

an ornamental purpose in the research enterprise: they must, in their accounts, carefully separate description from evaluation, and they must explicitly provide the criteria they are using in making their evaluations. Moreover, purely ethnographic accounts that seem to explain organizational performance are unlikely to be convincing. As the research methods literature has long emphasized, observational measures of organizational performance may be most valuable when they are complemented with more objective data.

In his (successful, I think) efforts to prove that Japanese firms are not benevolent families, Mehri focuses too much on openness, creativity, and egalitarianism and assumes that any firm that does not meet his personal standards of openness, creativity, and egalitarianism is not a good company. This is probably a big mistake when comparing Japanese and U.S. companies, because Japanese and U.S. employees will likely interpret openness, creativity, and egalitarianism differently. My guess is that, if allowed to choose, Japanese workers would choose Japanese over U.S. systems, just as U.S. workers would choose U.S. over Japanese systems. We need more ethnographic accounts, like Mehri's, of life in Japanese firms to supplement and complement contemporary scholarship and its emphasis on quantitative, survey-based research. But in future ethnographic research on Japanese companies, scholars may want to be more careful about what they claim their approach can really reveal about the complex relationship between practices of organizational control and organizational performance.

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- Shouldering Risks: The Culture of Control in the Nuclear Power Industry***, by Constance Perin. Princeton, NJ: Princeton University Press, 2004.

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Constance Perin, a cultural anthropologist, has done a masterful job of entering the working life of nuclear power generating plants, where people need both contextual and technical wisdom to shoulder lethal risks. This book essentially sets the agenda for second-generation studies of high-reliability organizations (HROs). In nuclear power plants, although electricity is presumably the primary output, the more important output is civic and market trust in manager and expert competence. Ensuring trust is vital, because the operating environment in nuclear units is so hostile to human activity. To paraphrase Phil, the electrical maintenance manager at the Charles Station plant, "If they had realized what they were looking at, they would have been running out of the room screaming" (p. 240). Many nonrepetitive tasks are concentrated in an environment made dangerous by temperature, pressures, fluids, mechanical power, electricity, and the sheer weight of the equipment. The plant is safest when it is running, which means that maintaining the capability for safe shutdown and startup without uncontrolled radioactivity release is the central concern. Designers, operators, and managers, however, deal with this concern differently, which tends to produce "an infrastructure of conundrums" (p. 263).

Perin wants to understand the ways of thinking that experts bring to bear in order to reduce operating risks. In her interviews she listens for categories that operators, managers, and maintenance people think with, meanings they assign, practices they believe will be effective and disappoint, arguments they make and feel they can make, ways they negotiate differences of opinion, and how they juxtapose technical expertise with common sense. Perin examines four events: a leaking valve and attempted repair, an inadvertent turbine shutdown when the wrong switch in the wrong cabinet is closed by a maintenance person working with a flawed checklist, a security lapse when a person with a disqual-

ifying past record is on the verge of being given unlimited access to the reactor, and a near serious accident when a melting step-up transformer in the switchyard is finally shutdown twenty-seven hours after suspicions are raised about its functioning. In each event, Perin examines the reports of the teams that investigated the incident, interviews the principals in the events, and then adds her own observations, reflections, insights, and excursions.

What does she find? She finds that three different logics are in contention: calculated logic (designers estimating risk), real-time logic (operators handling risk), and policy logic (managers fashioning policy focused on blame and penalties intended to manage dilemmas between the first two logics when production and profit are threatened). The first two logics live side by side. "But, as things stand, industry experts and station managers understand these logics less as a partnership than as a hierarchy; real-time logics should only execute and implement control methods handed down by reactor, production, and business risk calculations" (pp. 200–201). Each logic is part of a culture of control. Each logic generates tradeoffs, conundrums, and paradoxes. The issue is not just do we need a shutdown and can we do it safely, but, more important, what will it cost to purchase power to fill needs we can't fulfill directly, how will a shutdown affect our plant's reputation with the public and Nuclear Regulatory Commission, and what will happen to my personal reputation and career progression? "If you take a 1200 megawatt plant off line you've made a name for yourself and you don't want to make a wrong call" (p. 191). The result is expectable outcroppings of complexity, where people keep "untying the knots that the complex system can get itself into" (p. 203).

A resolution of these quandaries is not possible, since no "heroic technology" is perfectible once and for all. Instead, doubt and discovery are what keep people safe (p. 263). But therein lies the problem and the possible signature of second-generation organizational studies of risk reduction. "The principle of command and control to assure safe shutdown depends on the principle of doubt and discovery to identify the impediments" (p. 214). For doubt and discovery to be credible, the value that the industry now places on quantitative, measurable, hard, objective, and formal knowledge needs to be moder-

ated. Doing this takes an inclusive negotiating process that demands explicit rationales and robust analyses that keep dilemmas explicit and discussable, situation by situation, tradeoff quandary by quandary. Relevant inputs include memories, observations, experience, judgment, best practices, lessons learned, heuristics, and rules of thumb. But since these inputs to real-time logics resemble the inputs used when people confront everyday ambiguities of living, real-time logics are believed to be less rational if not nonrational in science- and technology-driven enterprises (p. 203). Nevertheless, the path to safe shutdown depends on the "interpretive competence" of the people who define, acquire, produce, interpret, and use "information" and "data" to reduce inevitable operating uncertainties. In another insightful turn of phrase, the events associated with these tradeoff quandaries are said to "demonstrate that station experts are unwillingly enrolled in a perpetual master class in irony: control strategies and techniques may make it more difficult to reduce risk and may increase it" (p. 10).

As Perin learns more about ways in which people think about risk, she also learns more about the organization in which the thinking occurs. Since orderliness itself is so often in question, she finds it more appropriate to think of nuclear plants as "enterprises." By this she means "a collective of people with diverse perspectives, skills, and responsibilities trying to maintain momentum toward several simultaneous goals" (p. 18). Tradeoff quandaries become central in such a depiction. And *safety* in an enterprise seems an inappropriate term since it implies an absolute condition. Instead of *safety*, Perin prefers the image of *reducing* and *handling* risk to capture the realities and dynamics of the (tradeoff) quandary (pp. 12–13).

Perhaps the most important contribution of the book is the proposal that a culture that seemingly coheres around the calculated designer logic actually holds together because of real-time logics that are built of doubt and discovery. This is a natural foot-in-the-door for Charles Sanders Peirce's important but neglected concept of abduction (p. 215). Deduction proves that something must be; it is the necessary consequences of a pure hypothesis. Induction does nothing but determine a value. Abduction is used to form an explanatory hypothesis and suggests that something may be. Abduction

is an act of insight that is markedly different from the additive, linear, top-down logic of calculation.

There is a growing body of work, articulated by people like Harrowitz (1988) and Patriotta (2004), that argues that the conjectural paradigm as exemplified by abductive reasoning is the foundation of inquiry. To imagine reality is to start with some tangible clue and then to discover or invent a world in which that clue is meaningful. The combination clue + world + connection is quite similar to the basic requirements for sensemaking: clue + frame + connection = sense (Weick, 1995: 110). The essence of conjecture and abduction is to take a fragment, such as an unexpectedly high temperature in a transformer, and then hypothesize an "axis of meaning" that suggests a world in which that discrepant temperature would be a meaningful symptom. Given an observed fact, a rule suggests itself to explain the origin of the observed fact. "The rule, then, generates the intelligibility of the observed fact, and the observed fact is read through the rule" (Harrowitz, 1988: 183). Thus, clues enable people to "leap from apparently significant facts, which could be observed, to a complex reality which—directly at least—could not" (Harrowitz, 1988: 88, 184).

Again, even though doubt, discovery, and interpretation fulfill technologists' intentions, and even though real-time logics put intentions into context to find out what they mean, and even though the advice vocabulary used in the nuclear industry admonishes people to be alert, vigilant, and candid, interpretations continue to be dismissed as "untheorized practices" (p. 223). A production mentality works against abduction, doubt, and curiosity.

An unexpected by-product of Perin's analysis is a clear indication of just how difficult the managerial task can be. For example, a "typical" tradeoff quandary is one in which, to keep radiation doses within acceptable levels, health physicists ask for shorter periods of work from a larger pool of people, but this raises costs, which may negatively affect market standing and investment. The role of management is to walk into quandaries such as these and, ideally, to "walk out with a consensus among conflicting, contradictory, or paradoxical concerns and commitments sufficient to realize the best intentions of all" (p. 19). Furthermore, managers work in two worlds: public and regulator. To the pub-

lic, managers argue that an accident won't happen here. To people inside the plant they argue that an accident can happen here, so take precautions. Robert Chia's insightful description of managing fits the case of nuclear managing quite well:

Managing is firstly and fundamentally the task of becoming aware, attending to, sorting out, and prioritizing an inherently messy, fluxing, chaotic world of competing demands that are placed on a manager's attention. It is creating order out of chaos. It is an art, not a science. Active perceptual organization and the astute allocation of attention is a central feature of the managerial task (Chia, 2005: 1092).

Routines, normally thought to be reliable sequences that form the backbone of risk reduction, turn out to be a lot more troublesome than expected. A microcosm of the issues is apparent when Dan, an outage manager says, "I didn't think to think about the meanings of what was going on. I knew what was going on, I knew pretty much what the plan was, and I didn't think to think what else could have happened if the original plan went awry" (p. 94), which it did. Routines and overconfidence tend to commingle. People doing "routine" jobs don't ask about contingencies or about the worst thing that could happen. "If we've done this a hundred times, we don't ask what could happen, what if?" (p. 94). Notice, by the way, that if Martha Feldman (2003) is right that routines are actually flexible and enacted differently each time they are deployed, then people in nuclear plants who claim they have done something 100 times actually may have done 100 slightly different things, each of which has been adapted to a slightly different context. The trick is to be attentive to these differences and not to treat them as essentially in the family of events known well.

In summary, Perin has written what could be called a manifesto for the second generation of studies involving HROs. The first generation of work that established this mainstream was developed by people like Karlene Roberts, Charles Perrow, James Reason, Paul Schulman, Gene Rochlin, Todd LaPorte, and Scott Sagan, with Diane Vaughan's work on the Challenger disaster, John Carroll's work on learning, and Scott Snook's work on interdependence bridging to newer themes. Taking the lead from Perin, one would expect that second-generation studies of high-reliability systems will dig deeper into

doubt and discovery > command and control, the importance of interpretive competence > computational competence (Lant 2002), a more in-depth treatment of how people manage tradeoffs between costs and safety, enumeration of many more of the oppositions that enter into the quandaries associated with high-stakes functioning, and a closer look at trust. Trust turns out to be tougher and less sturdy than it looks. For example, "competitive pressures, layoffs or attritions coupled with the sheer passage of time, bring people with fewer 'years in the trenches' into a trust and credibility system whose chief criterion has been those years" (p. 197).

Second-generation HRO studies are likely to take a closer look at the liabilities of specialist silos and at the necessity to develop a better understanding of interdependence and interorganizing. "The crux of reactor control [as well as the crux of control in most risky endeavors] is configuration control: keeping track of expectable interactions with a complicated, often opaque system and responding promptly to those not expected. Close coordination among many specialists' perspectives and knowledge is key" (p. xvi). Without transspecialty competencies, people think inside the box about the causes of failure, and, when the box is unresponsive, they tend to wash their hands of the problem and blame others. Thinking in compartments, whether because of experience in a function or in the military, tends to enact machine bureaucracies with silos. The alternative, in Perin's view, is to think ecologically and to acknowledge overlaps and interdependencies in plant activities. Finally, second-generation inquiry is likely to accord more prominence to the role of abduction, since it is so crucial to making sense of the unexpected.

*Shouldering Risks* occasionally labors under well-intentioned but confusing graphics (e.g., pp. 37, 243) or cumbersome sentences (e.g., "Competitive pressures that market order displaces onto the 'very talented people' responsible for valve maintenance seem to have made it 'a waste of time to put all these contingencies in place,' time being money"; p. 83). But these lapses are minor. Much more important is the fact that this book is a major, solidly grounded, agenda-setting piece of work held together by an amazing blend of concepts and evidence!

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***Unleashing Change: A Study of Organizational Renewal in Government***, by Steven Kelman. Washington, DC: Brookings Institution Press, 2005.

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About the time that author Steven Kelman resumed his duties as professor of public policy at Harvard University's John F. Kennedy School of Government—after serving a politically appointed four-year term as the administrator of the Office of Federal Procurement Policy at the U.S. Office of Management and Budget, during which time he conceived the study on which his book is based—two of my colleagues at the University of Michigan—Karl Weick and Bob Quinn—were completing a comprehensive review of the organizational change literature. Weick and Quinn noted, in their review, that concepts of change, such as the continuing centrality of Lewin's (1951) three stages of change (unfreeze, change, refreeze), the assertion that one cannot understand a system until one tries to change it, and the enduring concept of resistance to change, "have been surprisingly durable over the years" (1999: 363). Arguably (cf. the *Academy of Management Journal* 2001 Special Research Forum on Change and Development), little has changed in the intervening years.

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