FEATURE ARTICLE

The origins of safety culture in coalmining: "top-down" versus "bottom-up"

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Abstract

This article examines the origins of safety culture through an Australian coal mining company. Five mine sites demonstrated substantial and persistent differences in their OHS performance. Several characteristics of these sites are identified as being associated with the formation of a "bottom-up" safety culture. These findings have significant implications for the implementation of "top-down" corporate OHS initiatives, and may be relevant to other industries that share similar characteristics.

Keywords: safety culture; OHS; coalmining.

Introduction

Over the last 15 years, there has been an increasing focus on the role of safety culture in curbing work-related injury and disease. Particularly influential was the 1988 International Atomic Energy Agency (IAEA) report on this subject, prompted by the nuclear reactor accident at Chernobyl.[1] Other reports also gradually came to suggest that cultural factors (rather than just management systems, policies and procedures, or more technical aspects of safety) can play a major role in explaining the frequency, and severity, of injuries and disease within an organisation.[2,3]

Subsequently, the term "safety culture" entered mainstream policy discussion, with bodies such as the United Kingdom's Health and Safety Executive using it in its policies and reports, and defining it as follows: "The safety culture of an organisation is the product of individual and group values, attitudes, perceptions, competencies and patterns of behaviour that determine the commitment to, and the style and proficiency of, an organisation's health and safety management."[4]

Semantic disagreements (in particular, whether it was appropriate to refer to safety culture or only to "safety climate") now seem to be largely over.[5] And some important substantive questions — what distinguishes a positive safety culture from a poor one,

and how might a "good" safety culture be achieved — have also, in the main, been comprehensively addressed.

Reiman and Oedewald, for example, were able to trawl the literature to generate a compilation of positive safety culture descriptors, including "a safety policy", "visible commitment of management to safety", "clear definition of responsibilities and obligations", "balance between safety and production", "good training", "fairness and trust", "quality . . . rules and regulations", "reporting of events and accidents", "flow of information between the different levels", "continuous improvement", "sufficient resources", and "working relationships with authorities".[6]

And the seminal work of Reason has addressed the crucial question of how to build a positive safety culture.[7] Not least, Reason describes the significance of generating a reporting culture, a just culture, a flexible culture and a learning culture. Weick and Sutcliffe, in another influential work, emphasise the importance of a collective "mindfulness" of organisations, in particular through: "(1) preoccupation with failures rather than successes, (2) reluctance to simplify interpretations, (3) sensitivity to operations, (4) commitment to resilience and (5) deference to expertise, as exhibited by encouragement of a fluid decision-making system." In this respect, a key requirement is for "a person to become a mindful observer and actor, a vigilant and attentive actor, rather than one dependent on mindless control systems".[8,9]

Hale also identifies key aspects of a good safety culture, including the participation of workers at different levels of the management hierarchy, the active engagement and contribution of specialist safety staff, caring trust (looking out for each other), open communication between workers and management, management belief in safety improvements, and the mainstreaming of safety within an organisation (for example, by including OHS in all decision-making processes).[10] Finally, Cooper has attempted to remove some of the uncertainty surrounding precisely what safety culture is, by describing its three main components as being psychological, situational and behavioural.[11,12] According to Cooper, the psychological component includes peoples' norms, values, attitudes and perceptions of safety. The situational component involves the structure of the organisation (policies, working procedures and management systems). And the behavioural component addresses practices adopted by employees that can be observed.

However, one critical issue that, notwithstanding its centrality, has attracted relatively little investigation is: where does safety culture come from? A widely held view is that it is management, in particular corporate leadership, which plays the crucial role in shaping organisational and safety culture. For example, Peters and Waterman's view is that: "people way down the line know what they are supposed to do in most situations because the handful of guiding values is crystal clear."[13] Similarly, according to Hopkins: "it is the leaders who determine how the organisation functions and it is their decision-making which determines whether an organisation exhibits the practices which go to make up a culture of safety."[14] Schein has also argued that it is *corporate* management that creates culture, with the emphasis on its leadership role — culture is determined by what management pays attention

to, that is, the things management measures, controls and provides financial incentives for.[15]

In much of the literature, however, there is little attempt to locate the origins of safety culture and, in particular, little or no attempt to understand the importance of cultural development in specific industries, nor to consider the possibility that some sectors may have particular characteristics that do not conform to generic constructs. Nor does much of that literature give serious attention to the possibility that safety culture, contrary to the conventional wisdom, is not necessarily a "top-down" phenomenon. It is important to challenge both of the above, largely taken for granted, views because, to the extent that they are wrong or overstated, this may have important implications for how OHS is addressed and, ultimately, for OHS performance and practice.

This article investigates the formation of safety culture in the context of one specific industry, the Australian coalmining sector, and shows how sector-specific characteristics matter, and matter considerably. In doing so, it challenges the conventional view that safety culture is predominantly a top-down phenomenon, with corporate/senior management the driving force. On the contrary, it provides empirical evidence that, in this industry at least, it is better understood as largely a "bottom-up" creation of mine site management and workforces. This too has important implications for understanding safety culture and for the development of policies best able to improve that culture and, with it, OHS outcomes.

Methods

This research was conducted with the cooperation of an Australian coalmining company and five of its mine sites, and with the support of an Australian Research Council Grant. Consistent with the norms of social science research and the author's ethical responsibilities, this article does not identify the company or any of the individuals who participated in the research. Five mines were studied: one open-cut and four underground mines. Mine sites were selected in consultation with the participating company, with the intention of including a range of safety performance outcomes. Each mine site visit occurred over a two-day period in which a representative sample of both staff and workers participated in semi-structured interviews (62 in total). A typical sample of 12 interviewees from each mine included the general or operation manager, the mine manager, shift or process supervisors, the under-manager, the safety officer, engineering (mechanical and/or electrical) managers, crew leaders (deputy under-managers, team supervisors), and mine workers (the "crew") and tradesmen (including local check inspectors/site safety representatives). In most cases, the balance of managers to employees was split approximately evenly. Each interview lasted approximately 40 to 60 minutes.

Each interview was conducted in private, with interviewees informed in advance that all material arising out of the interviews would be treated confidentially and used anonymously in any subsequent publications. In addition to the mine site interviews, representatives from corporate management, including chief executives, safety managers and operational managers, were interviewed. A total of six corporate

interviews were conducted. Questions took the form of a series of prompts, with only those questions that elicited a substantive response being investigated in greater detail. This approach ensured that a diversity of perspectives was explored and that respondents were not constrained to address only particular preconceived issues. Qualitative material generated by the interviews was supplemented by reviews of both the domestic and international literature, including the organisational and safety culture literature.

In addition to quantitative data, the mining company provided comprehensive and historical internal policy background and safety statistical and audit data that were used to determine OHS performance at individual mine sites.

Results

Two key findings emerged from the research. First, the mine sites demonstrated substantial differences between each other in their safety performance. Briefly (because this is dealt with in detail in a related article[16]), internal safety statistics and audit data were aggregated and weighted to yield a single percentage score for each mine. This ranking produced a wide variation in safety performance, with an approximate 100% difference between the best and worst performers (the spread of rankings, from best to worst, was as follows: mine 1 — 51%; mine 2 — 62%; mine 3 — 77%; mine 4 — 96%; and mine 5 — 98%). This quantitative finding was largely consistent with qualitative rankings provided by interviewees.

Significantly, this variation in safety performance was registered, despite the presence of a sophisticated, comprehensive and uniform corporate OHS strategy. In particular, corporate management has increasingly sought to impose ambitious and uniform OHS management standards across all of the company's mines, against which they are regularly and comprehensively audited. In order to comply with these standards, detailed and uniform safety management systems have been introduced at each mine. The mines must also conform to a further set of OHS standards issued by the international headquarters, including, again, regular audits conducted by an international audit team. Monthly and quarterly meetings are held, and individual mine managers are required to report on OHS processes and performance, including not only conventional safety statistics, but also positive OHS performance indicators (which are intended to anticipate future safety performance).

In addition, the company has a behavioural-based safety program across all mines under which senior and middle managers are required to conduct a minimum number of "safety observations" per month. Finally, all OHS systems, reporting and actions at each mine are included on a single interactive database that is accessible across all mines and corporate management. Clearly, the company has gone to considerable lengths to minimise the differences in OHS systems and processes, and it appears implausible that differences in management systems and processes are the primary source of variation in mine site safety performance. One may also discount the influence of different regulatory requirements, as all five mines operate in the same regulatory jurisdiction. Finally, there was no consistent relationship between mine site physical and/or technical factors and OHS performance.

A second, and related, finding was that the variations in OHS performance persisted, and were consistent, over time (in this respect, the safety statistics and audit data covered a five-year period). This is significant because several of the mine sites in this study had experienced numerous mine manager (and senior mine management) changes, sometimes in quick succession, and yet this had no detectable impact on the trajectory of each mine site's OHS performance (as measured by the aggregated data). The mine sites were also subjected to successive waves of top-down corporate management OHS overtures and initiatives over this same period. Again, this had no discernable impact on the relative difference in safety performance between the mines (although there was a steady and consistent improvement over the five-year period across the mine sites as a whole, this was dwarfed by the persistence of differences in safety performance between the mines — if anything, the differences grew over time).

These findings strongly suggest that mine site bottom-up culture, including workers, but also middle and line management (as opposed to senior mine management and mine managers), is not only resilient, but also resistant to top-down corporate and senior mine site management influences on OHS performance. As one worker noted:

> "I wouldn't trust them [corporate management] as far as I could throw them . . . The safety stuff is just to cover their arses."

And such views were not restricted to workers. As the following quote demonstrates, middle management can also have strong misgivings about corporate OHS interventions:

> "They have totally unrealistic expectations about our workloads. Every time somebody in corporate dreams up a new safety initiative, I shudder because it just makes my job more difficult . . . and [it] doesn't change the reality — it just adds more paperwork."

The overriding finding, then, is that mine site culture is a primary determinant of OHS performance ranking among the five mines included in this study — a finding that is further supported by the fact that the five mines displayed distinctive cultural characteristics (again, this is explored in more detail in a separate article by Gunningham and Sinclair[16]). The reasons why and how bottom-up mine site safety culture can wield such clout in determining OHS performance outcomes, and the circumstances that give rise to this powerful culture in the first instance, are discussed below.

Discussion

Given the findings outlined above, what are the circumstances that may make coalmining particularly susceptible to a bottom-up formation of safety culture, and consequently, allow divergent mine site-specific characteristics to emerge? Several features of the coalmining industry facilitate such an outcome, and these are examined below.

Organisational culture is often seen as being "the way we do things around here".[17] The "around here" of coalmining is particularly localised and, both practically and figuratively, a long way from corporate management. Mine sites are geographically

remote, making it difficult for corporate management to exercise direct control, and particularly difficult to conduct regular visits. The high degree of remoteness does not end there, however. Mine workers are also physically remote from localised mine site management. In some mines, particularly underground mines, travel times can be up to half an hour from the surface to the "coalface". Finally, there is a paucity of computer access at underground work sites. This means that workers are, effectively, isolated from one of the principal means of communicating management decisions throughout the organisation. It is not surprising, then, that workers can and do spend virtually entire shifts without any senior or middle management contact, let alone direct supervision. Collectively, these circumstances conspire to create a high degree of physical and communication remoteness of mine site workers from both corporate and senior mine site management.

Another relevant feature is the longevity and insularity of the workforce. The average age of workers in most of the mines visited was approaching 50 years, with many of the workers having spent their entire working lives at a single mine, or at a very small number of mines. Further, many of these workers have worked side-by-side with a common set of colleagues, often in small team environments, in very confined spaces, for the majority of their working lives. This interconnectedness extends beyond the mine site too, with many workers having grown up together and continuing to live in the same communities, often socialising together and even maintaining a tradition of allocating worker positions to the children of existing mine workers. This creates a rare degree of worker cultural insularity. As one worker described it, this can entrench attitudes and behaviours:

> "Here . . . we've being doing it this way for 30 years, we're not going to change the way we do it. I've had many arguments . . . that because they have done a job a certain way for 10 years, doesn't mean it's been done the right way for 10 years."

The longevity of the workers can be sharply contrasted with that of senior and middle mine management, which are relatively transient, with rotation between mines and movement between companies common across the industry. In addition, during the average lifespan of a worker, the actual mine ownership can change several times. It is not surprising, then, that many workers, witnessing a procession of different management over the years, view themselves as the true custodians of "their" mine site. From their perspective, it is management that comes and goes, while they are "in it for the long-term". In the absence of stable management engagement, leadership inevitably flows to "informal high-status workers". These are usually experienced workers, often with a union role, that exert a disproportionate influence over the attitudes and behaviour of other workers, especially younger, new recruits. In extreme cases, such high-status workers may even attempt to sabotage management OHS programs, for example, by submitting fictitious incident reports. Conversely, they may play a crucial role in facilitating management OHS initiatives, for example, an extremely controversial behaviour-based safety program was successfully introduced because it gained the acceptance and support of the most influential worker subgroup.

The hierarchical nature of many coal mines facilitates these phenomena. Most mine sites operate on the basis of distinct work shifts, namely, day, afternoon and night. The significance of this lies in their relative attractiveness from a lifestyle point of view. For the vast majority of workers, for fairly obvious reasons, being placed on the day shift is the most desirable outcome, followed by the afternoon shift, then, lastly, the night shift. This introduces a hierarchy within the workforce, with those on the day shift at the apex. The union often controls the allocation of workers' shifts on the basis of worker longevity. The net effect is that the vast majority of new recruits work the night shift.

In addition to the shift hierarchy, there is also a task hierarchy. Just as the older recruits are able to access the preferred shifts, so too are they able to secure the more desirable tasks on those shifts, for example, operating key machinery. There are two important ramifications of this hierarchical distribution. First, as each worker progresses from the undesirable to the desirable shifts/tasks, so too are they exposed to, and subsumed within, the more entrenched "us-and-them" attitudes and sometimes laissez faire OHS practices that are often prevalent in the mining industry (it is very difficult for an individual to resist the views of the numerically superior and more senior/experienced workers who surround them). As one respondent noted:

> "There are people here who walk on one side of the line and, I believe, really don't necessarily want to be on that side of the line, but they're there because of peer pressure . . . I think that's where culture lies, yeah."

The above quote highlights the role and power that mine site peer pressure, particularly by informal high-status workers, can wield in generating, at best, ambivalence towards and, at worst, active resistance to, corporate OHS initiatives. This observation was also supported by middle managers at a number of mine sites. In particular, they reported that night shifts, with their more recent, younger recruits, have less entrenched and anti-management attitudes and a greater willingness to adopt new management initiatives, including those directed at improved OHS outcomes. In fact, night shifts were very often credited with being the most productive and safest at many of the mines (this was an interesting finding, given that other studies suggest that night shifts have more OHS problems; however, it was not possible to independently verify this claim, and it was also not possible to disaggregate company quantitative data on the basis of different shifts).

Closely related to hierarchy is the issue of union dominance. Indeed, coalmining is one of the most heavily unionised sectors in Australia. Not only has union membership been high, but the degree of control exerted by unions has been equally high, and only in recent times has this begun to wane (although this has occurred to varying degrees across different mine sites and mining companies). Union solidarity among the workforce has, to a large degree, shaped attitudes and relationships between workers and management at mine sites. Thus, workers have direct and deep exposure to an alternative "world view" to that being promulgated by corporate and mine management and, in this respect, OHS issues often fall victim to a "tug-of-war" between these two competing views. As one respondent explained:

> "I don't think they're [management and workers] all that much closer than what they were when I first got here, because there's always a large suspicion between the two. 'Why is management doing this?' 'Oh, it's because they haven't got safety in mind, it's because they want to do this, it's all saving money, or whatever.' And I suppose management are saying, 'Well, why aren't the blokes doing it this way?' And they'll come up with a reason, whatever reason, but, you know . . . At times, I feel that the management are trying to relay information, but whether it's past history, catching up with the blokes, past disagreements, that's still lodged in the minds of the men, there's still that suspicion."

In addition to informal high-status individuals and the role of unions, the other major driver of a bottom-up safety culture is line managers (also called crew leaders) who lead teams of six to 10 workers at the coalface. There was unanimous agreement across all five mine sites that line managers are uniquely placed to influence safety culture and OHS performance, particularly through establishing minimum standards and attitudes among the crews. For example:

> "Front-line supervisors have a critical role to play in raising safety awareness."

Equally, however, there was a widespread perception many fell well short of this ideal:

> "The hardest job is getting the front-line supervisor to do their safety job properly. You have got to set the expectation, help them to achieve it, hold them accountable, educate where necessary, and discipline is also an option."

It was claimed that this is because line managers were not given the necessary support by management, and did not have the appropriate management/leadership skills.

Another related problem was that line managers were "sandwiched" between workers and management. This can lead to questions by both management and workers as to where their loyalty truly lies:

> "The front-line supervisor is the conduit between management and workers — often seen by the workers as part of management, and seen by management as part of management, but are sometimes treated by managers as part of the workers. They run with the foxes and hunt with the hounds."

From the perspective of several line managers at middle and low-ranked mines, management support for their role was often less than forthcoming. As one noted:

> "We were told we were going to be made part of management and all the rest of the shit and we've always heard it that many times it ain't funny and we went close at one stage. Our enterprise agreement is with the staff now . . . and we get paid staff superannuation what the staff get and a few things like that, but that's where it stops. They were going to integrate us into the management system and it just sort of fell over I think."

The above suggests that multiple factors contribute to the development of a bottom-up safety culture at mine sites, and that this, in turn, is likely to be resistant to corporate intervention — at least without serious engagement with site-specific issues.

Conclusion

In contrast to the prevailing top-down view of safety culture, this research revealed a range of mine site characteristics that influenced the success or otherwise of corporate management's OHS initiatives. In particular, it was found that mine management and, in many cases, the workers themselves were the principal players shaping the interpretation and implementation of management tools, with corporate management little more than a shady background presence. That is, safety culture was found to be a predominantly bottom-up phenomenon. This, in turn, had a tangible and persistent impact on mine site safety performance over time.

Of course, it is possible that these findings are exceptional and largely confined to the particular circumstances of the coalmining industry, but this is unlikely. There is growing (albeit, at this stage, limited) evidence to suggest that the above findings and conclusions have much wider application. For example, the commercial shipping industry shares many traits with the coalmining industry: operational sites are very remote from corporate offices, crews work in close proximity to one another for long periods unsupervised, accidents have the potential for catastrophic consequences, and a single "site-level leader" (the ship's master — equivalent to a mine manager) rather than corporate management has the most influence on crew behaviour.[18] Accordingly, the shipping industry has begun to recognise the importance of fostering a positive safety culture on individual ships, rather than across the fleet as a whole.[19]

To the extent that the findings of this study into one Australian coalmining company resonate across other mining companies and, indeed, other industry sectors, important policy implications follow. Not least, site-specific factors matter; without engaging directly with the circumstances and subcultures that exist at individual sites, and that involve site-level management and the workforce, progress in reducing work-related injury and disease is likely to be seriously constrained. Only by focusing on a range of bottom-up, site-specific historical and cultural factors are corporate-driven OHS interventions likely to realise their potential.

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