wealth creation" than it delivers. In contrast to the judicious consideration and broad data marshaled by Mowery and his colleagues, Shane's work is more narrowly grounded and less deeply considered: using Stanford data, perhaps only 40 percent of university disclosures are ever patented, and only some of those are licensed; of those licensed, only some 14 percent are to spinoffs, Shane's target. While Shane cites some standouts like Lycos, Cirrus, and Genentech, Mowery and his colleagues are after far bigger game in addressing Bayh-Dole and U.S. patent policy, and Mowery et al.'s sheer mastery of innovation and economic history alone would make their volume worth a read, while its extensive and specific data and well-considered findings underline its value—especially at 40 percent of the price of Shane's book. Shane's book is a specialist's effort. Mowery et al. may well reshape the discussion on Bayh-Dole and intellectual property. It certainly should.

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Other Reviews

Whole World on Fire: Organizations, Knowledge, and Nuclear Weapons Devastation.
Lynn Eden. Ithaca, NY: Cornell University Press, 2004. 365 pp. $32.50.

According to Lynn Eden, "Nature is read from inside institutions" (p. 288). When it comes to reading nature in the form of damage produced by nuclear weapons, analysts read nature as behaving predictably when damage from blast pressures is examined, but unpredictably when damage from fire is examined. What analysts fail to see is that this conclusion is an artifact of their own organizational activities. It is driven by self-reinforcing knowledge-laden routines that date back to World War II, not by truths inherent in nature. This differential, path-dependent understanding of blast and fire is at the center of Lynn Eden's masterful analysis of the incomplete prediction of nuclear weapons damage. This partial understanding is important because the neglected effects of fire appear to be two to five times greater than the effects of blast. To some planners, these larger effects are "gravy." To others, they seriously understate the lethalness and "collateral damage" of nuclear explosions. To get some idea of the truly unimaginable scale of destruction involved here, if a 300-kiloton bomb exploded 1500 feet above the Pentagon on a clear day (the atomic bomb dropped on Hiroshima was 15

kiloton), the Lincoln Memorial, which is 1.3 miles away would be hit by thermal radiation that is 5000 times brighter than the desert sun at noon (p. 19). It is this thermal radiation that ignites surfaces and spreads nuclear damage farther than do the blast effects, which consist of pressures on structures from the front side of the blast wave and drag pressures created by winds on the back side of the blast wave. The title of the book, "whole world on fire," itself comes from a nuclear weapons test on November 1, 1952 (test shot Mike) in which the magnitude of the shock wave, heat, and light produced by the equivalent of 10 million tons of dynamite surprised even the most seasoned observers, who exclaimed, ". . . it was as if the whole world were on fire" (p. 147). Fire may have been highly salient in the moment of test shot Mike, but it was far less salient away from the test site. This book tells the story of why that was the case.

Lynn Eden, a Michigan-trained sociologist who is currently associate director for research at Stanford's Center for International Security and Cooperation, combs through a daunting mass of interorganizational detail to show how small early intelligence efforts in WWII that were focused on precision bombing and the blast damage of discrete, industrial targets drew attention away from incendiary bombing and the mass fire damage of large continuous areas. This pattern of unequal attention and resources became magnified as it was carried over to the atomic and nuclear eras, when it eventually led to the absurd product of plans for precision nuclear bombing. To make sense of this carryover, Eden grounds her research in the concepts of organizational frame, knowledge-laden routine, path dependence, problem solving, and incremental change.

These concepts are tied together by a fundamental self-reinforcing cycle in which frames, in the form of preferred ways of defining problems and searching for solutions, shape actions and activities, which then determine capacities, experience, and routines, which further affect how problems and solutions are understood, and so on (p. 56). For example, analysts saw atomic weapons as blast weapons, encoded predictions of atomic blast damage in a routine that generated vulnerability numbers for structures, and these numbers were mainly tweaked when it came to predicting the effects of hydrogen bombs. Equivalent encoding for fire damage did not occur until the mid '80s, but even then it did not achieve an equal footing in models of blast damage.

The notion of frame is central to the analysis. Eden defines frames as "problem representation and solution requirements within which are embedded organizational goals, assumptions and knowledge about the world and traces of previous definitions of problems and solutions" (p. 224). Frames pinpoint what is to be called a problem and what is to be deemed a solution. Frames mobilize expertise and resources and result in knowledge-laden routines. Two frames are basic to Eden's analysis, the blast frame and the fire frame. Within the blast frame, problems and solutions are defined by assumptions that the goal is to knock down vertical targets that enable the enemy to wage war, that pinpoint precision bombing should be directed at discrete economical-

ly important targets, and that structure vulnerability is what matters. The fire frame represents problems and solutions in such a way that the goal is to undermine civilian morale by knocking out cities rather than selected structures and that the means to cover area and horizontal targets is by means of mass fire rather than explosive blast force. The blast frame had a slight early advantage that rapidly became magnified. That slight advantage came from a combination of opposition to civilian bombing, Taylorism, which made people aware of the importance of industry, early experience in the air force with coastal defense, in which there is a premium on hitting ships, and the army's long-standing tradition of precision marksmanship (p. 70).

This early positioning is central for Eden's argument that differential attention to blast and fire damage is a result of path-dependent processes. As a result of learning, high research costs, interdependence, and self-reinforcing expectations, planes, bombs, bombsights, and training were all tied together to produce blast damage of precision targets. What carried over from era to era were personnel, goals, knowledge, and "an inherited sense of problems to be solved and solutions to be sought" (p. 94). New analyses had to be translated into routines consistent with past damage-predicting routines. As the understanding of blast predictability deepened, understanding of the other effects, such as fire, became more shallow, uneven, and incomplete, which led to the conclusion that fire damage itself was unpredictable. A classic self-fulfilling prophecy unfolded: fire damage was judged too unpredictable to be studied, so research and development funds were directed elsewhere, fire received relatively little attention and, sure enough, fire damage was unpredictable.

But this movement along the blast-damage path was not a complete lock-in. And herein lie lessons for students of path dependence and organizational change. For students of path dependence, Eden shows that lock-ins are breachable if the proposed changes are directed at the level of knowledge-based routines. Harold Brode, in the 1980s, significantly advanced the understanding of the physics of fire when he rewrote assumptions about fire dynamics that had been used up to that point. His insight was that mass fires generate their own environment and are not nearly as subject to external environmental influences as previous investigators had thought. His genius was to phrase this insight in categories that could be incorporated into the dominant knowledge-laden routine used by the nuclear blast community, the vulnerability number. Brode framed his findings for fire in units of analysis much like those used by blast analysts. Brode spoke of three sources of ignition and their effects: thermal radiation, blast disruption (e.g., fires from broken gas lines), and fire spread (e.g., embers thrown through the air). This conceptualization of fire damage diffused to higher levels in the targeting community and more widely than had been true for previous formulations of fire damage. But the diffusion stalled as a result of budget cuts, rotation of personnel, and the changing status of threats from the USSR. When the fire model got stalled, analysts pulled back from a more nuanced treatment of fire-blast interactions to a simpler, less nuanced

focus on what they already knew, blast effects. Organizational scholars are thus left with the suggestion that path dependence is malleable, but only up to a point. And they are left with the suggestion that continuous incremental change may be more effective than deep revolutionary episodic change. But the primary picture is one in which unexpected external forces seem to favor internal practices that gain their power from the reification of past choices.

This book is remarkably helpful to organizational theorists. Eden manages to keep multiple levels of analysis in play. While this is not an actor-centered analysis, specific actors and their roles are given considerable attention. Her summary of the argument in a 2 x 2 table, which combines the extent to which physical processes are understood with whether problem solving is consistent with the best contemporary standards of professional performance, enables her to locate the blast damage story in relation to the Titanic disaster, Ford Pinto gas tank fires, the Cerro Grande prescribed wildland fire that escaped into Los Alamos, the Grumman bus frame collapse on the streets of New York, childbed fever, the Tacoma Narrows Bridge collapse, and buildings that don't collapse. The focus in her model continues to be on how physical processes are understood and represented in documents and routines. Inadequate understanding comes from at least two sources. Either requisite knowledge is available but access to it is thwarted by the way in which problems and solutions are identified. This is the case with the partial prediction of nuclear weapons damage. Or inadequate understanding can mean simply that the problem is beyond current ability to understand it, as was the case with childbed fever and the processes used to manufacture steel for the Titanic.

The persistent focus on "collective cognitive representations of the world" helps articulate the ways in which path dependence is mediated cognitively. Problem solving and sensemaking are seen to be more intimately related than has been acknowledged in the existing literature. Students of sensemaking often make a big deal about the primordial "flux" out of which events and problems are bracketed and labeled. Eden assumes that the flux is bracketed in terms of problems. And the closest she gets to pure "flux" is analysts reflecting on bombing effects during the Second World War. The interesting question this raises is, is there ever mere flux? Hypothetically yes. Practically no. The assumption of flux may well be a modern-day reincarnation of the much older assumption of a tabula rasa. Sensemaking begins with the same old blank slate, only now, like so many other things, that slate is perpetually in motion.

Eden does move beyond problem solving when she acknowledges that actors don't just solve problems. They also explain why their actions make sense and why their chosen course of action makes more sense than do their unchosen paths (p. 56). In Eden's view, what is important about these accounts is that in constructing them, people reify their past choices and treat them as concrete material properties of the world rather than as personal constructions. In this move, Eden suggests a cognitive mechanism for inertia. Inertia is seen as an active accomplishment, not a passive default. The

relative benefits of current activity, compared with other options, increase over time. As a result, current routines make more and more sense.

In the end, this book alerts us to the persistence of templates and to the "bounded change" that occurs when people try to update these templates. Eden's story is about the organized persistence of experience from WWII, just as the recent 9/11 Commission's story (National Commission on Terrorist Attacks, 2004) is one of the organized persistence of experiences with nations rather than loose coalitions as the source of terrorism. The antidote in both cases, however, is not to develop ever more gritty worst-case scenarios. The problem with worst-case scenarios is that people don't pay enough attention to problems they are *not* trying to solve and what the worst-case scenarios for those problems might be (p. 303). To the credit of contemporary intelligence analysts, they at least recognize this gap. As the 9/11 Commission noted, "Beneath the acknowledgement that Bin Laden and al Qaeda presented serious dangers, there was uncertainty among senior officials about whether this was just a new and especially venomous version of the ordinary terrorist threat America had lived with for decades, or was radically new, posing a threat beyond any yet experienced. Such differences affect calculations about whether or how to go to war" (National Commission on Terrorist Attacks, 2004: 343).

Analysis of ways to correct fundamental blindspots in organizations that are infused with path dependence, problem sensing built into routines, and vested interest is a serious challenge for scholars of knowledge creation and knowledge management. Organizations are good at solving new problems, but not necessarily at solving novel problems. As Eden makes clear, blindspots are tough to remedy. They are clearly tougher problems to solve than organizational scholars typically encounter, given their own path-dependent frames, inherited templates, and knowledge-laden routines.

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Japan's Network Economy: Structure, Persistence, and Change.

James R. Lincoln and Michael L. Gerlach. Cambridge: Cambridge University Press, 2004. 409 pp. $80.00.

A book on networks in Japan speaks to two different agendas. First, work on the causes and consequences of interor-