



What Makes Transplants Thrive: Managing The Transfer Of “Best Practice” At Japanese Auto Plants In North America

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Multinational companies are a conduit by which superior organizing principles can be transferred across national, institutional, and cultural environments. However, for such transplantation efforts to be successful, the companies face the challenge of adapting their practices and principles to the requirements of local environments. In the process they risk losing the performance benefits from those practices. In this paper we study the North American transplant production facilities of Japanese automobile producers—companies known for their ability to achieve superior labor productivity and quality in their manufacturing plants, along with high levels of product variety—for insight into how the practices associated with superior performance (including work systems, technology choices, and supplier relations) can be implemented outside of Japan. By comparing the Japanese transplants with automobile plants in Japan, and Big 3 plants in North America, we show that the extent of transfer varies by type of practice. Furthermore, we find that plants can shape and alter their external environment, and can also buffer themselves from it. Despite these modifications, we find that the transplants are able to achieve productivity and quality levels similar to plants in Japan.

For multinational companies, the decision to “transplant” a key organizational capability developed in the home market to another country through foreign direct investment most often reflects the logical next step in its global strategy. As such, it is usually the

action of a competitively healthy company—different from the medical analogue, in which a transplant is undertaken only when the body’s original systems are failing.

Nevertheless, the analogy may hold in another way. The transplant of “home base” capabilities to a foreign setting faces a difficult adaptation threshold. The transplant operation must establish these capabilities, and the organizational practices and interaction patterns in which they are embed-

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ded, quickly and wholly (or nearly so) so that critical interdependencies among practices are supported. A healthy and strong system must be placed into the new setting all at once to increase survival prospects. Yet the transplant must also adapt to the surrounding local environment or risk rejection by the host.

Both risks of transplantation—implementing the full system too slowly at the start and failing to adapt to the environment during implementation—are high in the business context, and many transplants fail. So the question “what makes transplants thrive?” is highly relevant to the globalization prospects of many large multinational companies.

Here we focus on a particular set of transplants and the challenges they faced: Japanese-owned automotive assembly plants in North America. The capability being transferred in this case was “lean production”, derived from the Toyota Production System and adopted by most Japanese automakers (with some variation) by the early 1980s. Substantial evidence suggests that practices associated with lean production can yield a substantial competitive advantage in terms of both productivity and quality over more traditional mass production practices found in the West. These practices associated with the successful manufacturing performance of Japanese producers are the outgrowth of unique Japanese environmental conditions including culture, educational systems, unionization structure, religion, history, and geography (Hofstede, 1980, Ralston et al., 1997).

Although these unique conditions explain the distinctive character of Japan’s

production practices, they are also suggestive of the difficulties that may accompany the transplantation of these practices outside of Japan. Even these difficulties, however, may be less than those faced by non-Japanese corporations who try to adopt these practices in their home markets, given that their superior knowledge of the local environment is offset by their lack of experience and deep knowledge of the organizational capabilities themselves.

In this paper, we compare the implementation of lean production at Japanese-owned automobile plants in North America (hereafter, the “transplants”) with home country plants in Japan and with American “Big Three” plants to gain a unique perspective on what makes transplants thrive. These transplants have already been the subject of extensive debate, with some arguing that Japanese auto companies maintain their manufacturing practices upon moving to the U.S. (Kenney & Florida, 1993; Young, 1992), and others arguing that they require extensive modification to work effectively outside of Japan (Zipkin, 1991). By studying the nature and extent of transfer, as well as the modifications and adjustments required to operate lean production systems in the North American context, we gain insight into how the companies that developed this approach managed the transfer of “best practice.” We also explore the performance achievements of the transplants to assess their success at replicating the superior manufacturing performance attained in Japan.

Much of the research to date on the Japanese automobile transplants has focused on the work practices at individ-

ual auto plants but this study is the first to provide a detailed comparison of a large sample of Japanese transplants with a similar set of plants in Japan, as well as with American-owned plants in North America. Furthermore, we look at a broad range of practices associated with the Japanese production system, including work practices, technology choices, and supplier relations.

The data we report on are from a 1994 survey of automobile assembly plants worldwide, sponsored by MIT's International Motor Vehicle Program (MacDuffie & Pil, 1995). Our sample includes eight (out of eleven) Japanese auto transplants in North America, twelve plants in Japan,¹ and 25 U.S.-owned plants in North America (i.e., the "Big Three" plants of Ford, General Motors, and Chrysler). In addition to the survey data, we have visited about half of these plants for extensive shop-floor tours and interviews with managers (and, in some cases, workers and union officials). We primarily report the survey data here but our interpretations are heavily influenced by what we learned during our fieldwork (for additional detail, please see Pil & MacDuffie, 1999).

HUMAN RESOURCES AND WORK PRACTICES

Work practices and human resources (HR) policies are often considered central to the Japanese production system and hence to the success of Japanese automobile producers (Womack et al., 1990; Abegglen & Stalk, 1985; MacDuffie, 1995; Pil, 1996). The idea that

work practices can help firms create competitive advantage is not unique to research on Japan; there is an extensive body of literature about the U.S. (e.g., Kochan, Katz, & McKersie, 1986; Lawler, 1992). However, Japanese work practices were developed in a unique cultural and institutional environment and, as such, the question of their transferability overseas is an interesting one.²

Early work in comparative industrial relations argued that the so-called three pillars of the Japanese employment system—life-time employment, enterprise unionism, and seniority wages—have been vital for the success of large Japanese companies (Shimada, 1985). More recent research has emphasized the importance of work organization and skill development in the Japanese production system, including team-based production methods, worker participation in problem solving, job rotation, a small number of job classifications, few distinctions between management and employees, and high levels of training (e.g., Koike, 1989; Pil, 1996; Shimada & MacDuffie, 1999). These latter practices are less dependent on the institutional environment, although an important prerequisite is believed to be a homogenous workforce. In this section, we will consider the importance of each of these sets of practices in turn.

Life-time Employment

Life-time employment is said to be an important underpinning for a whole range of practices, including extensive

training, successful team work, and employee commitment to continuous improvement. Typically in Japan, life-time employment is offered only to a set of core employees. Part-time, seasonal, and contract workers are used to handle demand fluctuations and do not receive employment guarantees (Dore, 1986).

In our data, temporary employees make up almost 10% of the workforce in the Japan-based plants but less than 1% of the transplant workforce. With fewer temporary workers, it should be more difficult for the transplants to give employment security guarantees to their core employees. However, all the transplants have offered long-term employment assurances of some kind. The two unionized transplants in our sample have language in their union contracts that guarantees employment security up to the point where this commitment could jeopardize financial viability. The nonunion transplants use similar language to communicate a long-term employment commitment to their core workers, although there is no formal agreement.

As of 1998, none of the transplants have had any layoffs of core employees. During downturns, workers not needed for efficient production typically receive additional training. However, like the Japan plants, the transplants make no employment commitment to their temporary workers. Mazda and Mitsubishi Diamond Star, for example, have already laid off some of these workers.

Enterprise Unionism

The second mainstay of the Japanese employment system is purported to be

enterprise unions. All the Japanese plants in Japan have enterprise or company-based unions. In North America, all of the U.S.-owned (Big Three) plants are unionized, whereas only a third of the automobile transplants are unionized; the United Automobile Workers (UAW) represents all of these plants. The non-union status of many of the transplants is clearly a deliberate choice. UAW efforts to initiate campaigns at these transplants have mostly been unsuccessful. Managers at the non-union transplants have actively expressed their desire to retain this status, and there are reports (e.g., Saltzman, 1994) that these transplants actively try to remove pro-union applicants in their screening process. So the second pillar is clearly not transferred at these sites.

Although many of the transplants may be avoiding the UAW, there is some evidence that they have tried to create dynamics similar to those existing with an enterprise union.³ At the unionized transplants, the labor contract includes a union commitment to support the competitiveness of the plant (together with a management commitment to employment security) and establishes a variety of mechanisms for ongoing labor-management consultation. Five of the six nonunion transplants, in turn, have made efforts to implement a mechanism for employee voice by establishing committees of worker representatives (typically appointed by management) to raise concerns, provide input, learn about future plans, and review disciplinary cases. From all accounts, managers take these committees seriously, although there is no way to know if the commitment

would be as strong in the absence of a union threat. Thus, although the transplants do not have enterprise unions, they do try to create a similar venue for employee-management consultation and cooperation.

Seniority Based Wages

We have a variety of evidence related to the third "pillar" of the Japanese employment system, which is seniority-based wages. We find that promotions in Japan are more likely to be characterized as seniority-based than in other regions. We also find that the pay differential between production workers and supervisors is extremely low in Japan. This is consistent with the claim that Japanese companies prefer to minimize pay differentials across categories of employees to enhance the sense of community and equal status among employees at different levels (e.g., Womack et al., 1990). Indeed, we find that the highest paid production worker earns on average 10% more than the lowest paid supervisor, compared to 5–15% less at US-owned plants and transplants. Much of this reflects seniority pay to the most senior production workers.

It is interesting to note, however, that although *between* category differentials may be low in Japan, the pay differentials between the lowest and the highest ranks *within* employee categories is much higher. This differential ranges from 120% to 200% for production and maintenance workers and first-line supervisors for plants in Japan. The differential at Japanese transplants and Big Three plants in North America are

similar and range from 12 to 31%. The big differential in Japan is not due to differences in starting pay. Rather, it reflects bonuses used to reward individual-level differences in seniority, skill, and initiative in Japanese plants, compared to the policy at the transplants of awarding bonuses equally to all employees in a given category.

The transplants seem to be following the compensation norms in their local environment. Their pay differentials are almost equal to those of their Big Three counterparts for production workers and maintenance employees, despite the fact that they have fewer levels or job categories than either their Japan or their Big Three counterparts. Although Japan plants on average have approximately five classifications for production workers and maintenance workers, the transplants in Round 2 have only one production worker classification, and one or two maintenance worker classifications. This is very low for the North American context, where U.S.-owned plants had an average of 33 job classes for production workers, and 15 for maintenance workers in 1994. The U.S.-owned plants have been reducing their number of production worker classifications (the average was about 45 in 1989), and thus seem to be moving towards the Japan plants and the transplants in that respect.

The Japan plants also make extensive use of bonuses and merit increases in salary, based on company performance as well as individual performance. In contrast, the contingent compensation offered at the transplants is minimal and based only on company or plant performance (in many instances, company is

synonymous with plant when there is only one manufacturing plant associated with the US subsidiary). In this way, the transplants follow a policy similar to that of the Big Three plants. Neither the transplants nor the Big Three plants give bonuses or increases in salary to production workers on the basis of work group or individual performance, nor on the basis of seniority. This is very different from the Japan plants, where 50% offer individual-level bonuses and 33% offer seniority-based bonuses. In addition, since the transplants have only one rank for production workers, promotion from rank to rank cannot be used as a means to reward seniority as is the case in almost all the Japan plants. As a result, pay at the transplants bears little relationship to seniority.

Promotion at the transplants, most of which have grown rapidly and expanded repeatedly, has provided career advancement opportunities for high-tenure employees. Although seniority is not the basis for promotion, virtually all promotions are from the ranks of experienced employees. As such, promotion has undoubtedly served as a partial substitute for seniority wages.

In summary, two of the three so-called "pillars" of the Japanese employment system (or their functional equivalents) have been transferred to the U.S.-based transplants: assurances of life-time employment for core employees, and employee-management committees, which allow a variant of worker-management consultation found with enterprise unions. However, the transplants make no effort to create a seniority wage system. Beyond the

"three pillars," the transplants have transferred many other key HR and work practices from Japan, while modifying them for the North American context. We review these next.

Work teams

Scholars have long recognized the importance of on-line teams in Japanese manufacturing plants (Aoki, 1990; Koike, 1989). Like plants in Japan, all the transplants make extensive use of such teams, compared to only a third of the Big Three plants. Furthermore, an average of 70% of production workers in transplants and Japan plants are in work teams, compared to about 50% of workers at Big Three plants with teams. Management at Japanese plants generally appoints team leaders, although at the unionized transplants union officials are often involved in team leader selection. At the Big Three plants with teams, management indicates that team members have more say in team leader selection than is reported at either the transplants or plants in Japan.

Teams in both Japan plants and transplants have substantive influence over work allocation and methods of work, and very little influence over the selection of team leaders and the amount and pace of work. Unlike teams in the Japan plants, transplant teams are similar to those found in Big Three plants in that they have little influence over performance evaluations and the settlement of grievances and complaints. On the other hand, teams at the transplants do resemble their Japanese counterparts in that team members have influence on issues related to work methods and problem

solving. The Big Three teams have less influence in this area.

Job Rotation

Like work teams, job rotation is a means to foster flexibility and involvement on the part of the work force. Workers at the transplants rotate almost as much as workers in Japan plants, rotating not just within their teams but even across teams within a given department. In contrast, job rotation is still relatively uncommon in Big Three plants where, although workers are capable of doing other work tasks within their work group, they generally do not rotate jobs.

Problem-solving Groups and Suggestion Systems

Transplants and Japan plants differ significantly in the extent to which their employees engage in continuous improvement of the production process (known as *kaizen*) through off-line problem solving in quality circles. Only one-fourth of the production workers in transplants, on average, are involved in such circles, although there is quite a bit of variance. This percentage is similar to the Big Three plants that have on-line teams and stands in sharp contrast to the level of 80% in Japan.

It is possible that like the workers at the Big Three plants, workers at transplants believe that *kaizen* can result in job loss (Young, 1992). However, the employment security assurances of the transplants are intended to address precisely those concerns. An alternative view comes from Kenney and Florida (1993), who suggest that the low level

of quality circle and employee involvement activity at the transplants reflects their newness and that plants plan to increase their usage over time. However, three plants for which we have data in both 1989 and 1993/1994 showed only a minor increase in participation in quality circles. The most plausible hypothesis may be differences in the degree of normative pressure to participate in quality circles. Participation in "voluntary" small group activities in Japan plants is more likely to be viewed as mandatory by employees, because of management and peer pressure.

As with quality circles, the transplants make less use of suggestion programs than the Japan plants but considerably more than Big Three plants. Indeed, the average worker in a transplant offers roughly four suggestions per year, compared to 23 a year for workers at Japanese plants in Japan and only one suggestion for every *four* employees in the U.S.-owned plants. Unlike quality circles, the transplants have steadily increased the level of worker involvement with the suggestion system since they opened; the gap with plants in Japan is closing whereas the gap with U.S.-owned plants is widening.

Many of the Japan plants use a quota system whereby production workers need to provide a minimum number of suggestions per month. The number of suggestions actually provided by production workers then gets factored into their evaluations and individual bonuses. The transplants do not have an explicit quota system and as noted above, do not receive individualized bonuses. However, prizes of various kinds

are often offered to those whose kaizen suggestions provide the most value for the company. The steady increase in the number of suggestions at most transplants over time does suggest continuing management attention to boosting participation in this area.

Although the number of suggestions received is an important indicator of bottom-up improvement efforts, equally important is the percent of suggestions that are actually implemented, which indicates the degree to which these suggestions are valued. In the U.S.-owned plants, not only are very few suggestions received, but less than half of those suggestions are implemented. In contrast, transplants implement an average of 70% of the suggestions they receive and plants in Japan implement 80%.

Status Barriers

Another indicator of the overall philosophy of management toward production workers is the extent to which status barriers between these two groups are minimized. We have data about four policies affecting status barriers, and find that the transplants closely resemble the Japan plants in that production workers and managers park in the same parking lot, eat in the same cafeterias, wear a common uniform, and managers don't wear ties. Indeed, the transplants go even further in this direction than the Japan plants, some of which do have separate parking lots or cafeterias. This seems to be part of a deliberate strategy at the transplants to emphasize norms of symbolic egalitarianism, in the hopes of more readily winning the commitment

of American workers. Policies of this kind were relatively rare at Big Three plants in 1994, although they have become much more common since then—influenced, no doubt, by the transplant example as well as broader trends towards more informal workplace interactions (from speech to clothing and office layouts) in North America.

Recruitment and Selection

Before the transplants opened, one common expectation was that American workers were too individualistic, too diverse, and too poorly educated for the successful transfer of Japanese employment practices. Yet the transplants have been able to introduce high-involvement work practices like teamwork, job rotation, and suggestion programs that are quite uncharacteristic of the North American environment. One reason for this success may be that the transplants carefully select and socialize their employees. There is a range of attitudes and behaviors found in any population, and, with careful selection and socializing, one can develop a homogeneous workforce whose characteristics differ from the national cultural norm.

Only three of the transplants have hired production workers recently. On average, they hired only 5% of those who applied. Those who are hired are very well educated, with almost 40% of production workers having some college education. This is very high, compared with only 15% for U.S.-owned plants and less than 1% in Japan plants. We also asked managers to rank order the importance of various employee

characteristics in the hiring process. Big Three plants place greater emphasis on employees possessing previous experience in a similar job or specific technical expertise, whereas the transplants stress willingness to learn new skills and the ability to work with others. Selectivity at the transplants during the hiring process may mean that workers are homogeneous with respect to attitudes toward work and receptivity to Japanese manufacturing philosophies and human resource practices.

Training

Although both Japan plants and transplants provide similar levels of training to new employees, the transplants provide significantly higher levels of training to experienced employees. The transplants provide significantly more training than their American owned counterparts for all experienced employees, as well as for newly hired production workers. The difference between the transplants and the Japan and Big Three plants may reflect their newness and relatively shorter employee experience—even “experienced” workers have relatively few years of experience. However, there is also some evidence that training at the transplants is viewed not just as a means to develop skills but as a socialization tool. Indeed, a quarter of the experienced employee training provided at transplants deals with production methods and philosophies, compared to 10% at plants in Japan. Thus, although selectivity during the hiring process may mean that workers are relatively homogeneous with re-

spect to attitudes toward work and receptivity to Japanese manufacturing philosophies and human resource practices, the high amount of training in Japanese production methods also helps create a strong and consistent organizational culture.

Summary

Overall, the transplants have implemented most of the work practices found at their sister plants in Japan, including functional equivalents of two of the three “pillars” of the Japanese employment system. In some instances, implementation has been less extensive (e.g., quality circles), and in others, the transplants have had to make modifications (e.g., teams do not deal with certain issues in the U.S.). Furthermore, the transplants may have alleviated the difficulty of transferring practices across very different cultural settings through selective hiring and a heavy investment in training and socialization.

TECHNOLOGY

Although policies for managing the workforce affect the human capital that can be deployed in the production process, physical capital (more specifically technology) is equally critical to the transfer of organizational capabilities. Indeed, Caves (1982) argued that an organization’s technical capabilities were a key driver of foreign direct investment. Compared to work and HR practices, technology is less dependent on an organization’s institutional and cultural environment, and should not need as much modification when transferred across national bound-

aries. Here we find considerable similarity between the Japan plants and the transplants in the broad philosophy regarding automation—particularly in the areas of flexibility and worker involvement in equipment design and improvement.

Automobile production is generally organized in three departments, with different types and levels of automation in each. In the body shop, body panels are welded into a shell—known as the “body in white”—that will eventually provide the structure of the vehicle. Next is a paint shop, where the body is primed and painted and sealer is applied to prevent water entry and to reduce air noise at panel joints. Finally, in the assembly shop, all parts and trim are assembled into the vehicle, and the vehicle is inspected and prepared for shipment. Although some plants undertake additional activities (such as stamping), all high volume plants have body, paint, and assembly shops, and so, for comparability, that is what we focus on. The types and level of automation used vary dramatically from area to area, and we look at each in turn.

Considering overall automation levels by area, there do not seem to be major differences among the Japanese plants, the transplants, and the U.S. plants. Body shops are generally the most automated section of the assembly plant, with 78% (U.S.) to over 85% (Japan and transplants) of spot and arc/seam welds placed via automated equipment. Paint shops are less automated, with some processes fully automated and others completely manual. Here plants in Japan (42% of square inches of paint applied by automation) are similar to Big Three plants (47%),

compared with a higher level (61%) for the transplants; this difference reflects the fact that the transplants are newer facilities, having all been built in the last 15 years. Very few fully automated processes are found in assembly areas; all three groups of plants automate between 1% and 2% of the hundreds of assembly tasks.

Although automation levels are quite comparable across the different plants, there are some significant differences between the Japanese-owned plants and the U.S. plants when one looks more closely by department at the actual equipment in place and how that equipment is utilized.

For example, in the body shop, the primary difference between U.S.-owned plants and their Japanese counterparts lies in the use of flexible automation. Not only do the Japanese-owned plants automate a greater portion of their weld processes (both spot and seam welding), but a larger fraction of that automation is flexible (i.e., robotics). Indeed, almost 80% of spot welds at the Japanese-owned plants are placed by robots, compared to about 65% at Big Three plants. Not only do Japanese owned plants have more robotic welding, but they are more likely to use robots to hold and place parts as well. As a result, the Japanese-owned plants have an average of nearly 6 robots on a per-vehicle basis—twice as U.S.-owned plants. The transplants and plants in Japan are essentially identical with respect to these automation measures.

The higher levels of flexible automation at the Japanese plants make sense given the theorized links between automation and high-involvement work prac-

tices (cf. Pil & MacDuffie, 1996). By combining flexible automation with high-involvement work and HR practices, plants can handle greater product variety and undertake rapid model changeovers with fewer productivity and quality penalties than would be possible with either capability alone. This is the case because flexible automation lends itself more readily to worker involvement and the continual improvements associated with high-involvement work practices.

In the late 1980s and early 1990s, a decline in the Japanese labor force, as well as a reduction in the number of working hours, induced Japanese companies to look more closely at the automation of assembly work (Fujimoto, 1997). By utilizing automation to make their factories more "human friendly," the companies hoped to be able to attract workers who were increasingly shunning careers in manufacturing, while at the same time reducing their dependence on labor. Cheaper capital costs also helped.

However, the enthusiasm for assembly automation in Japan seems to be waning because expected labor savings did not materialize. (Also the onset and persistence of recessionary conditions in Japan reduced the immediate threat of labor shortage.) Labor reductions on the direct side were offset by increases in indirect labor, up-time was lower, the automation was more space-intensive, and the automated equipment generally restricted the mix of products that could be produced on a given line. These same problems had plagued earlier ambitious initiatives in the U.S. and Europe to expand the use of assembly automation; it is striking to see that

Japan's much-praised production expertise was not sufficient to overcome these obstacles.

When the Japan plants were experimenting with assembly automation, the Japanese transplants were not experiencing labor shortages and did not feel the same need to implement high levels of automation in their assembly shops. Thus the transplants have only implemented the most successful of the assembly automation experiments that took place in Japan.

Although fully automated assembly processes are on the wane, the Japanese companies are continuously expanding their use of "automation assist" (MacDuffie & Pil, 1997). These are tools that help the worker but do not replace him or her. Unlike full automation, automation assist tools do not perform full assembly tasks. Rather, they place parts, or deliver tools for workers to use, or finish off a task started by production workers.

Automation assist tools are generally quite simple and are designed in-house by teams of production workers and engineers using inexpensive, "off-the-shelf" parts—a further reflection of the philosophy of worker involvement. Workers feel a greater degree of ownership when they are involved in testing and installing their tools, doing preventive maintenance, and suggesting ways to improve their design. The same basic technology can play very different roles—controlling and de-skilling workers or empowering and up-skilling them. The goal at the Japanese-owned plants is to strive for the latter. This is equally true at the transplants as it is in Japan. For ex-

ample, when Mitsubishi recently purchased a new assembly line for its transplant facility (a joint venture with Volvo) in the Netherlands, it sent more than 400 workers to Japan to test the new equipment and to find ways to improve it before it was even delivered to the plant.

In summary, aggregate indicators of technology can mask important differences in how that technology is utilized. The Japanese-owned plants and the transplants share a similar philosophy towards automation, such as the desire for high levels of flexibility in the body shop, and involvement of workers in assembly area automation—one that differs quite substantially from the mass-production-influenced philosophy found at the U.S.-owned Big Three plants. The transplants have been able to implement this philosophy without much modification because there is little need to adapt technology to the different institutional environment found in North America.

SUPPLIER RELATIONS

The Japanese automobile producers are successful at building close cooperative ties with suppliers—ties that lead to advantages in product design, product cost, parts quality, and delivery assurance. These ties with suppliers are good examples of broader inter-company networks that are viewed as a key source of competitive advantage for Japanese companies.

Many reasons have been proffered for the successful relationships between assemblers and suppliers in Japan.

Some argue for the importance of partial financial ownership of suppliers (Klein, 1980). A recent study found that Nissan and Toyota own an average of 23% of the stock of their partner suppliers (Dyer, 1996). The suppliers in Japan are able to more easily finance their operations if they have close ties with an automobile assembler. Inter-firm employee transfers also help maintain trust and foster communication between assemblers and their suppliers, while bank-centered enterprise groups help regulate the alliances between the two, and supplier associations help reduce the likelihood of assembler transgression (Nishiguchi, 1994). None of these factors were available when the Japanese automobile companies set up operations in North America.

With the exception of the joint venture plants, and Honda to the extent that it was producing motorcycles in North America before producing cars, the transplants set up operations in North America with no supply base in place. Initially, the transplants placed heavy reliance on imported parts. Over time, however, they have shifted to local production to increase local vehicle content. At first, most of the sourcing went to Japanese suppliers that moved to the U.S., but over time U.S.-owned suppliers gained an increasing share of transplant parts purchases (Kenny & Florida, 1993). Given that organizations are subject to institutional influences in managing their supply base, we would expect that the relationships developed in North America by the transplants would exhibit similarities to those between Big 3 plants and their suppliers.

Instead, our data suggest that relationships between the transplants and their suppliers in North America are quite similar to the relationships between assemblers and suppliers in Japan. First, the transplants have very few suppliers—an average of 164, lower than Japan (195) and much lower than Big Three plants (503)—despite the fact that they outsource a greater number of parts and subassemblies than do their U.S. counterparts. This is beneficial because it reduces the logistical problems associated with dealing with a large number of suppliers. It also reduces the number of small-volume purchases—purchases that do not contribute to building strong relationships with suppliers and which pose significant burdens on logistics.

Another sign that the transplants have succeeded in building successful ties with their suppliers is their very low inventory levels (0.8 days, on average, for a basket of 8 critical parts, compared with 0.6 days in Japan and 1.4 days for the Big Three plants). Such low levels can only be maintained if there is tight coordination and information flow between supplier and assembler. The transplants also do virtually no inspection of incoming parts—evidence of their confidence in supplier quality. This is impressive in light of the fact that many of the transplants had been in North America for less than a decade at the time of data collection.

One potential factor explaining the similarity in supplier relations of the transplants with those in Japan, despite the limited relationship history and the

relative absence of institutional factors like keiretsu ties or supplier associations, is the support system that the transplants have put in place for their suppliers. Honda, for example, has a team of 50 employees who, in conjunction with engineers and managers from different parts of Honda, provide support and assistance to its suppliers in the form of its BP system—best process, best productivity, best partners (MacDuffie & Helper, 1997). Similar processes are in place at other Japanese transplants.

However, although the supplier support systems are modeled on similar systems in Japan, they are different in some ways. For one, they are free. Honda's BP system, for example, costs suppliers in Japan 2% of sales, whereas it is free in North America. Another difference is that in North America it is provided to all suppliers that could benefit from it, even if those suppliers also supply other companies (although companies like Honda do work hard to convince their suppliers to provide dedicated plants). This is further evidence of strong efforts by the Japanese transplants to recreate the same relationships with suppliers that are important for supporting the production system in Japan.

PERFORMANCE

We have discussed how the Japanese transplants resemble their Japanese sister plants in many ways. However, it is still the case that the transplants operate in a very different institutional and cultural environment from that found in

Table 1
Performance

	Japan	Transplants	Big 3
<i>Productivity</i> (labor hours per vehicle)	16.2	17.3	21.9
<i>By area</i>			
Body shop (direct)	2.3	2.8	3.2
Paint shop (direct)	2.1	2.7	2.4
Assembly shop (direct)	5.0	5.2	8.7
Indirect	3.2	4.6	5.2
Salaried	2.0	1.8	2.0
Part-time + seasonal	1.5	0.1	0.3
<i>Quality</i> (defects per 100 vehicles)	52	48	71
<i>By area</i>			
Body	8.5	7.8	13
Paint	12.8	11.2	16.6
Assembly	30.7	29	41.3
<i>Supplier quality</i>	21.8	19.1	27.3
<i>Model Mix Complexity Index</i> (0 = simplest model mix, 100 = most complex model mix)	39.5	24	20
<i>Specific complexity measures</i>			
# Engine/transmission combinations	100+	35	28
# Wire harness part numbers	100+	24	12
# Exterior colors	34	12	11
# of export markets	17.8	5.7	5.5
% of output for export	44.9%	33.2%	7.9%

Note: Figures not weighted by volume. Sample size for productivity: 12 Japan, 5 Transplant, 25 U.S. Sample size for quality: 10 Japan, 8 Transplant, 25 U.S. Sample size for complexity: 12 Japan, 8 Transplant, 25 U.S.

Japan. Many theorists argue that congruence between organizational practices and culture or values bears a strong relation to performance (Erez, 1986; Morris & Pavett, 1992). This raises the question of whether the transplants are capable of achieving the same levels of performance as their Japanese counterparts despite the different external environment.

To explore the performance of the transplants, we look at three measures of performance: productivity, quality, and capacity to handle variety.

Productivity

The productivity measure we use is a measure of the number of labor hours it takes to build a vehicle. The measure takes into account differences in vehicles produced, vertical integration, and working hours (see MacDuffie & Pil, 1995; Pil & MacDuffie, 1996, for details and specific adjustments made). Because three of the transplants did not provide all the data we need to calculate their productivity, our figures will reflect productivity for only five of the eight transplants discussed in this article.⁴

In Table 1, we see that overall productivity levels at the transplants are quite close to the levels found in Japan; the differences are not statistically significant. Whereas competitive pressures affect an organization as a whole, sub-optimal arrangements may nevertheless exist and persist within those organizations. We have the advantage of being able to break down performance by department, allowing us to explore how technology-intensive areas like the body shop perform relative to the labor-intensive assembly line.

In the paint shop, an area that is both technology- and labor-intensive, there are small statistically significant productivity differences between transplants and Japan plants in Japan. The transplants use more indirect employees (a category that includes material handling, quality control, and maintenance). This is offset, however, by significantly lower use of part-time and seasonal employees at the transplants. Although the Big 3 plants have higher overall labor hours per vehicle than the transplants, they have slightly fewer direct labor hours in the paint shop, an advantage that may be offset by their higher number of indirect labor hours. The biggest difference between the transplants and the Big 3 is in the assembly area where the Big 3 require almost two-thirds more labor. This difference is explained in part by the more traditional work practices in use at the Big 3 plants.

Quality

Our quality measure is based on J.D. Power and Associate's Initial Quality

Survey, which gathers detailed information from customers about the full range of problems encountered in the first four months of owning a new car. We aggregate data from these surveys across vehicles by plant of origin for all problems under direct control of the assembly plant like paint finish, fit of body panels, and water leaks (see MacDuffie & Pil, 1995). This provides us with a metric that is comparable across all plants that sell vehicles in the U.S., including all the transplants and Big Three plants in our sample, and eight out of the 12 Japan plants. We also calculate a supplier quality measure that captures the problems that aren't under the control of the assembly plant but generally originate at suppliers.

In terms of quality, we see no statistical differences between the performance of the transplants and their Japanese counterparts in our sample (see Table 1). There are also no significant differences across these two at the department level, and they attain similar supplier-related quality. The quality performance of the U.S.-owned plants in our survey sample, by comparison, is considerably worse. (It must be noted that Big Three plants have continued to close the quality gap with the transplants since these data were collected. However, our field work suggests that much of this quality improvement has come through inspectors and end-of-line repair rather than "getting it right the first time".)

Product Variety

Although the transplants achieve very good productivity and quality perfor-

mance, it is important to note that they follow a different product strategy from plants in Japan. Given that they produce high-volume products that are popular in the domestic North American market, the transplants have a much lower level of product mix complexity than plants in Japan, which produce models across a broader product range and which export extensively. Furthermore, the transplants deal with significantly lower parts complexity, e.g., witness the much lower number of engine/transmission combinations, wire harness variants, and exterior colors (a proxy for the number of facia and trim variations) for the products they produce. This is the case despite the fact that it would be possible to produce more variants and handle greater parts complexity at the transplants given their technology choices as well as the human resource capabilities provided by flexible work practices and high skill levels. Although this lower level of complexity may fit the product strategy of the Japanese companies, it does mean that the transplants currently face less difficult performance goals than their sister plants in Japan. Although the transplants are able to achieve impressive productivity and quality levels using tools and methods transferred from Japan, it is not yet clear whether they can achieve those performance levels at higher levels of variety.

CONCLUSION

As is summarized in Table 2, the transplants have undertaken extensive transfer of the operating practices and principles found in Japan. However, this

transfer did not occur blindly, and some adaptation was needed. The external environment played a role in determining what was transferred and what adaptation occurred. The compensation systems at the transplants tend to match those used by other Big 3 plants, rather than plants in Japan. Similarly, the transplants chose to follow the norms of the local environment when it came to assigning responsibilities to teams. However, the transplants also undertook steps to reduce the impact of being in a different institutional and cultural environment. These measures included comprehensive employee selection methods as well as training and socialization. They further included the development of proxies for Japanese institutional practices such as lifetime employment and enterprise unionism.

In the area of technology, we also see some, albeit fewer, influences of the external environment. We discussed, for example, how some automation efforts in assembly at the Japan plants was driven in part by environmental factors related to labor supply and cheap capital availability. These external factors were not present in the U.S., and as a result the transplants have less automated assembly equipment. In contrast, technology in the body shop is less influenced by external factors, and here we see almost complete transfer.

Perhaps the most interesting developments are on the supplier side, where despite a lack of institutional influences and historical precedent for collaborative relationships, the transplants have succeeded in developing relational supplier networks similar to those found in Japan. The development of these rela-

Table 2
Key Characteristics of Transplants Compared with Big 3 and Japan Plants

Organizational Characteristics	Japan Plants	Transplants	Big 3 Plants
<i>3-Pillars of Employment System</i>			
Job Security	Life-Time Employment	Employment security, expressed in formal agreements at union plants, pledged by management at non-union plants	Income security primarily, expressed in formal union agreements. "Job bank", job transfer rights under some conditions.
Union type	Enterprise unions	Enterprise unions not allowed under U.S. labor law, but non-union transplants attempt to create similar relationship with employees. Unionized transplants are UAW.	Industrial union (UAW)
Wage structure	Seniority Based Wages, large within-category pay differentials	No seniority based pay. Pay differentials within job categories match North American norms.	No formal seniority pay system, though wage dispersion has modest link to company (not job) tenure.
<i>Key Work Practices</i>			
Work Teams	Extensive use	Extensive use but unlike Japan, little influence over performance evaluations and settlement of grievances or complaints	Rare
Job rotation	Extensive rotation, within and across teams	Extensive rotation within and across teams	Rare
Problem Solving Groups	Extensive use	Moderate utilization	Moderate utilization
Suggestion Programs	Extensive use, and high implementation rates	Level of suggestions not as high as Japan though implementation rate similarly high	Rare, with low implementation rate
Recruitment Strategy	Recruitment emphasis on willingness to work in teams and learn new skills	Very high selectivity rate (much higher than Japan). Based on willingness to work in teams, learn new skills.	Hiring emphasis varies, moderate selectivity
Training levels	High training levels	Higher levels for experienced workers than in Japan; training topics differ	Lower training levels than transplants or Japanese plants
<i>continued</i>			

Table 2
Key Characteristics of Transplants Compared with Big 3 and Japan Plants

Organizational Characteristics	Japan Plants	Transplants	Big 3 Plants
Status Differentials	Moderate, some plants have separate cafeterias and parking lots for managers	Minimal, efforts to eliminate differentials as much as possible	Many
<i>Technology</i>			
Body shop automation	High levels, emphasis on flexible automation and robotics	High, emphasis on flexible automation, many robots	Moderate-high, emphasis on hard automation, fewer robots
Paint shop automation	Moderate levels of automation	High levels of automation	Moderate levels of automation
Assembly automation	Moderate assembly automation, high levels of automation assist	Little assembly automation, high levels of automation assist	Little assembly automation, little automation assist
<i>Supplier Relations</i>			
Number of 1 st Tier Suppliers	Few 1 st Tier Suppliers	Few 1 st Tier Suppliers	Many 1 st tier suppliers (as of 1994; decreasing by late 1990s)
Parts & in-process inventory	Low inventory levels	Low inventory levels	Average-to-high inventory levels, particular emphasis on decreasing parts (but not in-process) inventories
Inspection of incoming parts	No inspection	No inspection	Extensive (as of 1994; decreasing by late 1990s)

tionships is ongoing. Thus, although the transplants have moved cautiously towards involving U.S. suppliers in the product development tasks that are commonly shared with suppliers in Japan, we predict that more collaboration in product development is the likely extension of the relationships already developed.

The transplants have not always been equally successful in negotiating the difficult passage to operating effectively in the North American employment environment, as an extensive case study liter-

ature suggests (see Fucini & Fucini, 1990; Graham, 1995; Rinehart, Huxley, & Robertson, 1997). Yet the majority have succeeded in achieving many of the performance characteristics of plants in Japan. Although the transplants have certainly learned a lot from their counterparts in Japan, they are also learning from their new host environment. For example, although the Japanese companies have homogenous labor forces in Japan, that is by no means the case in North America. As this diversity manifests itself in new ideas and opportunities, the transplants may be-

come a source of innovation for plants in Japan trying to deal with new organizational and social challenges in their home country.

Given the strong performance of the transplants, will the demonstration influence of the transplants help induce change in practices in place at Big Three plants? In other research, we have discussed the difficulties inherent in fundamentally altering an organization's practices (Pil & MacDuffie, 1996; Pil, 1996). However, the Big Three are experimenting with new work practices at various locations, particularly in the U.S., and they have also been rethinking the ways in which they utilize manufacturing technology. The long-term effect of the transplants remains to be seen. What is clear, however, is that the transplants have succeeded in transferring and adapting many of the practices found in Japan and are finding ways to reduce the impact of their new environment on their internal operations. These lessons about what makes a transplant thrive can be valuable for U.S. automakers as they strive to implement lean production in their home operations and, more broadly, for any multinational company considering the transplantation of competitively significant capabilities to countries far from their home base.

NOTES

1. Surveys were translated to Japanese. Translations were translated back to English, as well as reviewed by a Japanese academic who specializes in the automobile industry to ensure they captured the same information as the English version of the surveys.
2. Japan is generally classified as being culturally

distinct not just from North America but also from all other countries considered in culture studies (e.g., Hofstede, 1980; Ronen & Shenkar, 1985).

3. Indeed, the desire to go to an enterprise union model is evident from a Japanese transplant in Europe. Nissan U.K. refused to set up operations unless there was an up-front agreement to permit the plant to be organized by a single union—something unprecedented in the U.K.
4. The data reported for productivity and quality, in Table 1, reflect simple averages of labor hours per vehicle or defects per vehicle at the plants in each grouping. This differs from how we sometimes present these data, in which we weight each plant's performance by its volume. We use weighted averages when describing the entire international sample, which includes many low-volume plants in developing countries, so that the averages are not distorted by the values of plants that may not be operating at minimum efficient scale. Here we are only comparing relatively high volume plants in the U.S. and Japan and so we judged that weighting was not necessary.

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