

Altogether, Malone effectively depicts what Thomas Hughes called a technological system. Hughes noted that electric light and power requiring the coordination of organizations and technologies over long distances, in contrast to the steam engine, which supplied power locally. Water power had a similarly complex character because Locks and Canals controlled water flow from distant sources, solved coordination problems among organizations, and innovated to more effectively deliver, measure, and utilize power. The two systems differed because waterpower at Lowell was organizationally centralized; Lowell firms—and related Lawrence and Manchester concerns—internalized most of the decisions. The systems also differed because the water power at Lowell was limited in quantity and found supplementary support by steam power. Hydroelectric power ultimately brought water power within the electrical system.

Given its purpose, the book rightly sticks closely to water power in Lowell. But it does raise broader issues of interpretation and importance. One is linked to its centralized organization. The ownership of Locks and Canals by waterpower-using firms created a collective interest in extensive, organized research, which benefited each firm in proportion to its water usage. This organization overcame free rider problems and minimized litigation. As such, it is an interesting solution to the appropriability problem. It readily shared its knowledge; Locks and Canals did not patent its inventions, and Francis's publications were widely disseminated. However innovators such as Uriah Boyden, who had worked at Locks and Canals, did patent his turbines, which he licensed to Locks and Canals and to others.

In addition, the choice between steam and water power could be further examined. Around 1850 Charles James, a leader in the steam mill movement, argued that steam power offered superior regularity of motion needed in higher-quality textiles, and the Corliss engine augmented this advantage. How did the power source affect the quality of the product? Finally, a fuller discussion of the lines of communication linking Lowell to the wider waterpower system could be illuminating. Malone does a good job situating Francis's work in the European and American context, but his provocative claim that Francis's experiments "had lasting impact not only on the field of hydraulics but also on American research and development in general" (p. 142) is surely worth exploring.

ROSS THOMSON, *University of Vermont*

GENERAL AND MISCELLANEOUS

Knowledge and Competitive Advantage: The Coevolution of Firms, Technology, and National Institutions. By Johan Peter Murmann. New York: Cambridge University Press, 2003 (paperback edition, 2006). Pp. xxi, 294.

While scholars in particular in evolutionary economics and strategic management have worked hard to develop theories that may account for the evolution of industries and industrial leadership, students of economic and business history have dug up vast empirical evidence on the heterogeneous development of industrial development and modern enterprise. However, one is sometimes tempted to exclaim that "never the twain shall meet." Despite years of collective endeavors, the lack of integration between theoretical conjectures and empirical evidence looms large over these niches of the academic community. In this Schumpeter Prize winning book, Johan Peter

Murmann takes on the challenge of applying and extending a coevolutionary framework on the emergence and industrial dynamics of the synthetic dye industry in Germany, the United States, and the United Kingdom. It is a very welcome contribution.

The book first outlines country-level performance in this science-based industry during the Second Industrial Revolution in the latter half of the nineteenth century, when Germany was able to catch up and outperform the United Kingdom and America. Analyzing the institutional evolution of the three countries, the thrust of the presented argument is stated as: "In essence, the German dye marched towards its global dominance by residing in a social context that provided a small, but undeniably better, university system in chemistry at the start of the industry and that later provided even larger numbers of highly trained science and engineering students who could give local firms a competitive advantage" (p. 51).

The book also provides a study of three pairs of firms (one successful and one less so) in each country. This is a methodological approach that allows for variation in performance/outcomes despite not studying the entire population of firms. The book provides an important description and analysis of market strategies, internationalization strategies, product strategies and patent strategies, corporate organization, and R&D activities of Bayer (DE), Jäger (DE), Levinstein and Brooke (UK), Simpson & Spiller (UK), Schoellkopf (US), and American Aniline Works (US).

Murmann canvasses a history of industry and enterprise which resembles the ones told by Alfred D. Chandler, Jr. (*Scale and Scope: The Dynamics of Industrial Capitalism*. Cambridge, MA: The Belknap Press of Harvard University, 1990) and William Lazonick (*Business Organization and the Myth of the Market Economy*, Cambridge, MA: Cambridge University Press, 1991) in its comparative institutional analysis. However, in addition to the Harvard approach (see also T. K. McCraw, ed., *Creating Modern Capitalism: How Entrepreneurs, Companies, and Countries Triumphed in Three Industrial Revolutions*. Cambridge, MA: Harvard University Press, 1997) to business history, which particularly emphasizes the development of entrepreneurs and organizational capabilities, Murmann is also able to show the intricate interdependencies between firm evolution and the evolution of institutions (primarily the systems of education and intellectual property rights) and the dynamics of the growth of scientific knowledge applied in industry. In line with the argument presented by Wolfgang König ("Science-Based Industry or Industry-Based Science? Electrical Engineering in Germany Before World War I." *Technology and Culture* 37, (1996): 70–101), knowledge of synthetic dyes was very much developed in the R&D labs of industrial firms, pointing to interdependent coevolution in industry-based science (see also L. S. Reich, *The Making of American Industrial Research: Science and Business at GE and Bell, 1876–1926*, Cambridge, UK: Cambridge University Press, 1985 and D. Hounshell and J. K. Smith, Jr., *Science and Corporate Strategy: Du Pont R&D, 1902–1980*. New York: Cambridge University Press, 1988).

In particular, the way Murmann is able to operationalize abstract concepts of a coevolutionary theory into observable events in history is highly commendable. Admittedly, the author's self-acclaimed major contribution is the conceptualization of industrial coevolution in chapter 4. However, while the book draws upon an impressive theoretical framework and develops a cohesive analytical framework, there are still a few conceptual issues that can be raised and some need for clarification regarding theoretical positioning. One minor point of criticism is the way research in strategic management and organizational evolution is depicted as completely neglecting the interaction between organizational and institutional evolution. While

certainly Murmann's work constitutes a major contribution also to this literature, coevolution of organizations and institutional environments has been investigated for instance in the organizational systematics literature (e.g., J. A. C. Baum and J. V. Singh, eds., *Evolutionary Dynamics of Organizations*. New York: Oxford University Press, 1994) and does constitute a facet of mainstream economic conceptualizations of strategic management (see e.g., A. Gillespie, *Foundations of Economics*. New York: Oxford University Press, 2007).

In addition, the book provides an important empirical contribution by describing and analyzing the evolution and competitive effects of an important exemplar of the Second Industrial Revolution, that is, the synthetic dye industry. International comparisons are still lacking in the field of industrial dynamics, and the systematic pursuit of comparative analysis in this piece is laudable. In general, there are numerous illustrations, both in quantitative terms, but also in vivid quotes (primarily) from industrialists and scientists. At times, however, one feels that more analysis of the quantitative data could have been provided and also more incisive discussions about what the data actually represent (for instance, Murmann discusses relative patent shares as market shares on pp. 41–43, while no market shares proper in terms of sales are presented in the subsequent entry/exit analysis). This having been said, in the way comparative institutional history has been pursued and informed by a relevant theoretical framework, the book constitutes a landmark addition to our knowledge of the dynamics of science-based firms and industries. The book reads very well, and is highly recommended to all readers interested in the dynamics of global knowledge-based economies.

FREDRIK TELL, *Linköping University*

Slave Systems: Ancient and Modern. Edited by Enrico Dal Lago and Constantina Katsari. Cambridge: Cambridge University Press, 2008. Pp. xiii, 375. \$99.00, cloth.

This book flows from a relationship between two scholars who do research on slavery in very different societies. Enrico Dal Lago works on the southern United States, Konstantina Katsari on ancient Rome. In 2004 they held a conference at the National University of Ireland in Galway. This is a selection of the papers. They focus on Greco-Roman and modern American slavery and are more concerned with comparison than with continuities. This means that they are dealing with the first and the most developed of what Moses Finley considered "slave societies," societies based on slave labor and where slavery shaped politics, social structure, and cultural values. They are concerned with systems rather than with slavery in more general terms.

In their introduction, Dal Lago and Katsari lay out different approaches to comparison, focusing on Peter Kolchin's distinction between "rigorous" and "soft" comparison. The soft approach looks at a particular case, but uses comparative data to lay out possible explanations. Rigorous comparison involves the selection of two societies and examines a precisely defined theme in those societies. Only two papers use the rigorous approach. A model of this approach is the paper by the two editors examining slave management in Rome and the U.S. South. Books and articles on slave management in the two societies are surprisingly similar, recommending a balance between paternalism and a strict approach to work and to discipline. The experts in both societies believed in equity and a judicious balance between the carrot and the stick. The other example of the rigorous approach is a similar paper by Rafael