in organizational design and suggested new connections between practices, perceptions of practices, and results. The results also supported the possibility that advances in work environment reform (Deutsch, 1981), particularly with regard to increased worker control over safety practices, may improve workplace safety.

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