Invention and Its Returns

Technology and the Pursuit of Economic Growth. DAVID C. MOWERY and NATHAN ROSENBERG. Cambridge University Press, New York, 1989. viii, 130 pp., illus. $29.95.

Mowery and Rosenberg have written an ambitious three-part book. One part is a history of the development of technology in the United States, the second is an analysis of what they call the "U.S. research system," and the third is a critique of current U.S. technology policies. Though the three parts are distinct and can be read separately, they are united by four common themes.

The first is an attack on what the authors call "the appropriability framework." The focus on appropriability as the central idea to understanding the economics of R&D is derived from a 1962 article by Nobel laureate Kenneth Arrow. Arrow devised an economic model in which inventors find their potentially profitable inventions copied by others. The competition in the marketplace between the inventor and the free-riding imitators will drive down the profits from an invention, even to the point where the inventor may not recover his or her costs. A patent granting exclusive rights to the invention is the traditional way of protecting an inventor from imitators. Many socially valuable inventions, however, are not patentable. Since the development of technology is the major source of economic growth, the returns to society from inventions are likely to be vastly in excess of the private returns to the inventor, given the competition from imitators. The gap between social and private returns provides an economic case for government subsidization of research.

Mowery and Rosenberg find the appropriability analysis incomplete in two significant ways. First, the costs and time required for imitation are often substantial, which serves to limit the number of imitators and gives inventors a head start. As a result, the market system does not do as badly by inventors as the appropriability analysis would have us believe. Furthermore, focusing on appropriability neglects the importance of the utilization of inventions as opposed to their creation. It is, of course, only with commercialization of a new product or process that the technical change has a pay-off for economic growth.

The American economy, even by the turn of the century, had developed a system for utilizing inventions that was superior to the practice in other industrial nations because of the growth of large, centrally managed firms serving a competitive national market. The authors trace the formation of industrial research laboratories from 1890 to 1946, demonstrating that they became common first in large chemical firms and then, by 1940, in the other industries and smaller firms. They conclude that "the expansion of industrial research was linked as both cause and effect with the reorganization of the American corporation during the late nineteenth and early twentieth centuries. Technically trained managers, a strong central staff able to focus on strategic, rather than operating, decisions such as marketing—all were associated with the growth of R&D within the firm."

These criticisms of the appropriability analysis are not novel; one can find the same points in the writings of Christopher Freeman, Edwin Mansfield, and Richard Nelson. Mowery and Rosenberg's contribution is the historical detail they provide in support of the empirical importance of the factors omitted from the appropriability framework. Particularly telling is their discussion of the slow growth from 1900 to 1950 of British industrial research. British science was distinguished, but large British firms were not. In comparison with their American contemporaries, British firms had fewer technically trained personnel, less powerful central staffs, smaller national markets, and less intense competitive pressure, particularly with the British toleration of cartels that divided the domestic market among established firms.

Mowery and Rosenberg's second theme is the importance of integrating the R&D function into the planning and operations of a firm. Commercially successful R&D, they say, is based on a recognition of unique strengths of the firm, and marketing and manufacturing must be closely coordinated with R&D to bring a new product successfully to market. R&D conducted externally to the firm is distinctly second best. The authors demonstrate this proposition in several ways. Separate contract research institutes such as Arthur D. Little, Mellon, and Battelle were once thought to be the major way in which industrial research should be carried out. Such organizations could avoid duplicative research and capitalize upon economies of scale. Mowery and Rosenberg examine the archives of these organizations for the interwar period and find that research institutes drew most of their clients from corporations that had already established their own laboratories. Apparently a firm needed its own researchers both to pose the question and to understand the answers. Thus, outside research organizations were a supplement to rather than a substitute for a firm's own research activities. Mowery and Rosenberg's stress upon the integration of R&D within the firm makes them skeptical of the current enthusiasm for creating cooperative research institutions loosely linked to the firms that they serve.

Mowery and Rosenberg's third theme is the importance of universities to the U.S. achievement in industrial research. From the 1890s on, the state universities educated large numbers of engineers and scientists and carried out applied research of interest to industry. No other country matched the U.S. record. The provision of university-based education for engineers is particularly given high marks. In contrast, the British industrial research was limited by low university enrollments and the practice of training engineers by apprenticeship.

Mowery and Rosenberg do not share the current concerns in the United States over increased industry involvement in university research. They regard this development as a resumption of an established practice that was interrupted by the massive flow of federal R&D funds to universities after World War II. They see both the economy and the universities as benefiting from industry funding and participation.

The last theme of the book is the effectiveness of public policy toward technology. Throughout their historical accounts the authors implicitly or explicitly assign grades to various policies or institutions for their contributions to economic growth. Such an examination includes the policies of the United States, Japan, and Britain. Mowery and Rosenberg see the future as one in which nations are technological equals and there will be extensive collaboration of firms across national boundaries.

They are critical of any attempt by the U.S. government to restrict international collaboration on the grounds that such measures will not work and, if they did, would make Americans and everyone else worse off. "Proposals to restrict scientific and technological knowledge at the water's edge fly in the face of the growing interdependence of national R&D systems." They are also skeptical of recent proposals to provide federal subsidies for commercial development.

As Mowery and Rosenberg point out, the Reagan Administration entered the White

House convinced that federal funding should be limited to basic research and that commercialization was best handled by the market. "The contrast between its 1981 posture and the administration's 1987 response to the demonstration of the phenomena of high-temperature superconductivity, the formation of Sematech, or the 1988 development of standards and research programs for high-definition television is dramatic."

Mowery and Rosenberg do not consider why the Administration changed its view. It surely did not lose its faith in the market. Rather, other nations did not share that faith, and so the Administration had to face an international reality in which other nations subsidized commercial R&D and were not as open as the United States to sharing R&D results. Other nations engaged in what the authors call "scientific mercantisism." What then should the United States do? All the authors offer is an exhortation to continue efforts to persuade other nations of their folly. Perhaps the United States should be an island of virtue in a sea of vice. But then perhaps not.

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A Psychiatric Enterprise

Before It's Too Late. The Child Guidance Movement in the United States, 1922–1945. MARGO HORN. Temple University Press, Philadelphia, 1989. xii, 224 pp. $34.95. American Civilization.

In 1922, there were only four psychiatric clinics for children in the United States; by 1942, there were 60. In *Before It's Too Late*, Margo Horn, a historian at Stanford University, addresses this important development within American medicine.

Between 1925 and 1945, the child guidance movement emerged as a new form of psychiatric practice that reflected the ameliorative spirit of the Progressive Era and its basic faith that investments in children constituted sound social policy. Although child welfare programs were generated by many different kinds of Progressives—government bureaucrats, feminists, labor activists, educational and municipal reformers—Horn's monograph focuses on the activities of a single, influential philanthropic foundation, the Commonwealth Fund, and its role in fostering the formation of child guidance clinics and on the simultaneous development of the professions that made up the child guidance team: psychiatry, psychiatric social work, and psychology.

The most interesting and controversial subtext in this book is the story of professional—rather than children's—behavior. Despite her access to clinical case records from the archives of the Commonwealth Fund, Horn avoids the social history of childhood in the interwar years and says relatively little about changes in the situation of children, their problems, and their relationship to families. Instead, she focuses on the Fund's changing therapeutic mission and demonstrates, quite effectively, that the child guidance movement was shaped and driven by professional concerns and rivalries. Throughout Horn's account, the mental health professions exist in an uneasy alliance shaped by both status anxieties and gender politics. In this respect, Horn's book is a noteworthy contribution to our understanding of the evolution of the modern professions.

A number of critical transformations in the history of the Commonwealth Fund reveal the dynamics of "profession-making" in the 20th century. In the late 1920s, the Fund apparently shifted its emphasis from the prevention of juvenile delinquency to the treatment of the normal (or merely "malajusted") child—that is, a child who could be treated in an out-patient clinic within the community. According to Horn, the new orientation "resulted from the Fund's definition of its proper role in society as well as the emerging professional interests of psychiatrists" (p. 10).

Horn underscores psychiatry's problematic relationship to medicine in this period: psychiatrists were not widely accepted members of either the medical or the educational world. But psychiatry found a way to release itself from the heritage of the 19th-century asylum by establishing psychiatric wards in general hospitals and, eventually, lucrative private practices in the community. In the interwar years, the child guidance clinic provided the perfect niche. By making problem children the target population, psychiatrists screened out intractable problems and developed an increasingly middle-class clientele. Like all professional groups, psychiatry needed ways to demonstrate its efficacy and also improve its economic status.

In terms of therapeutics, there is a more unsettling story. According to Horn, child guidance actually had "little effective clinical technique" (p. 136); the early child guidance team, she says, used an amalgam of methods to help children. Yet, by 1930 an influential shift occurred from behaviorism (which emphasized changing the behavior of the parent or child) to psychotherapy (which focused on emotional and intrapsychic factors). This change was apparently motivated by professional concerns rather than research or progress in treatment outcomes. Horn rightly asks why child guidance professionals shifted away from "a behavioral approach that they recognized as ineffective to a more psychodynamic approach that was, by their own admission, even less effective" (p. 135). The answer, she says, has to do with the intellectual hegemony of Freudian ideas in the psychiatric profession at the time and with "the practical advantages" that a psychodynamic model offered psychiatry as a professional group. Horn argues that the new therapeutic stance—that is, dynamic psychotherapy—empowered psychiatrists at the same time as they became more passive (and less didactic) in their relationship with patients and also more competitive with non-medical colleagues on the child guidance team.

In the scenario Horn presents, status concerns and intraprofessional rivalries called the cadence at the Commonwealth Fund. Although the child guidance clinic was based on the cooperative efforts of a team, the Fund clearly put its economic resources into fostering child psychiatry through fellowship and training programs—but only for the "right" people. In fact, the status concerns of psychiatry were played out in discriminatory policies that affected the development of the profession. Leaders in the child guidance movement openly stated their preference for white, Christian males and justified their bias in terms of what was "best" for the profession. Efforts to screen out low-status applicants—namely Jewish women—were "part of the specialty's sensitivity about its own professional status" (p. 126).

Predictably, gender politics were also part of the evolution of child psychiatry precisely because the closest "helping profession"—psychiatric social work—was already a feminized field. Some child psychiatrists in the movement made pointed efforts to differentiate themselves from psychiatric social workers who had actually begun their outpatient work with children as visiting teachers, a short-lived feature (1921–27) of the early Program for the Prevention of Delinquency. Here the author supplies an interesting and generally ignored piece of the early history of women in social work.

But when Horn calls the Commonwealth Fund a "conservative innovator," the reader is forced to ask why she has chosen such a benign label. In fact, her narrative and analysis say almost nothing about the Fund's role in stimulating innovation or creativity in child psychiatry. Although many notable psychiatrists are named here—among them Frederick Allen, Augusta F. Bronner, William Healey, Helen Langner, and George Stevenson—there is no substantive discus-