

Problems of American Industry

The Competitive Challenge. Strategies for Industrial Innovation and Renewal. DAVID J. TEECE, Ed. Ballinger (Harper and Row), Cambridge, MA, 1987. xii, 256 pp., illus. \$26.95. Ballinger Series on Innovation and Organizational Change. Based on lectures, Berkeley, CA, 1984–85.

This book is a collection of nine papers with an introduction and conclusion by the editor, who also contributed one of the papers. The collection is divided into two parts, of which the first is entitled American Industry in International Competition and the second The Theoretical Context of Strategic Management. This division is largely an artificial one, as in fact all the papers are about strategy, whereas only two of them are about international competition. However, the papers are nevertheless of great interest to external observers of the American scene, as they illustrate rather well the state of the American debate on corporate strategy and (unintentionally) why Japanese competition is proving such a problem for American firms. It is what the papers do *not* say that is of the greatest interest, both for Americans and for foreigners.

But before coming to that topic: What they do say is also important and represents a substantial original contribution to innovation studies and the worldwide literature on corporate strategy. The chapter by the editor, "Profiting from technological innovation," is a particularly interesting one in which the empirical evidence and the theoretical argument are closely related. Teece is concerned to analyze the importance of "complementary assets" for the success of technical innovation in relation to the "appropriability regime." He contrasts the relative failure of the British electronic firm EMI with its CAT scanner and the relative success of the IBM with personal computers and of Searle with Nutrasweet.

EMI's technological sophistication and the award of the Nobel Prize to the inventor of the CAT scanner, Godfrey Hounsfield, were not enough to compensate for the lack of "complementary assets"—in particular, the failure to establish an appropriate marketing organization for the product. Although EMI's patent rights were ultimately upheld by the courts and earned a substantial royalty income, EMI was overtaken by both GE and Technicare and was then taken over by Thorn, who later sold the CAT scanner business to GE.

IBM, on the other hand, had fallen behind the competition in the area of personal computers in the late 1970s. It retrieved the situation through Estridge's design team in Florida, which produced a solid, reliable micro. Although the IBM PC incorporated some novel features, it was certainly not a radical technological breakthrough comparable to the EMI CAT scanner. However, it was a far greater commercial success, mainly because IBM knew how to exploit its complementary assets: in this case its manufacturing strength, market power, and reputation for reliability and service.

Searle's Nutrasweet has been an extraordinary commercial success and has enjoyed the additional advantage of a tight appropriability regime—an extremely strong patent position in the United States and elsewhere. However, Teece demonstrates that Searle has taken a number of steps to strengthen its complementary assets so that it will be able to meet the competition it will face as the patents expire. These steps include some relating to trademarks and brand image and some relating to manufacturing know-how.

Earlier international studies of success and failure in innovations, such as Project SAPPHO at the Science Policy Research Unit, had already demonstrated that innovative success depended on a close coupling of research, development, manufacturing, and marketing and could not normally be achieved without all-round strength in these areas. Teece has taken this analysis a stage further, particularly in relation to the "appropriability regimes," which vary a great deal in different sectors of the economy. He shows very clearly under what circumstances it may or may not be advantageous to subcontract activities outside the corporation and when it is best to keep them in-house.

This micro-level analysis leads him to a conclusion that is of the greatest importance for American industrial policy as well as for corporate strategy: the rejection of the "holow corporation" approach and emphasis on the key importance of in-house manufacturing capability for competitive survival:

The notion that the United States can adopt a designer role in international commerce while letting independent firms in other countries, such as Japan, Korea, Taiwan, or Mexico do the manufacturing is unlikely to be viable as a long-run strategy.

By an entirely different route this conclu-

sion is confirmed by Steven Wheelwright in the only chapter of the book that confronts head-on the problems of the declining competitiveness of U.S. manufacturing on world markets. Wheelwright attributes this malaise to management attitudes and strategies in all sectors of the economy. Describing the prevailing attitude as "static optimization," he contrasts it with "dynamic evolution," which he believes is more characteristic of Japanese firms. Static optimization is a top-down view of the management function, attempting to prescribe limited and fragmented tasks to the work force and supervise their execution through a hierarchy of middle managers. Organizations dominated by this type of approach find it hard to achieve changes that require integration of many functions and initiative at all levels. Process innovation becomes particularly difficult and product innovation takes precedence. However, even satisfactory product innovation and high quality become difficult to achieve without simultaneous and integrated process innovation.

Of special interest in Wheelwright's chapter is his explanation of why American industry lost the dynamic approach to systemic process innovation that he believes it once had. In his view this occurred because the vertical Taylorist approach did yield very good results for a long time, so that management became complacent and rigid, just as the British did in an earlier period. He comes close to formulating a theory of "techno-economic paradigms" comparable to that of Carlota Perez, in which institutional inertia inhibits a flexible response from the established leaders in what were once dominant technologies but are now being displaced.

Although Wheelwright does address one of the most fundamental questions confronting American industry and government, he does not discuss the characteristics of the new information and communication technologies and how they might affect the organization and management of the firm. Michael Porter's chapter "Changing patterns of international competition" is the only one that looks at this question. Porter points out that communication and coordination costs are falling and computerization of manufacturing and design facilitates global coordination of dispersed sites. He concludes that "Japan has clearly been the winner in the post-war globalization of competition" and poses the problem for the United States as one of catching up with the Japanese in a variety of technologies and learning how to gain the benefit of coordination.

To turn finally to what the book does *not* say: None of the contributors examine the question of the dominant orientation of

U.S. high technology toward military objectives and the consequences for the civil economy, both in terms of opportunity costs and in terms of strategic orientation of corporations. None of them address the problem of the U.S. capital market and its influence on long-term strategies or the lack of them. Only Sidney Winter's chapter "Knowledge and competence as strategic assets" examines in depth the complementary roles of R&D, tacit knowledge, and various other forms of technology accumulation in firms.

Until more American industrialists and the U.S. government are prepared to confront the strategic issues raised in this book (and some of those that are not raised), it is improbable that the relative decline of U.S. manufacturing will be reversed.

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Nuclear Waste Disposal

Nuclear Imperatives and Public Trust. Dealing with Radioactive Waste. LUTHER J. CARTER. Resources for the Future, Washington, DC, 1987. xiv, 473 pp. \$25.

Nuclear Imperatives and Public Trust attempts to sort out the "sticky tangle of political and technical issues" surrounding nuclear power and the exceptional demands imposed on it by a wary public. The title of the book refers to the imperatives to safeguard potential nuclear explosives and to contain radioactivity throughout the nuclear fuel cycle, both of which must be satisfied to assure public trust. Although nuclear waste disposal is only part of the overall problem of meeting the safeguards and containment imperatives, it is crucial to the future of nuclear power that this problem be solved.

Carter's emphasis throughout is on the need for simplicity in dealing with complex problems. This is reflected in his convincing arguments in favor of the geological disposal of spent fuel and against its reprocessing and in his argument favoring the early selection of a single disposal site relatively free of land-use and environmental conflicts versus an emotionally demanding and politically unrealistic nationwide search for the "best" site.

The book is divided into four parts. In part 1, Carter documents the "sources of public unease." As a "technology ahead of itself," nuclear power was developed before many of the health and safety issues associat-

ed with nuclear technology had been dealt with, "in particular the waste issue, the reactor safety issue, and the safeguards dilemma inherent in the fact that plutonium is a nuclear explosive as well as a nuclear fuel." There were early efforts to confront these issues by the Atomic Energy Commission, but for the most part the AEC "plunged ahead with commercial reactor development as though no hazards or major problems of containment existed." The public response to leaking waste tanks at Hanford, the selection and eventual rejection of a salt mine near Lyons, Kansas, as a repository site, the accident at Three Mile Island, and the threat of nuclear proliferation associated with reprocessing was predictable. Nuclear power had come too far, too fast.

In part 2, Carter takes us on the long search for a waste policy—a search that begins in the Ford Administration in the mid-1970s and ends in 1982 with the signing of the Nuclear Waste Policy Act by President Reagan. He describes and analyzes the policy struggles in the bureaucracy as AEC's replacement, the Energy Research and Development Administration, attempts "to get the waste program off the limb where it was put when ERDA informed thirty-six of the fifty governors of its plans to search for repository sites in their states." Carter examines the investigative effort and problems with regard to each of the potential sites in the ten states selected for further study by ERDA's successor, the Department of Energy, and concludes that the abstract approach to policy analysis practiced by a bureaucracy far removed from local decision makers and from DOE people in the field has "little relevance to the real world."

The blow-by-blow description of the behind-the-scenes struggle in Congress to forge a consensus on a national waste policy is not appropriate reading for the timid. The four major interests—the nuclear industry, the environmental and antinuclear groups, the potential host states, and the Department of Energy—shaped a legislative answer to the waste problem that was "an unusual mix of strong and weak points." Whatever its faults, the Nuclear Waste Policy Act of 1982 did get the program moving again. The act created a source of funding, set up a schedule (yes it was unrealistic, but it gave DOE something to shoot for), spelled out the rights of the host states, and provided for two repositories with the informal understanding that one would be in the West and one in the East. The Nuclear Waste Policy Act was hailed by its creators as a final solution—at best it was "a rough blueprint for an effort that would have to continue over two decades and that would almost

certainly require some major midcourse changes to succeed."

Part 3 (more than a third of the book) deals with the international aspects of nuclear waste disposal. "Like the Americans, the Europeans and Japan launched nuclear development on a commercial scale without the means to dispose of radioactive waste to be generated." Carter describes in detail the history of nuclear power and the approach to nuclear waste disposal in the United Kingdom, France, Germany, Sweden, and Japan. Unfortunately, the well-developed waste program in Canada, our closest ally, along with the cooperative work of Canadian and U.S. researchers, is given only a brief mention. Carter concludes that "an international system of spent fuel and waste management is still very much needed, but despite a few encouraging signs is still beyond the horizon."

Carter completed the book manuscript in October 1986, at a time when the nuclear waste program was caught in a "morass from which some way of escape must be found." In May 1986, DOE named sites in Washington, Nevada, and Texas as candidates for the first repository. At the same time, under strong political pressure from eastern states named as potential hosts, DOE cancelled the second repository, stating that it was no longer needed. The delicate balance between east and west was upset. In anger, the states turned to members of Congress, who responded by introducing more than 50 pieces of legislation during 1986 and 1987 amending the Nuclear Waste Policy Act. It is in the midst of this turmoil that the book ends—as if the last chapter had been lost.

In his summary, Carter identifies what is needed for a new nuclear waste policy to be adopted. As "a way out," he recommends that emphasis be placed on a single primary-candidate site (Yucca Mountain in Nevada is his first choice), that the role of engineered barriers (for example, the waste package) be strengthened, that the National Academy of Sciences study the program and address the key issues, that an independent peer-review board be given the authority to look into any technical issue at any time, and that states that agree to accept a repository be given substantial economic benefits.

On 21 December 1987, President Reagan signed the Omnibus Budget Reconciliation Act. Among its many provisions is a restructuring of the nuclear waste program in the form of an amendment to the Nuclear Waste Policy Act. Under the leadership of Senator Bennett Johnston (D-LA), a compromise was worked out in the final hours of the first session of the 100th Congress that selects Yucca Mountain as the first repository site,