

advice for managers, who are the central target of the book. However, the underlying rationale is also appealing to scholars, and while there is some underlying research and theory reported, the book aims at a relatively high level of abstraction. Thus, there may be numerous opportunities to test these ideas more formally (Barabasi, 2002).

All three of these books propose that knowledge is the lever for strategic success and that bringing it to bear in the marketplace is the critical task. In all three, the authors argue, from different perspectives, that evolving the knowledge base of the firm is a critical and very complex task of increasing importance. And all three books are well worth the time needed to read them. I might quibble that Chandler's book, written "with the assistance of Takashi Hikino and Andrew von Nordenflycht," is not quite up to the magisterial level of *The Visible Hand* (Chandler, 1977), but that would be carping: this is a fine book. Doz et al. are less theoretical and less massively documented than either of the other two books, and their book is clearly aimed at managers. Still, the abundant caselets, well-crafted logic, and (mostly) helpful diagrams are compelling. Murtha et al. focus on a single case, so perhaps we might argue that their conclusions are not generalizable. But a more useful perspective is to reflect on how closely these very different books support one another in documenting the increasingly central role of knowledge in business; the difficulty of creating, capturing, and evolving it; and the importance of collaboration and alliances in using it.

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## Book Review Essay: New Perspectives on Global Industrial Dynamics

*Managing New Industry Creation: Global Knowledge Formation and Entrepreneurship in High Technology*, by Thomas P. Murtha, Stefanie A. Lenway, and Jeffrey A. Hart. Stanford, CA: Stanford University Press, 2001.

*From Silicon Valley to Singapore: Location and Competitive Advantage in the Hard Disk Drive Industry*, by David G. Kendrick, Richard F. Doner, and Stephan Haggard. Stanford, CA: Stanford University Press, 2000.

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The study of globalization through specific industries and their evolution, focusing on the strategies employed by firms and countries in these industries, is a grossly underdeveloped aspect of our discipline. As anyone who has talked to practicing managers in such sectors as integrated circuits and IT products will testify, managers and the firms they represent see their tasks in terms of complex processes of industrial dynamics—industry cycles, product cycles, value chain dynamics—that are rarely captured in the mainstream frameworks of strategy. Moreover, we will comprehend globalization poorly if we tackle it only at the macro level, where industry specifics are dispensed with. Hence, books that bring these issues into focus are especially welcome.

Two new books from Stanford University Press—*Managing New Industry Creation: Global Knowledge Formation and Entrepreneur-*

ship in High Technology (on the global flat panel display [FPD] industry) and *From Silicon Valley to Singapore: Location and Competitive Advantage in the Hard Disk Drive Industry*—take global industrial dynamics analysis to a new level of sophistication and authority. These books demonstrate that, in order to understand the way industries are created, configured, reconfigured, and then restlessly reconfigured again, we need insights from both strategic management and economics. But to grasp the dynamics of product cycles and the location of activities in the value chain, such insights need to be coupled with comprehension of the engineering and technological dynamics involved. This is a tall order—and it certainly goes well beyond the boundaries of the limited insights available from neoclassical economics, which even in its international production location guise still works with Ricardian notions of comparative advantage and continues to deny the salience of created competitive advantage.

In the first book under review, Murtha, Lenway, and Hart examine the global evolution of the FPD industry, with particular reference to the dominant technology that has emerged—namely, TFT-LCD displays. This technology was invented in the United States in the 1960s and then commercialized in various ways in Japan by such firms as Sharp, Toshiba, and IBM-Japan. The book takes the story from the origins right up to the end of the 1990s, when firms like Samsung, LG-Phillips, and the newly formed AU Optronics from Taiwan were taking over global leadership.

The concern of these authors, all of whom are involved in international political economy (two coming from the strategic management tradition and one from political science), is to demonstrate why the U.S. efforts to build a FPD industry in the 1990s failed and, in particular, why the U.S. Display Consortium (USDC) was unable to spark a domestic industry on American soil. The argument turns on the insularity of the efforts involved and the refusal by many of the participants in the process (which cost U.S. taxpayers well in excess of \$1 billion) to open up to the knowledge dynamics generated in East Asia. The parallel argument is that U.S. firms that did open up to the possibilities of knowledge generation and knowledge sharing in East Asia, particularly IBM, Corning, and Applied Materials—all of which created joint ventures in

Japan and then expanded, along with the FPD industry, to Korea and Taiwan—have all done well. Along with this polemical goal, the book tells the story of the rise and development of the FPD industry as a global and particularly East Asian phenomenon and, in doing so, provides what must be seen as the definitive account of the industry's early years.

In contrast, the second book, by international political economists McKendrick, Doner, and Haggard, is concerned with a success story for U.S. manufacturing—namely, the hard disk drive (HDD) industry, where U.S. firms like Seagate and IBM have demonstrated continuous leadership ever since the early 1980s. In place of looking for explanations from product life cycle theory, industrial policy, or organizational dynamics, the authors pose the provocative argument that U.S. firms succeeded because they globalized their value chain faster and harder than their Japanese competitors. This industry is one of the great success stories of Silicon Valley, where the industry was created and where U.S. firms have maintained a clear advantage over all rivals—as distinct from the series of failures associated with the FPD industry. The reason, argue these authors, is that U.S. firms have been prepared to outsource more and more elements of the value chain to locations where they can most competitively produce the needed components, modules, or, in some cases, the final products.

The HDD industry is notable for having concentrated so much of its activity in Singapore, where the bulk of global production took place up until the end of the 1990s, the point at which this book leaves off. Cost of production is certainly a factor (in a sophisticated sense, involving logistics costs, labor, and process engineering), but other factors are involved as well, such as availability of skilled labor and management, financial management issues, and issues concerned with the living conditions of management and employees: housing, health, and education, among others. While U.S. companies pioneered both the HDD industry and the strategy of outsourcing many of the operations to Singapore, Japanese companies followed suit a few years later, with a similar strong focus by both leading producers and suppliers in the Philippines. Thus, East Asia also turns out to be a center of industry dynamics for HDDs but for

very different reasons from those operating in the case of FPDs.

Both books emanate from a series of global industry studies funded through the 1990s by the Sloan Foundation. These covered the FPD and HDD industries, as well as integrated circuits (ICs), PCs, computer software, and—for a dash of the traditional—autos as well (for details see the website [http://www.sloan.org/programs/stdndrd\\_industries.shtml](http://www.sloan.org/programs/stdndrd_industries.shtml)).

The books agree in several lines of argument. The first and most fundamental point is that the firms that have done well in advanced industries such as FPDs and HDDs, whether as producers of the products themselves or as suppliers of the equipment and materials involved, are those with a global reach and global perspective. This is brought out strongly in each of the books. For Murtha et al. the most damning feature of the USDC and its supporting programs in the 1990s was the narrow, domestic focus, where participating firms appeared to believe that a U.S. industry could be built without reference to what was being accomplished elsewhere. The most arresting feature of the analysis by McKendrick et al. is that the successful firms in the HDD industry were those that globalized earliest and most thoroughly, in terms of their own value chains and in terms of their customer base. One of the prime reasons for Seagate—and then for other U.S. firms—to locate key operations in Southeast Asia and elsewhere was to be close to IT firms producing PCs and other IT products in the region.

Second, the competitive dynamics of these industries have actually shaped the globalization processes involved. As made clear by Murtha et al., the dynamics of the FPD industry emanated from Japan, where the initial mass production trajectory based on TFT-LCDs originated. However, it was not only Japanese firms that benefited from this discovery but also Korean and Taiwanese fast followers, and, more particularly, U.S. firms like IBM, Corning, and Applied Materials that were close to the Japanese sources of the new trajectory. Now we see the competitive dynamics propagating the industry to Singapore as well as China, in a further wave of globalization pressures. Likewise, in the HDD industry it was the competitive dynamics between Japanese and U.S. firms that led U.S. firms to outsource to Singapore and Southeast Asia in the first place, and it was the success of

such firms as Seagate in this endeavor that forced Japanese firms to follow suit, with the relocation of much of their value-adding activities to the Philippines.

Third, these patterns are themselves highly dynamic. Since the books were published, the U.S. lead firms in the FPD sector have restructured and pulled out of the East Asian joint ventures that powered their initial entry. IBM has terminated its involvement in international display technology, allowing the Taiwanese firm Chi-Mei Optronics to pick up a controlling interest and leverage its way to leading involvement in the global industry. Applied Materials pulled out of its joint venture with Komatsu and has now consolidated worldwide through AMJapan, AMKorea, AMTaiwan, AMChina, AMSEAsia, and AMEurope, thus giving the company greater focus in its globalized operations. Corning, by contrast, has intensified its presence in the East Asian region, expanding its operations in Japan and in Korea (through the Corning Samsung joint venture) and opening, in 2002, a major integrated AM-LCD glassworks in Taiwan. In the HDD industry, Seagate continues to prosper through its highly integrated value chain, while other companies have been forced to consolidate. But alternative technologies such as optical disk drives (ODDs) have put pressure on the HDD firms; a consolidated data storage industry is emerging that encompasses both magnetic and optical-based products.

In these fast-moving fields, one way to test the soundness of the arguments employed by the authors is to ask what has happened since the books appeared. Nothing points to the theses being invalidated. In the case of the FPD industry, it has further consolidated in the East Asian region; in particular, Singapore and China are now players—countries passed over in relative silence in the Murtha et al. book. And yet this development would have been interesting for them to discuss, because one sees a continuing pattern of “fast follower” dynamics operating along distinctive national lines in Korea, Taiwan, and Singapore. In the first industry that all three countries mastered—namely, semiconductors—they did so in characteristic national fashion: Korea utilized large existing companies (the *chaebol*, led by Samsung, LG, and Hyundai) backed by strong state incentives, such as cheap finance; Taiwan created new enterprises as spin-offs from its public sector research insti-

tute (ITRI), which helped the country to overcome diseconomies of scale in R&D, and which have since grown to become industry leaders in their own right (such companies as UMC, TSMC, or Vanguard); and Singapore built its strategy around the attraction of MNCs, many of which located IC fabs in the high-technology parks, more or less alongside the HDD fabs that were also locating there.

The interesting thing is that the FPD industry, which postdates ICs by a decade, also follows the same nationally characteristic patterns of fast follower industrial dynamics. The Korean *chaebol*, again led by Samsung and LG, secured the TFT-LCD technology in the 1990s partly through leverage and partly through their own efforts and rapidly became major contenders, driving the Japanese to ever-faster product generational dynamics. The Taiwanese came in more cautiously, in the late 1990s, after experimenting and building up capabilities over many years. Seven companies, many of them start-ups, plunged into the industry in 1998/1999, all with technology transfer from Japanese firms. And in Singapore the same approach as before has been followed, with the emphasis on attracting MNCs—in this case, a joint venture between Toshiba and Matsushita, called Advanced Flat Panel Display (AFPD) Ltd, which opened its doors in November 2002 with a \$1 billion facility. So the Koreans, Taiwanese, and Singaporeans show an institutional consistency that is indeed striking—an issue where one might have hoped for some comment from the authors.

It is a pity that Murtha et al. devote so little space to the Taiwan industry, which has risen over the past four or five years to become second or third largest in the world, depending on how such matters are counted (second in terms of revenues, third in terms of profits). The Taiwan phenomenon is covered in a couple of pages, out of a 200-page analysis, and the authors give only a cursory examination of the efforts made by the Taiwan firms themselves, focusing instead on the strategic decisions made by the Japanese to transfer technology. While it is no doubt true that the Japanese leading producers were keen to extend the market for their TFT-LCD panel-producing equipment, as argued by the authors, and, hence, were keen to see production expand to encompass Taiwan, this cannot be the only or the decisive reason. Surely the more fundamental reason that Japanese produc-

ers started to transfer technology to Taiwan in 1998, in typical Japanese convoy fashion, after resolutely refusing to do so earlier was the effect of the entry by Korean firms. Once the Korean producers Samsung and LG were well established, the Japanese producers no doubt saw it as expedient to squeeze them not just from above but also from below, with lower-cost Taiwan competitors. Such a move would have been consistent with the need of Japanese producers to find outlets for the large-screen technology while moving themselves to higher value-adding small-screen applications. Such are the geopolitical pressures that shape strategies in these high-technology industries.

In the case of McKendrick et al., the main counter to their argument, which is convincing for the industry chosen—HDDs—is not the alternative frameworks of explanation with which they contrast their own but an alternative industry—namely, the semiconductor industry. Here is the industry that was the focus of the most embittered international competition between U.S. and Japanese firms in the 1980s, and where U.S. decline was followed by U.S. revival in the 1990s, alongside outstanding success by Korean and Taiwanese firms as well as some European firms that bounced back after near eclipse in the 1980s. Is the openness to East Asian influences, described by Murtha et al. for the case of FPDs, the source of U.S. revival in the 1990s? Is it the case that the rapid and sustained globalization of value chains, described by McKendrick et al. for the case of HDDs, was the source of U.S. revival in semiconductors? The answer appears to be subject to sufficient doubt and contradictory evidence as to be declared unsettled. The short comparison between the semiconductor industry (four pages) and the HDD industry reveals that the very factors identified by McKendrick et al.—namely, globalized production chains and outsourcing—were present in the U.S. semiconductor industry in the 1980s but that these were insufficient to halt the tide of Japanese competitiveness.

When U.S. firms were bouncing back in the 1990s, many were certainly doing so on the strength of renewed globalization of value chains and location of key activities in Southeast Asia (e.g., Intel's large plant in Penang, Malaysia), but there were several other factors at work. It seems that the more the industry value chain in semiconductors disintegrated,

the more U.S. firms were able to occupy key positions at the head of the value chain, while ceding more and more of the productive operations to original equipment manufacturer (OEM) firms in East Asia and to their direct competitors in East Asia (often the same firms, which were utilizing OEM contracts to build their own industrial capabilities). Thus, the processes of outsourcing have themselves been responsible for seeding new global competitors.

The revival of U.S. fortunes in the semiconductor industry also appears to be linked directly with the steep increase in patenting rates in the industry (as documented, for example, in Hall and Ziedonis, 2001) and the turn by leading U.S. producers to adopt aggressive IP protection strategies. This has forced East Asian competitors to likewise build their own IP portfolios, which Taiwan and Korean firms have been doing assiduously in the semiconductor sector as well as in FPDs and ODDs. It is striking that neither the Murtha et al. study of FPDs nor the McKendrick et al. study of HDDs has much (if anything) to say about IP strategies, which must be counted now as one of the principal factors—if not drivers—of industrial dynamics in global industries.

A final point concerns debates over management strategies and the way that these books, with their empirically based arguments, engage with them. The McKendrick et al. study has an explicit engagement with the work of Harvard business theorist Clayton Christensen. (It is kept separate from the main text, in an appendix.) The authors query Christensen's widely admired perspective that innovators face a peculiar kind of dilemma, in that they wish to prolong their innovative range of products and are reluctant to cannibalize them with newer versions. In Christensen's study of the hard disk industry (Christensen, 1997), the point is made that great firms frequently fail because they become too closely tied to their existing customers and fail to respond to disruptive technologies. Christensen identifies a series of disruptive new technologies in the disk drive industry, each of which displaced the lead firm and allowed challengers to enter the industry—until, argue McKendrick et al., the case of Seagate, which has followed a conservative approach of entering new markets only after the initial firms have tested the waters. So while Christensen's perspective seems to have some validity early in a

new industry's experience, it could become weaker as an explanation as the industry matures. Here lies the value of the empirical approach.

The other FPD study, by Murtha et al., also engages with a leading business theorist, albeit implicitly. Michael Porter (1998) has argued strongly, on the basis of his "national diamond" of competitiveness, that firms need to be able to build their competitiveness at home first, before testing it in the dangerous waters of international competition. He explicitly queries whether firms can go abroad in order to get close to the competitive action and then apply the experience elsewhere. And yet this is exactly what the U.S. firms involved in FPDs have done, according to Murtha et al.; firms like Corning Glass, Applied Materials, and IBM went to Japan in order to build their competitive capabilities in FPDs, and it was this kind of initiative that helps to explain their success. So, again, we find a global industry being used as a setting where prevailing theories of competitive advantage can be put to the test.

These cases, where theories can be tested in such a rigorous and interesting way, only point to the need for many more such studies of the kind discussed—and to the need for publishers like Stanford University Press to support them—for it is a fact that after more than 100 years of the dominance of the neoclassical economics orthodoxy, we know less about how industries actually work today than Marshal must have known when describing the industrial districts of his own day. It is the rareness of empirically based studies of industries and of industrial dynamics that is the most striking feature of the current scholarly landscape, and this argues most strongly for a different kind of scholarly paradigm for industry studies, in which strategy and the management sciences will have to play important roles.

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