

Shaping the Industrial Century: The Remarkable Story of the Evolution of the Modern Chemical and Pharmaceutical Industries. By Alfred D. Chandler Jr. Cambridge: Harvard University Press, 2005. xix + 366 pp. Index, notes, figures, tables. Cloth, \$29.95. ISBN: 0-674-01720-X.

Reviewed by John K. Smith Jr.

Shaping the Industrial Century represents an important extension of the framework that Alfred Chandler has developed in several seminal books published during his long and productive career. In his earlier books, he explained the remarkable staying power of the large firms in the American—and European—economies from 1880 until the 1970s by outlining the characteristics that these firms shared: they were first movers in new, capital-intensive technologies that exhibited potential economies of scale and scope; once established, they had to build marketing organizations to sell their products; and finally—and most critically—they had to develop a system of oversight for their entire operations. With the proper management structure in place, firms might prosper forever. From the perspective of the 1960s, and even the 1970s, this seemed a reasonable proposition, but the last three decades have been traumatic, if not lethal, for many of the traditionally elite members of American industry.

As Chandler describes in detail, the chemical industry has experienced unprecedented economic turmoil, leading to mergers, fragmentation of firms, and sales of various assets. So what happened? Was the industry's downward spiral the result just of bad management? In this book and in its partner on the electronics industry—which is summarized in the concluding chapter—Chandler develops a set of concepts to explain these events, a set of concepts that complement, rather than replace, his earlier theories. Here, much of his focus is on how the managerial hierarchy responds to changing circumstances. In other words, it is more on strategy than structure, and more Schumpeterian in its emphasis on persistent technological innovation as a requirement for the long-term health of businesses.

Chandler uses three concepts to interpret the enduring success or failure of large high-technology companies. The first, which he calls “barriers to entry,” encompasses

much of his earlier work and explains how and why particular industries end up with stable oligopolies. The large firms that constitute the oligopoly are the ones he calls “core firms.” A mature industry is made up of both these core firms and the many smaller ones that either provide materials to the core firms or process or sell their products. Chandler makes the important observation that once the industry infrastructure becomes fully elaborated, usually about fifty years after the initial innovation, it is nearly impossible for new core firms to develop.

The second concept, “defining the strategic boundaries of the enterprise,” is concerned with a firm’s ongoing need to pursue the “virtuous strategy” of using retained earnings to develop new products that are related by scale or scope to the existing “integrated learning base.” In other words, firms learn how to do specific things, and that learning gives them their long-term competitive advantage. Firms define their strategic boundaries mainly through related diversification, though forward and backward integration could be considered in the same way. According to Chandler, firms that define their strategic boundaries incorrectly and diversify into unrelated businesses face dire consequences. He offers the example of RCA, which “created the audio and video industry worldwide between the 1920s and 1960s. Then within a decade it destroyed itself and with it the U.S. industry” (p. 295). When RCA became a conglomerate, it stopped supporting its “integrated learning base” and opened the door for Japanese firms to enter the field of electronics.

The concept of strategic boundaries is particularly important in high-technology industries. Chandler looks at the boundaries between the oil and chemical industries and between the chemical and pharmaceutical industries. He concludes that, even in these related fields, firms in one industry have not been able to expand their strategic boundaries into the domain of the comparable one. The chemical industry needed to expand its strategic boundary because it ran up against Chandler’s third concept: the limits to growth of an industry, which Chandler sees as occurring when major technological innovation ends because of a lack of “new scientific learning.” While this might be the cause, there are—especially for the chemical industry—other possible explanations. The chemical industry seems not to have exhausted its ideas in research and development, but, rather, to have run out of ideas for its strategy. It thrived for over a

century by replacing materials derived from limited natural sources with those made from widely available, and hence, cheaper ones. Now that it has transformed industries such as paint, rubber, and textiles, perhaps it has no more target industries upon which to deploy its weapons of research and development, scale and scope.

By developing this model, Chandler has done more than provide a case study of the evolution of the modern chemical and pharmaceutical industries. *Shaping the Industrial Century* is a dynamic demonstration of how strategy takes precedence over structure in determining the ongoing success or failure of an industry that has reached its mature phase.

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