

The Hybridization of the Japanese Production System in the United States and East Asia

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ABSTRACT

This paper examines the international transferability of the Japanese production system to the United States (US), Korea, Taiwan, Malaysia, Thailand, and Singapore, by utilizing the "application-adaptation analytical framework".

Three major factors determine particular application-adaptation hybridization characteristics in individual countries: strategic necessity of industry and company; specific attributes of the elements comprising the Japanese production system; the historical, social, and managerial environment of the host countries.

KEY WORDS

*the international transferability of the production system
Japanese production system
managerial environment of the host countries*

INTRODUCTION

This paper examines the international transferability of the Japanese production system to the US, Korea, Taiwan, Malaysia, Thailand, and Singapore. The competitive advantage of Japanese manufacturing companies in the automotive and electronics industries stems from the existence of a system that produces a large variety of products with high quality, great production efficiency, and punctual delivery. The core of the system is the work organization where employees receive long-term training in a wide variety of skills, participate actively in plant operation, cope with various problems both quickly and flexibly, and make a constant effort to improve their work methods (Abo, 1994).

The following discussion is based on an analytical model of the Japanese production system overseas called the "application-adaptation analytical framework". In this model, "application" refers to the behaviour of transplanting Japanese elements of the Japanese production system to the host countries, and "adaptation" refers to the act of introducing elements that are characteristic of systems native to the host countries. Twenty-

three items, which are considered key elements in the international transfer of the Japanese production system, are selected. These items are divided into two major categories: "Method" and "Result". Each of these categories is in turn divided into two sub-categories: "Human" and "Material". Each item is evaluated as to its extent of application by applying a 5-point evaluation that permits the comparison of application-adaptation hybridization characteristics in different countries and different industries (see Table 2 and Table 3).

HYBRID PLANTS OF AFFILIATES IN THE US

Field studies were carried out in the US in 1989. Table 1 describes the thirty-four Japanese affiliates surveyed, which included nine auto assembly, nine auto parts, nine consumer electronics (mainly colour TV), and seven semiconductor plants (Abo, 1994).

As Table 2 shows, there is a notable contrast between the auto assembly and the consumer electronics plants with regard to the degree of application for "Method". Auto assembly plants receive a high average 3.6 rating, whereas electronics assembly plants are

TABLE 1. Surveyed Japanese Plants in the USA

	Automobile Assembly	Automobile Component	Electronic Assembly	Semiconductor	Total
Number of plants	9	9	9	7	34
Ownership					
90% - 100% ⁽¹⁾	6	7	9	7	29
50% - less than 90%	3	2	0	0	5
- less than 50%	0	0	0	0	0
Nationality of top manager					
Japanese	7	9	7	6	29
Local	2	0	2	1	5
Number of employees					
- 499	0	7	2	4	13
500 - 999	2	2	5	3	12
1,000 - 1,999	1	0	2	0	3
2,000 - 2,999	3	0	0	0	3
3,000 -	3	0	0	0	3
Start of operation ⁽²⁾					
- 1960 s	0	0	0	0	0
1970 s	0	0	6	3	9
1980 - 1985	3	2	1	2	8
1986 -	6	7	2	2	17

(1) Including cases where the Japanese parent companies own majority and all other owners are Japanese trading companies or Japanese banks

(2) Year of acquisition or equity participation in case of entries doing so

Data is at day surveyed.

rated a low average 2.5. However, there is a narrower gap between these two industries in the "Result" category. As auto assembly and consumer electronics plants are representative of the Japanese manufacturing industry, this paper will focus on these two industries in examining the hybridization of the Japanese production system in the US.

1. *Eliminating Established Systems and Applying Japanese Systems in Their Place*

The most difficult problem that the Japanese affiliates face is the well-established production systems that exist in industrially advanced countries such as the US. When these US production systems hinder the transplantation of the Japanese production system, then the affiliates must carry out two separate tasks: one is to eliminate the established systems and the other is to replace them with the methods of

the Japanese production system. However, the more deeply the existing systems are entrenched in the US social and historical environment, the more likely that these two tasks will generate friction and bear tangible or intangible costs. Whether companies are prepared to take such risks depends on how necessary the application of the Japanese production system is for the successful operation of their plants.

The reason auto assembly plants receive high ratings of application for "Method" is that this industry is obliged to apply the Japanese production system. First, in order to be competitive, the auto assembly industry relies on Japanese plant operation methods such as employing multi-skilled workers and carrying out small-lot production on a diverse product line, to a much larger degree than do other industries. Second, the plant scale in this industry, in terms of the number of employees

TABLE 2. Hybrid Evaluation of Japanese Affiliated Plants Abroad

	USA	Avg. of T & K	Korea	Taiwan	Avg. of ASEAN	Malaysia	Thailand	Singapore
Method	3.1	3.5	3.4	3.6	3.2	3.1	3.2	3.2
Human-Method	3.2	3.5	3.4	3.6	3.2	3.2	3.3	3.1
I Work Organization & Administration	2.9	3.7	3.6	3.7	3.3	3.2	3.3	3.1
1. Job classification	3.7	4.9	4.9	4.9	4.3	4.3	4.9	3.8
2. Multi-skilled workers	2.6	2.9	2.5	3.1	2.6	2.6	2.5	2.5
3. Education & training	2.9	3.4	3.5	3.3	3.3	3.0	3.4	3.5
4. Wage system	2.4	3.9	3.9	3.9	3.1	3.1	2.8	2.8
5. Promotion	3.1	3.7	3.4	3.9	3.1	3.3	3.0	3.0
6. Firstline supervisor	2.9	3.4	3.3	3.4	2.9	2.9	2.9	3.3
II Group Consciousness	3.2	3.4	3.3	3.5	3.2	3.2	3.1	3.3
7. Small group activities	2.5	3.2	3.0	3.3	2.9	2.9	2.8	3.0
8. Information sharing	3.5	3.5	3.4	3.5	3.3	3.4	3.3	3.3
9. Sense of unity	3.5	3.6	3.5	3.7	3.3	3.3	3.8	3.8
III Labour Relation	3.6	3.4	3.3	3.4	3.1	3.1	3.3	2.8
10. Hiring policy	3.4	3.0	3.1	3.0	3.1	2.9	3.3	2.5
11. Long term employment	3.4	3.3	3.3	3.3	3.0	2.9	3.3	2.5
12. Harmonious labour relations	4.4	4.0	3.5	4.2	3.3	3.3	3.3	3.3
13. Grievance procedure	3.3	3.2	3.1	3.2	3.1	3.0	3.3	3.0
Material-Method	2.9	3.4	3.4	3.4	3.1	3.1	2.9	3.4
14. Maintenance	2.6	3.3	3.1	3.4	3.0	2.9	3.0	3.5
15. Quality control	3.4	3.6	3.6	3.6	3.2	3.3	3.0	3.5
16. Manufacturing process								
management	3.0	3.5	3.6	3.5	3.2	3.1	3.2	3.5
17. Procurement method	2.5	3.2	3.1	3.3	2.8	3.3	3.0	3.3
Result	3.6	2.8	2.9	2.8	2.8	3.3	3.1	3.1
Human-Result	3.6	2.1	1.8	2.2	2.7	2.7	2.6	3.4
18. Ratio of Japanese expatriates	3.7	1.5	1.3	1.6	1.6	1.7	1.3	2.5
19. Managerial position of Japanese	3.6	2.7	2.4	2.9	3.9	3.8	3.8	4.3
Material-Result	3.6	3.3	3.6	3.2	3.6	3.7	3.5	4.0
20. Equipment	4.3	3.5	3.6	3.5	4.0	4.1	3.7	4.8
21. Local content	2.6	2.9	3.3	2.7	3.1	3.2	3.0	3.5
22. Suppliers	3.9	3.5	3.9	3.3	3.8	3.9	3.8	3.8
Delegation of authority	3.6	2.7	2.6	2.8	3.2	3.0	3.4	3.0
23. Delegation of authority								
Average of 23 items	3.3	3.3	3.3	3.4	3.2	3.2	3.2	3.3

TABLE 3. Hybrid Evaluation by Industry

		United States						Taiwan & Korea						ASEAN 3 countries					
		Auto	Auto	Consm.	Semi-	Auto	Auto	Auto	Elec.	Elec.	Comp.	Assy.	Auto	Auto	Auto	Elec.	Elec.	Elec.	
Method	Assy.	Comp.	Elect.	Cond.	Assy.	Comp.	Assy.	Comp.	Assy.	Comp.	Assy.	Assy.	Comp.	Assy.	Comp.	Assy.	Comp.		
Human-Method	3.6	3.4	2.5	2.9	3.8	3.3	3.7	3.5	3.1	3.1	3.2	3.2	3.2	3.2	3.2	3.2	3.2		
I Work Organization & Administration	3.7	3.6	2.5	3.1	3.8	3.4	3.7	3.5	3.2	3.1	3.2	3.2	3.2	3.2	3.2	3.2	3.2		
1. Job classification	4.8	4.2	2.8	2.7	5.0	4.8	5.0	4.8	4.8	4.7	4.7	4.2	4.2	4.2	4.2	4.2	4.6		
2. Multi-skilled workers	3.2	2.7	2.1	2.6	3.8	3.3	2.5	2.4	3.1	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.3		
3. Education & training	3.4	2.9	2.2	3.0	3.6	3.3	3.3	3.3	3.4	3.2	3.1	3.1	3.1	3.1	3.1	3.1	3.4		
4. Wage system	2.1	2.6	2.0	3.1	4.4	3.7	4.0	3.9	3.1	3.2	3.2	2.8	2.8	2.8	2.8	2.8	3.2		
5. Promotion	3.2	3.3	2.7	3.1	3.4	3.7	4.3	3.7	3.0	3.2	3.2	3.0	3.0	3.0	3.0	3.0	3.0		
6. First-line supervisor	3.1	3.0	2.6	2.7	3.4	3.2	3.8	3.3	2.9	3.0	3.0	2.9	2.9	2.9	2.9	2.9	3.0		
II Group Consciousness	3.9	3.7	2.3	2.9	3.9	3.4	3.4	3.4	2.9	3.1	3.1	3.3	3.3	3.3	3.3	3.3	3.2		
7. Small-group activities	2.7	2.8	2.2	2.4	4.0	3.3	2.8	3.1	2.9	2.7	2.7	3.0	2.8	2.8	2.8	2.8	2.8		
8. Information sharing	4.4	3.9	2.4	3.3	3.8	3.2	3.7	3.6	3.3	3.2	3.2	3.5	3.5	3.5	3.5	3.5	3.5		
9. Sense of unity	4.6	4.4	2.1	2.9	4.0	3.7	3.8	3.6	2.6	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5		
III Labour Relation	4.2	4.1	2.7	3.5	3.6	3.0	3.8	3.4	3.2	3.0	3.0	3.1	3.1	3.1	3.1	3.1	3.2		
10. Hiring Policy	4.3	3.8	2.4	3.1	3.0	2.7	3.5	3.3	2.9	3.0	3.0	3.2	3.2	3.2	3.2	3.2	3.1		
11. Long term employment	4.9	3.8	2.2	2.3	3.6	3.0	3.7	3.3	3.1	2.8	2.8	3.0	3.0	3.0	3.0	3.0	3.1		
12. Harmonious labour relations	4.2	5.0	3.4	5.0	4.2	3.5	4.5	4.0	3.9	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.4		
13. Grievance Procedure	3.2	3.9	2.8	3.6	3.4	2.8	3.5	3.1	3.0	3.0	3.0	3.1	3.1	3.1	3.1	3.1	3.3		
Material-Method	3.2	3.1	2.6	2.5	3.6	3.1	3.8	3.4	2.8	2.8	2.8	3.2	3.2	3.2	3.2	3.2	3.3		
14. Maintenance	2.9	2.8	2.1	2.6	3.2	3.2	3.8	3.1	2.8	2.8	2.8	3.2	3.2	3.2	3.2	3.2	3.1		
15. Quality control	4.0	3.9	3.0	2.4	3.8	3.3	4.0	3.6	2.8	3.3	3.3	3.4	3.4	3.4	3.4	3.4	3.3		
16. Manufacturing process management	2.9	3.0	3.3	2.9	3.8	3.2	3.7	3.7	3.0	3.0	3.0	3.2	3.2	3.2	3.2	3.2	3.5		
17. Procurement method	3.0	2.6	2.1	2.3	3.6	2.8	3.5	3.3	2.5	2.2	2.2	3.1	3.1	3.1	3.1	3.1	3.3		
Result	3.4	4.0	3.1	4.1	2.6	2.9	2.5	3.3	2.9	3.2	3.2	3.4	3.4	3.4	3.4	3.4	3.6		
Human-Result	3.6	4.3	2.9	3.9	2.1	2.4	1.8	2.3	2.3	2.3	2.3	2.7	2.7	2.7	2.7	2.7	3.0		
18. Ratio of Japanese expatriates	3.8	4.6	2.6	3.9	1.6	2.0	1.2	1.3	1.3	1.7	1.7	1.6	1.6	1.6	1.6	1.6	1.8		
19. Managerial position of Japanese	3.3	4.0	3.2	3.9	2.6	2.8	2.3	3.3	3.3	3.7	3.7	4.1	4.1	4.1	4.1	4.2	4.2		
Material-Result	3.3	3.7	3.2	4.2	3.0	3.2	3.0	4.0	3.3	3.3	3.3	3.4	3.4	3.4	3.4	3.4	4.0		
20. Equipment	3.9	4.8	4.0	4.6	3.6	3.2	4.1	3.0	3.0	4.2	4.2	3.8	3.8	3.8	3.8	3.8	4.7		
21. Local content	2.3	2.7	2.0	3.7	2.4	2.7	3.4	3.0	3.0	3.8	3.8	2.7	2.7	2.7	2.7	2.7	3.3		
22. Suppliers	3.8	3.8	3.6	4.4	3.0	3.5	4.3	3.8	3.8	3.7	3.7	3.8	3.8	3.8	3.8	3.8	4.0		
Delegation of authority	3.3	4.0	3.2	4.0	2.4	2.5	2.8	3.3	2.8	2.7	2.7	3.2	3.2	3.2	3.2	3.2	3.7		
23. Delegation of authority	3.5	3.6	2.7	3.2	3.5	3.2	3.4	3.4	3.0	3.0	3.0	3.2	3.2	3.2	3.2	3.2	3.3		
Average of 23 items																			

and the amount of investment, is the largest among the four industries studied, so it is imperative to manage the local plants successfully. Third, automobiles produced in the US by Japanese affiliates must compete against those produced by their parent companies in Japan. These factors force the Japanese affiliates to actively apply Japanese methods.

Each of the Japanese auto assembly plants in the US has taken the bold step of simplifying the job classification system. Without exception, these auto plants have drastically reduced the number of job titles down to two main categories: semiskilled and skilled. In contrast, traditionally unionized US plants occasionally have over one hundred job titles. Furthermore, the affiliates have implemented the practice of job rotation and fostered the development of multi-skilled workers, which are necessary to sustain such a flexible work organization. Auto plants have also introduced a team system in which the workers themselves assign job tasks to team members, train newcomers, cope with various changes and unusual situations, and undertake *kaizen* (job improvement) activities. Compared with their counterparts in Japan, the extent of job rotation and the function of the team system at the auto plant affiliates are limited at the present stage. Nevertheless, they are clearly oriented toward the application of Japanese methods.

2. Institutional Hindrances

There exist, however, various kinds of institutional practices that hinder the affiliates in their attempt to apply Japanese production systems. The wage is one of the most salient examples. The traditional US wage system for production workers provides a wage rate to correspond to one of many multi-layered labour grades. Several job titles are contained within each labour grade. In Japanese auto plants, wage rates are determined on the basis of simplified job categories. The Japanese affiliates apply neither a performance evaluation system for production workers, nor the Japanese-style seniority system, in which workers receive raises in accordance with their length of service, however their parent plants in Japan apply both of these practices. In that sense,

Japanese auto assembly affiliates apply a US-style wage system, although in a more simplified form. If, to a certain degree, this prevents employees from staying with a company for a long time, or from participating in plant operation, then management may consider that the formation of a wide variety of skills, or the implementation of a flexible work organization is excessively restricted.

Another example of limited application is quality control. The Japanese method of quality control is characterized by careful attention by shop-floor workers, and on the part of quality control, process engineering, and product design sections; as well as cooperation and information sharing among these sections. This type of quality control has not sufficiently penetrated the local plants, however. This seems to stem not only from the relatively short experience of these plants, but also from the influence of traditional American practices, namely, the strict separation between production workers and the quality control section, and the presence of rigid job demarcation lines within the corporate hierarchy. To achieve product quality that is competitive with the quality of automobiles imported from Japan, the affiliates have doubled the ratio of quality control personnel to production workers from that of their parent plants.

3. Application Ratings for "Group Consciousness" and "Labour Relations"

It is noteworthy that the auto assembly industries receive a higher application rating for "Group Consciousness" (3.9) and "Labour Relations" (4.2) than for "Work Organization & Administration" (3.3), which contains the core human elements of the Japanese system. At Japanese auto plant affiliates, all employees, including shop-floor workers, are referred to as "associates" or "team members". They use open-style offices, have company canteens for all employees, have managers make frequent trips to the shop-floor, and install TV monitors in order to communicate with employees. Auto plants also have a "no lay-off" policy, (in fact, reflecting the companies' desire to avoid lay-offs as much as absolutely possible), and pursue harmonious labour relations regardless of whether or not workers

are unionized. Clearly, Japanese auto plant affiliates desire to gain workers' management participation and to achieve flexible plant operation through an egalitarian approach and cooperation among all the employees.

4. *Adaptation to US Production Systems*

Japanese consumer electronics affiliates, which mainly produce colour televisions, receive strikingly lower application ratings for "Method" (2.5) than do auto plants. Since they procure the chassis from Mexican or Southeast Asian sister plants, and the picture tubes from the US, most of these affiliates only carry out final assembly with simple production equipment that requires few skilled workers. Perhaps it is not surprising that Japanese affiliates in the consumer electronics industry lack the motivation to apply Japanese methods, which have the potential for conflicting with existing US production systems or with the social environment and consequently producing disharmony with the employees.

In contrast with affiliates in the auto industry, Japanese consumer electronics affiliates generally, though in varying degrees from plant to plant, have not simplified the job classification system, and job rotation is only implemented to a limited extent. These affiliates also receive a low application rating for Group Consciousness and Labour Relations.

5. *Strong Reliance on "Human-Result" and "Material-Result"*

Japanese affiliates in both the auto and the consumer electronics industries achieve relatively good productivity and quality (Womack, Jones and Roos 1990), in spite of the existence of certain hindrances to the application of Japanese methods. In the Human, as well as the Material domains, the Japanese affiliates supplemented their insufficient application of Method-type elements with a higher application of Results-type elements. This tendency was common to all four industries investigated.

More than 4 per cent of the employees at sixteen of the thirty-four Japanese affiliates surveyed were Japanese expatriates. This indicates that despite variation among the plants, there is a generally high ratio of Japanese expatriates throughout. In addition,

temporary personnel from Japan, ranging in number from dozens to hundreds (as many as two hundred in one case), remain at the auto assembly plants to instruct and train local employees. Also, twenty-nine plants have Japanese top executives, and twenty-nine plants are almost fully controlled by headquarters in Japan, or by a US headquarters that is in turn controlled by a Japanese headquarters.

The affiliates use almost the same production equipment as the parent plants in Japan. Local content ratios, ranging from 50 to 75 per cent in the auto assembly, and from 60 to 80 per cent in the consumer electronics industries are very high. However, key, functional components are often procured from Japanese affiliated suppliers in the US, sister plants in Mexico or Southeast Asian countries, or suppliers in Japan.

The essence of the Japanese system is embodied in the personnel, the equipment contains the accumulated knowledge of the parent plants, and high-quality components that are produced reflect the long term relationship between assemblers and suppliers. These elements play a considerable role in sustaining the plant operation of Japanese affiliates in the US.

HYBRID FACTORIES IN EAST ASIA

A. **Taiwan and Korea**

Twenty-five Japanese affiliates were surveyed in Taiwan and Korea in 1992, including five auto assembly plants, seven auto plants, six electronics assembly plants, and seven electronic component plants (Table 4).

Table 2 shows that, with the exception of a few items, Japanese affiliates in Taiwan and Korea basically have the same tendency with regard to application, and Table 3 shows that there are no major differences among the four industries surveyed. Therefore, hybridization features in both countries and in the four industries will be discussed together.

1. *High Application for "Method"*

The most conspicuous difference between the characteristics of Taiwan and Korea and those of the US, are that the application rating of "Method" (3.5) clearly exceeds that of "Result"

TABLE 4. Surveyed Japanese Plants in Taiwan and Korea

	Automobile Assembly	Automobile Component	Electronics Assembly	Electronic Component	Total
Number of plants	5	7	6	7	25
Ownership					
90% - 100% (1)	0	1	3	4	7
50% - less than 90%	0	3	2	3	9
- less than 50%	5	3	1	0	9
Nationality of a top manager					
Japanese	1	4	3	5	13
Local	4	3	3	2	12
Number of employees					
- 499	0	5	1	0	6
500 - 999	1	1	1	3	6
1,000 - 1,999	1	1	1	3	6
2,000 - 2,999	1	0	2	0	3
3,000 -	2	0	1	1	4
Start of operation (2)					
1960s -	0	0	3	2	5
1970s	1	4	2	4	11
1980 - 1985	2	0	1	0	3
1986 -	2	3	0	1	6

(1) Including cases where Japanese parent companies own majority and all other owners are Japanese trading companies or Japanese banks

(2) Year of acquisition or equity participation in case of entries doing so

Data is at day surveyed.

(2.5). Furthermore, Work Organization & Administration, which embraces core human elements, receives the highest degree of application (3.7) among groups or subgroups of elements. In other words, Japanese systems are transferred in such a way that "Human-Method" and core systems precede other elements.

The major reason that "Method" is applied successfully is that Japanese companies have not been faced with institutional hindrances in Taiwan and Korea as they were in the US. First, industrialization does not have such a long history and tradition in these countries. Second, their industrialization has been influenced by local production carried

out by Japanese companies. Third, these countries may possess a similar manner of organizing work systems and of treating personnel, particularly in terms of the blurred distinction between job categories. In any case, Japanese affiliates have been able to introduce the methods they apply in their parent plants, without having to make a concerted effort, and sometimes almost unconsciously.

Job classification and the wage system illustrate this point clearly. In contrast to the US, in Taiwan and in Korea as in Japan, the "job" concept itself is weak and there are no obvious partitions separating individual job categories. Therefore, the wage system of Japanese affiliates basically resembles that of

the parent plants in Japan in that the wages of each employee are determined not by a job title, but by a rank based upon corporate-specific qualification grades that employees receive according to their length of service, academic careers, and individual performance evaluations. We may describe this type of wage structure as being "person-centred". Unlike at US auto assembly plants, there is even a performance evaluation for production workers. However, Japanese expatriates frequently complain about difficulties in having the evaluation carried out by local superiors.

With job classification and the wage system providing a foundation for implementing the Japanese production system, other items under Work Organization & Administration, such as education and training, promotion, and first-line supervisor, receive higher average application ratings (3.7) than Japanese affiliates in the US (2.9). The average application rating for core "Human-Method" elements (3.5) reflects conditions that promote the application of "Material-Method" including maintenance and manufacturing process management. The application rating for "Material-Method" in Taiwan and Korea (3.4) exceeds not only the average in the US (2.9) but also that of Japanese affiliates in the US in the auto assembly industry (3.2).

2. *The Discrepancy between the Planned Systems and Actual Operations*

It should be noted, however, that the high application of "Method" in Taiwan and Korea has important limitations. An example of such a limitation is the difference between the application rating for developing multi-skilled workers and that for job classification or the wage system. In spite of a foundation for developing multi-skilled practices, the degree of application for multi-skilled workers is lower (2.9) than it is for job classification (4.9) or the wage system (3.9). Of course some plants are eager to develop multi-skilled workers. However, even in plants where there is high motivation, the extent of job rotation is confined almost entirely to a team of individual workers, in which respect these practices differ markedly from those at the parent plants in Japan.

Another important example is the gap between quality control method and the "in-

process" quality. Most Japanese affiliates require production workers to pay attention to product quality, check defects that occur during the production process, and develop ideas for improving quality. This type of quality control is called "building quality into the process." However, in many Japanese affiliates, defect ratios are twice to several times as high as in Japan. Defective products are rejected during final product inspection in order to ensure product quality.

There are four major factors that may account for differences between planned and actual operations. These are high personnel turnover, social class barriers that discourage participation in management, lack of co-operation among sections, and lack of determination by the Japanese companies.

First, not only is turnover high, generally 20 to 30 per cent a year, but it also seems particularly to affect key personnel such as young engineers and maintenance technicians. As one Japanese manager expressed it, "Our plant is just like a training school for engineers and technicians." Second, social class distinctions prevent employee promotion from within the company, and this ruins employees' motivation to participate in plant management. Third, as several Japanese managers pointed out, various sections within a company often fail to cooperate closely, resulting in a detrimental effect upon quality control within the process. Fourth, is the lack of determination or enthusiasm on the part of the Japanese companies themselves, with regard to investing the time and effort necessary for properly implementing the Japanese production system. Although the limitations imposed by inadequate skill formation and a lack of flexibility in work organization was partly responsible for inefficient production and for additional quality inspectors, up until the latter part of the 1980s, Japanese affiliates were able to compensate for the extra costs by virtue of a relatively low domestic currency to US dollar exchange rates (in the case of exports) and low wage levels for labour. However, as a result of the appreciation of those currencies (Korean Dong and the Taiwanese Dollar) against the dollar, and soaring wage levels that followed, Japanese affiliates are now at a critical juncture where they must either take substantial steps

to implement Japanese methods, or curtail local production.

3. Local Managers

With the exception of two newly established auto parts plants, the ratios of Japanese expatriates to total employees are considerably lower in Taiwan and Korea than in the US. Fifteen out of twenty-five plants have less than 1 per cent Japanese expatriates. Five plants have ratios between 1 and 2 per cent, and three plants are between 2 and 3 per cent. Moreover, almost half of the plants surveyed employ local people among their top executives. Plants that are basically operated by local managers, with the advice and assistance of Japanese expatriates, are found particularly in the auto assembly and electronics assembly industries. In short, Japanese affiliates in Taiwan and Korea are managed by local managers according to Japanese methods. Management by local personnel is attributed to their thorough understanding of the Japanese system, as well as by the fact that the majority of the plants are joint ventures with local capital, and that many plants have relatively long experience in local production. However it is also notable that, particularly in many electronic parts plants and in some electronics assembly plants, the Japanese exercise strong authority and leadership.

Method can be characterized as an East Asian type. This is particularly evident in the case of low barriers between job categories. However the application ratings for Method (3.2) and for Work Organization & Administration (3.3) are considerably lower than in Taiwan and Korea, though slightly higher than in the US (Table 2).

This is attributed to the following factors. First, there is weaker motivation to implement Japanese production systems on the part of the affiliates in these countries. This is illustrated by the wage system and attitudes towards developing multi-skilled workers. Here, again, Japanese affiliates generally try to introduce a person-centred wage system where each employee's wages are determined by length of service and academic background. Twenty-six of the thirty-five plants carry out performance evaluations on production workers. However the wage structure is not as systematic and well-organized as it is in Taiwan and Korea. With regard to the practice of developing multi-skilled workers, the affiliates are even less eager to implement these practices than are their counterparts in Taiwan and Korea. Managers themselves sometimes confine job tasks of individual workers to narrower ranges.

Second, the social structures of the host countries influence the application of Japanese methods. Since these countries have begun to industrialize relatively recently, people are in general not used to the idea of working in large organizations. Japanese companies must first begin by training employees to work in modern factories before they are able to introduce Japanese methods such as job rotation. Wider gaps between social classes, and resulting differences in academic backgrounds also restrict the internal promotion system and create great disparities among employee wage levels.

These limitations for application of Human-Method (rates at 3.2) govern the degree of application of Material-Method. Thus, in the three ASEAN countries surveyed, the application ratings for items in the group Material-Method (3.1), such as maintenance, quality control, and manufacturing process management, are lower than those in Taiwan and Korea (3.4).

B. Three ASEAN Countries: Malaysia, Singapore and Thailand

Thirty-five Japanese affiliates were surveyed in Malaysia, Singapore and Thailand in 1993. These included eight auto assembly, six auto parts, ten electronics assembly and eleven electronic component plants (Table 5). These plants are divided into two groups: older, domestic market-oriented plants, and newer, export-oriented plants.

1. East Asian Type Application of Method and Its Limitations

As in Taiwan and Korea, there are no clear institutional hindrances to implementing Japanese systems in the ASEAN countries surveyed. In that sense the application of

TABLE 5. Surveyed Japanese Plants in ASEAN 3 Countries

	Automobile Assembly	Automobile Component	Electronics Assembly	Electronic Component ⁽³⁾	Total
Number of the plants	8	6	10	11	35
Ownership					
90% - 100% ⁽¹⁾	2	1	3	10	16
50% - less than 90%	1	2	4	1	8
- less than 50%	5	3	3	0	11
Nationality of a top manager					
Japanese	5	6	10	11	32
Local	3	0	0	0	3
Number of employees					
- 499	0	2	0	2	4
500 - 999	3	2	3	1	9
1,000 - 1,999	1	1	5	4	11
2,000 - 2,999	1	0	2	2	5
3,000 -	3	1	0	2	6
Start of operation ⁽²⁾					
1960s -	4	1	2	0	7
1970s	0	1	2	2	5
1980 - 1985	3	2	1	1	7
1986 -	1	2	5	8	16

(1) Including cases where Japanese parents companies own majority and all other owners are Japanese trading companies or Japanese banks

(2) Year of acquisition or equity participation in case of entries doing so

(3) Including semiconductor

Data is at day surveyed.

2. *The Conspicuous Hybridization of "Human-Result"*

The ratios of Japanese expatriates to local personnel in the three ASEAN countries are as low as they are in Taiwan and Korea. Eighteen out of the thirty-five plants have less than 1 per cent Japanese expatriates. Thirteen plants have between 1 and 2 per cent, and four plants between 2 and 3 per cent. There are no plants with more than 3 per cent Japanese expatriates. This stems mainly from two factors: one, is that the governments of the host countries are somewhat hasty in their pursuit of technological transfer, and therefore they restrict the number of work permits issued to Japanese expatriates. Another, is that the headquarters of the Japanese companies

wish to limit expenses incurred by stationing Japanese personnel abroad.

However, a small number of Japanese personnel generally exercise strong leadership in these three ASEAN countries. In contrast with Taiwan and Korea, thirty-two top executive posts at the thirty-five plants are occupied by Japanese personnel, despite the fact that more than half of these affiliates are joint ventures with local capital. In addition, Japanese expatriates also take up important positions in the manufacturing, production engineering, production control, quality control, purchasing and marketing divisions. Furthermore, many companies dispatch extra employees from Japan for short-term temporary assignments to their affiliates, particularly newly established

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or recently restructured plants, in order to train employees and to assist in introducing new production lines or new models, improving product quality, and raising the amount of local procurement. A shortage of managerial talent within the newly industrializing societies, cultural dissimilarity to Taiwan and Korea, Western influences on people with higher academic backgrounds, and linguistic communication difficulties, require the presence and strong leadership of Japanese employees. This presence and leadership clearly compensates for an insufficient application of Method.

3. Comparison between Newer and Older Plants

In these three ASEAN countries, Japanese affiliates can be divided into two groups: one includes the older, domestic market-oriented plants, and the other the newer, export-oriented plants. The former have fewer automated machines and produce a variety of products and models in much smaller lots than in Japan. The latter are specialized for producing a few products and models, engage in mass production, and utilize new, fully-automated equipment.

At the present stage, the newer export-oriented plants rely more clearly upon Result, with regard to both human and material elements. In other words they rely upon Japanese employees, and equipment, components and material from Japan. However, these newer plants also make greater efforts to select and train employees, and to offer technological assistance to local suppliers. Therefore we can predict that in the future these plants will be able to implement Japanese systems more successfully and to achieve a higher application for Method.

CONCLUSION

Three factors determine the hybrid configuration. The first factor is the extent to which application of the Japanese production system is necessary by industry and company. This strategic factor stems from technological features and the degree of market competition within the industries. The second factor involves the attributes of the elements that compose the Japanese production system. The third

factor includes the historical, social, and managerial environments of the host countries.

In the US, even in the auto assembly industry, where there is greater need for implementing Japanese methods, the degree of application for the core of the system varies from element to element. Moreover, application ratings for the sub-system exceed those for the core system. In this case, the insufficient application of "Method" is supplemented by that of "Result" in terms of human and material elements. In Taiwan and Korea, Method significantly surpasses Result in the extent of application. Particularly the core aspect of Human-Method receives a high application rating, while Human-Result receives a low rating. Though the three ASEAN countries have no clear institutional hindrances, just like Taiwan and Korea, Japanese affiliates in those countries have not adequately introduced Japanese methods. The strong leadership of Japanese expatriates compensates for this insufficiency.

It is noticeable that the average degree of application of the twenty-three items in each country converges around a rating of 3.3, despite different hybrid configurations. This can be explained as follows. Companies endeavour to transfer strategically important elements into host countries and expect to manage local plants successfully by centring their systems about these elements. At the same time, companies must utilize limited managerial resources and avoid friction with employees and with the local environment. These factors impose restrictions on the introduction of Japanese elements. The 3.3 rating is just a balance between the necessity to maintain a certain managerial performance, and to avoid needless tangible or intangible costs.

It can be projected that Result-centred hybridization will shift to attaching greater importance to Method application. The more firmly Japanese affiliates desire to establish a production base, the more necessary it becomes to implement Japanese methods. On the other hand, host countries will increasingly request Japanese companies to exploit local managerial resources and to procure local components. In addition, Japanese affiliates themselves intend to rely upon local managers

and local procurement to decrease the personnel expenses of expatriates within a globally expanding production network, and to absorb soaring costs with a strong Yen.

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