

Beyond Toyotism: Thinking about the Japanese Economy in the 21st Century

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1 Introduction

The 1990s have been the most difficult years for the Japanese economy since the first Oil Crisis. The simultaneous collapse of the financial bubble, the dramatic increase of the value of the yen in 1995 followed by its equally dramatic fall in value severely affected the Japanese political economic system. For many American analysts these developments were a sure sign of Japanese industrial decline and U.S. ascendance. This paper does not share this perspective, because the microlevel determinants of previous Japanese success remain as robust as ever. While aspects of the economy such as leading industries may change, the wellsprings of Japanese economic strength remain intact. The fundamental reason for Japanese industrial success has been the ability of Japanese firms to mobilize the creative powers of their employees and this ability continues (for further discussions see Kenney and Florida 1988; 1993).

In a competitive world with ever-shortening product life-cycles, the ability to motivate workers and the power to increase the intellectual component of products are central to corporate viability. Fortunately for Japanese firms, these two factors have been the basis of their past success in overcoming currency appreciation and high wages. An important new element for Japan was the rapid economic growth of the rest of Asia and its equally dramatic collapse. Asia was an important new market for Japanese industry, which supplies much of the industrial equipment and important components necessary for Asian industrialization. As the technological leader in Asia, Japanese industry was the major developed-country beneficiary of growth and the current crisis is having an impact on Japanese industry. The collapse of the Asian economies during 1997 and continuing into 1998 will be a significant drag on the Japanese economy.

However, despite the wild oscillations in the external environment Japanese industry has not collapsed. Perhaps, the most interesting challenge for students of the Japanese economy is to explain why Japanese firms remain competitive despite the unpredictable changes in the value of the yen. In crucial sectors such as electronics and industrial

equipment, Japanese firms are global competitors in both production and development. This is true even though U.S. firms based in Silicon Valley and Route 128 are exploiting many of the newest high-technology electronics breakthroughs.

The future of the Japanese economy is best understood by focusing on the technoeconomic trajectory of the leading sectors of the new global economy, such as computers, microelectronics, software, and communications-related technologies. These technologies are not only commodities in themselves; they are also inputs and enabling technologies for the creation of various other commodities. Most important, these new technologies are a prominent feature of an all-encompassing realignment of the global economy to emphasize information and knowledge creation. As the importance of information technologies increases, the expenditure of human energy in physical activity is of less significance as a source of value.¹ Finally, the emphasis on knowledge creation can assist in a reinterpretation of the bases of Japanese economic growth (Nonaka and Takeuchi 1995).

This essay begins with a brief overview of some fundamental theories that underlie the debates about the nature of the Japanese production system. Here I try to move beyond explanations of Japanese economic success based on models generated from studying the automobile industry. The second section discusses the strengths in Japanese firms that are built by harnessing the intellectual capabilities of their employees. The third section examines the role of interfirm relationships in knowledge creation. The fourth section discusses the effect of accelerating change on economic activity. The conclusion reflects upon the implications of these changes for the Japanese and the global economy in the twenty-first century.

2 Theoretical Considerations

The usual base for scholarly thought about the nature and structure of industrial economies is a dominant paradigm or, more properly, a metaphor. During the last seventy years the metaphor of the automobile assembly line dominated thinking, as reflected in the term "Fordism," coined by Gramsci (1972), resurrected by Palloix (1976), expanded into a central organizing idea by Aglietta (1979), and finally developed into a full-fledged self-conscious school by the Ecole de Regulation group."

It is not surprising that industrial practice by the leading sector of the moment conditions academic understandings, but when the underlying sector is no longer dominant, its generalizability is questionable.

The pervasive use of electronics and computer networking has altered the nature of production in the 1990s. To capture this reality, in earlier work with Richard Florida I developed metaphors such as "Fujitsuism" and "innovation-mediated production" to describe the leading role of information and knowledge-based industries in Japanese economic development (Kenney and Florida 1988; Florida and Kenney 1990; Kenney and Florida 1993). These were efforts to escape the conceptual straitjacket of the auto assembly line model and its intellectual analogue, Fordism, and derivative formulations such as Toyotism, PostFordism, and Volvoism, to name only the most prominent.

By most accounts the last twenty years have been an unstable period with erratic economic growth for most OECD countries. In many ways this period resembles the interregnum between World War One and World War Two. Interestingly, the timing of the current conjuncture also correlates well with periodizations postulated by long-wave theories (see, for example, Mandel 1975; Freeman (ed.) 1984).¹ In previous resolutions of these stagnant periods there have been major social reorganizations and changes in technologies and leading sectors (Freeman and Perez 1988). The technological forces are now apparently in place for a new technical paradigm based on the information technologies. The remaining question is whether social and institutional paradigms are emerging to match these technologies.

Obviously, recognition of the importance of the information industries is widespread. In 1985 Perez (1985) wrote a seminal article arguing that the basis of the emerging technoeconomic paradigm is microelectronics. The only shortcoming in her formulation was an inability to fully foresee how pervasive digitalization would become, and the immense momentum created by the fusion of microelectronics, distributed computing power, and telecommunications. Likely, in the future there will be more recognition that the period from 1947 (the invention of the transistor at Bell Laboratories and the development of the first effective computers) through approximately the 1980s laid the technological basis for a new growth phase based upon information technologies. The result is the creation of an entirely new paradigm based upon interconnected, distributed computing power.

New knowledge creation is increasingly important as production is automated and brought on-line. The declining cost of storage and computational power allows the digitalization of ever more complex analog problems, and increased automation. There is a direct relation between the processing power inherent in computers and the operational core of computers, integrated circuitry. However, human beings need to examine the informational outputs and transform them into action. This is the transmutation of information to knowledge.

There has been little study of the importance of these changes for the nature of value-creation. There are two notable exceptions. Based on intensive factory-level ethnographic research Zuboff (1988) suggests that in highly information-intensive environments, where knowledge and participation are necessary, old style top-down management systems are incapable of harnessing employee creativity. Morris-Suzuki (1984; 1986; 1988) concludes that Japanese capitalism (this should be broadened to capitalism, generally) is entering an era characterized by "perpetual innovation." These conclusions are echoed by certain of the management theorists such as Drucker (1993). At the dawning of the twenty-first century, Japanese industrial prospects depend on taking current strengths and adapting them to an environment of increasingly rapid change driven by the computerization of production. The key for firms wishing to participate in this innovation- and information-intensive economy is their ability to harness the intellectual faculties of their workers to create new knowledge, whether in research laboratories or in factories.

3 The Knowledge Factory

The factory has been a focal point of interest for political economists such as Adam Smith, Charles Babbage, and Karl Marx during the last two centuries. Recently, the organization and operation of Japanese factories have received significant attention (Fruin 1992, 1996; Kenney and Florida 1993; Adler and Cole 1993). There is general agreement that Japanese industry has made a systematic effort to create factories capable not only of producing, but also of continually improving their production. These factories often have research and engineering units integrally linked with actual production. The plants are consciously managed to upgrade the capabilities of their

employees through both learning-by-doing and training. Investments in training are not goals in themselves; rather, they are necessary to create the means by which to improve production. The Japanese conception of the factory may be understood as a laboratory where workers transcend simple "laboring" to innovate and create knowledge. Thus the firm harnesses the uniquely human capability to transcend previous problem-solving and create new solutions.

The factory also resembles a laboratory in the sense that production take place in a rigorously controlled environment." As in a laboratory where rigorous control of each step in the experiment is necessary to ensure reproducibility, Japanese factory operations are characterized by rigorous documentation. Adler (1993) in a study of the GM-Toyota joint venture NUMMI plant in Fremont, California, captures and describes the process in yet another way. He concluded that standardization "is not only a vehicle and a precondition for improvement but also a direct stimulus. Once workers have studied and refined their work procedures, problems with materials and equipment quickly rise to the surface" (Adler 1993). Experimentation controls as many parameters as possible to allow strict comparisons and judgment of the merit of proposed changes. Careful descriptions of the steps involved in each task form the basis for experimentation in the pursuit of improvement.

The Japanese production system is a complicated, many-faceted phenomenon. There is constant stress for greater efficiency, productivity, and quality. Mike Parker and Jane Slaughter (1985) have criticized the Japanese system as "management by stress." This notion captures another dimension of the efforts to eliminate "waste," such as unnecessary labor, inventory, or equipment." In effect, Japanese firms have created a tightly coupled system in which a change of production parameters, such as line speed or staffing level, creates a problem or bottleneck. These bottlenecks become the foci of innovatory activity or knowledge creation. Thus stress is a central aspect of the entire system, placing constant demands on factory personnel, and becoming a fundamental factor in forcing change as problems or learning opportunities emerge.

Because the team is the fundamental building block of the Japanese factory (Fruin 1992; 1996), stress is not usually directed at the individual. Continuous improvement is made by harnessing teams to resolve problems (Cole 1989). While Japanese firms divide production into discrete routinized steps which individuals perform, the recombination

occurs within the team itself. Thus the team simultaneously resocializes work procedures and consciously manages the social side of the production process (Kenney and Florida 1988; 1993)."

In Fordism, teams had no place. Individuals were responsible for discharging job tasks defined by engineers, sometimes in consultation with the union. Though all workers were together in the factory producing, (i.e., it was inherently a social process), the individual worker was isolated and compartmentalized. In effect, U.S. human resource management denied the reality that factory production is a social cooperative effort. The lack of communication and interaction meant that there was no avenue for improvement. U.S. factory and assembly lines, once installed, became static and incapable of evolving. Evolution came only when a new model was introduced and new machinery was installed. This static model crippled knowledge creation and improvement.

The product turbulence of the contemporary environment requires a factory that can quickly bring a new model to full-scale production and take advantage of learning-curve economies. Because the marketplace is so dynamic, the static factory of the Fordist era no longer serves; it is unable to improve production sufficiently rapidly. One of a factory's greatest assets is its ability to implement new designs and to produce them quickly with both high quality and low cost. Such a factory creates value not merely through its production, but through its ability to create knowledge about producing the product. In a perpetual innovation environment, stable production is only a transient state, as new models are constantly being introduced. This type of factory is continuously developing knowledge and experience while ramping-up production of new models.

In the production of routine mass goods, Japanese factories can no longer compete on a cost basis, but must now compete through their ability to quickly begin manufacturing a new product and move it down the learning curve. The factory's output is, of course, sold, but value-added comes from its explicitly producing learning or knowledge. After the achievement of learning curve economies, the production can continue in the learning curve factory or be moved offshore. In this system the Japanese factory is competitive almost entirely on the basis of the intensity of its learning.

4 Supplier Relations -- Media and Messages

There are two ways of thinking about supplier relationships. The first way is to see suppliers as simply deliverers of an input. The second is to see suppliers as selling their knowledge, as embodied in a particular physical product. In the first mode, one need only manage suppliers on the basis of price. In contrast, what becomes important in the second mode is to manage and think about suppliers as knowledge creators. The relationship then becomes much more complex, but also capable of creating far greater value. In a path-breaking study of automobile suppliers, Fujimoto (1994) observes that at each stage in the value-chain, humans imprint a product with human effort, creativity, and knowledge. The major input is human knowledge and effort; the output is "congealed" human knowledge and energy. The supplier provides knowledge about a particular input, e.g., how a headlight works, the materials involved, etc. In effect, the assembler purchases the objectified knowledge in the product. In such an environment it is good business for purchasers to provide information to suppliers to encourage use of their knowledge to meet the purchasers' needs.

Another important set of inputs is the machinery and equipment necessary to produce final goods. Fujimoto argues, for example, that the molds for plastic injection molded parts, or the die used for pressed metal parts, resemble software. These molds transfer knowledge to basic material, such as steel sheet or plastic (Kuroda 1995). Machine tools are vital inputs, and their usability is related to their computer controllers.

So, for example, the steel Toyota purchases is really physical material imprinted with knowledge." The knowledge of the steel maker is embodied in the steel with its particular molecular structure and myriad other specifications. If the media specifications are not met (for example, the steel sheet has various flaws), then it will transmit faulty information (it is "buggy" in software terms). The buggy material makes it certain that the next step in the value-chain will be difficult to execute flawlessly, thus that knowledge will have a higher probability of not being transmitted flawlessly to the materials. From this perspective a defect is a faulty communication. Thus, as the purity and exactness of the various attributes of materials increase, their "messages" become simpler and clearer. The user is then not as likely to be surprised.

The necessity of "low noise" makes routines such as factory housekeeping vitally important. The more noise or entropy remaining in the manufacturing process, the greater the possibility that it can disrupt the entire operation. Dirty factories encourage unplanned events or "accidents." In the Fordist U.S. factories, these unexpected occurrences were continual, expressing themselves as injuries and defects.

In industries such as assembly or sewing, some levels of entropy or noise may be tolerable, as precision need not be so high. But in factories for semiconductors and liquid crystal displays, noise in its physical manifestation as dust or even human skin cells may be devastating and quickly impact the serviceability of the output, i.e., the yield. Not only is extreme cleanliness crucial, elimination of unplanned vibrations and other disruptions is necessary. In such production processes, humans have often been eliminated from the production area because their mere physical presence creates entropy. Increasingly, human involvement is limited to monitoring processes by sensors and computers, repairing machines, and inspecting results.

The materials industries are media creation industries and produce both standard and specialty materials. Specialty materials are made in small batches and are designed for specific purposes; they usually command higher prices than the commodity materials, because scale economies make them more expensive to produce. The reason for buying specialty materials is the unique "message" or knowledge imprinted in them, allowing the user a more nearly perfect rendering of its final product. For example, Toyota requires a unique coating for the galvanized steel used in its automobiles. The American manager at an U.S.-Japanese steel maker characterized Toyota's specifications as "kinky" (Florida and Kenney 1992). Toyota wants steel customized (containing the right knowledge) for their particular purpose; in other words, they pay extra for knowledge that will actualize their vision of the final product.

The current reorganization of Japanese assembler-supplier relationships, which includes a continued loosening of previous keiretsu ties, can be interpreted within this framework. The loosening is not a movement to the U.S. system of little if any information-sharing between assembler and supplier, but rather toward a network whereby suppliers are linked to a number of assemblers, thereby sharing information-intensive relationships with a number of assemblers. This accelerates learning benefiting the entire system.

5 Change and Obsolescence

The increased speed of knowledge creation and new product development is dramatically altering the value of commodities today. In a knowledge-intensive economy, commodities are not best understood by their physical characteristics, but by the knowledge embedded in the commodity. When this becomes obsolete and loses value, a rapid devaluation takes place in numbers of industries as the perpetual-innovation economy accelerates.

Product life-cycles are decreasing in length. Businesses whether in Japan or other countries have little choice but to innovate rapidly or risk being outflanked. Contemporary business is awash in a sea of obsolescence. Whereas in earlier times only fashion and various other consumer goods became obsolete in design, rapid outdating has now extended to consumer durables and industrial goods. In information-related goods such as computers, telecommunications gear, and software, obsolescence currently occurs in less than four years. Due to the rapidity of change, especially in their electronic "brains," industrial equipment also becomes obsolete almost immediately. At their time of purchase many consumer products are already obsolete, especially personal computers and other information appliances.

Japanese electronics firms are actively striving to keep up with incessant technological advances. For example, semiconductor memory capacity is doubling every other year, and disk drives are increasing their areal memory density by 40 percent per annum. Yet the price per chip or disk drive remains roughly constant. Thus, price per bit of information processed is decreasing exponentially. In effect, consumers see the price of ever more powerful systems remain roughly constant. Moreover, decreasing price allows integrated circuitry to invade ever more economic activities and products. This creates an environment within which the Japanese electronics firms must constantly innovate to survive.

As memory capacity and speed of information retrieval and processing increases, it becomes possible to digitize new activities. One observer, Michael Borrus, has somewhat hyperbolically argued that the Japanese are leading in the application of microelectronics to various products:

The fastest growing product [areas] are miniaturized systems built around embedded, often dedicated microprocessors (or microcontrollers) with embedded software for control and applications. They are multi-functional, combining computing functionality with communication, consumer with office, etc. . . . They are also networkable, that is their capabilities are significantly enhanced by being networked together into larger information systems . . . Taken together these products define a new electronics industry segment (Borras 1993:20).

New competitors are entering the global economy. Even as Korean and Taiwanese companies enter core memory businesses, Japanese electronics firms are fighting back by proliferating designs and moving to new products. So, for example, in DRAM memories Japanese firms are using product differentiation to create new varieties with special features such as low voltage consumption or smaller size. Yet in the process the Japanese companies are constantly being challenged by Korean and Taiwanese competitors.

Japanese success in such areas depends not only on excellent research and development but on close linkages with manufacturing to ensure that the new designs are quickly ramped-up to full-scale production. Electronics technologies depend greatly on the creativity of scientists and engineers, but, except for software, the results of R&D must be manufactured. The acceleration of new product development is necessary for rapid manufacturing, and operators and, especially, technicians are a vital link in the transfer from R&D to production. The rapidity of new product introductions means the linkages between R&D and manufacturing are a key strength for Japanese firms.

Other machinery industries have a similar trajectory. For example, Japanese corporations are leaders in automating printed circuit board (PCB) component insertion. The rapid improvement in machines and components means that machinery becomes obsolete in two years or less (Kawai 1992), changing the cost calculation in assembling PCBs. This has important implications for developing countries, as inexpensive labor is less attractive when there is little direct labor left in production (Mody et al 1995). PCB insertion automation is not entirely due to cost and quality considerations. The miniaturization of parts and the increasing density of parts on multilayered PCBs makes it physically impossible to assemble many PCBs by hand. The layout of these PCBs

has also been automated as it is no longer possible to diagram all of the connections by hand. Certain components are little larger than the periods on a typewritten document. Moreover, many components are being directly incorporated onto the silicon of an integrated circuit and thus cease to be components. Many consumer products are shrinking in size so rapidly that, for example, assembly of cellular phones and camcorders is entirely by machine. This tendency toward smaller, thinner, and lighter products is occurring in nearly all industries. Japanese business in the next century will have to evolve institutional forms capable of retaining traditional strengths in development and manufacturing, while cultivating the ability to innovate within entirely new product areas.

7 Conclusion -- The Global Innovation Economy

This essay has argued that formulations such as PostFordism or Toyotism provide little analytical basis for understanding the contemporary Japanese political economy. On the contrary, these terms may inhibit original thinking about the new technoeconomic paradigm. A useful guide for further research would be to recognize that the ability to extract value in the form of human creativity and knowledge has become much more central. Moreover, all industries can be reinterpreted in light of the increasing importance of the information processing capabilities unleashed by digitalization. These changes are not simply due to the increasing ability to process information by using computers. Human beings are necessary to transform and make sense of the information, and thereby create new knowledge. Knowledge creation is social, whether it occurs in the R&D laboratory or in the factory, or is created in an integrated process including the laboratory, the factory, and marketing.

The Fordist system of treating workers as nonthinking entities in the production process is giving way to a broader view of factories as places in which groups of employees collaborate to monitor and improve current production and prepare to introduce new models. Employee involvement and the ability to tap employee ingenuity are more important than ever. Whereas in the Fordist factory workers' involvement was neither encouraged nor wanted, to be competitive in the contemporary economy workers must be integrated into the "logic" of the firm and the system. Knowledge creation in its

many facets is the pivot for capitalist accumulation. As pointed out earlier, the importance of knowledge creation is expressed in software's critical role both in commodities and as a commodity.

The increasing importance of knowledge will have profound implications for those concerned with the current economic system. For example, traditional Western-style unions will find it difficult to resist business efforts to integrate the workplace into a new paradigm based on involvement and limited forms of employee autonomy. If employees are responsible for the smooth operation of production, there will be a decisive weakening of old forms of resistance based on the assumption that management is solely responsible for production. Simultaneously, old forms of management will also be placed under intense pressure to change. The older forms, based upon a more antagonistic attitude toward employees, will be difficult to sustain. The success of Japanese business has been due to its ability to effectively innovate, design, and produce commodities for the global economy. Increasing labor costs and rising yen value mean that Japan will increasingly depend on exporting high-knowledge, high value-added products. To continue to be successful, Japan must be able to increase the amount of knowledge and creativity embedded in its products. In goods, such as electronics and communications gear, software and specialized integrated circuits are the source of value. Similarly, Japanese skills in producing capital goods embodying extremely high knowledge or skill components are the key to Japanese success." Often, the knowledge embedded in such products is quite tacit and therefore is extremely difficult for other global locations to reproduce, thus providing sustainable competitiveness. As long as Japanese firms can produce such high-value products, the Japanese economy should be able to eventually overcome the current malaise.

¹ Physical labor will not disappear. There are still many highly routinized production activities that do not require significant intellectual activity but are uneconomical to automate. For example, in the garment and footwear industries the production process requires little intellectual input from workers; for the most part the concentration of knowledge-related activities is in the design area. The reasons for not automating are the physical recalcitrance of the materials and the fact that in some parts of the world labor is very inexpensive. For the host countries of these low-skill labor processes, the most pressing issue is upgrading these production activities and their role in the international economy through developing higher value-added activities (see Kaplinsky 1994).

² For a critique of the regulation school project and "Fordism" as a model for postwar U.S. industrial development, see Brenner and Glick 1991; Sayer and Walker 1993; Walker 1995.

"Ernest Mandel (1975) argued that before a country rises to hegemonic status it has a financial crisis more severe than its competitor countries. If this is accurate, then it is possible that the contemporary Japanese crisis is an analog to the U.S. Great Depression. According to this long-wave explanation, such economic crises provoke a reorganization of the political economy permitting renewed growth. For those so inclined, speculation about the implications of the changes currently underway in Japan and in its relationships to its Asian neighbors could prove fruitful. It is possible to argue that the forces are already in motion to make East Asia the dominant region of the global economy. East Asia would then be the core of a Kondratieff upswing already in motion.

" Freeman (1985) first suggested thinking of the factory as a laboratory. This was later developed more fully in Kenney and Florida (1993).

' This management philosophy underlies Womack et al's (1990) terming the Japanese system "lean production."

" In personal conversations Nohara (1995) makes the point that recently Toyota has been rethinking its previous strategy of merely engineering the work process to use all of the worker's time even if various tasks are entirely unrelated. The difficulty of this approach has been that even though it appeared efficient, it has led to a loss of meaning and comprehension, striking at the ability of workers to improve the work process. Toyota is again reintegrating tasks in ways to allow the group to actually produce one pseudoproduct, such as a door. This provides coherence, which encourages productivity.

"" This parallels McLuhan's argument that the medium is the message. Perhaps, we should slightly rephrase this to say the medium has a message.

"" An excellent example is eyeglass frames. Small and medium-sized Japanese firms control the world market for titanium eyeglass frames. Titanium with its great strength and heat resistance is difficult to manipulate. Through a learning-by-doing approach, these small Japanese companies became the global leaders in fashioning titanium for the production of small objects.