BEYOND MASS PRODUCTION

The Japanese System and Its Transfer to the U.S.

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Acknowledgments

This is the authors' second book together. In both volumes, we have tried to develop new concepts and understanding of the new industrial revolution that is going on all around us. Our first book explored the U.S. response to this new industrial revolution. This one chronicles the rise of an entire model of production and industrial organization in Japan and the transfer and diffusion of that model to the United States. We are equally responsible for this work. The order of the names reflects our long-standing policy of rotating lead authorship.

We began the set of projects that led to *Beyond Mass Production* in 1986 as a study of the Honda automobile assembly complex in and around central Ohio. That small study soon mushroomed into a major research undertaking on the origins and development of the Japanese production system and its transfer to the United States in the manufacturing sectors of automobile assembly, automotive parts, steel, rubber and tires, electronics, and more. In the course of this research we visited dozens of plants; we interviewed hundreds of managers, executives, union officials, workers, and government representatives; we collaborated with various scholars, and we benefitted from the able assistance of dozens of graduate students and staff members. In any undertaking of this size and scope, significant debts are accumulated.

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Finally, we both acknowledge the many and often neglected contributions made by our friends and families.

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Nature builds no machines, no locomotives, railways, electric telegraphs, self-acting mules, etc. These are the products of human industry. . . . They are organs of the human brain, created by the human hand; the power of knowledge, objectified. The development of fixed capital indicates to what degree general social knowledge has become a direct force of production.

KARL MARX, *The Grundrisse*, p. 706.

A company will get nowhere if all the thinking is left to management. Everybody in the company must contribute and for the lower level employees their contribution must be more than just manual labor. We insist that all our employees contribute their minds.

AKIO MORITA, former Chairman of Sony, *Made in Japan* (New York, Penguin, 1986), p. 165.

1

Introduction

Two steel mills sit barely an hour apart in the heart of America's industrial rustbelt. The first is a sprawling, old, rusted mass of buildings, pipes, wires, dirt, and sheds. Inside, thousands of workers covered in sweat and grime toil over aging steel furnaces, turning molten metal into steel slabs. There is a distinct hierarchy here; each worker does his or her own job with its own rate of pay, which is codified into a legalistic system of literally hundreds of separate job classifications. Managers and supervisors in shirts and ties stand watch over the workers, who perform the actual physical labor. Strewn everywhere across the muddied dirt floor are old wires, chemical containers, tools, and all sorts of debris. The noise level is so deafening that some of the workers wear protective ear coverings. The steel moves slowly by overhead crane, or at times on aging trucks, across the huge complex to be processed into steel sheets and coils. Outside, rusted steel slabs and coils are piled everywhere; beside them rest broken-down machines, trucks, and industrial vehicles.

The second mill is a gleaming white building reminiscent of the futuristic industrial parks of Silicon Valley. Inside are brightly colored machines, day-glo–colored guardrails, and a brightly polished concrete floor. Gleaming sheets of steel zip through the machinery, like sheets of paper through a paper mill. At the center of the process stands a large glass-enclosed booth housing computers, digital readouts, and electronic gauges and controls. Workers, managers, and engineers in the same dark uniforms oversee the process, but do not actually handle the steel. The workers themselves monitor, modify, and program the computers that guide the steelmaking process. Some even carry mobile computer packs so they can control the process from anywhere within the plant. They do so with assistance from, but not the interference of, managers and engineers. These workers, engineers, and supervisors are constantly discussing new ways to improve the process and make it more efficient. Strikingly, there are no time clocks or time cards in this factory; everyone here draws a monthly salary. This steel mill produces cold-rolled steel in less than an hour from start to finish; it used to take as long as 12 days for the same process.

The first factory is owned and operated by a U.S. business, and the other is a joint venture between a Japanese steel company and an American one. This book attempts to explain how such a contrast could exist. It provides a theoretical and historical analysis of the Japanese production system and examines the transfer of

that system to the United States. We argue that Japan is at the center of an epoch-making new model of technology, work, and production organization that is now being transferred to the United States and elsewhere around the globe. The key to the new model lies in organizational forms and practices—work teams, rotation, and workers' involvement—which when taken together effectively function to harness the intelligence as well as the physical labor of workers. We see this new model as involving a synthesis of innovation and production and thus refer to it as "innovation-mediated production." This revolutionary method of organizing production integrates the knowledge and intelligence of a far wider spectrum of workers, from R&D (research and development) scientists and engineers who create new technologies and product ideas to shop-floor workers who turn those innovations into products. It blurs the boundaries between innovation and production, emphasizes continuous improvement in manufacturing processes, and, most significantly, results in a powerful synthesis of intellectual and physical labor. This is a major advance over traditional fordist mass production, which was based simply on squeezing physical labor out of workers. By applying intelligence to mass production, this new model has transformed forever the way work is done, even in the United States—the home of the old Taylor–Ford model of scientific management and assembly-line mass production.

Japanese Transplants in the United States

Over the past two or three decades, entire segments of American mass-production industry declined; cities and entire regions bore the brunt of devastating deindustrialization, and millions of workers lost their livelihoods and homes. For most students of economic change, the prognosis was bleak—the United States would face long-term deindustrialization, and rustbelt industry would become a relic of the past. But in the very face of all of this, a startling turnaround emerged. Armed with a new model of production organization, Japan's leading industrial corporations are transplanting a modern manufacturing infrastructure into the U.S. industrial heartland—right beside the one abandoned by American companies.[1]

During the 1980s and continuing into the 1990s, 1,275 Japanese "transplants" established manufacturing operations in the United States.[2] There are now 8 Japanese automotive assembly transplants (3 more are in Canada near the U.S. border), more than 320 Japanese-owned or Japanese-American joint venture automotive suppliers in the United States, 72 Japanese-owned or Japanese-American joint ventures in steel (roughly a dozen larger integrated steel mills, mini-mills or steel coating lines, the remainder being smaller steel processors and steel service centers), and 21 Japanese-owned rubber and tire plants.[3] A large share of these transplants are in heavy industry—the industry that experienced widespread deindustrialization, decapitalization, and disinvestment under U.S. fordism.[4] Since 1987, for example, some 32 Big Three auto plants have closed.[5] Figure 1.1 shows the heavy concentration of automobile assembly, automobile parts, steel, and rubber and tire transplants in and around the industrial heartland—in a region we term the "transplant corridor."[6]

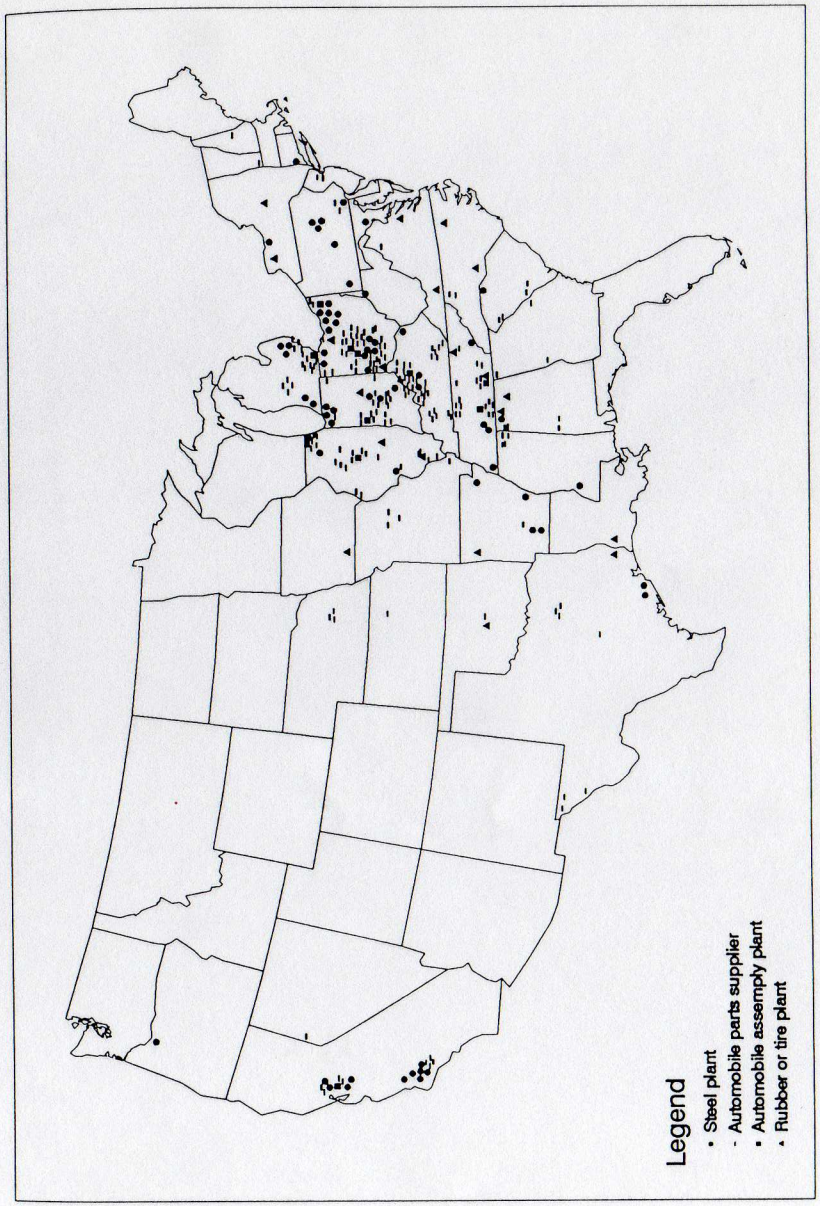

FIGURE 1.1. The Transplant Heavy Industrial Complex.
Source: Authors' database.

The automobile industry has been the catalyst for the wave of Japanese investment in American heavy industry. Automotive transplants include a large Honda assembly and manufacturing complex in central Ohio; Nissan's plant in Smyrna, Tennessee; the NUMMI joint venture between General Motors (GM) and Toyota in Fremont, California; a large Toyota assembly complex in Georgetown, Kentucky; a Mazda assembly plant on the grounds of an old engine and transmission foundry outside Detroit; Diamond Star, which began as a joint venture between Mitsubishi and Chrysler plant in Illinois, but which is now wholly owned by Mitsubishi; SIA, a joint venture between Subaru-Isuzu in Indiana; and a new Ford-Nissan joint venture in northeastern Ohio. These transplant assembly plants have been complemented by hundreds of transplant parts suppliers who have chosen to locate in close proximity to them.

Japanese steelmakers have followed automakers to the United States, in large part to tap the growing demand for high-quality steel generated by the automotive transplants. Japanese involvement in the American Steel industry has come in three forms: joint ventures with U.S. corporations in large integrated production facilities, new galvanizing and coating lines that serve the automotive transplants (galvanizing is a technology that Japanese steelmakers have refined far beyond U.S. firms), and solely owned steel-processing facilities and steel service centers. Japan's major steel corporations—Nippon Steel, NKK, Kobe Steel, Kawasaki Steel, and Sumitomo Metal—all operate U.S. plants. NKK is working to revitalize old National Steel mills near Detroit, Chicago, and St. Louis. Kobe Steel has brought new technology and new production organization to an old U.S. Steel plant in Lorain, Ohio. Kawasaki Steel is working with Armco to refurbish two of Armco's old Midwestern steel mills. Nippon Steel, Sumitomo Metal, and Nisshin Steel are bringing to America state-of-the-art steel galvanizing lines that coat and prepare steel for automotive and other uses.

Japanese corporations have also invested heavily in American rubber and tire production, mainly through direct buy-outs and acquisitions of U.S. companies. In 1983, Bridgestone, Japan's largest rubber and tire producer, purchased a Firestone plant in Tennessee, and in 1988 it purchased all of Firestone Corp. for $2.6 billion. In 1986, Sumitomo Rubber bought Dunlop's entire U.S. tire operations for $350 million and has since spent more than $200 million turning them into state-of-the-art factories. Yokohama Rubber has recently purchased Mohawk Rubber. Toyo Tire is involved in a joint venture with both Yokohama and German tiremaker, Continental. Today, four of Japan's five major rubber and tire companies have U.S. factories.

Japanese manufacturing investment in the United States is not simply confined to mature "sunset" industries; Japanese multinationals are also rapidly extending their investments into U.S. high technology. This has come in various forms: direct investment in electronics factories; alliances, mergers, and acquisitions of existing U.S. high-technology firms; and financial investments in U.S. venture capital funds. Nearly all major Japanese electronics companies operate television, semiconductor, telecommunications, and computer manufacturing facilities in the United States. A growing number of them are building new product-development centers and advanced R&D labs in the United States to bolster their technological capability and to support U.S.-based manufacturing activities.

Large Japanese firms in both high-technology and traditional industries have pursued an aggressive policy of alliance building with fledgling U.S. startups. Japanese multinationals are pumping capital into U.S. microelectronic, software, biotechnology, and superconductor firms in return for privileged access to the cutting-edge technology these American companies develop. Japanese companies in traditional heavy industries, such as steel, view these technologies as part of an effort to create a "new iron age" that will use high-technology microelectronics and software to transform steelmaking into a revolutionary continuous process.[7] Between 1983 and 1989, Japanese corporations invested more than $882 million in 217 U.S. enterpreneurial startup companies and another $224 million in American venture capital funds directly.[8] For example, Steven Jobs' company, Next, sold 16 percent of its shares to the Canon Corporation of Japan for $100 million.

Transfer of the Japanese System

The phenomenon of Japanese industrial transplants in the United States raises two basic issues: the first concerns the process of organizational transfer or transplant itself, and the second revolves around the deeper question of the generalizability of the Japanese production system and the new model of innovation-mediated production that it reflects.

Ever since the 1950s, there has been a persistent tendency among scholars to explain Japanese industrial and production organization as the product of unique social and cultural attributes. Early theories explained the Japanese production system in terms of cultural stereotypes such as homogeneity, obedience, groupism, paternalism, and Japan, Inc.[9] These were seen to promote a close alignment among individuals and groups or organizations. In a now classic formulation, the British sociologist Ronald Dore contrasted the Japanese system of "welfare corporatism" with the Anglo-American model of "market individualism."[10] In the late 1970s, the management literature advanced the argument that the Japanese system was little more than a set of techniques that could be copied by traditional U.S. firms.[11] More recent work in the neo-Marxist tradition conceptualizes the Japanese model in terms of the "hegemonic despotism" of Japanese firms and the super-exploitation of Japanese workers.[12] Mike Parker and Jane Slaughter advance the concept of "management-by-stress," arguing that the key to the Japanese model lies in a fast work pace and the self-discipline imposed by work teams.[13] Interestingly, while both the culturalist and neo-Marxist perspectives see the Japanese model as a product of unique social and cultural climate and/or economic factors, and thus imply that it cannot be transferred to other nations, the managerialist perspective reduces it to a simple set of "cookbook" techniques that can be replicated in piecemeal fashion.

More recent formulations see the Japanese system as comprising a unique model. Kurt Hoffman and Raphael Kaplinsky advance the concept of "systemofacture" to describe the restructuring of the labor process and supplier relations in the Japanese manufacturing industry.[14] Several scholars associated with the MIT International Motor Vehicle Program suggest that Japanese organizational practices constitute a new model of "lean production" toward which companies all over

the world are converging. The defining features of so-called lean production include efficient use of resources, low inventories, and just-in-time production and delivery practices.[15] Of course the Japanese production system is efficient. The real question is why—what underlying organizational, institutional, and behavioral factors make it efficient. This is the question this book tries to answer.

In examining the transfer of the Japanese system to the United States, we confront questions similar to those advanced by the Italian social theorist, Antonio Gramsci, in his classic essay "Americanism and Fordism."[16] Gramsci was concerned with the impact of American production methods and American culture on Europe in the period immediately following World War I. Gramsci posed this question: Were the changes occurring at the point of production the beginnings of a new historical epoch? From this, two additional questions followed. First, could the then new model of U.S. fordism be transferred to Europe? And second, to what extent was the fordist model bound up with a set of social and cultural practices Gramsci referred to as "Americanism"? Gramsci answered that the new model of fordism was the most advanced system of production organization of its time and that as such it would surely diffuse to Europe over time. He further argued that there was not a necessary or determinant relationship between fordism and American culture. Fordism represented certain organizational practices constructed at the factory level; these practices were not dependent upon Americanism and thus would eventually be transferred to Europe.

The findings of our research—based upon site visits to dozens of firms, personal interviews with hundreds of company officials and factory workers, and detailed survey research—provide ample evidence that in the old fordist industries the Japanese transplants are successfully transferring the basic elements of the Japanese production system to the United States. The Japanese system, along with the underlying model of innovation-mediated production upon which it is based—like the fordist mass-production model before it—consists of organizational practices whose fundamental "genetic code" can be successfully inserted into another society and can then begin to successfully reproduce in the new environment. In this sense, the system is independent of Japanese culture and society.

This transfer is neither natural nor automatic, but rather is the result of the concerted actions and strategies undertaken by large Japanese corporations to implant their new model of production organization in a nonsupportive U.S. environment with its long legacy of fordist practices. Where the Japanese companies did not actively try to implement the innovation-mediated production system such as in electronics, the existing situation is far closer to that of their U.S. competitors. Generally speaking, we advance the argument that the Japanese system of production organization is a set of interactive organizational practices that are transferable to foreign environments.[17]

Beyond Fordism?

This brings us to an even more fundamental issue—the extent to which the Japanese model can play a role as a general model for industrial organization and as

such function as a successor model to fordism. Our research informs a view that differs and goes beyond contemporary theories of Japanese production and industrial organization.[18] The underlying conceptual premise of this book is that Japan is at the cusp of a new model of production organization that mobilizes workers' intelligence as well as physical skill. This new mode of production organization extends across all facets of the innovation-production spectrum, harnessing the intelligence and knowledge of both R&D scientists and engineers and factory workers. It is organized through the use of teams and other organizational techniques that explicitly harness workers' knowledge at the point of production. As such, the new model has transformed ordinary workers' knowledge and intelligence into a source of value, created new methods of work, and established a very efficient system for turning the potential value embodied in innovations into mass-produced commodities that are the source of tremendous profit and capital accumulation. This system of innovation-mediated production harnesses the worker more totally and completely than did previous institutional and organizational arrangements.

We thus see this new model as a fundamental supercession and potential successor to mass-production fordism. Indeed, its rise is in many respects more sweeping than the growth of fordist mass production during the industrial revolution of the late nineteenth century, when the rise of the factory system, scientific management, and the moving assembly line enabled industrial capitalists to more efficiently harness physical labor from huge masses of relatively unskilled shop-floor workers.[19] This theoretical premise allows us to tackle the question of the transfer of the Japanese production system in terms of the broader question of the generalizability of innovation-mediated production as a successor to fordist production organization.

This leads to a related question: Is Japan postfordist?[20] There are really two answers—depending upon how the term "postfordist" is interpreted. The answer is yes, if postfordist is simply used to refer to a new model that comes "after" fordism. It is no, however, if postfordist is used strictly to imply a direct progression from and a strong genealogical link to fordism.

Clearly, Japanese industry benefitted from contact with and learning from U.S. fordism. It is well known that U.S. quality-control experts such as Deming and Juran were accepted, even hailed, in Japan. Further, as even popular books such as David Halberstam's *The Reckoning*[21] have made widely known, Japanese managers and others visited U.S. factories en masse and returned to Japan with a variety of ideas. Certainly some of the technical aspects of production in Japanese factories were fordist—for example, the moving assembly line and the implementation of statistical quality-control techniques among other things. But, the organizational context into which these seeds were planted was sufficiently different from that of U.S. or even Western European production organization. Facing deep industrial conflicts and a unique constellation of management-labor relations, Japanese industry embarked on an evolutionary path that was markedly different from Western fordism quite early on. The social relations of production were based on social contract between capital and labor that differed markedly from those in Western countries. For these reasons, it is difficult to consider the organization of work and production in immediate postwar Japan as fordist.

It is important to point out here that we are principally concerned with developing an objective theory of the Japanese production system and of the new stage of capitalism which it reflects. We do not consider the normative question of whether this model is "better" or "worse" than fordism or other Western economic arrangements. However, it is clear that the Japanese production system and the Japanese transplants in the U.S. are beset by various tensions and contradictions. Japanese scholars and critics of the Japanese industrial system have long noted the problematic features of the Japanese production system. Long hours and high stress are defining features of Japanese manufacturing. Workers in Japanese industry average more than 2,000 working hours annually, roughly 200 to 500 hours more than their counterparts in the United States and Europe.[23] Life on the Japanese assembly line is stressful, difficult, and at times even unhealthy.[24] A 1986 survey by the All Toyota Union found that approximately 124,000 of its 200,000 members suffer from chronic fatigue.[25] In Japan, a major social issue is *karoshi*, or death from overwork.[26]

As many have noted, the positive aspects of the Japanese production system—high wages, secure employment, and long-term tenure—accrue mainly to male, permanent employees of large companies who comprise roughly one-third of the labor force. Fundamentally linked with this "core" of the Japanese labor force is an extensive periphery of lower-paid, part-time, and temporary workers, especially women, who work for suppliers, subcontractors, and small firms and who do not benefit from the conditions afforded core workers. Both Japan and Japanese industry continue to suffer from serious problems of racism, sexism, conformity, and exploitation. Of course, some aspects of workers' standards of living, especially housing, are lower than in the advanced Western industrialized nations.

Theories of Industrial Change and Restructuring

In this book we consider the Japanese production system and its transfer to the United States in light of the more general debate over new models of production and industrial organization. Our conceptualization builds from and goes beyond a variety of contemporary theories of industrial and technological change, organizational transformation, and political-economic restructuring. Over the past decade or so there has been an outpouring of theory and speculation over the issue of what comes next: What are the new technological, social, and organizational forms that might replace fordist mass production? Theorists have advanced various alternative models of the next stage of capitalism. While the debate has taken different forms in different places, the core issues are strikingly similar. There is broad concern for the rise of new organizational forms, much of which has been stimulated by the decline and transformation of twentieth-century fordist industrial capitalism. Moreover, there is a general awareness of and concern for the rise of new technologies as reflected in the outpouring of writing on high-technology industry, postindustrialism, the information economy, and postfordism.

Long-Wave Theories

The first of these theories is the renewed interest in the long-wave perspectives that grew up almost simultaneously within the Marxian, Schumpeterian, and mainstream traditions in the mid- to late 1970s. The long-wave perspective basically contends that capitalism can be divided into a series of stages or historical periods that differ on the basis of underlying technological conditions, organizational forms, and so on.[27] This includes the work of Ernst Mandel on the Continent,[28] Christopher Freeman and the Science Policy Research Unit of Sussex University (SPRU) school in Great Britain,[29] and the "social structure of accumulation" perspective in the United States.[30] Adherents of the SPRU school—most notably Christopher Freeman and Carlotta Perez—emphasize the relationship between technology and social structure, conceptualizing this in terms of "techno-economic paradigms."[31] These authors suggest that the existing mode of technological-economic organization is in the throes of decline and change because existing institutional and organizational forms are ill-suited to support new technologies. They in turn suggest that advanced industrial societies are entering a new techno-economic paradigm based upon information technologies. Following Schumpeter, both Freeman and Perez place great emphasis on technology effects and the adaptive responses in social and economic structures.

Postindustrialism

As early as the 1960s, sociologists in the United States, Europe, and Japan began to argue that the United States was moving from an industrial society to one based on postindustrial information and service industries. According to this view, capitalism was evolving toward a postindustrial white-collar world where manufacturing would be replaced by automation. In Daniel Bell's conceptualization, the industrial working class would shrink and be replaced by a growing white-collar meritocracy.[32] In contemporary versions of the postindustrial thesis, Fred Block and Larry Hirschhorn contend that services and automated manufacturing are coming to replace older manufacturing industries.[33]

The postindustrial position has important weaknesses. First, there is no sustained analysis of what exactly constitutes a "service."[34] Indeed, not all services are created equal and not all services are services. According to the postindustrialists, only sweaty, physical labor in traditional heavy industries qualifies as industrial activity. This is a very narrow definition. Is the woman who cooks hamburgers at McDonald's a service worker? She is performing an activity that physically transforms meat from an uncooked to a cooked state. There are some rather basic similarities between her work and that of a steelworker who transforms iron ore into steel. Is a software programmer a service worker? The programmer produces a product that actually performs work—it totals numbers, runs machine tools, etc. How different is this software worker from a machinist who, by using his physical strength and knowledge of metal, essentially instructs a machine tool in metal cuts?[35]

The entire postindustrial position rests on the belief that the demise of the steel, automobile, and other heavy industries in the United States is co-terminus with the rise of a new postindustrial order. Yet the United States continues to have a manufacturing base. According to recent empirical studies, manufacturing continues to comprise roughly the same share of the American economy as it did in earlier times.[36] A semiconductor fabrication facility and a biotechnology fermentation plant are both industrial facilities; they are not postindustrial at all. Both cost money to build, employ operators, and actually produce things. According to Michael Cusumano, software production in Japan can and does take place in factories that on many dimensions are comparable to Japanese automobile factories.[37] Moreover, Japan and Germany, two of the most vibrant economies on earth, have strong manufacturing bases: How do they fit with the postindustrial thesis?

Indeed, recent research has found that so-called postindustrial technologies such as software and computerized automation are inextricably bound to manufacturing and actual factory production. According to recent research, computer automation is most successful in environments where workers are integrated into the production process and where continuous learning can occur.[38] In other words, effectiveness stems from an organizational context and concrete social relationships that can optimize the use of new technology, not from technology that simply displaces workers. These social relationships are critical for implementing higher and higher levels of technology.[39] And as we shall demonstrate, to be truly effective in the new environment, the factory is more—not less—important. Indeed, the laboratory and factory must be linked in a continuum of innovation and production.[40] In short, postindustrialists understand that intellectual activity will become ever more important, but they make the mistake of assuming that industrial production will disappear.

Flexible Specialization

Flexible specialization was originally put forward by the Italian economist Becattini and his students in Italy and later brought to the United States by Michael Piore and Charles Sabel.[41] Piore and Sabel basically argue that there is an historical tension between two basic modes of production organization: mass production and craft production. In their politically contingent model of development, which they call the "branching tree model," struggles among political groups (though not necessarily classes) determine which of these forms will predominate in a given historical epoch. Using this general theoretical framework, they contend that the past century or so of industrial history saw the political ascension of mass-production organization over craft production. However, the current period of decline of mass production opens up a renewed era of indeterminacy and choice, when a new form of craft production or flexible specialization becomes politically possible. The ideal-typical model of flexible specialization is the tightly networked firms of northern Italy, which are characterized by high degrees of cooperation and knowledge sharing, joint development, and joint involvement in production. They further argue that the seeds of this new form of production are already in place in many of the advanced industrial countries that have and continue to experiment with cooperative networks of small industrial firms. The flexible specialization model has been subject to stinging critiques on various theoretical and empirical grounds as scholars have questioned its underlying theoretical framework, the conceptual validity of the flexible specialization model, and whether this is a transitory phenomenon or simply a misreading of current trends.[42]

Still, both this and other works have stimulated an outpouring of research on the changing social division of labor in capitalism that integrates a wide range of disciplines and perspectives including the transaction-cost approach to economic organization pioneered by Oliver Williamson,[43] the "social embeddedness" theory of Mark Granovetter,[44] and Charles Sabel's[45] recent arguments regarding the role of trust in economic development. Interestingly, this work has influenced an intense debate over what are the most effective mechanisms for organizing the division of labor, including research on new forms of corporate organization[46] and inter-firm production networks.[47] These and other approaches share a common point of departure, for they contend that the future of capitalism can be best understood by looking at changes in the organization of the division of labor.

This theoretical and empirical preoccupation with the social division of labor inside and outside the firm and related organizational forms diverts attention from the more fundamental matter at hand: the restructuring that is going on at the point of production. To place the matter in perspective: It is akin to elevating the theory of industrial bureaucracy or the multidivisional, vertically integrated corporation[48] to the level of a theory of twentieth-century fordist industrial capitalism. Simply put, the debate over networks and flexible specialization as it is currently taking place revolves around important but nonetheless second-order phenomenon.

Regulation Theory

Perhaps the most significant current body of theory and research aimed at explicating the development of capitalist economies is the "regulation school" of political economy.[49] Going beyond the long-wave approach, but still operating within a world historical context, adherents of the regulation school focus on relationships between the technological base of production and consumption (or demand), which in their vocabulary constitute an abstract "regime of accumulation," and the concrete institutional fabric of society, which they refer to as the "mode of regulation." This perspective represents a melding of insights of Schumpeter and Keynes within a basic Marxian perspective that emphasizes the primacy of the forces and relations of production in outlining the parameters of social and economic structure.

There are a number of views from within regulation theory that focus on future pathways of industrialization. Perhaps the most common is that of neo-fordism.[50] As its name implies, the neo-fordist position suggests that the current period is not a break with the older model of fordism, but simply represents an extension and advance of that model. A variant of this, to which we will return later, is the "toyotism" model of Knuth Dohse and his colleagues.[51] The toyotism model suggests that Japanese capitalism has established a more efficient way of organizing produc-

ion based upon the regrouping of tasks and a very fast workpace. Toyotism thus extends but does not break with fordist principles for the organization of mass production.[52]

A number of regulation theorists suggest that a new model of industrial organization is developing as a clear-cut break with fordism. Annemieke Roobeek suggests that the rise of new information technologies will increasingly disrupt fordist organization, thus resulting in the rise of a new postfordist order.[53] Although her analysis is somewhat vague, it suggests that microelectronics, biotechnology, and new materials technology are bringing about both increased productivity and the "de-materialization" of production, as for example, fiber optics replace copper wires and genetically engineered products replace traditional chemicals. This in turn requires new social institutions and organizational forms that are different from those of fordism. Benjamin Coriat argues that we are witnessing a melding of traditional mass production, automated robotics technologies, and flexibility.[54] Coriat's basic argument is that automated technologies—for example, numerically controlled machine tools, flexible manufacturing systems, and robotics—are fundamentally transforming industrial production, leading to a new model of "flexible mass production."

Our conceptualization builds from regulation theory and from elements of the other theories outlined above, as well as from detailed research and observation in actual factories and laboratories, to outline the contours of a new model of production organization that is emerging as a successor to mass-production fordism.

Innovation-Mediated Production: A New Model

The salient features of a new model of production organization are now visible across the landscape of global capitalism. They are increasingly evident in the sweeping transformation of production, innovation, and organization in the factory, in the R&D laboratory and in relations among and between firms. What we are witnessing is a fundamental realignment of the forces and relations of production that is opening up new possibilities for value creation, productivity improvement, capital accumulation, and economic growth.[55] This is in keeping with the nature of industrial progress to the present—the rise of textiles, steel, and automobile production technology as defining features of previous industrial epochs.

In our view, there are five basic dimensions to the new model: (1) a transition from physical skill and manual labor to intellectual capabilities or mental labor, (2) the increasing importance of social or collective intelligence as opposed to individual knowledge and skill, (3) an acceleration of the pace of technological innovation, (4) the increasing importance of continuous process improvement on the factory floor and constant revolutions in production, and (5) the blurring of the lines between the R&D lab and the factory. This new model can be conceptualized as one of *innovation-mediated production*—a concept we advance to refer to the integration of innovation and production, of intellectual and physical labor.

Innovation-mediated production should not be considered synonomous with the Japanese model. Just as the previous model of mass-production fordism could

be seen as distinct from the United States, the new model of innovation-mediated production is distinct from Japan. And just as different regions, different firms, and different nations developed their own specific variants of fordism, so too it should be possible with innovation-mediated production. Simply put, innovation-mediated production is neither specific to Japan per se nor only possible in the Japanese context; rather, as Chapters 2 and 3 will show, historical conditions, struggles, conflicts, and structures specific to Japan caused it to crystalize there and become dominant.[56] However, we argue that Japan, like the United States before it, has gone the furthest toward generalizing the new model across the broad spectrum of its industrial structure and broader political economy. Japan—more than any other nation—has been able to institutionalize and generalize the new model at the very core of its industrial structure. The Japanese expression of innovation-mediated production thus comprises both the traditional heavy industries of automobile, steel, and rubber and the new high-technology industrial sectors of electronics and biotechnology.

The cornerstone of innovation-mediated production lies in the harnessing of workers' intelligence and knowledge of production. Here we conceptualize knowledge as a form of human creative capability and value-creating activity. This includes, for example, the knowledge embodied in software programs that image the labor process and "run" machines and the ability of shop-floor workers to modify and improve the production process. Our conceptualization of social or collective knowledge thus extends to both the abstract scientific and technical knowledge of R&D workers, which is embodied in innovations and salable commodities, and the knowledge of shop-floor workers, which provides a crucial source of shop-floor product and process improvements. This overcomes the traditional (and largely artificial) distinctions among science, technology, and factory production, and the related distinction between mental and manual labor.[57] In our view, these are different faces of the same general process of human creativity and value creation. In a word, value is created both on the factory floor and in the R&D laboratory. Innovation-mediated production integrates the knowledge and intelligence of all workers, from R&D scientists and engineers who create new technologies and product ideas, to shop-floor workers who turn those innovations into marketable products. It is thus a major advance over traditional mass production, which was based simply on pumping physical work out of workers and pumping plans and specifications out of researchers and engineers.

The new technologies and productive forces are increasingly digitized and cybernetic—that is, they are run by computer programs that encapsulate abstract intelligence. This contrasts with the practical or mechanical methods of fordist mass production that both promoted and were based upon de-skilling and an attendant separation of intellectual from manual labor both on the shop floor and between the factory and R&D laboratory. The new forces of production thus provide an additional impetus for the synthesis of intellectual and manual labor, as abstract mathematical reasoning is increasingly required of workers. Among all workers, narrow skills must be accompanied by broad knowledge and an ability to understand and think abstractly and to continually grasp new concepts.

At the organizational level, the new model revolves around the blurring of the

lines between "production" and "innovation." We refer to this reorganization as the *new shop floor*—by which is meant the easing of the distinctions between the factory floor and the R&D lab, as innovation becomes more continuous and the factory itself becomes a laboratory-like setting. The underlying organizational feature is the self-managing work team that enhances the *functional integration* of tasks. The new shop floor thus integrates formerly distinct types of work—for example, R&D and factory production, thus making the production process ever more social. In doing so, the organizational forms of the new shop floor mobilize and harness the collective intelligence of workers as a source of continuous improvement in products and processes, of increased productivity, and of value creation.

At the technological level, the new model is characterized by an increasing pace of innovation. Here, one need only note the incredible pace of progress in semiconductor electronics and computers where new products and technologies are revolutionized in a period of three or four years. This is a product partly of the wide open technological opportunity for upgrading and improving these technologies and partly of the intense capitalist competition in these sectors. In one of the most insightful examinations of contemporary capitalism, Tessa Morris-Suzuki advances the concept of "perpetual innovation" to explain the rapid and continuous nature of technological change that follows the shift from older mass-production industries to new information-intensive, microelectronic technologies and industries.[58]

Innovation-mediated production is distinguished by an emphasis on incremental improvement innovation as well as radical new breakthrough technology.[59] What matters is not only the ability to invent new products and technologies but also the ability constantly to upgrade and improve those products and manufacture them as efficiently as possible. Small, incremental improvements in products and processes accumulate into major advances. In industry after industry, Japanese firms, for example, have overtaken very advanced technological competitors by constantly upgrading and improving the features of the products that they offer. A salient example of this is the nearly constant new product releases of laptop computers with new and improved features: screens, hard drives, processors—all in smaller yet more powerful packages.

The output of innovation-mediated production—its products—are incredibly diverse. This is in sharp contrast to the highly standardized mass products of fordism. Products are constantly improved, customized, and revolutionized to tap into and indeed to open up new market spaces. This revolutionizing process provides an incredible mechanism for realizing the value and super-profits created by the process of innovation-mediated production. This in turn requires constant revolutions in the production process itself.

Of crucial importance here is the role of *continuous process improvement* on the factory floor. At bottom, all product improvements require process improvements. Furthermore, manufacturing and the point of production on the factory floor are the crucial sites for process improvements. There have no doubt been major process breakthroughs such as Ford's moving assembly line[60] or Taiichi Ohno's *kanban* system.[61] But even these provide only a short respite from competitors. To survive in

capitalism it is necessary to adapt, refine, and improve manufacturing processes, while also developing new products. The factory itself and its workers are the arena for accomplishing continuous process improvement. Japanese firms see workers' involvement in continuous process improvement as the key to their productivity, and even have a word for it—*kaizen*. As a result, the production process under innovation-mediated production is dynamic and continuously becomes more efficient.

The ability to diffuse and integrate innovations throughout the industrial structure is another important element of the new model. In Japan, for example, both technological and organizational innovations diffuse readily through the industrial structure. Innovations in electronics and other advanced technology areas are quickly adopted in new industrial systems and processes, office products, and consumer goods. Moreover, there is a high level of organizational congruence and integration across the industrial structure—the transcendance of traditional industrial boundaries.

In short, under innovation-mediated production, the organization of production and the labor process are oriented toward harnessing the intellectual capabilities of workers. This is not to imply that the extraction of physical or manual labor at the point of production is no longer important; it simply suggests that intelligence and knowledge are more explicitly integrated into the production process. Simply put, what lies at the bottom of the new industrial revolution is a synthesis of intellectual and manual labor designed to mobilize and harness the knowledge and intellectual capabilities (in addition to the physical labor) of the entire strata of workers from the R&D lab to the factory floor. Far from being romantic or naive, this view recognizes quite explicitly that the new industrial revolution exploits the worker more completely and totally than before.

Outline of the Text

This book explores the emergence of innovation-mediated production in Japan and the diffusion of that model to the United States. Many scholars have chronicled the decline of the old system of mass production, and an increasing number have begun to identify various dimensions of the new order. Yet we still lack anything approaching a unified theory of this new stage of capitalism. Through an exploration of the development of Japanese industry in both the traditional heavy industries and the new high-technology sectors of microelectronics and biotechnology, Part I of the text develops the theoretical structure with which to understand the rise of innovation-mediated production in Japan.

Chapter 2 develops the main theoretical structure of the book, outlining the transition from fordism to innovation-mediated production in Japan. This chapter provides a theorized history of the Japanese model in light of changing economic conditions, state policy, and evolving conflicts between labor and capital. It focuses on the establishment of the unique Japanese "social contract" or "class accord" among capital, labor, and the state in the immediate postwar years that institution-

alized many of the basic elements of the Japanese production system and laid the foundation and the constraints within which Japanese capitalism would develop.

Chapter 3 continues this historically grounded theoretical excursus by exploring the further development of innovation-mediated production in Japanese high-technology industry. It documents the ability of the Japanese model to incubate and foster high-technology industry within large, powerful corporations. This chapter also focuses on the role of knowledge-intensive production in Japanese high technology, the integration of innovation and production activities, and the development of industrial galaxies of small and medium-sized firms around large industrial corporations.

Part II turns to the transfer and diffusion of the Japanese expression of innovation-mediated production to the United States, exploring the issue of its generalizability. This section of the book confronts a series of basic conceptual questions of organizational theory and of the general relationship between organizations and culture. To answer these questions, we examine the transfer of the Japanese expression of innovation-mediated production to the United States in a series of key industrial sectors—automobiles, automotive parts, steel, rubber, and electronics.

Chapter 4 begins the empirical analysis of the Japanese transplants, exploring the Japanese automotive transplants—the linchpin of the Japanese heavy industrial transplant complex. It outlines the nature and extent of investment and the different strategies pursued by various auto assemblers. It focuses upon the transfer of the basic features of Japanese production and work organization: work teams, job rotation, long-term employment guarantees, *kaizen*, and quality-control circles among others. This provides evidence of the successful transfer of Japanese production organization to the United States. These data are used to counter the prevailing culturalist interpretation of Japan, suggesting instead that the Japanese model consists of a set of basic organizational practices that can be implanted in other societies.

Chapter 5 deepens our analysis by examining the relocation of Japanese automotive parts suppliers to the United States. This entails an examination of the transfer of work and production organization in these suppliers and of the transfer of Japanese subcontracting relations to the United States. The supplier transplants are far more numerous than the automobile assemblers and thus are planting the "seeds" of the Japanese model more widely across the United States. The basic finding is that the transplants have re-created a Japanese-style just-in-time subcontracting system in the United States. This further confirms the thesis that the Japanese production system is transferable.

Chapter 6 explores Japanese investment in the American steel industry. Ever since the early 1980s, Japanese steel manufacturers have made major investments in U.S. production. The steel investments are thus a major and vital cog in the Japanese heavy industrial manufacturing complex that is emerging in the United States. We also explore the transfer of Japanese production organization in the steel industry. Our findings here suggest that Japanese firms have had considerable success in transferring the Japanese model to U.S. transplant facilities. The basic conclusion of the chapter is that Japanese investment is resulting in both the successful transfer of the Japanese production system and a creeping takeover of the American steel industry.

Chapter 7 explores Japanese investment in the rubber, tires, and related industries, and the process of transferring the Japanese model in these industries. It documents the emergence of an integrated transplant industrial complex of automobile assembly, automotive parts, steel, rubber, and other basic industries. It explores the impact of this complex on jobs and employment and examines its underlying geographic and locational logic. This chapter also examines the question of whether Japanese firms are simply opening low-end branch plants or whether they are bringing higher-end, higher value activities to the United States; in particular, the chapter looks at domestic sourcing of key components and the establishment of product development and R&D facilities. In doing so, it contrasts Japanese-sponsored "reindustrialization" with the long legacy of deindustrialization and disinvestment under U.S. fordism. Finally, it provides a critical look at the current array of economic development policies being used to recruit transplant producers and new industry, suggesting a new model for policy intervention.

Chapter 8 focuses on Japanese investment in consumer and high-technology electronics—televisions, semiconductors, computers, and telecommunications. It examines trends in Japanese direct investment in plant and equipment via new investment and the purchase of U.S. facilities. This chapter explores the process of transferring both work and production organization and Japanese supplier relations in these sectors. The basic conclusion of this chapter is that the process of transfer has occurred differently in the electronics sector. Basically, the electronics transplants show greater evidence of "fitting in" to the American environment.

Chapter 9 looks at the tensions and contradictions of the transplants. It explores problems of injury, fast work pace, racial discrimination, and labor-management relations. But most importantly, it focuses on the new model of corporate control that the transplants and the Japanese model more generally use to motivate, indoctrinate, and control workers. Here we explore the origin, impact, and ramifications of corporate hegemony. This powerful system of corporate motivation and control, which is required to harness workers' energy and necessary for the very functioning of the new model of production, can create serious problems.

The concluding chapter reflects on the epochal changes in production and industrial organization that are sweeping the globe. We reexamine the general issue of the transfer of production systems in light of the dynamics of international economic competition and the requirements of capital accumulation. The actual and potential limits to transfer and diffusion of production systems—for example, the particular constellation of class forces, the ingrained legacy of past organizational practices, the nature of industrial unrest and class struggle, internal contradictions, etc.—are revisited. From there we turn to the question of a potential new international division of labor organized around and based upon the new model. Finally, we speculate on the potential emergence of a broader model of social and economic reproduction or mode of social organization in Japan that would establish the conditions for long-term, self-reinforcing growth. In doing so, we set out some basic propositions, concepts, and theoretical insights which, we believe, can help reframe the debate over the sea-change in production and industrial organization now occurring in the advanced industrial economies.