Japanese Automotive Transplants and the Transfer of the Japanese Production System

April 1994

Richard Florida, Director

Center for Economic Development
H. John Heinz III School of Public Policy and Management
Carnegie Mellon University
Pittsburgh, PA 15213 USA
FAX: (412) 268-5161

Martin Kenney

Department of Applied Behavioral Science
University of California at Davis
Davis, California 95616

This chapter is an expanded and updated version of our article, "Transplanted organizations: The transfer of Japanese industrial organization to the United States," originally published in the *American Sociological Review* 56, 1991, pp. 381-398. The research was funded in part by the National Science Foundation, Economic Research Service of the U.S. Department of Agriculture and the Ohio Board of Regents and more recently by the Alfred P. Sloan Foundation. The authors would like to thank Nicole Biggart, Robert Cole, Norman Glickman, Akio Kida, Donald Smith, and Shoko Tanaka, and Fred Deyo for their comments. We gratefully acknowledge the collaboration of the Ritsumeikan University Automobile Industry Research Group, particularly Akio Kida, on site visits and interviews, and the research assistance provided by Donald Smith, Davis Jenkins, Mitsumasa Motoya, James Curry, W. Richard Goe, James Gordon, and Marshall Feldman at various phases of the research. The authors are equally responsible for this article.

> The key to success of Toyota Motor Manufacturing USA, Inc, will depend upon the support and contribution of our human resources in implementing the Toyota Production System. ... They very basis of the Production System is respect and dignity of team members through effective utilization of their time -- allowing team members to use their ingenuity and to participate in the design of their jobs. Toyota, Motor Manufacturing USA, Inc. *Team Member Handbook*.[1]

> The idea is to work smarter, not harder. Joel Smith, original UAW representative to NUMMI.[2]

INTRODUCTION

Since 1980, Japan's major automobile companies have set up 12 major automobile assembly plants or *transplants* in North America -- 9 of these are in the U.S., another 3 are in Canada. These transplants produce more than 2.5 million cars per year, roughly 20 percent of total U.S. production. These transplants are supported by more than 350 transplant component suppliers, some 75 steel facilities, and more than 20 Japanese affiliated rubber and tire producers (Florida and Kenney 1992). In addition, the automotive assembly transplants operate 22 research, development and design centers in the United States (Kenney and Florida 1993; Florida and Kenney 1994). By 1993, transplant investment in the automotive related industries in the U.S. was more than $25 billion dollars, and it continues to increase. Taken as a whole, these automotive-related transplants employ more than 100,000 American workers.

The transplants have generated a great deal of attention both among scholars and other experts and in the popular media. Although a number of research studies have been published, myths and misconceptions about the transplants continue to abound. Perhaps, the

most widely studied transplant is NUMMI, the GM-Toyota joint venture located Fremont, California. In an important, early study which was to inform many of the key ideas in the best-selling book, *The Machine that Change the World*, John Krafick, then a graduate student at MIT and a former engineer at NUMMI (Krafick 1986), found that NUMMI was able to recreate many of the key elements of the fabled Toyota production System, including reduced numbers of job classifications, use of work teams, rotation of workers, and a focus on *kaizen* or continuous improvement. Krafick's findings have been reinforced by more recently published studies by Brown and Reich (1989) and, more recently, by Gronning (1992) and Adler (1993). In a series of papers and a forthcoming book, Welford Wilms (Wilms et al. 1994a, Wilms 1995) and a group of industrial anthropologists at UCLA who have spent five years working on NUMMI's factory floor have documented the emergence of "third culture," a core of Japanese production techniques and the Toyota Production System, wrapped with elements of American management and organizational style.

In *The Machine that Changed the World,* which summarized the key findings of MIT's International Motor Vehicle Program, James Womack, Daniel Roos and Daniel Jones (Womack, Jones and Roos 1990) suggested that the automobile industry--and to some extent manufacturing industry more generally--was in the midst of a paradigm shift from the traditional mass production model to a new model built largely around the Japanese production system which they referred to as "lean production." This book, which reached a large audience and had significant impact not only within the academy but also within the industry, suggested that the core characteristics of lean production were the products of organizational design rather than culture, and that as such amenable to transfer and diffusion

across national boundaries. A more recently published study by Tetsuo Abo and his collaborators at the University of Tokyo (Abo 1994), explored the experience of Japanese transplants in the automotive assembly, automobile component parts and electronics sectors. Their work suggests that the automotive industry has seen a significantly higher rate of transfer of core elements of the Japanese production system than the electronics sector. They also found a relatively lower rate of transfer to North America, and suggested that the ability to effectively transfer core elements of the Japanese production system to the North American environment tends to require a relatively higher level of commitment of managerial and other resources by the firm. An intriguing case study of the Subaru-Izusu plant in Indiana by Graham (1993) found that there was considerable resistance to the transfer of Japanese production methods; however, evidence provided in the study indicated that those production methods were still being transferred. In a more journalistic exposition based upon off-site interviews with employees and union officials, Fucini and Fucini (1990) argued that the Mazda plant in Flat Rock Michigan has experienced numerous problems in the transfer of Japanese production methods including high rates of injury, worker discontent, and labor-management conflict.

This chapter provides a summary and update of our own research on the Japanese automotive-related transplants (see especially Florida and Kenney 1991, Kenney and Florida 1988, 1993). That work has consisted of nearly a decade of data collecting and analysis based upon field research at dozens of plants in the U.S. and Japan, survey research of hundreds of others, and the development of both conceptual and analytical models of the transfer of elements of the Japanese production system and the location decisions and

geographic organization of Japanese automotive-related manufacturers in the United States. The bottom line contribution of our work is two fold. First, we argue that the Japanese production system represents a major advance over the previous model of fordist mass production. The key to this new model of production organization--or production system--lies in the fact that it has more effective organizational forms and divisions of labor for harnessing the intellectual as well physical capabilities of the entire workforce from the R&D laboratory to the factory floor. We thus find ourselves more or less in agreement with management theorists such as Peter Drucker (1993) and Ikujiro Nonaka (1991) who suggest that the new age of capitalism is one of "knowledge creating capitalism." We have elsewhere (Kenney and Florida 1993) advanced the concept of "innovation-mediated production" to capture synthesis of intellectual and physical labor, or innovation and production, under this new system of capitalism (for a debate and discussion of our work see Kato and Steven 1993). Second, and related to this, we suggest that this new model of capitalism is premised upon new organizational forms. As the leading edge of this new model, the Japanese production system represents a set of organizational practices which are not reducible to culture. Indeed, our research indicates that these organizational techniques and practices can be lifted out of the Japanese context and transferred aborad. Furthermore, we find that Japanese transplants have not adapted to their environment as existing organizational and management theory would have predicted, rather they have effectively transformed their environments to meet their needs and functional requirements.

We believe that the Japanese automotive transplants provide an ideal lens from which to view these issues. We note that the U.S. industrial environment is typically said to be

individualistic, diverse and market-oriented, while Japan is said to be group-oriented, homogeneous, paternalistic and corporatist (see Dore 1973). And of course, traditional U.S. firms are distinguished by high levels of functional specialization, large numbers of job classifications, extensive internal labor markets (Edwards 1979), adversarial labor-management relations (Kochan, Katz, and McKersie 1986, Katz 1985) and arm's length relations between corporations and their suppliers (Womack, Jones and Roos 1990), while Japanese corporations have pioneered new organizational forms such as small numbers of job classifications (Aoki 1988), team-based work organization (Koike 1988), consensual relations between labor and management (Shirai 1983), and long-term supplier relations (Dore 1983, 1986, 1987).[1]

RESEARCH DESIGN

For the purposes of this study, we defined *transplants* as firms that are either wholly Japanese-owned or have a significant level of Japanese participation in cross-national joint ventures in the automobile assembly and automotive component parts industries. We developed a database of Japanese transplant assemblers and suppliers from data provided by the Japan Economic Institute, U.S. government sources, industry trade journals, and newspaper reports. Eight assembly centers were identified in the United States, of which one operated two plants at one site and the rest operated single plants. In addition, 229 transplant suppliers were identified; this number has since grown to more than 350. These

[1]These are ideal-typical characterizations of large manufacturing firms, particularly automobile firms, in these countries, designed to focus attention on salient differences highlighted in the literature. In reality, there are significant differences among firms in each country, and there are likely to be hybrid or mixed forms.

transplants are heavily concentrated in a transplant corridor of the lower Midwest and upper South--an area with a legacy of traditional U.S. (fordist) organizational practices (see Florida and Kenney 1992a). Four of the assembly transplants, Mazda, NUMMI, Diamond-Star, and the Ford-Nissan joint venture are unionized; four others, Honda, Nissan, Toyota, and Subaru-Isuzu (SIA), are not.

Field research was conducted at six of the seven operating transplant assembly plants in the U.S. (Honda, Nissan, Toyota, Mazda, NUMMI, and Subaru-Isuzu) and at various supplier firms including Nippondenso which has the largest investment in the U.S. of any transplant supplier.[2] More than 100 personal interviews were conducted with Japanese and American executives, managers and engineers; shopfloor workers and trade union officials; and state and local government officials.

A mail survey was administered to the universe of Japanese-owned or Japanese-U.S. joint venture suppliers in the United States. The survey questionnaire collected data on start-up date, employment, sales, industry, end-users, information on work organization, number of job classifications, use of teams, rotation, quality control circles, wages and wage determination, employment security and work-force characteristics, and information on interfirm relationships such as delivery times, frequency of communication, shared personnel, and cooperation in R&D and product design. Addresses were located for 196 of the 229 suppliers in the original database. (Some of the firms for whom addresses were unavailable likely had not yet begun operations). Each establishment was then contacted by

---

[2]We were unable to arrange a visit to Diamond-Star, and the Ford-Nissan venture was not yet operational.

telephone to identify the appropriate person to complete the survey. The survey was mailed in 1988, and a series of follow-up post cards and letters resulted in 73 completed surveys for a response rate of 37.2 percent, which is comparable to the rates in other research of this type (see Lincoln and Kalleberg 1985 for example).

TRANSFER OF THE JAPANESE PRODUCTION SYSTEM

Work and Production Organization

Table 1 summarizes the main characteristics of work and production organization for transplant assemblers and for a representative Big Three automobile companies at the time our original study was conducted (1988). Table 2 presents similar information for transplant suppliers.[3]

Work Teams: In Japan, work is organized on the basis of teams that are responsible for planning and carrying out production tasks (Aoki 1988; Koike 1988). Teams socialize production tasks and assign immediate managerial tasks to shopfloor workers. Table 1 indicates that work teams are used at all of the transplant assemblers. At Honda, Toyota, and NUMMI teams meet daily to discuss production improvements and redesign of tasks; meetings at the other transplants take place at least once a week. More than three-fourths of transplant suppliers organize production on the basis of work teams (Table 2).

Rotation: Rotation of workers among tasks within a team is a key feature of Japanese production organization. Rotation functions to train workers in multiple tasks and to reduce the incidence of repetitive motion injuries. While rotation is used by all transplant

[3] Here, we note that not all Japanese automobile firms are organized the same way; each has its individual "company way."

assemblers, its frequency varies, as it does in Japan. Toyota, Honda, and NUMMI rotate workers in the same team quite frequently. Toyota workers in high stress jobs, e.g., jobs that require the use of a high impact torque gun or involve constant bending or lifting, rotate as frequently as once an hour, others rotate at break times, at lunch, or every other day. According to a NUMMI worker: "We would be rotating every time we had a break or change. If we had a break in the morning, we rotated. And then lunchtime, we rotated. And we had a break in the afternoon, we rotated. Every time the line stopped, a break or whatever, we rotated." Rotation is less frequent at Mazda, Nissan, and SIA. While these companies consider rotation a long-term goal, each has slowed or even stopped the use of rotation during production scale-ups. Our interviews with Mazda workers confirm that infrequent rotation has been a major cause of repetitive motion injury at the Mazda plant. Rotation from team to team is less common both in Japan and in the transplants. In Japan, this type of rotation is typically mandated by management; in the U.S., it is more common for workers to apply for job transfers.

According to the supplier survey, roughly 87 percent of suppliers rotate workers within teams, while approximately 66 percent rotate among teams. Nippondenso rotates workers in high stress jobs every hour or two and encourages workers to apply for rotation from team to team. Both U.S. and Japanese managers at all the transplants we visited, as well as many workers, felt that it was too early for implementation of a full Japanese-style rotation system and that it may be a few years before workers have enough basic skills and knowledge to be moved regularly from team to team.

[Tables 1 and 2 about here]

Inventory Control: In Japan, production takes place according to the just-in-time system of inventory control in which materials are forwarded as needed and inventory is kept to a minimum (Monden 1982; Cusumano 1985). All the assemblers and over two-thirds of suppliers (68.5 percent) use a just-in-time system of production control.

The supplier survey asked: "How similar is your manufacturing process to one that might be found in Japan?" Eighty-six percent of the respondents said that their U.S. manufacturing practice was either "exactly the same" or "very similar" to one that might be found in Japan; only one supplier said that it was not at all similar.

The Division of Labor

Job Classifications: Few job classifications are a key characteristic of the Japanese model. This contrasts sharply with traditional U.S. production organization in which virtually every job has its own job classification and job classifications are seen by workers and unions as a "job ladder" that provides the basis for wage increases and employment security. Kochan et al. (1986) report that the unionized plants in a multidivisional U.S. manufacturing firm had an average of 96 job classifications. Table 1 indicates that transplant assemblers use no more than four job classifications, whereas a representative traditional U.S. Big Three auto maker had 90. Although the implementation of few job classifications might seem especially difficult at transplants which employ large number of managers and workers that were originally socialized to traditional Big Three practices, e.g. NUMMI which has a large percentage of former GM workers, interviews with NUMMI officials and workers indicated few adaptation problems.

More than 85 percent of transplant suppliers use five or fewer job classifications for

production workers; and one-third use only one job classification. Several indicate that they have instituted more job classifications than would be ideal (as many as ten) to keep American workers happy by providing the appearance of an internal career ladder.

Team Leaders: Japanese production organization includes a class of workers, referred to as team leaders, who are members of shopfloor work groups but also have managerial responsibility for immediate production activities. There are no foremen or low-level managers whose job is to supervise shopfloor workers. Team leaders are used at all the transplant assemblers we visited, and 84 percent of suppliers use them as well. At Honda, Toyota, NUMMI, Nissan, and SIA team leaders are the first line of supervision and play a crucial role in the organization, design, and allocation of work on a daily basis. At some transplants, team leaders are selected by management, while at others, especially the unionized transplants, team leaders are selected by joint labor-management committees. All the transplants consider the input of workers to be an important criterion for the selection of team leaders.

Status: Overt status distinctions between management and blue-collar workers are less evident in Japan than in the U.S. For example, in Japan workers and managers eat in the same cafeteria; middle level managers wear the same uniforms as shopfloor workers. Managers typically do not have enclosed offices but sit at desks on a large open floor adjacent to the production facility. All transplants we visited had single cafeterias. At Nippondenso, all executives including the President work at desks on the floor. Nissan is the only transplant in which status distinctions are more visible, e.g., a separate parking lot for top managers' cars and plush American-style offices. This may be because Nissan has a

much higher percentage of former American automobile executives than other transplants. All the transplants provide uniforms, although some give workers the option of wearing street clothes. Transplant officials we interviewed suggested that uniforms create an identification between workers and the company. Most top executives wear company uniforms, although Nissan is again the exception. In fact, the transplants tend to have greater visible status equality than obtains in Japan where top executives have chauffeured company automobiles and wear suits and ties rather than work uniforms.

Hierarchy: Lincoln, Hamada and McBride (1986) indicated that management hierarchies are taller in Japan than in the U.S. Our findings suggest that management hierarchies in the automotive transplants are relatively flat. At Honda, there are nine levels in the internal hierarchy: associate, team leader, coordinator, department manager, plant manager, assistant vice president, senior vice president, executive vice president, and president. This structure is typical of the other transplants as well. At Honda, the various vice presidents do not form separate levels in the reporting structure, but are part of Honda's senior management team, which includes the plant manager and the president of Honda America Manufacturing. This senior management team makes decisions as a group and thus functions to some extent as a single reporting level. The president of Honda America is a member of and reports to the Board of Directors for Honda Japan. A number of shopfloor workers have risen to management ranks at Honda and the company actively encourages such mobility. Toyota officials indicate that shopfloor workers are recruited for middle-level management positions in the factory and the front office.

Worker Participation and Quality Control

It is important to distinguish between the form of Japanese organization and its substance, i.e., its effects on worker behavior. A main objective of the Japanese system of work and production organization is to harness the collective intelligence of workers as for continuous product and process improvement (Kenney and Florida 1988, 1993). This stands in sharp contrast to traditional American automobile industry practices in which there are formal and informal organizational barriers and norms that inhibit the use of worker intelligence (Braverman 1974). In Japan, workers actively participate in company suggestion programs and quality control circles as well as informal, everyday *kaizen*, or continuous improvement activities. In Japan, different automobile corporations emphasize different aspects of kaizen activity. Toyota places greater emphasis on team activities, like quality circles, whereas Honda emphasizes individual initiative and innovation. Japanese scholars use the term *voluntarism* to explain the extraordinary initiative of workers in Japan. However, Japanese automobile companies vary significantly in their ability to generate voluntaristic behavior -- with Toyota being the most effective.

Worker Initiative: Transplants encourage worker initiative through the delegation of managerial authority and responsibility to shopfloor workers. Workers at the transplants, especially Honda and Toyota, have significant input into the design of their jobs. More than 60 percent of respondents to the supplier survey indicate that workers are involved in the design of their tasks. At Toyota and Nippondenso, work teams actually design standardized task descriptions for their work units and post them in the form of drawings and photographs with captions at their work stations. Roughly 80 percent of suppliers indicate that workers

are responsible for routine maintenance on their own machines.

Japanese corporations use suggestion systems to harness workers' knowledge and ideas. Honda and Toyota have fairly well-developed suggestion systems. Although Mazda has a suggestion system, Mazda workers have occasionally times boycotted it to express their dissatisfaction with management policy. SIA does not yet have a suggestion system, although management indicates that the company will institute one in the future. Thirty percent of transplant suppliers provide cash awards for worker suggestions, and two-thirds report that "willingness to suggest new ideas" is a key criterion for evaluating production workers.

Quality Circles: Quality circles are an important element of the Japanese system (Cole 1989a; Lillrank and Kano 1989). In Japan, quality circles are groups of workers who devote effort outside regular working hours to improving an element of the production process. According to Lincoln et al. (1986, p. 354), 76 percent of employees in a sample of Japanese plants participated in quality circles compared to 27 percent of workers in U.S. plants. The transplants vary in the extent and intensiveness with which they employ quality circles. Toyota and Honda use quality circles extensively, Mazda and NUMMI "moderately," and SIA not at all. Slightly less than half of suppliers use quality circles, and 68 percent of those who do not use quality control circles plan to do so in the future.

Transplant assemblers pay workers for quality circle activity. Of suppliers that use quality circles, 83 percent pay workers for hours spent working on quality circles. In both transplant assemblers and suppliers, participation in quality circles usually occurs immediately before or after shift work. Several transplants set up competitions between

quality control circles and use prizes, plaques, and cash awards as additional incentives for quality circle participation. Some transplants have sent American quality circles to Japan to participate in annual company competitions. All the transplant assemblers and suppliers that we visited indicated that they will devote significant effort to establishing quality control circles on a par with Japan. We thus agree with Cole's assessment (1989, pp. 111-12) that it is still too early in the transfer process to expect full use of quality control circles. Such activity will likely increase as the transplants complete the process of implanting organizational forms and move on to more subtle techniques of shaping and motivating worker initiative.

We also asked Japanese managers to tell us how much, in percentage terms, Japanese *kaizen* or continuous improvement activity they have been able to replicate in their American work force. Honda executives feel they have completely replicated Japanese practice in their Marysville, Ohio plant. A Toyota manager who has worked in numerous Toyota plants in Japan as well as at NUMMI and Georgetown, Kentucky, indicated the Georgetown plant is at 60 percent of Japanese practice and NUMMI at 40 to 50 percent. Management actively trying to implement greater kaizen activities. Nippondenso, a Toyota group member, has also closely replicated Japanese practice. Mazda and Nissan have had more difficulty implementing kaizen activity, and stand at roughly 50 percent of Japanese practice. Executives of SIA, which is the most recent transplant, estimate that the plant is currently at about 30 percent of Japanese practice. Still, the progress of the transplants on this dimension is remarkable, given the time they have had to socialize American workers to the requirements of Japanese production. The central role played by worker initiative and the

use of workers' knowledge contradicts the view that the Japanese model is simply an extension of fordist mass production. It lends support to the alternative conceptualization that it is a new and potential successor model based upon harnessing workers' intellectual *and* physical capabilities.

Transplants recognize this deficit and are working hard to replicate the worker initiative and voluntaristic behavior of Japanese firms. Numerous Japanese executives see the lack of independent initiative of American workers as a product of previous attitudes and socialization, and suggest that it can be changed by education and socialization to Japanese practices. According to the Japanese president of a transplant supplier, education and effort is required to "remove American barriers to worker initiative." Japanese transplants indicate that they will concentrate on this issue in the next few years. Going even further, Toyota is working with the local school system to redesign curriculum and other socialization mechanisms to impart group-oriented behavior, problem solving, and initiative to students. SIA has also sent local school officials to Japan so that they can learn more about Japanese group-oriented educational practice.

Work Force Selection and Socialization

Japanese corporations do not simply impose Japanese production organization and manufacturing practice on their American work forces. Instead, they use a number of selection and socialization mechanisms to ensure effective transfer.

Selection: Recruitment and selection processes identify workers who possess initiative, are dedicated to the corporation, work well in teams, and do not miss work. The process differs from the recruitment policies of Japanese corporations in Japan (Rosenbaum

and Kariya 1989) but serves a similar function. Moreover, the process differs markedly from the typical U.S. practice of hiring off the street. The transplants subject potential workers to cognitive and psychological tests and other screening procedures to identify workers who fit the Japanese model. Previous job records or high school records are scrutinized for absenteeism. Potential employees go through extensive interviews with personnel officials, managers, and even members of their potential work teams to rate their initiative and group-oriented characteristics. While theorists have generally treated the so-called loyalty of the Japanese work force as a product of Japanese culture, the screening and selection process constitutes an organizational mechanism that selects potentially loyal workers from a large, diverse population. Simply put, this long held cultural effect is also a product of organizational practice.

Socialization: Prior to start-up, all the assembly transplants sent key employees (e.g. managers and team leaders) to Japanese sister plants for three to six months. There they received both formal training and informal socialization to Japanese practice (e.g. team work and kaizen). They worked closely with veteran Japanese trainers, who transfer formal and tacit knowledge of production and who function as role models to some extent. Workers and trainers also spend time together outside work to continue the socialization process. These trainers then came to the U.S. for periods from three months to two years to work alongside the same U.S. employees and their teams. The supplier survey indicates that 33 percent of American managers were sent to Japan for training. According to workers at different transplants, trainers provided the most substantial and significant exposure to Japanese practices.

The transplants use ongoing training and socialization programs to acclimate workers to Japanese production. Most employees begin with a six- to eight-week introductory session that includes an overview of automotive assembly and fairly rigorous socialization in the Japanese model. After this, workers are assigned to teams where they continue to learn from senior employees. According to the survey, suppliers provide an average of eight days of training for factory workers before they assume shopfloor activities (range = 0-180 days); assemblers have longer training periods. This is supplemented by an average of 61 days additional training on the shopfloor (range = 1-302 days).

Adaptation: Shopfloor workers in the U.S. have experienced few problems adapting to the Japanese system. NUMMI workers who previously worked for GM indicate that they prefer the Japanese model to U.S. fordist practice. According to one: "I was at GM and the part I didn't like -- which I like now -- is that we had a lot of drug and alcohol problems. It was getting to the point, even with me, when it got around lunchtime I had to go out ... and take down two or three beers." Mazda has had the most adaptation problems including significant worker discontent and the recent election of a new union local that is less conciliatory. However, Mazda workers indicate that such adaptation problems are largely due to management's failure to fully implement Japanese production organization, e.g., not rotating workers to prevent repetitive motion injury.

Management has been the site of recurring adaptation problems at the transplants. During site visits and interviews, we were told repeatedly that American middle managers, especially those recruited from U.S. automobile corporations, have experienced great difficulty adapting to Japanese production organization and management. Honda officials

indicate that the previously formed attitudes and prejudices of U.S. middle managers toward factory workers are a serious problem. White and Trevor (1983) documented a similar problem in U.K. transplants. NUMMI workers complain that American managers are still operating in the GM style are a major obstacle to implementation of a full-blown Japanese system that they see as more favorable to workers than the old fordist system. According to a NUMMI worker: "A lot of things have changed. But see, you hear people talk. You hear them saying once in a while: 'Oh, we're going back to the GM ways.' I hope not. That was rough. ... I think to completely bring back the Japanese way, Japan would have to take over the plant completely and have nothing to do with General Motors at all." Japanese transplant managers indicate that problems with American middle managers have encouraged them to promote shopfloor workers to supervisory positions.

Wages and Industrial Relations

In any industrial system, the immediate organization of production is reflected in rules, regulations, and norms that form create the context in which production takes place. This broader production environment includes wage rates, wage determination, the organization and function of the internal labor market, degree of tenure security, type of unionization, and pattern of labor relations. These factors create incentives for work effort, establish the context for labor-management relations, and form the framework for mobilizing employee demands and mediating disputes. In Burawoy's (1979) terminology, they provide a sociological context for *manufacturing consent*.

Wages and Bonuses: The Japanese *nenko* system of wage determination is based on a combination of seniority, job-related performance, and the ability to work in a group context

(Suzuki 1976; Gordon 1985; Kagono, Nonaka, Sakikabara, and Okumura 1985). Semiannual bonuses constituting roughly 30 percent of total remuneration are used to supplement regular pay (Aoki 1988).

Both the transplant assemblers and suppliers are relatively high wage employers. At the time of our original study (1988), the transplant assemblers had average annual compensation between $28,598-36,013 dollars, compared to an average of $36,089 for Big Three auto makers. Hourly wages for production workers ranged from $13.94-$16.81 per hour, compared to an average of $16.41 for Big Three firms. As Table 1 shows, by 1993, average annual compensation had increased to $36,294-41,545; and average hourly wages had increased to $15.62-17.85. Note that average annual compensation refers to regular pay plus bonuses, but does not include overtime pay or the value of benefits. When overtime is taken into account, a significant number of workers at the transplants achieved average annual compensation in excess of $50,000.

Transplant suppliers also paid relatively high wages as of 1988 when our original survey was conducted: $7.21 per hour to start and $8.00 after a year on the job for low skill workers, to more than $11.00 for high skill workers--a rate which is slightly below the wage levels at U.S. parts suppliers (U.S. International Trade Commission 1987). Total annual compensation at the transplant suppliers averaged $21,200 per year. This wage differential between assemblers and suppliers is thus roughly similar to that in Japan.

The wage determination policies of the transplants are more standardized and uniform than in Japan. This is somewhat striking because academic studies and conventional wisdom contrast American individualism to Japanese groupism. Transplant assemblers pay uniform

wages for each class of workers, with raises at regular intervals. Transplant suppliers report that work effort, absenteeism, "willingness to work in teams," and "willingness to suggest new ideas" are the major criteria used to evaluate workers for wage increases and promotions.

Bonuses are not as common in the transplants as they are in Japan, and they are not an important component of employee wages. Bonuses at the transplants tend to be across-the-board, equal-percentage wage supplements to all workers. Honda provides a monthly bonus of $100 for perfect attendance. Bonuses represent only 1 percent of total compensation for transplant suppliers. However, 49 percent of transplant suppliers provide small cash awards for attendance, 30 percent provide small cash awards for suggestions, and 18 percent provide small cash awards for participation in quality circles.

Job Security: Long-term employment tenure is a much discussed feature of the Japanese system (Abegglen 1958; Taira 1970; Dore 1973; Cole 1979; Lincoln and Kalleberg 1985). The pattern of employment security differs between unionized and nonunionized assembly transplants, and between assemblers and suppliers. Our review of the labor-management agreements for the unionized assembly transplants indicates that all of them have formal contractual agreements that stipulate tenure security, guaranteeing jobs except under conditions that jeopardize the financial viability of the company. Both NUMMI and Mazda have fulfilled their commitment to no layoffs. NUMMI has kept full employment during periods of up to 30 percent reduction in output by eliminating overtime, slowing the work pace, offering workers voluntary vacation time, placing workers in special training programs, or transferring them to other jobs. Mazda workers have been loaned to local

governments during slowdowns. The nonunionized transplants provide informal assurance of tenure security, although this is not reflected in contractual agreements with workers. Nissan and Toyota have redeployed workers to other jobs to avoid layoffs. However, it is impossible to know at this stage whether the nonunionized transplants will remain committed to tenure security in the event of a severe economic downturn.

Transplant suppliers do not offer formal guarantees of tenure security. However, more than two thirds of the supplier respondents indicate that the Japanese long-term employment system *should* be transferred to the U.S. Nevertheless, they offered a wide range of opinions on this issue -- some saw long-term employment as a source of long-run productivity increases, others saw the threat of termination as a way to motivate American workers.

Unionization: The Japanese system of unionization is one of enterprise or company unions (Taira 1961; Shirai 1983), which differs markedly from the prevailing U.S. practice of industrial unionism. Levine (1958), Taira (1961), and Koike (1988) observed that the U.S. has always had a system of decentralized plant-specific locals that operate in a way that is similar to enterprise unions by aggregating worker demands and establishing the context of labor-management relations at the plant level.[4]

The transplants have developed two basic strategies to cope with U.S. labor relations and to recreate some elements of Japanese industrial relations. Most automobile transplants have simply chosen to avoid unionization. Only 4 of the 71 supplier respondents were

---

[4] The U.S. industrial relations system is experiencing a general decentralization of such functions to the local level. For example, the new GM Saturn plant in Tennessee has instituted an agreement with unique provisions.

unionized. The four nonunionized assemblers--Honda, Toyota, Nissan and SIA-- have chosen rural *greenfield* locations at least in part to avoid unionization. Nissan went to great lengths to defeat a unionization drive. SIA has implemented an in-plant video system to communicate messages to workers in anticipation of a unionization campaign. Nonunionized transplants, notably Nissan and Toyota, use employee handbooks that provide plant rules and regulations and have formed employee associations that collect employee input and create a stable structure through which work-related grievances can be addressed. The unionized transplants, Mazda, NUMMI, and Diamond-Star, have established independent agreements with their respective union locals that enlist the union in the implementation of Japanese work organization. These agreements make it possible fewer job classifications and more flexible work rules and to utilize pay systems that differ markedly from the typical U.S. assembly plant. However, recent research by Smith and Florida (1994) which explored the location choices of a large sample of Japanese automotive-related transplants found no statistical evidence that transplant manufacturers were avoiding relatively unionized locations. In fact, transplant manufacturers tended to cluster in manufacturing-intensive areas with relatively higher concentrations of union locals.

Dualism: The transplants are recreating aspects of Japan's highly segmented or dual labor markets (see Koike 1988; Kalleberg and Lincoln 1988). In Japan, for example, a large manufacturing facility will typically have nonunionized temporary workers or lower-paid workers from subcontractors working side-by-side with regular employees. The transplants use part-time or temporary employees to provide flexibility. At both Mazda and Diamond-Star, temporary employees were laid off during a downturn in the automobile market in early

1990 (Guiles and Miller 1990). The use of temporary workers has been a source of ongoing labor-management conflict at Mazda where (in contrast to Japan) union leaders see temporary workers as a threat to labor solidarity.

Gender is the most common basis of work force segmentation in Japan. Japanese women are prohibited from working in assembly plants by Japanese laws that make it illegal for women to work the night shift. The transplants do not show the extreme pattern of gender-based segmentation that is common in Japan. The supplier survey indicates that women comprise 34 percent of production workers. However, women are only 10 percent of the management work force.

Race is a typical line of work force segmentation in the U.S. Earlier research (Cole and Deskins 1988) inferred racial bias from the site selection and work force composition of Japanese transplants. We did not see large or even representative numbers of minorities in site visits. According to the supplier survey, minorities fill 11 percent of production positions and 9 percent of management slots. Recent data indicate that the transplant assemblers are hiring relatively more minority workers in production jobs. For example, Honda has increased minority employment from 2.8 percent in 1989 to 10.6 percent in 1990. Similarly, Toyota in Kentucky reports that 15 percent of its employees are nonwhite (also see Cole 1989b). In all likelihood, this is a response to the political pressure that resulted from publicizing earlier hiring practices. Furthermore, recent research by Smith and Florida (1994) explore the locational choices of automotive related transplants, and found no statistical evidence that transplants manufacturers were avoiding areas with relatively higher concentrations of minority populations.

TRANSFER OF JAPANESE SUPPLIER RELATIONS

The Japanese supplier system differs markedly from that of the U.S. The Japanese just-in-time system of supplier relations is characterized by close geographic proximity of producers, long-term relationships, and tight interfirm linkages characterized by personnel sharing, joint participation in product development, and regular communication and interaction (Asanuma 1985; Odaka, Ono and Adachi 1988; Nisiguchi 1994). In Japan, suppliers provide as much as 70 percent of a car's components, while U.S. automobile assemblers rely on suppliers for 30 to 50 percent of inputs (Mitsubishi Research Institute 1987; U.S. International Trade Commission 1987). The Japanese supplier system is organized in a pyramidal structure with 500 first-tier suppliers, a few thousand second-tier suppliers and more than 20,000 tertiary automotive parts suppliers (Sayer 1986, Nishiguchi 1987, Sheard 1983). The parent or *hub* company plays a key role by structuring linkages and coordinating flows within the network (Florida and Kenney 1992a). The Japanese supplier system is embedded in a set of organizational relationships that structure economic behavior. Dore (1983) advanced the concept of relational contracting to capture elements of the Japanese system and to contrast it with the arm's length system of the U.S. (see also Nisiguchi 1994).

Japanese assembly transplants initially located facilities in the lower Midwestern region of the United States to take advantage of the indigenous infrastructure of domestic automobile parts suppliers. However, indigenous supplier firms were unable to adapt to the delivery and quality requirements of Japanese just-in-time system. Dismayed by the performance of U.S. suppliers, assembly transplants encouraged their first-tier Japanese suppliers to locate in the U.S.. The Japanese suppliers, in turn, found it in their interest to

expand overseas. In effect, the creation of a Japanese-like supplier system in the U.S. can be understood as a *creative response* (Schumpeter 1947) to the deficiencies of the U.S. environment.

Transplant assemblers have played an active role in the creation of this new production environment by financing and helping to set up U.S. branches for key suppliers. For example, Honda encouraged two of its Japanese suppliers to form Bellemar Parts to supply it with seat subassemblies. In another instance, Honda provided technical and financial assistance to a group of Japanese suppliers to form KTH Parts Industries, a company that took over U.S. production of chassis parts that were once produced in-house by Honda at Marysville. Nearly half of Honda's main suppliers in Japan now operate U.S. plants. The supplier survey indicates that 12 of 73 suppliers are partially owned by the assemblers they supply.

Furthermore, assemblers played a key role in influencing both the original decision of transplant suppliers to relocate production in the U.S. and their choice of locations in the U.S. According to the supplier survey, more than 75 percent set up U.S. operations to maintain close ties to a major Japanese customer, and 90 percent chose their specific locations to be close to a major customer. Traditional environmental factors like the local labor market or local labor costs have relatively little impact on locational choices. Recently, other Japanese parts suppliers have opened U.S. plants on their own initiative to access the growing market for their products. Most of the supplier plants are located in states with transplant assembly plants. The strong role played by large assemblers in orienting and structuring the transplant supplier complexes contradicts the claim (Sabel 1989;

Friedman 1988) that the Japanese model is converging toward flexible specialization.

Supplier Relations

Table 3 summarizes data from the supplier survey on the main characteristics of relations among transplant assemblers and suppliers. This table reports the responses of 73 transplant suppliers on their supply relationships with transplant assemblers and with their own second-tier suppliers. Geographic proximity is a basic characteristic of the Japanese supplier relations (Sayer 1986). Among transplant suppliers, 40 percent are located within a two-hour shipping radius of end-users, and almost 90 percent are located within an eight-hour radius. Eighty percent make just-in-time deliveries. Still, the distances separating end-users from suppliers are somewhat greater in the United States than in Japan. Transplant complexes are essentially stretched out versions of Japan's dense just-in-time supplier system, likely due to the greater availability of land, well-developed highway systems, larger trucks and greater storage capacity in the U.S.

[Table 3 about here]

Interaction and Information Exchange: Table 3 reveals a continuous exchange of information between transplant assemblers and suppliers. Approximately 97 percent of transplant suppliers are contacted immediately by phone when they deliver a defective product. Eighty-two percent indicate that engineers from their major customer came on-site while they were setting up U.S. operations, three-quarters report that engineers from their major customer make ongoing site visits to deal with production problems, and 97 percent indicate that engineers from their major customer make ongoing site visits to deal with quality control problems.

Joint Product Development: Joint participation in design and development is another key characteristic of Japanese supplier relations. Fifty percent of suppliers said they participate closely with assemblers in the development of new products. This includes interaction with U.S.-owned firms as well. Honda engineers, for example, developed new production techniques for a small Ohio plastics firms that became a Honda supplier. Honda, Toyota, and SIA send teams of engineers and shopfloor workers to consult with suppliers on new product designs and production machinery. Honda intends to use its Marysville R&D center to integrate both transplant and U.S. suppliers into the future design of cars. We thus conclude that Japanese style supplier relations, like high levels of interaction, joint development, and long-term contracts, which typically have been viewed as a function of Japan's sociocultural environment, are actually a product of the organizational relation itself.

Supplier Tiers: In Japan, first-tier suppliers play a critical role in organizing and coordinating supply flows between lower-level suppliers and main assembly plants. They are located close to assemblers, interact frequently with them, and often are at least partially owned by them (Asanuma 1985). First-tier suppliers are probably more important in transplant complexes. For example, the windshields for Honda's American-made vehicles originate at PPG, an American producer. PPG supplies windshields to a Japanese supplier, AP Technoglass, twice a week. AP Technoglass screens them for defects, cuts and grinds them, and delivers them to a Honda subsidiary, Bellemar Parts, twice a day. Bellemar, which is located one mile from the Honda plant, applies rubber seals to the windshields and makes just-in-time deliveries to Honda every two hours. Bellemar also screens for defects, so that Honda receives much higher quality windshields than it would without its suppliers.

In this way, first-tier suppliers serve as a buffer between assemblers and the environment.

Table 3 reveals the pyramidal nature of transplant supplier relations. Second-tier suppliers, who supply to the first-tier suppliers, have less interaction in design or development of new products. One third of first-tier suppliers integrate second-tier suppliers in new product development. Just 43 percent of the first-tier suppliers receive just-in-time deliveries from their second-tier suppliers, whereas in Japan, tight supplier relations extend to second- and third-tier suppliers. However, this may be due to the fact that the transplant complex is still in the process of formation so linkages are at an early stage of development. Other evidence indicates that linkages are being extended down through the hierarchy to producers of basic inputs like steel and automotive plastics (Florida and Kenney 1992a, 1992b).

Integration of and Diffusion to U.S. Suppliers: Transplant assemblers are forging linkages to U.S. producers, leading to the rapid diffusion of Japanese practices among U.S. producers. Over half of Mazda's U.S. suppliers are U.S.-owned firms: 43 of Mazda's 96 suppliers are independent U.S.-owned firms, 10 are owned by Ford, and 43 are Japanese-owned or Japanese-U.S. joint ventures (*Automotive News* 1989). Helper (1990) indicated that 41 percent of 437 U.S. automotive suppliers surveyed supplied at least one component to the transplants.

Transplant assemblers work with U.S. suppliers to accelerate the diffusion of Japanese practices. As in Japan, Toyota has set up an organization of its Kentucky suppliers, the Bluegrass Automotive Manufacturers Association (BAMA), and has held meetings with U.S. suppliers in Las Vegas and Japan to encourage diffusion of Japanese practices. NUMMI has

organized a supplier council of 70 mostly U.S.-owned suppliers to share information sharing and facilitate product improvement (Krafcik 1986). SIA has organized teams of engineers, purchasing representatives, and manufacturing people who work with suppliers to improve quality. Johnson Controls, an American-owned automotive supplier in Georgetown, Kentucky, is now the sole source supplier of seats for the Toyota Camry. Toyota has worked with the company to implement a full-blown Japanese production system. Johnson Controls delivers completed subassemblies to Toyota according to just-in-time requirements every four hours. We visited a ten-person small machine shop in rural Ohio that formerly rebuilt tractor engines, but now rebuilds robot heads for Honda and Honda suppliers.

The emergence of a new system of Japanese supplier relations in the U.S. is exerting a sizable demonstration effect on U.S. practice. Helper (1989) provided empirical evidence of U.S. convergence toward the Japanese model. A recent study by the McKinsey Global Institute (1993) provides cross-national evidence that transplant firms increase the productivity of domestic industries by accelerating the adoption and diffusion of best-practice production organization and management. Osterman (1994) indicates that roughly one third of U.S. manufacturers are making the transition to best-practice or high-performance production organization and management, suggesting that there may be increasing convergence of production and management practices among Japanese-affiliated manufacturers and traditional U.S.-owned firms. Rather than taking on characteristics of U.S. suppliers or the broader environment of U.S. supplier relations, the Japanese transplants are transforming existing patterns of supplier relations in the U.S.

CONCLUSIONS

Our findings indicate that both transplant assemblers and suppliers have been remarkably successful in implanting the Japanese system of work organization in the U.S. environment. The basic form of Japanese work organization has been transferred with little if any modification. There are differences in the extent to which the transplants have been able to replicate Japanese behavior in kaizen, quality circles and other such activity, but they are working hard to increase the participation of U.S. workers in these activities. Japanese wage determination and labor relations practices have been somewhat modified to fit the U.S. context. However, these practices still resemble Japanese more than U.S. traditions.

Our findings also indicate that the transplants have effectively recreated key elements of the Japanese supplier system in the U.S. Our findings are thus in line with the hypothesis that the Japanese model is a set of organizational practices that can be removed from the Japanese environment and successfully implanted elsewhere. However, we do not imply that the transfer process has occurred automatically. Japanese firms have taken great care to select and even to alter the environment to make it conducive to new organizational forms.

Our findings may come as a surprise, given the legacy, conceptual orientation, and predictions of industrial sociology and organization theory. These theories imply that the environment has a strong effect on organizations, that it is difficult to transfer organizations between dissimilar environments, and that once transferred, organizations tend to take on characteristics of the new environment. The transplants have effectively recreated the basic Japanese system of production organization and are working hard to implant it fully. They have also recreated the Japan's relational contracting system, establishing a new production

environment for automobile manufacture. Thus, our findings suggest that too much explanatory power has been given to cultural factors in organizational development. Outside the plant as well as inside, the Japanese model forms a set of organizational practices that has been effectively transferred to the U.S.

On a more general level, our research suggests a general symmetry between intra- and interorganizational characteristics. The Japanese transplants have replicated long-term, interactive, participative, and/or mutually dependent relations at both the intra- and interorganizational levels. These findings are not specific to the transplants but are reflected in comparative institutional research -- the U.S. pattern of short-term adversarial labor-management relations is reflected in the short-term arm's length pattern of U.S. supplier relations. We believe that there may be an underlying rationale for such symmetry. Organizational pressures and incentives may lead to increasing continuity in the governance structures inside and outside the firm. Firms that effectively organize intraorganizational activity are likely to replicate it in dealings with external firms as well. More research and theory-building are needed on this crucial issue, using other sectors, industries, and types of organizations.

Our research indicates that organizations can and do shape their environments. Thus, the concept of environmental embeddedness should be revised to incorporate measures of the power, intentions, and purposeful activities of organizations. Transferring organizational practices and forms from one society to another means that they must be uncoupled from the environment in which they are embedded and recreated in the new environment. The transplants provide clear evidence that organizational forms can be effectively lifted from an

originally supportive context and transferred to a foreign environment. Furthermore, they show that organizations can mold the new environment to their needs and to some degree create the conditions of their own embeddedness. In general terms then, organizations have the resources to alter the environment. Large powerful firms, for example, can control the machines, the organization of production, the hiring of employees, and the establishment of interorganizational connections. These organizational resources can be used to offset and transform the social matrix of the environment.

We do not wish to imply that any type of organization can be made to fit any environment. The German automobile manufacturer, Volkswagen, failed to implement its production organization in the U.S. context -- its U.S. plant experienced high levels of worker discontent, serious strikes, and was closed after less then ten years of operation. Successful organizational transfer is neither natural nor automatic; it hinges on the strategic action organizations take to shape the environment to meet their requirements. Based on our findings, we conclude that the organizational-environmental tie works in both directions.

Finally, our research provides useful insights for the debate over new forms of production and industrial organization. The findings resonate with the general notion of a movement toward new models of production organization; the transplants reflect the more general restructuring of production organization, supplier relations, and industrial networks. We find little evidence to support the claim made by Sabel (1989) that the Japanese model, as manifested by the transplants, is converging toward flexible specialization. In fact, the evidence clearly suggests that U.S. firms are converging toward the Japanese model. By focussing on what is or can be transferred, our research reveals three defining features of the

Japanese model: (1) high levels of task integration, (2) integration of workers' intelligence as well as physical capabilities, and (3) tightly networked production complexes. In organizational terms, the transplants, and the Japanese model in general, display a high degree of *functional integration* that differs markedly from previous forms of functional (and/or flexible) specialization. Based on our findings here and related research on U.S. high-technology industrial organization (Florida and Kenney 1990), Kenney and Florida 1993), we believe that these features may be the underlying and defining elements that will determine the success, survival, and diffusion of the competing models of industrial organization that are emerging around the world. It remains for future research to further assess the broad generality of these trends.

REFERENCES

Abegglen, James. 1958. The Japanese Factory Cambridge, MA: MIT University Press.

Abo, Tetsuo (ed.). 1994. Hybrid Factory: The Japanese Production System in the United States New York: Oxford University Press.

Adler, Paul. 1993. "Time-and-motion regained." Harvard Business Review 71, 1, 97-109.

Aiken, Michael and Gerald Hage. 1968. "Organizational Interdependence and Intra-organizational Structure," American Sociological Review 33 (December): 912-930.

Altshuler, Alan et al. 1987. The Future of the Automobile Cambridge, MA: MIT Press.

Aoki, Masahiko. 1988. Information, Incentives and Bargaining in the Japanese Economy Cambridge: Cambridge University Press.

Arensen, Paul, Robert Cole and A. R. Krishna, 1987. "Japanese Auto Parts Companies in the U.S. and Japan: Implications for U.S. Competitors," Ann Arbor: University of Michigan, East Asia Program, manuscript.

Asanuma, Banri. 1985. "The Organization of Parts Purchases in the Japanese Automotive Industry." Japanese Economic Studies. (Summer): 32-53.

Automotive News. 1989. "Mazda: $1 Billion to Suppliers." (23 October):E29.

Baron, James and William Bielby. 1986. "The Proliferation of Titles in Organizations." Administrative Science Quarterly 31:561-586.

Benedict, Ruth. 1946. The Chrysanthemum and the Sword (Boston: Houghton-Miflen Publishers).

Bradley, Keith and Stephen Hill. 1987. "Quality Circles and Managerial Interests," Industrial Relations, 26 (1):68-82.

Brown, Clair and Michael Reich. 1989. "When Does Union-Management Cooperation Work: A Look at NUMMI and GM-Van Nuys," California Management Review 31, 4: 26-44.

Burawoy, Michael. 1983. "Between the Labor Process and the State: The Changing Face of Factory Regimes Under Advanced Capitalism," American Sociological Review 48:587-605.

Burawoy, Michael. 1979. Manufacturing Consent Chicago: University of Chicago.

Chappell, Lindsay. 1989a. "Increased Capacity and Flexible Production Schedules are Built

Into the Design of the Plant." Automotive News (7 August):53.

Chappell, Lindsay. 1989b. "UAW Battered in Nissan Vote, Finds Old Pitches Don't Work." Automotive News (31 July):2

Clark, Rodney. 1979. The Japanese Company New Haven, CT: Yale University Press.

Cole, Robert. 1989. Strategies for Learning Berkeley: University of California Press.

Cole, Robert. 1979. Work, Mobility and Participation Berkeley: University of California Press.

Cole, Robert. 1971. Japanese Blue Collar Berkeley, University of California Press.

Cool, Karel and Cynthia Legnick-Hall. 1985. "Second Thoughts on the Transferability of the Japanese Management Style." Organization Studies 6:1-22.

Dillman, Donald. 1978. Mail and Telephone Surveys: The Total Design Method New York: John Wiley and Sons.

DiMaggio, Paul and Walter Powell. 1983. "The Iron Cage Revisited: Institutional Isomorphism and Collective Rationality in Organizational Fields." American Sociological Review 48 (April): 147-160.

Dohse, Knuth, Ulrich Jurgens and Thomas Malsch. 1986. "From Fordism to Toyotism? The Social Organization of the Labor Process in the Japanese Automobile Industry." Politics and Society 14, 2: 45-66.

Dore, Ronald. 1983. "Goodwill and the Spirit of Market Capitalism." British Journal of Sociology 34:459-482.

Dore, Ronald. 1973. Japanese Factory, British Factory Berkeley: University of California Press.

Drucker, Peter. 1993. Post-Capitalist Society (New York).

Dunphy, Dexter. 1987. "Convergence/Divergence: A Temporal Review of the Japanese Enterprise and Its Management." Academy of Management Review 12 3:445-459.

Edwards, Richard. 1979. Contested Terrain New York: Basic Books.

Ennis, Peter. 1987. "NUMMI Struggles to Close the Culture Gap." Tokyo Business Today September:32-36.

Florida, Richard and Martin Kenney. 1991. "Transplanted organizations: The transfer of Japanese industrial organization to the United States." American Sociological Review 56, 381-398.

Richard Florida and Martin Kenney. 1994. "The Globalization of Innovation: The Economic
Florida, Richard and Martin Kenney. 1992a. "The Japanese Transplants, Production Organization and Regional Development," Journal of the American Planning Association (Winter 1992): 21-38.

Florida, Richard and Martin Kenney. 1992b. "Restructuring in Place: Japanese Investment, Production Organization, and the Geography of Steel," Economic Geography, 68, 2 (April 1992): 146-173.

Florida, Richard and Martin Kenney. 1990. The Breakthrough Illusion New York: Basic Books.

Fucini, J. and S. Fucini. 1990. Working for the Japanese. New York: Free Press.

Gordon, Andrew. 1985. The Evolution of Labor Relations in Japan: Heavy Industry, 1853-1955 Cambridge, MA: Harvard University Press.

Graham, Laurie. 1993. "Inside a Japanese Transplant." Work and Occupations 20, 2, 147-173.

Granovetter, Mark. 1986. "Labor Mobility, Internal Markets, and Job Matching: A Comparison of the Sociological and Economic Approaches," Research in Social Stratification and Mobility 5: 3-39.

Granovetter, Mark. 1985. "Economic Action and Social Structure: The Problem of Embeddedness." American Journal of Sociology 91, 3 (November):481-510.

Gronning, Terje. 1992. Human value and "competitiveness: On the social organization of production at Toyota Motor Corporation and New United Motor Manufacturing, Inc. Ph.D. dissertation, Ritsumeikan University.

Guiles, Melinda and Krystal Miller. 1990. "Mazda and Mitsubishi-Chrysler Venture Cut Output, Following Big Three's Lead." Wall Street Journal (12 January):A2, A12.

Hannan, Michael and John Freeman. 1988. "The Ecology of Organizational Mortality: American Labor Unions, 1836-1985," American Journal of Sociology 94, 1 (July): 25-52.

Hawley, Amos. "Human Ecology," in David Sills (ed) International Encyclopedia of Social Sciences (New York: MacMillan): 328-337.

Helper, Susan. 1989. "Changing Supplier Relationships in the U.S.: Results of Survey Research," (Cambridge, MA: MIT International Motor Vehicle Project).

Hill, Richard Child, Michael Indergaard and Kuniko Fujita. 1988. "Flat Rock, Home of Mazda: The Social Impact of a Japanese Company on an American Community." Paper presented at the Eighth Annual Automotive Conference, University of Michigan, March.

HAM (Honda America Manufacturing). 1988. "The New Wage Plan." The Stamping Press (7 March):2.

Jacoby, Stanford. 1993. "Pacific Ties: Industrial Relations and Employment Systems in Japan and the U.S. since 1900," in Howell Harris and Nelson Lichtenstein (eds.) Industrial Democracy in the Twentieth Century New York: Cambridge University Press.

Jacoby, Sanford. 1979. "The Origins of Internal Labor Markets in Japan," Industrial Relations 18 (Spring): 184-196.

Judge, Paul. 1990. "U.A.W. Faces Test at Mazda Plant." New York Times (March 27):D1, D8.

Kagono, Tadao, Ikujiro Nonaka, Kiyonori Sakakibara and Akihiro Okumura, Strategic Vs. Evolutionary Management (Amsterdam: North Holland, 1985).

Kamata, Satoshi. 1982. Japan in the Passing Lane (New York: Pantheon).

Kato, Tetsuro and Rob Steven (eds). 1993. Is Japanese Management Postfordist? An International Debate (Tokyo: Madosha Publishers, in Japanese and English).

Katz, Harry. 1985. Shifting Gears (Cambridge, MA: MIT Press).

Kenney, Martin and Richard Florida. 1993. Beyond Mass Production: The Japanese System and Its Transfer to the U.S. New York: Oxford University Press.

Kenney, Martin and Richard Florida. 1988. "Beyond Mass Production: Production and the Labor Process in Japan." Politics and Society 16, 1: 121-158.

Kertesz, Louise. 1989. "Injury, Training Woes Hit New Mazda Plant." Automotive News (13 February):1,52-53.

Kochan, Thomas and Joel Cutcher-Gershenfeld. 1988. "Institutionalizing and Diffusing Innovation in Industrial Relations," (Washington D.C.: U.S. Department of labor, Bureau of Labor-Management Relations and Cooperative Programs).

Kochan, Thomas, Harry Katz and Robert McKersie. 1986. The Transformation of American

Industrial Relations New York: Basic Books.

Koike, Kazuo. 1988. Understanding Industrial Relations in Japan New York: St. Martin's.

Krafcik, John. 1986. "Learning From NUMMI." MIT International Motor Vehicle Program unpublished manuscript.

Levine, Solomon. 1958. Industrial Relations in Postwar Japan Urbana: University of Illinois Press.

Lillrank, Paul and Noriaki Kano. Continuous Improvement: Quality Control Circles in Japanese Industry Ann Arbor, MI: Center for Japanese Studies, The University of Michigan.

Lincoln, James and Arne Kalleberg. 1985. "Work Organization and Workforce Commitment: A Study of Plants and Employees in the U.S. and Japan," American Sociological Review 50 (December): 738-760.

Lincoln, James, Mitsuyo Hanada and Kerry McBride. 1986. "Organizational Structures in Japanese and U.S. Manufacturing," Administrative Science Quarterly 31: 338-364.

Mair, Andrew, Richard Florida and Martin Kenney. 1988. "The New Geography of Automobile Production: Japanese Transplants in North America." Economic Geography 64: 352-373.

Marsh, Robert and Mannari, Hiroshi. 1976. Modernization and the Japanese Factory Princeton, N.J.: Princeton University Press.

Meyer, John and Brian Rowen, "Institutionalized Organizations: Formal Structure as Myth and Ceremony," American Journal of Sociology 83,2 (September): 340-363.

Mitsubishi Research Institute. 1987. The Relationship Between Japanese Auto and Auto Parts Makers Tokyo: Japanese Automobile Manufacturers Association, Inc.

Nakane, Chie. 1970. Japanese Society Berkeley: University of California Press.

Nishiguchi, Toshihiro. 1994. Strategic Industrial Sourcing: The Japanese Advantage New York: Oxford University Press.

Nonaka, Ikujiro. 1991. "The Knowledge Creating Company," Harvard Business Review.

NUMMI. 1986. "New United Motor Manufacturing, Inc. and the United Automobile Workers: Partners in Training." A Case Study for the ILO/Turin Center Seminar on Labor-Management Cooperation in Training and Retraining, May 21.

Ouchi, William. 1980. "Markets, Bureaucracies and Clans," Administrative Science Quarterly 25 (March): 129-141.

Parker, Michael and Jane Slaughter. 1988. "Management by Stress." Technology Review (October): 36-46.

Patterson, Gregory. 1990. "GM Has a New Worry: Tough UAW Official Could Lead Fall Strike." Wall Street Journal (10 January):A1, A8.

Patterson, Gregory. 1989. "The UAW's Chances at Japanese Plants Hinge on Nissan Vote." Wall Street Journal (25 July): A1, A12.

Perrow, Charles. 1981. "Markets, Hierarchies and Hegemony: A Critique of Chandler and Williamson." In Perspectives on Organization Design and Behavior edited by Andrew Van de Ven and William Joyce New York: Wiley Interscience pp. 371-386.

Robins, James. "Organizational Economics: Notes on the Use of Transaction-Cost Theory in the Study of Organizations," Administrative Science Quarterly 32 (March): 68-86.

Rosenbaum, James and Takehiko Kariya. 1989. "From High School to Work: Market and Institutional Mechanisms in Japan." American Journal of Sociology 94:1334-65.

Schlesinger, Jacob. 1987. "NUMMI Keeps Promise of No Layoffs by Setting 'Nonproduction Workdays'." Wall Street Journal (29 October):A26.

Sheard, Paul. 1983. "Auto Production Systems in Japan: Organizational and Locational Features." Australian Geographical Studies 21 (April): 49-68.

Shimada, Haruo. 1986. "Japanese Industrial Relations in Transition," MIT Sloan School of Management Work Paper #1854-88 December.

Shirai, Taishiro (ed.). 1983. Contemporary Industrial Relations in Japan Madison, WI: University of Wisconsin Press, pp. 29-62.

Smitka, Michael. 1992. Competitive Ties: Subcontracting in the Japanese Automotive Industry New York: Columbia University Press.

Smith, Donald and Richard Florida. 1994. "Agglomeration and Industrial Location: An Econometric Analysis of Japanese-Affiliated Manufacturers in Automotive-related Industries." Journal of Urban Economics.

Suzuki, H. 1976. "Age, Seniority and Wages." International Labour Review 113 January-February: 67-83.

Table 1
Comparison of Organizational Practices in the Automotive Transplants and the Big Three

	Work Teams	Rotation	Job Classifications	Worker QC	Annual Wage	Hourly Wages*	Union
Auto Alliance	+	+	2	o	-	16.22	Yes
Diamond-Star	+	+	2	o	38,406	17.00	Yes
Honda	+	+	3	o	36,982	16.20	No
NUMMI	+	+	4	o	41,545	17.85	Yes
Nissan	+	+	4	o	36,294	15.62	No
Subaru-Isuzu	+	+	3	o	-	-	No
Toyota	+	+	3	o	39,582	16.43	No
Big Three	-	-	90	-	-	17.59	Yes

Source: Author's compilation from various sources.
*This does not count cost of living wages received in unionized transplants which are calculated separately, but increase worker's pay quarterly.

Note: + = similar to Japan
o = modified
- = different from Japan
However, in the last five years, many Big Three plants are adopting Japanese-style work practices.

Table 2: Percentage of Transplant Parts Suppliers with Selected Japanese Intraorganizational Practices: U.S., 1988

Characteristic	Percent	Number of Cases
Work Organization		
Work teams	76.7	73
Rotation within teams	87.0	69
Rotation between teams	66.2	68
Just-in-time inventory control	68.5	73
Worker Involvement		
Production workers maintain their own machines	79.5	73
Production workers do routine quality control	98.6	73
Production workers help design their own jobs	60.9	69
Division of Labor		
Number of job classifications		
1	34.3	67
2	14.9	67
3	16.4	67
4	14.9	67
5	6.0	67

Table 3: Percentage of Transplant First-Tier Suppliers with Selected Japanese Interorganizational Linkages: U.S., 1988

Characteristic	Linkages to Assemblers	Number of Cases	Linkage to Second-Tier Suppliers	Number of Cases
Transit time:				
1/2 hour	6.9	72	--	--
1/2 hour-2 hours	33.9	72	--	--
2-8 hours	38.9	72	--	--
8-24 hours	9.7	72	--	--
Deliver according to just-in-time schedule	80.0	70	43	72
Immediate feedback on defective parts	90.2	72	97.2	72
Customers' engineers visit plant site:				
For quality control problems	96.8	62	96.9	65
For production problems	74.2	62	83.1	65
Interaction in design:				
Close interaction between supplier and customer	50.0	72	33.8	71
Supplier bids on customer design	31.9	72	62.0	71
Supplier can alter customer design	22.2	72	11.3	71
Supplier designs subject to customer approval	15.3	72	11.3	71
Supplier designs but customer can alter	6.9	72	8.5	71