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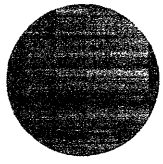

TRANSFERRING JAPANESE HUMAN RESOURCE PRACTICES: JAPANESE AUTO PLANTS IN JAPAN AND THE U.S.

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ABSTRACT

Transferring Japanese Human Resource Practices:

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We examine the transferability of human resource practices used by Japanese manufacturers with 1993 data from Japanese-owned automotive assembly plants in Japan and the U.S. We find some well-known practices in Japan are not transferred to the U.S. while most practices related to work organization are transferred, albeit with modifications.

The structure and operations of Japanese manufacturing firms have evoked a flurry of interest from researchers and business leaders the world over. As early as 1973, in-depth research appeared contrasting the "Japanese production system" with the manufacturing practices of the West (Dore 1973). The recent literature is replete with anecdotal and other evidence proclaiming the wonders of Japanese manufacturing systems (see Young 1992). Furthermore, there is substantial evidence that in several industries, these practices have been instrumental in allowing Japanese plants to outperform their competitors in both productivity and quality (Abegglen & Stalk, 1985, Womack et al., 1990, MacDuffie & Krafcik, 1992).

There are multiple elements that make the Japanese production system unique, including product design practices, accounting control systems, and purchasing philosophies. We will focus on another critical aspect of the Japanese production system -- namely, its human resource practices, and the way these are used to develop and utilize a highly flexible, well skilled, and motivated workforce (MacDuffie 1991). The idea that human resource policies can help firms create competitive advantage is found not only in the literature about Japan, but also in an extensive body of literature about the U.S. (e.g. Tichy et al. 1982; Dyer, 1988; Kochan, Katz, and McKersie, 1986; Lawler, 1992). However, one crucial question raised when exploring the role of human resource policies in the Japanese production system is whether or not these policies are transferable outside the Japanese context.

If the world fit a true neoclassical economic model, there would be no difficulty in implementing Japanese human resource systems abroad. It is clear, however, that there are significant cultural and institutional differences that might slow or inhibit the adoption and implementation of such practices (Schein, 1986). Westney (1987) argues that in the process of

cross-cultural transfer, practices get modified and adapted to fit the local environment. Kochan, Dyer, and Batt (1992) state that understanding the transferability of practices across national boundaries is one of the critical challenges facing researchers in the human resources/industrial relations field.

The best way to study whether Japanese human resource practices are transferable, either completely, or in modified form, is to look at Japanese plants that establish operations overseas, and to analyze whether their human resource systems are the same in both locations. These firms would be fully cognizant of how their human resource systems work in Japan, and therefore, lack of transference could not be attributed to ignorance of how the system works.

It has long been acknowledged (e.g. Doeringer and Piore, 1971) that economic forces and product market decisions affect the internal operations of the firm and how the employment relationship is organized. We focus here on a single industry context -- automotive manufacturing -- in order to avoid the confounding influence of different product markets and production requirements that would be found in a cross-industry sample. The fact that Japanese automotive companies have established a number of "transplant" manufacturing facilities in the U.S. makes this a particularly relevant choice for studying the transferability of employment practices.

Much has been written about human resource practices in some of the Japanese automobile transplants (e.g. Shimada and MacDuffie, 1986; Brown & Reich, 1989, Fucini & Fucini, 1990; Adler, 1992), but no one has provided a detailed comparison of the full set of Japanese automobile transplants in North America with a similar set of plants in Japan. Some authors (Kenney and Florida, 1993; Young, 1992) have argued that Japanese auto companies have maintained their manufacturing practices upon moving to the United States rather than modifying them to meet the

needs of the US environment. Others have argued that the Japanese production system, and its human resource system in particular, is not well suited to the U.S. context and must been modified extensively in order to function. (Parker and Slaughter, 1988) However, most of these arguments are generalizations based on readings of work on particular transplants, or on what has appeared in the popular press.

In order to understand whether Japanese human resource practices are transferable, and indeed, whether they are critical for successful automobile manufacturing, it is important to look in detail at the practices as they are put into effect in Japan. One body of literature has emphasized the "so-called" three pillars of the Japanese employment relationship -- life-time employment, seniority wages, and enterprise unionism (Shimada, 1985; Smith & Misumi 1989). As we will show, evidence from the Japanese auto transplants indicates that these may not be as crucial to the Japanese production system as they were once thought to be. Another body of literature explores the human resource policies more directly related to work organization and skill development in the Japanese production system, e.g. team based production methods, a small number of job classifications, few distinctions between management and employees, and worker participation in problem solving (Koike, 1989; Cole, 1979; MacDuffie & Krafcik, 1992). As we will show, these latter practices are all prevalent in the transplants, but appear to undergo some adaptation to the North American institutional and cultural environment.

Data and sample

All the major Japanese car manufacturers opened assembly plants in North America, either wholly-owned or joint ventures with American or Japanese partners, between 1982 and 1992 --

Toyota, Nissan, Honda, Mazda, Mitsubishi, Fuji Heavy Industries (Subaru) with Isuzu, and Suzuki. Our data are collected from an international survey of automotive assembly plants worldwide, sponsored by MIT's International Motor Vehicle Program. Here we report plant-level survey data on human resource practices from 8 of the 11 Japanese auto transplants in North America (survey available from authors upon request). All survey responses are for the 1993 model year (i.e. from Sept. 1992 to August 1993). In addition, we have performed extensive plant visits and interviewed management representatives at five of these plants.

We have collected the same survey data for 12 automobile plants in Japan. We have done extensive visits of 12 Japanese plants, and interviewed the management of 10 plants, as well as corporate-level managers at three of the five major companies in Japan. The data we present below are all based on the survey responses, but our commentary will reflect insights we have developed during the course of visiting the plants and conducting our interviews. At this preliminary stage of our data analysis, we present primarily comparisons of means between Japanese plants in the Japan and those in the U.S.

Assessing the Transferability of Japanese Human Resource Practices

The first main-stay of the Japanese human resource system is its guarantee of permanent employment for workers. This is important for the successful implementation of a whole range of practices, including the provision of extensive training, successful team work, and employee commitment to continuous improvement. This permanent employment is offered to a set of core employees. Part-timers, seasonal employees, and contract workers are used to handle demand fluctuations, and these do not receive employment guarantees (Dore, 1986). Today, these employees

make up about 6.5% of the workforce in the Japan-based plants that we surveyed. In the transplants, they make up on average less than 1% of the workforce. Since this smaller "buffer" of temporary employees gives the transplants much less protection from demand fluctuations (and given the pronounced cyclicality of auto sales in the U.S.), one might expect it to be much more difficult for the transplants to give employment security guarantees.

The two transplants that are unionized have included a commitment to employment security in their union contracts. These do not constitute legal guarantees, because they are conditional on such a policy not jeopardizing the financial viability of the company. The nonunion transplants have no such formal agreements, but have also indicated a strong commitment to maintaining long-term employment for their core workers. None of the transplants have had any layoffs of these core employees to date. They have been in a growth mode for much of their existence, and during downturns, workers not needed for efficient production typically receive additional training. However, the transplants make no employment commitment to their temporary workers. Mazda and Diamond Star, for example, have already laid off some of these workers. (source?)

Closely related to the employment security issue is the question of whether employees actually stay with the company once hired. Dore (1973), in his comparison of British to Japanese factories, noted that in the Taga plant, the average age of the employees was 31.3 years. The average age of entry was 21.8 years, and the average length of service was 9.5 years. This suggests that on average, the Japanese employees had worked solely for their company since entering the labor force. We find that this pattern persists to the present. The average age in the Japanese plants is now 36.5 years, versus 34.5 in the transplants; while this difference is statistically significant, its magnitude is not that great. However, the employees in Japan have been at their plant an average

of 15.4 years versus the 4.2 years that the average transplant employee has worked at his/her plant. However, it must be remembered that the transplants are extremely new, with half having started operation in the last five years.

Turnover (defined as resignations, retirements, and terminations) is currently quite high in Japan plants compared to the transplants, (8.7% vs 2.7%). The relatively high turnover in Japan is surprising, given the long-term relationships the Japanese plants are purported to have with their employees. Since the data are from 1992-93, a time of recession in the Japanese auto industry, it is unlikely that the high turnover reflects the labor shortages common in manufacturing industries during the boom years of the late 1980s. Instead, it may reflect the widely publicized reluctance of young Japanese to stay in manufacturing jobs.

The low rate of turnover in the transplants is also a surprise, given the propensity for job-switching in the U.S. These trends suggest that the gap in employment tenure between the two groups of plants will narrow further in years to come. Furthermore, the turnover rate combined with the unscheduled absenteeism rate (which is also quite low at the transplants -- 2.2% compared with 1.2% in Japan and 5.1% for U.S.-owned plants) do not provide support the view that American workers at the transplants are dissatisfied with their experience in a Japanese production system, as predicted by Parker and Slaughter (1988).

Long term employment is very important when companies consider investment in training. Firms that are planning to utilize employees for longer periods of time, and that are confident employees won't leave, are more likely to invest in employee development than firms that treat their workers as an expandable commodity. Given the greater emphasis at Japan plants on a long-term employment relationship, we would expect them to have higher training levels. The lower

turnover levels at the transplants, on the other hand, and their "start-up" status would lead us to expect higher levels of training there.

In Table 1, we see that 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. Among experienced employees, while there is not statistically significant difference in the level of training for production workers, the transplants do provide much more extensive training to experienced first-line supervisors and engineers. This may be due to the fact that our "experienced" category encompasses all employees with more than one year of tenure. To the extent that more training is needed during the initial 5-10 years on the job for these employees, the relative newness of the transplants could explain this differential.

TABLE 1: TRAINING LEVELS

TRAINING TYPE:	JAPAN	TRANSPLANTS'	t-test
New Employee Training	2.81	2.75	
Experienced Employee Training	1.67	4.13	***
Training For New Hires By Category			
New Production Worker	2.91	3.00	
New Supervisor	2.91	2.88	
New Engineer	2.82	2.88	
Training for Experienced Employees by Category			
Experienced Production Worker	3.22	4.12	
Experienced First-Line Supervisor	2.78	4.63	***
Experienced Engineer	2.00	4.50	***

For new employees, 1= 0-40 hrs/year; 2= 41-80 hrs/year; 3=81-160 hrs/year; 4= 160+ hrs/year.
For experienced employees, 1=1-20 hrs/year; 2=21-40 hrs/year; 3=41-60 hrs/year; 4= 61-80 hrs/year; 5=80+ hrs/year.
T-tests done using 2-sided confidence intervals: * = .1; ** = .05; *** = .01

We emphasized earlier the importance of having a good detailed understanding of the

Japanese practices in Japan in order to study whether they are transferred abroad. This significance is highlighted when we look in detail at the training for production workers. There is little difference in the **hours** of training for production workers between the Japan plants and the transplants. However, when we break down the training of new and experienced production workers we see that there are significant differences in the **type** of training being provided to the two groups of plants. We will refer to specific differences in production worker training below.

TABLE 2: BREAKDOWN OF TRAINING FOR PRODUCTION WORKERS

New Production Workers

Percent of Training Time Spent on:	Japan	Transplants	t-test
Plant orientation	20.5	22.5	
Basic skills	1.3	0.0	
Interpersonal skills	14.7	4.7	**
SPC & problem-solving	5.2	5.6	
Production methods & philosophies	2.8	13.5	***
General technical skills	30.0	13.1	*
Specific technical skills	3.8	6.4	
Health & safety issues	13.7	19.6	
Environmental policies	1.1	11.1	**
Other	7.0	3.5	

Experienced Production Workers

Percent of Training Time Spent on:	Japan	Transplants	
Plant orientation	3.9	0.0	**
Basic skills	1.7	0.0	
Interpersonal skills	24.8	4.6	**
SPC & problem-solving	41.9	12.4	**
Production methods & philosophies	9.9	26.6	
General technical skills	4.7	10.1	
Specific technical skills	0.3	8.8	*
Health & safety issues	8.3	23.0	*
Environmental policies	0.0	6.7	**
Other	4.7	7.9	

T-tests done using 2-sided confidence intervals: *=.1, **=.05, ***=.01

In addition to training, workers become multi-skilled through job rotation. Through extensive rotation, workers familiarize themselves with a range of jobs. This helps eases scheduling problems, helps with redeployment of workers as work loads shift, eases ergonomic problems from repeated operations, helps reduce the monotony of work, and helps with employee problem solving efforts (to be discussed below). It also helps prevent the development and assertion of sectional interests that are inconsistent with the goals of the plant.

We have found that job rotation in the Japan plants is more extensive than in the transplants. Although the transplant workers rotate some within their work group, they rarely rotate across work groups. In the Japan plants, workers rotate within their work groups, and habitually rotate across work groups as well. Florida and Kenney's work with transplant auto parts suppliers (1993) suggests that this may be due to workers in U.S. plants not yet having the knowledge to move regularly from team to team. Transplant workers rotate at more frequent intervals, however, than workers in japan, typically for ergonomic reasons.

To help ease job rotation, pay in Japan plants is attached not to the job, but rather to employee rank. Employees in a given rank can do a range of jobs, and rank is often more an indicator of seniority and how many jobs an employee has learned than a "right" to work in a particular job. These are analogous to job classifications in the U.S., although, as noted above, are not necessarily attached to a particular job. Plant-specific customs dictate the general pattern of rotation among jobs for employees of the same rank (Koike, 1989). The Japan plants in our sample have five different ranks for production workers and five ranks for maintenance workers.

In comparison, the transplants in our sample have only one production worker classification, and one or two maintenance worker classifications. This is very low for the U.S. context, where

traditional plants often had hundreds of classifications. As in Japan, pay is completely separated from the actual job that is performed. In both sets of plants, this approach shifts employees' incentives away from moving up a strict job ladder and towards skill and knowledge acquisition as a source of status or satisfaction (MacDuffie, 1988).

Given the low number of ranks, how is employee compensation determined? According to Aoki (1990), unions in Japan do not negotiate pay rates for each job. Rather, they negotiate about entry-level wages, inter-rank wage differentials, and rates of inter-rank progression. However, given the small number of ranks, this does not offer much leeway in what to pay employees. As Table 3 below shows, the Japan plants make extensive use of bonuses. These are provided based on plant and company performance, but also based on individual performance.

Among the transplants, some give bonuses for plant or company performance, but none give bonuses to production workers based on individual performance. ("Company" for many of the transplants refers to the U.S. manufacturing subsidiary, and as such is synonymous with "plant", except when the same parent company has two different transplant facilities.) Almost all the transplants, however, provide merit increases in salary to engineers and supervisors. This is less common in Japan because it is felt that it leads to a high fixed wage structure that cannot be adjusted during downturns. It is also interesting to note that no transplant offers bonuses for seniority. Since there is only one rank of production worker, unlike in the Japan plants, this means that pay at the transplants bears no relationship to seniority. This shift away from seniority based compensation may reflect the fact that Japanese companies are not happy with it. 72% of Japanese managers report that the seniority system adversely affects the morale of those who are the most able (Smith & Misumi, 1989).

Table 3: CONTINGENT COMPENSATION

Percent of Plants Reporting	Prod. Workers		Supervisors		Engineers	
Compensation Type	JPN	Trans	JPN	Trans	JPN	Trans
Bonus for Company Performance	50%	63%	50%	63%	42%	63%
Bonus for Plant Performance	50%	38%	50%	25%	17%	25%
Bonus for Individual Performance	50%	0%	50%	13%	17%	13%
Bonus for Seniority	33%	0%	33%	0%	25%	0%
Merit Increase in Salary for Individual Performance	50%	0%	58%	88%	25%	100%

A frequent claim regarding compensation in Japanese plants is that there is an emphasis on minimizing the pay differentials between employees. This is said to enhance the sense of community and equal status among employees at different levels (e.g. Womack et al., 1990, Florida & Kenney, 1991). The literature on intra-company wage differentials has stressed the relatively low differential between the highest and lowest paid employees in Japanese companies.

Our research indicates, however, that the differentials between the lowest and highest ranks within employee categories is much higher in Japan than in the Japanese transplants in the US (see Table 4). We have found that this differential is not due to differences in starting pay (2100 yen = $1). There is no statistical difference in entry-level pay for production workers between Japanese plants and the transplants, nor for engineers. The lowest paid supervisors in Japanese plants earn more than their counterparts in the transplants. The reverse is true for maintenance workers.

Table 4: PAY DIFFERENTIALS

Pay Differential between Highest and Lowest paid	JAPAN	TRANSPLANTS	t-test
Production Worker	204%	24%	***
Maintenance Worker	205%	12%	***
First-Line Supervisor	117%	31%	***
Manufacturing Engineer	446%	130%	***

T-tests done using 2-sided confidence intervals levels: *=.1, **=.05, ***=.01

Since pay in this case includes both base wages and various bonuses (while excluding benefits), it seems likely that these very large differentials reflect the use of bonuses to reward individual-level differences in seniority, skill, and initiative in Japan-located plants, compared to the policy at the transplants of awarding bonuses equally to all employees in a given category.

The importance of team work in Japanese plants has long been recognized by scholars (Aoki 1990, Koike 1989). Like plants in Japan, the transplants make extensive use of teams. Management generally appoints team leaders, although at the unionized transplants, union officials are often involved in team leader selection. Teams in both Japan plants and transplants are similar in the degree of influence they have in various areas, according to management respondents. Teams are reported to have the most influence over who should do what job and methods of work, and the least influence over the selection of team leaders and the amount and pace of work. The only statistically significant differences between the two groups are in the area of employee voice, with teams in the Japan plants reported to have more influence over performance evaluations and settling grievances and complaints.

Table 5: TEAM INFLUENCE

AREA OF INFLUENCE	JAPAN	TRANSPLANTS	t-test
Use of new technology on the job	2.3	2.0	
Who should do what job	3.6	3.1	
The way work is done; revising methods	3.6	4.1	
Performance evaluations	2.7	1.4	*
Settling grievances or complaints	3.5	2.1	*
How fast the work should be done	2.3	2.0	
How much work should be done	2.0	1.6	
Selection of team leader	1.3	2.1	

Note: Scale from 1-5 where 1 = no influence, and 5 = extensive influence
T-tests done using 2-sided confidence interval: *=.1, **=.05, ***=.01

Although Japan plants and transplants both make extensive use of teams, they 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. One such activity is quality circles. Looking at Table 6, we find that a much larger percent of the workforce in Japan plants are found in quality circles or employee involvement groups than in the transplants (although even among the transplants there is quite a bit of variance). One possibility is that *kaizen* leads employees to fear that they will work themselves out of a job (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 in the transplants reflects their newness, and that plants plan to increase their usage over time. Furthermore, according to Cole (1979), participation in these "voluntary" small group activities in Japan plants is more likely to be viewed as mandatory by employees, due to management and peer pressure, than in U.S. plants.

The Japan plants and the transplants differ significantly in how the quality circle activities are organized. In Japan, a third of the plants reported having quality circles or employee involvement groups meeting for at least a portion of their time during non-paid hours. All but one of the transplants pays employees during the time their quality circle meets. The heavy emphasis placed by the Japan plants on problem-solving activities is seen from table 2, which shows that over 40% of the training provided to experienced production workers in those plants is related to problem solving and SPC, compared to just over 10% in the transplants.

The Japan plants also receive significantly more suggestions per employee than do the transplants. However, several of the plants we visited in Japan told us they place explicit quotas on

the number of suggestions employees should make each month. That is generally not the case in the transplants. Only seven of the twelve Japanese plants responded to the question of whether they paid for suggestions. However, all seven answered affirmatively. In contrast, only three of the eight transplants paid for suggestions. We know from interviews that the transplants prefer non-monetary forms of recognition, such as reward ceremonies or points that can be accumulated towards prizes, because of concerns that monetary awards cause employees to focus solely on major-impact suggestions that generate large awards. Furthermore, transplant managers believe that it is difficult to establish an allocation system for monetary awards that will be perceived as objective and equitable.

Table 6: KAIZEN ACTIVITIES

Indicators of Off-line Problem Solving	JAPANESE	TRANSPLANTS	t-test
Percent of employees in Quality Circle or Employee Involvement group	81	27	***
Suggestions per Employee	130	4	**
Percent implemented	80	60	

T-tests done using 2-sided confidence intervals: *=.1, **=.05, ***=.01

Before the transplants opened, one common expectation about the transferability of Japanese employment practices was that American workers would be too individualistic, too diverse, and too poorly educated to fit with that system. Yet the transplants have been highly successful, in terms of productivity and quality performance, with an American workforce whose turnover and absenteeism is very low. One reason for this success is that the transplants spend inordinate amounts of time on selecting and socializing their employees. The ten Japan plants in our sample that hired production workers in the recent past hired on average over 80% of those who applied.

Only three of the transplants have hired production workers recently, but they were much more selective. On average, they hired only 5% of those who applied. Those who are hired are very well educated (Table 7), with almost 40% of production workers having some college education.

Table 7: PRODUCTION WORKER EDUCATION LEVELS

Percent of Employees by Educational Category	JAPANESE	TRANSPLANTS	t-test
No Secondary School	16.2	1.0	*
Some Secondary School	0.5	6.8	***
Secondary School Degree	82.5	54.0	***
Some College	0.2	23.8	***
College Degree	0.7	14.4	***

T-tests done using 2-sided confidence intervals: *=.1, **=.05, ***=.01

Some academics also argue that the transplants strove to approximate the homogenous labor force they have access to in Japan by locating in states with few minorities (e.g. Cole & Deskins 1989). Although the locational choices of the Japanese plants may reflect some biases on the part of the Japanese parent company, it is not clear to us that these biases persisted after the plants opened. In every transplant we visited, we found minorities and women represented just as extensively as in most American plants that we have visited. Indeed, we found that 19.5% of the production workers in the transplants we surveyed are female, compared to only 11.6% in other North American plants, and only 2.1% in Japanese plants. While the transplant workforces may be demographically diverse, the extreme selectivity during the hiring process may mean that workers <u>are</u> homogeneous with respect to attitudes towards work and receptiveness 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 (see Table 2).

One major institutional difference between the transplants and the Japan plants is the

structure of worker representation. All the Japan plants in our sample are unionized with enterprise unions. Enterprise unions have long been viewed as crucial to the success of Japanese companies, because the union represents both blue-collar and white-collar employees in a single firm, and thus can help align employee goals with those of the organization. While Shimada (1985) disputes the claim that enterprise unions are docile and always cooperative with management, it is clear that this union structure is associated with a high level of management-union consultation on strategic issues and a less adversarial relationship, given that many managers begin their careers as union members in the lower management ranks.

In contrast, only two of the eight transplants in our sample are unionized, and their workers are represented by the United Automobile Workers (UAW), an industrial union. There is some evidence that the transplants have tried to create similar dynamics to those existing with an enterprise union. At the unionized transplants, the labor contract includes a union commitment to support the competitiveness of the plant (together with a management commitment about 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 establish some governance structure for employee representation by establishing committees of worker representatives (typically appointed by management) to provide worker representation. However, transplant managers discuss fewer issues with these employee committees than do managers at the Japan plants. As is shown in Table 8, the only issue most of the transplants discuss with their employees are health and safety related. The other issues are generally only discussed by the two unionized transplants, with only one non-unionized transplant discussing grievance issues, personnel policies and employment conditions, and changes in strategy or policy, with their worker

representatives.

Table 8: TOPICS THAT ARE DISCUSSED WITH WORKER REPRESENTATIVES

Issues Addressed by Worker Representatives (Percent of firms responding)	JAPANESE	TRANSPLANTS
Grievances/Due Process	100.0	37.5
Personnel Policies/Employment Conditions	66.7	37.5
Health & Safety	100.0	87.5
Major Changes in Strategy or Policy	58.3	25.0

When asked about the influence of worker representatives on management decisions (Table 9), transplant managers claimed the influence was greatest for decisions about new technology and work allocation. In contrast, managers in the Japan plants indicate that worker representatives have a lot of influence over decisions about reductions in staffing and changes in the amount of overtime to be worked, but relatively little in other areas.

Table 9: WORKER INFLUENCE ON DECISION MAKING

Influence Exerted by Worker Representatives before Formal Management Decision	JAPANESE	TRANSPLANTS	t-test
New investment plans (e.g. expansion of current operations)	1.8	1.6	
Design of new technology	1.0	1.6	***
Evaluation and selection among new technology options	1.0	2.2	***
Restructuring of jobs and duties as result of new technology	1.8	2.6	
Planning and coordination of training for new technology	1.4	2.6	***
Reductions in staffing	4.9	2.2	***
Changes in work allocation	1.9	3.0	*
Amount of overtime to be worked	3.9	1.8	***
Changes in work to be subcontracted	1.4	2.0	

T-tests done using 2-sided confidence interval: *=.1, **=.05, ***=.01

This analysis suggests that not all the characteristics of the Japanese human resource system are necessary to achieve superior performance. Indeed, what were once considered the "three pillars" of the Japanese human resource system: guaranteed lifetime employment, seniority wages, and enterprise unionism, are not found in Japanese transplants. Why then, do the transplants perform almost as well as their counterparts in Japan (MacDuffie & Krafcik, 1992; Womack et al, 1990)? We would argue that the key is a system of human resource practices -- those reviewed above -- that result in a highly committed, motivated, and flexible workforce. This is not to say that these practices have been transferred blindly to the transplants. Almost each one of them has been modified or adapted in some way by the transplants, but generally in ways that are still consistent with the overall logic of the production system.

It is harder to predict whether Japanese human resource systems can be adapted and incorporated into the operations of existing U.S. plants, the "brownfield" sites. All of the Japanese transplants, with the exception of NUMMI, were established at greenfield sites. Even at NUMMI, the entire human resource system was rebuilt from scratch because of the plant closure and the new management team. According to Koike (1989), production systems represent complex interactions of technological and social systems (including human resource systems), and although it is easy to change the technical systems, it is much harder to alter the social systems that develop in work sites over time. We have shown that the transplants, which did not have to deal with entrenched employment practices, have been successful in transferring and adapting Japanese human resource practices to the North American environment. We are now in the process of conducting research to see whether these practices can be transferred with the same level of success to older, more traditional, unionized American plants.

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