

CHAPTER ONE

Introduction

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Globalization is much more than simply moving employment and activities from developed nations into nations with lower-cost labor forces. Such a simple conclusion obscures the complicated skein of cross-border relationships that have evolved out of firm strategies seeking to balance a kaleidoscope of variables including labor and inventory costs, transportation, quality, concentration of valuable knowledge in clusters, and temporal proximity to customers. Understanding firm strategies at a single moment in time is complicated enough, but unfortunately these variables also fluctuate. For example, Singapore—at one time a low-cost environment with a weak infrastructure for hard disk drive manufacturing—over two decades evolved into a high-cost environment with a very sophisticated infrastructure. Today Singapore is a manufacturing, R&D, and logistics center. For firms, the global map is a gigantic, evolving chessboard upon which boundedly rational corporate strategists operating in internal and external political environments must not only situate production but also decide to make or buy.¹ These decisions, though complicated, are not random; corporate managers are responding to real constraints and opportunities.

For most Americans, the closest interaction with the enormous number of nations in the United Nations occurs on visits to their local Wal-Mart, which, of course, means that the world is in our homes, a part of our everyday life. A stroll through Wal-Mart's aisles reveals national origin labeling on objects from Bangladesh, China, Haiti, Honduras, Indonesia, Korea, Mauritius, Mexico, Taiwan, and a myriad of other nations. But as the chapters in this book show, these labels are deceptive, because the product is an assemblage of physical and intellectual inputs from yet other nations. The goods we buy are the end result of an elaborately choreographed transnational odyssey. These objects are part of an

economy whose tendrils reach ever further outward, linking, integrating, and transforming both far-flung and nearby places.

Firms and industries generate powerful economic forces shaping the lives of all human beings. Often industries are treated as black boxes, a perspective implying that economic shifts, technological change, and market dynamics will shape every industry similarly. Our chapters recognize that firms are remarkably different, and thus their repertoires for creating advantage are diverse. We are unified by an understanding that firms within industries are evolving, as are the locations in which they operate. Current configurations are responses to past conditions and prior strategies. History matters, insofar as previous decisions shape the contemporary landscape within which firms compete for future competitive advantage.

In the current conjuncture, firms scan the globe for favorable combinations of production factors and factor prices. And yet, as Paul Duguid in his foreword and Bruce Kogut in his concluding chapter remind us, cross-border trade has a long history. All of the parties to this trade have attempted to create power asymmetries to strengthen their bargaining position versus those of their partners. The resulting configurations can lock in for extended periods. However, it is equally possible, and perhaps likely, as Kogut points out in his chapter, for multinational firms to also operate as highways for the diffusion of knowledge, thereby sowing the seeds of change. Firm strategies create regional economies and institutions.

Locating Global Advantage

This book is the result of an ongoing commitment by the Alfred P. Sloan Foundation to study how U.S. firms are both actors in and subjects of globalization.² The foundation's tenet has been that the evolution of national economies and firm behavior can be understood only through intensive examination of firm actions within an industry context. All of the chapters focus on the organizational configuration and locational choices of U.S. firms. Although the decisions and actions of these firms can be critical to local economic development, the chapters were not meant to assess the economic development impacts of corporate actions. Nonetheless, this book will be useful for readers interested in international development, as the chapters elucidate the dynamics that frame corporate locational choices.

The contributors to this volume share certain common beliefs, both methodological and philosophical. Fieldwork (especially practitioner's interviews) is particularly important; it is only through factory visits and personal interviews that a researcher can grasp the dynamics within which corporate ac-

tors make decisions. We also are influenced by evolutionary economics (Nelson and Winter 1982) and share its perspective that firms and industries can be understood only in a historical context. Put succinctly, globalization is an evolutionary process.

Locating Global Advantage quite properly studies the spatial dimension. Each of the authors treats the spatial dimension as an organizational and operational outcome of an evolutionary set of decisions, and as such the meaning of various locations may not be so obvious. But, more important, our authors recognize the evolutionary and nonergodic character of spatial configurations (Arthur 1994; David 1986), and the evolution of places as knowledge-laden locations or learning regions (Florida 1995; Storper and Salais 1997). To rephrase Storper and Walker (1989), firms and industries build places, and this process is the source of clusters that benefit from both traded and untraded interdependencies.

To examine the globalization of industries, the authors recognize that the production and marketing of a commodity are segmented into juridically separate organizations or, as Winter (1987) termed them, “units of accrual.” While recognizing that the intellectual roots of the social division of labor (Sayer and Walker 1993) can be traced at least as far back as Adam Smith, we draw most directly upon Michael Porter’s (1990, 1986) concept of value chains, Kogut’s (1985) concept of value-added chains, and Hopkins’s and Wallerstein’s (1986) concept of commodity chains, which was further developed by Gereffi (1994, 1999). The chapter authors more frequently use the term *value chain*, because it explicitly recognizes the significance of less commodified activities such as R&D and marketing.³

There are difficulties with the “chain” metaphor, which is probably more appropriate for thinking about the internal activities of the firm but can create a misleading image when considering the production of an assembled product. The other metaphor that has long been used to describe these interfirm ties is, of course, “networks” (Bartlett and Ghoshal 1989). More recently, the use of networks to describe social and economic relationships has become ubiquitous. Despite some felicitous aspects of networks as a metaphor for the way a production system might be modeled, there are also difficulties. For example, in the network conceptualization there is no sense of a relatively unidirectional motion of goods toward the consumer (though obviously information and money flow in the other direction). If a metaphor is necessary, then we believe a more appropriate metaphor would be the one used often in industry—namely, that of a dendritic river basin that drains into the sea, which is the final consumer. However, the authors in this book, for the sake of ease and uniformity, adopt the chain metaphor.

We are interested in how and why the various processes involved in value creation are distributed among different firms. For example, as Leachman and Leachman show, the producers of DRAMs (dynamic random access memories) and microprocessors for personal computers integrate a larger portion of the value chain than do firms involved in the custom logic chip chain. For custom chips an interorganizational division of labor between design firms (fabless) and silicon foundries has evolved. Even within industries there is often an astonishing richness in the way interorganizational linkages are structured. This is very often overlooked by those who have not studied the firms and industries closely. Individual industries have their own logic, so globalization and vertical disintegration should be expressed differently in each industry (for an excellent overview, see Dicken 1998).

Our book complements research in international trade economics that recognizes that differing industries have distinct profiles in how they organize their praxis and create advantage (Feenstra 1998). Still, for methodological reasons, economists generally view globalization in terms of trade statistics disaggregated at the three- or four-digit Standard Industrial Category (SIC) code. While helpful, these studies sometimes suffer from a lack of specificity and thus ignore firm strategy. They also find it difficult to explain the reasons for changing patterns of trade. For example, SIC Code 3344 contains all semiconductors including DRAMs, microprocessors, and other logic chips, but the difficulty with this aggregation, as Leachman and Leachman indicate, is that corporate strategies, spatial and organizational configurations, and evolutionary dynamics in each category differ.⁴ This is not easily captured in the statistics but can obscure some of the underlying firm choices shaping the global economy and America's place in that economy. For example, is a semiconductor designed and marketed by a Silicon Valley firm, but fabricated in Taiwan, a Taiwanese semiconductor, an American semiconductor, or what? The chapters provide the thick description that excavates below numbers and statistics to expose the difficult, complicated world of business in a global economy.

Five Cross-cutting Dynamics

The richness of these industry studies provides insight into five dynamics that are propelling globalization and appear in different guises in nearly every chapter. The first dynamic concerns the technological and organizational advances in the fields of transportation and communication that operate in the background of each industry. The second dynamic is the multifaceted drive for greater speed, in terms of speed-to-market, more rapid product design, and more rapid inventory turnover—all meant to reduce various cycle times. Unre-

lenting cost pressure that continually commodifies existing products forcing businesses to lower costs is the third dynamic. In situ knowledge creation, whereby deep experience and capabilities are concentrated in certain locations or industry, is the fourth dynamic. Finally, the fifth dynamic concerns management's decisions regarding where to site the various corporate functions in relationship to their customers. These dynamics pressure firms to continually consider the location for various activities. Like a kaleidoscope for which each twist of the cylinder creates a different picture, in each industry and even industrial subsector, these dynamics create different patterns.

Transportation, Communications, and Globalization

The decreasing cost and increasing speed and capabilities in transportation and communication networks are the foundations for the expanding reach of global value chains. Technical improvements allow firms to pursue innovative approaches to operating the value chain. Multimodal transportation systems based on standardized cargo containers for land-sea shipping and sophisticated air freight systems have shortened the elapsed time and increased reliability. These innovations and others are loosening some earlier locational constraints.⁵ Transportation improvements lag compared with the even more dramatic decline of information transmission prices. The result has been an electronic data interchange web connecting an ever greater number of the nodes in the value chain, thereby increasing information sharing. Decreasing costs of communication are only one benefit, as significant as the far greater flexibility and transmission bandwidth created by developments such as the graphical nature and open protocols of the Internet (Cohen et al. 2001).

This is not the first time that new transportation and communication technologies have affected the organization of capitalism. Chandler (1977) credited the railroad and telegraph as critical technologies in enabling the creation of the multidivisional firm. In the last decade, there has been a metamorphosis of transportation providers into logistics firms capable of handling both the movements of bits of information and atoms of product. Increasingly, communications networks permitting the tracking of an artifact's progress from inception to the final consumer are interlinking a value chain's disparate activities. The impacts of these advances are stunning. By one account, in 1980 U.S. logistics spending was 17.2 percent of total GDP, and of that 9 percent of total GDP was inventory investment. By 1995 this had dropped to 10.8 percent and 4.3 percent, respectively (Lappin 1996). Today, transport costs constitute only approximately 1 percent of the final price of consumer goods (Taggart 1999). From the rapid replenishment system described by Abernathy et al. for garments to Dell's build-to-order PC production system described by Curry and

Kenney, the transportation and communications advances are providing firms with more efficient and transparent logistics systems.

Logistics specialists such as UPS or Federal Express not only handle deliveries at a global scale but are also capable of undertaking some measure of final assembly: packaging, inventory management, and distribution. Retailers, assemblers, suppliers, and logistics firms responsible for moving the physical goods are having their software systems woven into an integrated global web. What began as a just-in-time (JIT) system that required close proximity between assemblers and suppliers is evolving into a JIT system spanning national boundaries and oceans as firms strive to access widely dispersed production factors even while reducing inventory costs and depreciation risks by keeping goods continuously flowing downstream toward the final consumer. Logistics firms experience continuous pressure to further shorten transit times, improve delivery predictability, and lower costs. As the recent West Coast dock lockout showed, there is also heightened vulnerability caused by the constantly swelling tide of goods in motion. For example, the number of freight containers handled by the world's ports increased from 6.3 million in 1972 to 163.7 million in 1997, while prices on the Asia-U.S. route dropped by an inflation-adjusted 65 percent during the same time period (Taggart 1999).

Although shipping costs have dropped significantly, communication and data processing costs have fallen far more precipitously, while international (and national) bandwidth has grown dramatically. For example, the annual cost of leasing an E-1 telecommunications circuit from New York to London dropped from \$125,000 in October 1998 to approximately \$10,000 in February 2002, an annual decrease of 50 percent per year (Telegeography 2002). Put differently, the investment cost per minute decreased from \$2.443 per minute in 1956 to \$0.001 in 2001 (Blake and Lande 2001). The decreasing cost of communications permits the transmission of ever greater amounts of information in real time, thereby keeping upstream participants in the value chain better informed, allowing them to make more timely decisions, thus decreasing uncertainty. The Internet has created even more opportunities to use communications systems to rationalize the value chain (see, for example, Hammond and Kohler 2001; Kenney and Curry 2001; Fields 2003).

Users can take advantage of the availability of low-cost communications bandwidth to develop innovative solutions to production and distribution bottlenecks, thereby minimizing the impediments to the flow of goods. For example, new information systems make it possible to pack garments into shipping containers properly ordered in Hong Kong so that they can be unloaded directly into U.S. retail stores. This eliminates the need to unload the container en route, thereby saving time and money (Taggart 1999). As another example, Leachman and Leachman show that these communication networks permit

real-time monitoring by Silicon Valley chip designers of the progress of their orders in Taiwanese fabrication facilities.

In the contemporary market, delivery times are often more important than prices; failure to get the right part or component or even the finished product to the right place at the right time may cause bottlenecks and adversely affect an entire value chain—or simply miss the market. We are witnessing the unfolding of a system capable of ever more closely synchronizing production with demand, thereby removing inventory that is not in motion. The continuing improvement in logistics of air, sea, and land freight continues to drive transportation costs down, while computational advances combined with less expensive communication technologies are increasing the predictability and transparency of the supply chain. But most powerfully, each advance creates the base for yet further experimentation.

Time and Speed

Clock time appears to be invariant. And yet, each industry operates on a different tempo. Transportation and communications are only one dimension of the time equation with which managers wrestle (Fine 1998; Kenney and Curry 1999). Businesses must constantly grapple with the relationship between space and time (Schoenberger 1997). One salient expression of this is just-in-time production, which was introduced to the U.S. automobile industry by Japanese manufacturers (Womack et al. 1990). On a more fundamental level, the history of capitalism indicates a secular trend toward an accelerating pace. With the exception of the television industry, accelerating the tempo of activity seems a central concern of managers. The character of globalization is shaped by the emphasis on time and speed.

The preoccupation with time management is not new to contemporary industry.⁶ For example, the standardization of time into time zones was spearheaded by the railroad firms (1990). However, today's firms face more complex temporal dimensions than those contained in simple concepts such as transit times (Curry and Kenney 1999). For example, as Abernathy et al. indicate, location and distance affect the placement of activities, but that is only the most obvious dimension of temporality. More recently, other temporal dimensions such as speed to market and speed in terms of ramping up production have become considerations for globalization. In the case of hard disk drives (HDDs), McKendrick shows how important managing a rapid production ramp-up in Singapore is for corporate success. In the case of the semiconductor industry, Leachman and Leachman show how being late to the market can significantly depress profitability. Even the automobile industry has been pressing to shorten its three-year design cycles.

Technological time and its grim reaper, obsolescence, are central issues in a number of chapters.⁷ Each of our chapters on HDDs, personal computers, flat panels, and semiconductors indicates that they are plagued by endemic and rapid technological change that inexorably devalues yesterday's products. As Abernathy et al. show, in "fashion-forward" garments, a similar dynamic is manifested because of the creativity of designers and the changing sensibilities of customers. For these items, the market value of products is transient and product life spans are truncated. A fashion-forward item or personal computer idling in a shipping container on the way from a distant low-cost production site could easily lose much of its value prior to being unpacked. This obsolescence threat actually affects an industry's spatial fix—that is, where various activities are undertaken (Harvey 1982).

Producers of assembled goods can have an even more difficult situation, because components may "age" at different speeds. For example, as Curry and Kenney show, a personal computer contains components such as fans, the case, and floppy drives that age very slowly, and components such as semiconductors and HDDs that age very rapidly. Within a single box, the effect of time varies dramatically by component. The components that are most subject to aging should, of course, be purchased as close as possible to the time when the final consumer purchases the PC.

Temporal dynamics color the industrial organization and geography of each industry. In the emerging industrial environment characterized by rapid new product development and accelerated production and delivery times (D'Aveni 1994), slower-moving firms will find that moving production to lowest-cost foreign labor sites will not necessarily prevent them from being outflanked. As our chapters show, for some firms the temporal dynamics are forcing a relocation of certain functions closer to the final customer, while in other cases it has meant that there must be a closer integration between value chain nodes in different countries.

Pricing Pressure and Overcapacity

Competition has always been fierce, but during the last decade it appears to have become more ferocious than ever. Japan is already grappling with deflation, which some believe is occurring in the United States. Every industry in this book suffers pricing pressure, which is manifested at the macroeconomic level by price declines, or at least, near price stagnation, combined with strong productivity growth. In 2002, overcapacity plagued the auto, PC, television, HDD, and semiconductor industries, though in semiconductors this was previously a cyclical phenomenon. In industries such as garments and televisions, which are dependent on large retailers (or what Gereffi 1994 terms buyer-driven

chains), profit margins are thin, even for Wal-Mart. In DRAMs, Flat Panel Displays (FPDs), and HDDs, profits are cyclical and only the leaders experience profits during the positive portions of their business cycles. With the exception of Dell, none of the major PC firms enjoy predictable profits—and Dell as the cost leader continues to drive costs lower. For most firms the pressures appear only to be increasing.

The intense pricing pressure forces a continual reassessment not only of the proper spatial location of value-chain activities but also whether to perform them internally or to outsource them. As Sturgeon and Florida show in autos, outsourcing has resulted in an increase in jobs among the parts suppliers employing less expensive, usually nonunionized labor as opposed to the high-wage unionized assemblers. In addition, the importation of finished automobiles from lower-wage production facilities in Mexico continues to increase, though U.S. parts exports to Mexico increased apace. In the PC industry, Dell recently introduced a very low price machine (retail \$499) assembled by the Taiwanese firm Mitac in China and shipped directly to the customer. Each ratcheting down of prices conditions consumers to expect still lower prices, thus placing pressure on rivals to match the reduction or face a market share loss.

For many of these industries, the endemic overcapacity has been insoluble. Sturgeon and Florida describe this problem for the auto industry: even while suffering from global overcapacity, Japanese and European assemblers continue expanding factories and building new plants in North America. In 2001 semiconductor overcapacity was perhaps the worst it has ever been, as a result of a boom in plant construction during the late 1990s and a slump in consumer demand. With prices stagnant, the only way to increase profits is either to lower labor costs or to increase efficiency. Locating a plant or some of the processes in a lower factor cost environment can momentarily overcome the price pressure problem. And yet, paradoxically, this increases global capacity.

With the high cost of labor in developed nations, there is a constant temptation to relocate not only routine production, but also engineering and other activities, to lower wage environments. Skilled personnel are not uniformly distributed, however, so relocation is constrained by the capabilities of the workforce. Because of the pricing pressure, China has become the destination of choice for relocated production activities, a shift that both solves and exacerbates overcapacity and the downward pressure on prices. However, even for developing nations such as Malaysia and Mexico, which are losing production to China, there is the possibility of upgrading. It should be possible to carve out production niches by further increasing the division of labor. And yet, despite all of this turbulence, design, R&D, and marketing have largely remained located in their traditional havens, where labor costs are high. In the meantime,

manufacturing or certain manufacturing processes have been relocated, often repeatedly.⁸

Overcapacity and downward pressure on prices appear to be inextricably linked with globalization. For routine assembly activities, the allure of low wages is powerful, but not overwhelming. The continuing brutal competition almost surely means that overcapacity will remain high, as firms continue to ramp up production in lower-cost environments. This could be further exacerbated if the deflationary environment continues.

Knowledge, Capabilities, and Clusters

The relationship between specialized knowledge and clusters has been recognized since at least Alfred Marshall (1890). Outside of economic geography, this insight was largely ignored by the social sciences. Then in the early 1980s, clustering once again attracted scholarly attention from outside the geography community. The enormous interest in the book *The Second Industrial Divide* by Michael Piore and Charles Sabel (1984) heralded this reawakening.⁹ In the early 1990s, economist Paul Krugman (1991) and business strategy professor Michael Porter (1990) highlighted the importance of clusters for business performance. These contributions and others sparked a line of research examining the linkages between firms and the external knowledge in their locational environment (see Almeida and Kogut 1997, 1999; Jaffe et al. 1993; Kogut 2000). Brown and Duguid (2000b) explained this by the participation of the denizens of these regions in networks of practice through which knowledge and information flow.¹⁰ Murtha et al. persuasively illustrate the importance of active participation in the knowledge creation process by recounting how the U.S. firms that actively participated in creating the FPD cluster in Japan profited handsomely. Most significant, those U.S. firms choosing not to participate in that localized knowledge-creation process, which in this case was concentrated in Japan, were unable to enter the industry profitably. Paraphrasing the Peter Sellers movie, being there is important.

Industries are based on sets of knowledge bases and capabilities that are created, spatially fixed, and exercised in specific social environments (Brown and Duguid 2000b; Kogut 2000; Kogut et al. 1993; Dunning 2000). Very broadly speaking, an industry can either cluster or not, and then a cluster can either consist of rivals (i.e., a horizontal cluster) or complementary firms (i.e., vertical clusters) such as suppliers and customers—or contain both.¹¹ The industries in this book exhibit a spectrum of clustering behaviors.¹² For example, the PC industry exhibits little clustering outside of Taiwan (and now China), where manufacturing is clustered, while in HDDs, as McKendrick shows, there is a dominant design cluster in Silicon Valley and a production cluster centered in Singapore.

As Kogut indicates in his concluding chapter, the relationship between multinational firms and regions are complex and contingent and should be understood in processual terms rather than as single events. Our chapters indicate a complicated skein within which there is an interaction between firm-based knowledge and region-based knowledge that is difficult to fully disentangle, quite specific, tacit, and even inimitable (Gertler 2001). The firm-based knowledge is, as Kogut argues in his conclusion, embedded in routines and may be transmitted transnationally, though not without friction, difficulty, and frequent failure. Regional knowledge is far more constrained to place and contexts. Brown and Duguid (2000b) perceptively note that Xerox Palo Alto Research Center had enormous difficulty transferring knowledge inside Xerox, but the knowledge transferred nearly effortlessly to the surrounding Silicon Valley community. Thus firms have internal knowledge that they can attempt to transmit internally, even while they absorb external knowledge and contribute to a knowledge commons (Kogut and Zander 1992).

Proximity to the Customer

From the Anglo-Portuguese wine industry to the PC industry, proximity to customers can make the difference. In each of the chapters, firms must decide the relative importance of proximity to customers. Given the increasing efficiency of transportation and communications, it might be thought that low factor costs would become the dominant aspect of deciding where to locate. However, in a number of value chains, proximity to customers can modify and even in some cases overwhelm factor costs such as inexpensive labor. The importance of proximity to customers can be driven by very different reasons. For example, in the auto industry the importance of customer proximity at the international level is driven by a combination of trade barriers and an ability to better understand the market by immersion in it. At the macro-regional level, the strong supplier base in the U.S. Midwest helps offset the high costs of labor and thus continues to attract investment, if not directly in the Midwest, then in the Middle South. In personal computers, Dell has been remarkably successful by assembling computers in the market within which they will be sold (with the exception of the previously mentioned low-priced machine assembled in China). However, in the Dell case the location of the supplier's production is not as significant an issue as proximity to the final customer. The chapters carefully examine the role of proximity in determining location.

Each segment of the value chain has a downstream customer. Thus, there are a number of supplier-customer relations, each of which might require a different spatial configuration. In some cases, the market is another set of downstream corporations, while in other cases, it is the final consumer. In textiles, as Abernathy et al. demonstrate, it is the rapidity of change in the tastes of the fi-

nal consumer in particular products that determines the most efficient production location. On the other hand, Murtha finds that in the case of FPDs, for U.S. equipment and materials makers, proximity to customers was critically important, while proximity to U.S. notebook computers did not appear to be of great significance for the FPD producers. Most interestingly, it is also possible that the necessity of proximity may also shift over time as production cost factors, the role of tacit knowledge, and brand strength change.

The detailed research in these chapters highlights the fact that proximity to customers is often loosely used, and that it is more valuable to consider which corporate function(s) should be located in close proximity to the customer. For example, is proximity required for R&D, design, headquarters, and/or manufacturing, and why? In the auto industry, Sturgeon and Florida show that the new global suppliers have been pressured to locate both R&D and manufacturing facilities close to their auto assembler customers' R&D facilities. In garments and textiles, there seems to be little pressure to locate any functions close to each other. In the PC industry, Dell requires that suppliers except Intel place a warehouse within twenty minutes of its assembly facilities. In the television industry, there seem to be no immediate clustering requirements regarding R&D or television tube facilities, although over the longer run the tube facilities are attracted to large clusters of TV assembly plants, because of the costs and risks of transporting tubes long distances. Our chapters show that it is necessary to decompose the concept of proximity to customer and comprehend when and what makes proximity economically attractive.

The Chapters

This book is divided into three parts. The first examines globalization in three mature industries in order of their chronological emergence: garments/textiles, automobiles/auto parts, and televisions. The garments industry pioneered the Industrial Revolution, and the auto industry pioneered mass production. The television industry built upon the pre-World War II radio industry and grew quickly in the postwar period, but by the early 1970s it had become a relatively mature industry. The end-users for the products of these three industries are household consumers, and brands are extremely important for their success. Given their long histories and the development of powerful interest groups, these industries also are far more subject to government intervention in the form of tariffs, duties, quotas, and various other trade restraints.

Globalization in the garment and textile industry is fascinating, because despite the fact that it is one of the oldest industries, success depends on closely tracking consumer preferences. Since it is a fashion industry and consumers are

fickle, inventory risk is a pervasive problem. Garment production was one of the first industries to be moved offshore because of the relative lack of skills needed for assembly processes and the low-capital intensity. The casual observer accepts that it is natural for garment production to move to the lowest cost environment, particularly given the enormous pricing pressure on manufacturers. Drawing upon their book *A Stitch in Time*, in Chapter 2 Abernathy et al. show that for certain garments, a new locational logic has emerged motivated by what they term “lean retailing.” In this system, retailers carry only minimal inventory, finding that it is more economical to rapidly replenish goods that have sold. Lean inventory decreases the risk of holding stocks that might become obsolete with a quick change in fashion. However, leanness implies that the danger of being out of stock increases. Rapid replenishment depends upon having factories close to the end market and linked to retailers by sophisticated communications systems. This desire for rapid replenishment has led to a production shift for many types of garments for the U.S. market from Asia to the Caribbean Basin and Mexico, while in Western Europe production is being relocated from Asia to North Africa and Eastern Europe. Firms must balance between production and transportation costs and speed, which, in rough measure, is a function of distance and transportation modality. Chapter 2 explores the trade-offs that garment firms must make when deciding where to source their production. This is illustrated by a provocative demonstration of how low labor costs can be offset by the inventory cost savings and risk reduction that can be achieved by producing in a higher cost environment in closer proximity to the customer.

The third chapter, on the automobile industry, provides insight into many facets of globalization. The automobile is a particularly interesting product, because it is the paragon of the mass production system, and with more than thirty thousand individual parts, it is the most complicated and bulky mass-assembled product. Because of the large number of parts and interdependence involved, Sturgeon and Florida study the globalization of both the auto assemblers and their major suppliers. Given its complexity and importance to national governments, globalization in the automotive industry has always had a political dimension.

They argue that there are four different forms of globalization underway in the industry. The first form of globalization is characterized by increasing imports and exports, though they predict that this trend will decline because of the second form, which consists of the establishment of assembly plants in closer proximity to the final consumer. The impact of this form of globalization will be moderated by a movement to establish new plants in low-wage nations, such as Mexico for the United States market and Spain and Eastern Europe for

the Western European market. Because of this, they predict that the shipment of automobiles across oceans will decrease. . However, the new plants being established by foreign competitors are exacerbating an already severe overcapacity problem that is driving prices down. The third form is the cross-national consolidation through merger and acquisition of the industry into an ever fewer number of major auto assemblers. The final form is the globalization of vehicle platforms and models as the same vehicle is introduced in a number of different markets. The evolution of these different forms not only affects the auto assemblers but also is propelling the establishment of global parts suppliers that can service their customers in every market. However, these new forms are not simply spreading automobile production uniformly over the landscape, since transplants tend to be sited relatively close to traditional automobile manufacturing regions, albeit with some shifts to proximate, lower-wage environments. More important, Sturgeon and Florida find that global design clusters are emerging, given the increasing need for interaction between auto assemblers and parts suppliers earlier in the vehicle design process. Their chapter richly illustrates the multiple dimensions of globalization, and how the interaction between assemblers and parts suppliers affects the dimensions of globalization.

In the fourth chapter by Martin Kenney, the long sweep of globalization in the television industry is examined using North America as a case study. The spatial configuration of the value chain for televisions, unlike that for automobiles, has shifted substantially during the last five decades as it has for a number of other industries in this book. And yet, transportation and communication, though significant, have not profoundly influenced the industry. What has been most important is finding relatively low cost labor pools in reasonably close proximity to the final consumer. In terms of speed of change and obsolescence, of course, shrinking inventory is important, but televisions do not experience the same loss of value dynamics as garments and PCs. However, since televisions are commodities, price pressures are ferocious.

Chapter 4 examines the shifting location of television production, and documents the reasons for the growth and decline of U.S. firms and domestic production. Fittingly, this globalization begins with RCA's transfer of technology to Japan and ends with the relocation of television production to northern Mexico. Segmenting the television value chain into components, color picture tubes (CPTs), and final assembly provides the reader with greater insight into the unfolding and constantly changing map of globalization, which in the case of North America ends with a production cluster created by Asian firms in northern Mexico to serve the U.S. market. This Mexican production cluster that began with simple assembly has deepened as it has attracted an increasing num-

ber of parts makers from Asia and CPT producers from the United States, drawn by Mexico's proximity to U.S. consumers.

Part II examines globalization in the new industries formed in the postwar period. In Chapter 5, James Curry and Martin Kenney examine the dynamics of globalization in the personal computer industry, which plays a major role as a consumer of the outputs of the component industries studied in the chapters that follow. Its juxtaposition with the television industry discussed in the previous chapter is also fascinating because the PC shares so many similarities with the television in terms of assembly process and components; in fact many believe these two products might converge.

As Linden et al. in their chapter and, to a lesser degree, Murtha et al. in their chapter argue, the centrality of the desktop PC may decline in the case of semiconductors and FPDs. This may also be true in the HDD industry with the advent of Tivo, which uses an HDD to record television programs. Thus the television might compete with the PC even if the proverbial convergence never occurs, and it will provide new outlets for the components discussed in Part II.

Another feature distinguishing the industries in Part II is that they experience value erosion based on the speed of technical change. They share this emphasis on speed with the oldest industry in Part I, garments, revealing that technical change and fashion experience similar loss-of-value dynamics.

The PC industry is characterized by extremely rapid change caused by the devaluation of its constituent semiconductors and the HDD. This rapid pace creates a business environment in which proximity to the final customer is especially important because long transit times for a finished PC can lead to significant losses of value.

This intense pace of depreciation creates an interesting anomaly. Taiwan is the only discernible PC cluster in the world, housing the headquarters for firms that in factories situated around the world assemble more than 50 percent of all PCs sold; yet the most important brand name firms are not located in this cluster. The reason is that the highly modular nature of the PC with its rigorously specified interfaces between components means that tacit knowledge about production is not especially important. Proximity to the market is more critical. Thus, while one might think that the ease of assembly and ready availability of all the constituent components of the PC would allow Asian firms to gain dominance, this is not the case. U.S. firms dominate the industry because they not only provide the components with the greatest value added but also are located in, and can learn from, the world's largest market and its highly sophisticated customers.

The next three chapters discuss industries that produce the three most valuable PC components, and the concluding industrial chapter argues that, at least

in semiconductors, a “post-PC” world is dawning. In Chapter 6, David McKendrick examines the HDD, which is the final major assembled component in the PC that continues to be dominated by U.S. producers. This chapter examines the historical evolution of the spatial configuration of the manufacturing, R&D, and headquarters functions. It finds that R&D and headquarters functions are increasingly clustered in Silicon Valley, with a smaller cluster in Japan, even while manufacturing is concentrated in Asia, especially Southeast Asia and China. In fact, the HDD industry demonstrates that it is possible to internalize both R&D and manufacturing within the firm and manage both processes, though they occur on different continents. HDDs resemble semiconductors and FPDs in that they experience rapid change, short product cycles, and severe cost pressures. However, in contrast to semiconductors and FPDs, an HDD consists of a relatively large number of components that must be physically assembled to very tight tolerances. As in the case of DRAMs, the need for speed, cost, and quality have meant that the leading firms have integrated much of the value chain and conduct manufacturing in-house. In contrast to PCs, consumer proximity was not necessary for the HDD industry. McKendrick draws upon and extends his research, first presented in the book *From Silicon Valley to Singapore*, to elucidate how the dynamics of globalization affect this important high-technology industry.

In Chapter 7, Murtha et al., drawing upon their book *Managing New Industry Creation*, examine the global dimensions of the establishment and growth of the flat panel display industry. They show how the initial research was undertaken in the United States, but the commercialization occurred in Japan, where an early cluster of FPD manufacturers and equipment makers ignited a knowledge-creation dynamic that soon outdistanced firms not located in the cluster. They differ from conventional accounts by showing how a number of U.S. firms that embedded themselves in and contributed to this knowledge-creation dynamic experienced great success. In FPDs, globalization was a process of participating in a very local knowledge-creation dynamic. For materials and equipment suppliers, proximity to lead customers was vital for success, because of the great amount of tacit information that was both exchanged and mutually created.

The semiconductor has probably been the most important artifact of the second half of the twentieth century. Semiconductors store, display, and process data; they are components that make computing and the Information Age possible. The market for semiconductors is treacherous because of notoriously rapid improvement cycles, escalating capital expenditures, and brutal competition. Semiconductors share another technical commonality with FPDs—namely, they are both based upon the substrate silicon.

The final two industrial chapters comprising Part III examine the semicon-

ductor industry from different perspectives. In Chapter 8, Leachman and Leachman examine the status and development of semiconductor production along two dimensions: spatial location and the organizational integration of the design and production functions. The pattern of globalization varies depending upon the type of semiconductor being produced. In the case of microprocessors and DRAMs, producers continue to integrate design and manufacturing, although for different reasons. In the case of logic chips, a surprising spatial and organizational division of labor has emerged. This chapter explains the reasons why Taiwan has developed a cadre of firms that specialize in logic chip fabrication for companies around the world. They show how these Taiwanese chip foundries provide a “market-based collective action” solution to problems that the design firms faced.

Linden, Brown, and Appleyard complement the chapter by Leachman and Leachman by examining the relationship between designers of logic chips and their customers. They suggest that the locational patterns of the semiconductor industry may be transformed by a shift of revenues and profits away from the PC world epitomized by the U.S. firm Intel (by far the most profitable semiconductor firm in the world) toward telecommunications products. They argue that the proliferation of communication devices using a variety of competing standards combined with regional differences in communications infrastructure present an opportunity for semiconductor firms that are rooted in Europe or Asia and have strong relationships with telecommunications providers. They feel that this will lead to a shift from the PC world in which U.S. semiconductor firms were dominant to a pattern in which dominance will accrue to the semiconductor firm best able to form alliances with network owners such as NTT Docomo, Deutsche Telecom, or Singtel, which will begin to drive the functionality designed into the semiconductor.

The concluding chapter by Bruce Kogut synthesizes and extends the findings of the industry chapters into a more comprehensive understanding of globalization. The central actor in this understanding is the multinational corporation (MNC), which is an agent in the diffusion of knowledge embedded in artifacts, industrial processes, and organizational routines through its cross-border activities. And yet, despite their global reach, the MNCs are unable to escape “the pull of geography.” This pull is due to the knowledge and capabilities embedded in regions. Further, these qualities are not static but rather evolve and increase in tandem with economic action; learning-by-doing is a powerful force for localization. Through their purposive action and interaction with other local institutions, they modify the global geography of knowledge and capabilities. This contribution allows the reader to see the earlier chapters in new ways by interpreting and extending the chapter findings.

Conclusion

Globalization will continue to be a topic of intense debate. These contributions will not end that debate; however it is our hope that they will contribute to a more nuanced understanding of the actual dimensions of globalization. Whereas the debate has treated globalization as a uniform phenomenon, our chapters show that it has proceeded differently in each industry. I have identified five dynamics that are present in all of these industries. The chapters will show that these dynamics are shaped by the contours of each industry.

Although the chapters are about firms, the reader will immediately notice the importance of places. Locating global advantage is about firms finding locations with favorable factor prices, but it is also, as Kogut asserts, about how firms interact with those places to evolve positive externalities such as improved skill levels in the workforce, the creation or attraction of suppliers, and an infrastructure of collective goods such as universities, research institutions, and transportation or communications facilities. Such developments can actually magnify the pull of geography over time and permit the activities undertaken in that location to climb the value-added ladder. Conversely, other developments can diminish the efficacy of one place and promote another—such as the movement of the locus of television production from the United States to Mexico. These chapters illustrate what Storper and Walker (1989) have referred to as the inconstant geography of capitalism.

These chapters will show policy-makers that the impacts of globalization differ by industry and the particular configuration of its value chain. For example, had the U.S. government intervened in the HDD industry to prevent manufacturing jobs from going offshore, it is likely that they would have destroyed the entire industry. In the case of the FPD industry, Murtha et al. show that U.S. government intervention led to catastrophic results for those firms obeying government dictums. The U.S. firms that plunged into the industry-creation process in Japan were amply rewarded. In the television industry, repeated government efforts to save U.S. firms failed. However, in response, Japanese television firms moved operations to the United States and, at least for two decades ensured that U.S. workers were employed. All of these chapters demonstrate that policy must be shaped with the industry realities and dynamics in mind; otherwise it will fail either mildly or, in certain cases, catastrophically.

These chapters communicate the excitement and enjoyment we all have experienced during our studies. We believe that only through intensive study of specific industries and its firms can one understand the rhythm of business. This work is not easy, as firms and industries are among the most complicated

social structures created by human beings. They are shaped by, and help to shape, not only physical space but also labor markets, communities, and even our cultural heritage. It is our hope that this book will inform policy-makers and encourage yet more scholars to study the microdynamics of globalization.

Notes

1. We do not take a position in the debate on the nature of either the firm or the multinational enterprise (MNE), and likely our authors would disagree among themselves—something that we editors appreciate, because we do not believe that these debates are closed. Ours is a more limited focus; we seek to provide solid empirical studies that those interested in these issues can use for their theory building. On the nature of the firm, there is almost an inexhaustible literature; some of the classics are Kogut and Zander (1992), Nelson and Winter (1982), Penrose (1959), and Williamson (1985). On the nature of the firm from the organizational capabilities perspective, an important recent edited contribution is Dosi et al. (2000). For the literature on the MNE, classic citations include Dunning (1980), Hamel and Prahalad (1994), Porter (1985), and Vernon (1971).

2. An excellent cross-national comparative perspective is Dunning (1997).

3. For an excellent further discussion of the relative merits of these two terms for chains and their intellectual merger, see Gereffi (2001).

4. In the import-export databases, this is reported as Harmonized Tariff Schedule number 85415000.

5. For discussions of containerization and air freight, see Taggart (1999) and Lippin (1996). The importance of transportation for the economic growth of capitalism has been recognized by economists at least as far back as Karl Marx. Marx paid special attention to improvements in terms of speed. In more recent times, economists, especially Douglass North (1958, 1968), have examined the impacts of ocean freight rates. They were less interested in measuring—or perhaps less able to measure—the importance of qualitative changes such as increased speed and reliability. For modern just-in-time production systems, reliability is as important as speed, and, in certain cases, as important as cost. Reliability has become a major criterion for judging supplier quality.

6. One of the first economists to consider the importance of time for capitalist businesses was Karl Marx (1981). Of particular interest here is the discussion of circulation time—that is, the time goods spend outside the production process—in chapters 15 and 16 of volume two. For businesses, the time a good spends idling is money lost. The time and motion studies of Fredrick Winslow Taylor focused largely on time when the worker was not in motion, but also displayed much interest in greater efficiency in goods handling. Given the significance of time, it is remarkable how little theoretical attention it has received.

7. For a discussion of the interaction between knowledge creation and obsolescence, see Kenney (2001).

8. Florida (2002) discusses the desire of the most creative individuals to live in pleasant environments. For tasks requiring these kinds of labor power, firms do not have unfettered locational flexibility.

9. Roughly contemporaneously, geographers including Michael Storper, Richard

Walker, and Allen Scott were undertaking research on business clusters, or what they termed “agglomeration economies.” See, for example, Storper and Walker (1989) or Scott (1988); for a more recent discussion, see Sayer and Walker (1993).

10. The classic citation on embeddedness is Granovetter (1985).

11. The literature on clustering and the reasons for clustering is enormous. See, for example, Krugman (1991) and Harrison (1996),

12. There have been a large number of taxonomies of districts offered. See, for example, Krugman (1991) and Markusen (1999).