Learning Factories or Reproduction Factories?: Labor-Management Relations in the Japanese Consumer Electronics Maquiladoras in Mexico

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This article compares and contrasts the labor-management practices of Japanese consumer electronics maquiladoras in Mexico with those of consumer electronics factories in Japan and assesses the extent to which the labor-management practices of Japanese factories have been transferred to maquiladoras in Mexico. An idealized model of the labor-management system employed in Japanese factories in the consumer electronics sector is delineated from the available research literature. Data on labor-management practices of the Japanese consumer electronics maquiladoras are derived from personal interviews with 75 Mexican production workers. The findings suggest that the consumer electronics maquiladoras in Mexico are using a hybrid labor-management system that is similar to but differs in important ways from the system used in consumer electronics factories in Japan.

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In recent years, Japanese firms have dramatically increased their direct investment in maquiladora operations in Mexico.¹ In 1996, Japanese firms

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employed approximately 40,000 Mexican workers in more than 100 factories.² Large Japanese firms such as Sony and Matsushita now employ more than 5,000 workers each in their various Mexican operations. The investment in Japanese maquiladoras has involved not only assembly but manufacturing; numerous Japanese suppliers are making parts and components in Mexico (Curry & Kenney, 1996). As part of a movement to establish offshore production, the Japanese maquiladoras serve as production platforms for North American markets.

Japanese factories are considered by many observers to set the global standard for production management (Dertouzos, Lester, & Solow, 1989). A key facet of Japanese production management is its work organization and labor-management system. Japanese factories are managed as learning environments in which shopfloor workers not only produce items but continuously gain new knowledge that is employed to improve the production process and enhance product quality (Adler & Cole, 1993; Cole, 1989; Fruin, 1997; Kenney & Florida, 1993). The possibility of learning while producing has led to great interest in the transfer of Japanese production practices to developing countries (Humphrey, 1993, 1995; Kaplinsky, 1994, 1995).

The operation of the Japanese maquiladoras appears to offer Mexican workers the opportunity to work in and become familiar with global-class production facilities. It is uncertain, however, that these facilities represent the "learning factories" described by Fruin (1997) and Kenney and Florida (1993). For example, research conducted during the 1980s found little evidence that the maquiladoras were using advanced Japanese labor-management practices (Carrillo & Hernandez, 1985; Fernandez-Kelly, 1983). More recent research has yielded mixed findings. Several studies have found that such practices are being used more extensively in some maquiladoras (Gonzalez-Arechiga & Ramirez, 1992; Pelayo-Martinez, 1992; P. A. Wilson, 1992). Other studies have found the use of Japanese labor-management practices in the maquiladoras continues to be minimal at best (Kamiyama, 1994; Kenney & Florida, 1994). The primary objective of this research is to compare and contrast the labor-management practices of Japanese consumer electronics maquiladoras in the 1990s to those of consumer electronics factories in Japan and assess the extent to which the labor-management practices used in Japanese factories have been transferred to maquiladoras in Mexico.

This study is based on in-depth interviews with 75 Mexican production workers in Japanese consumer electronics maquiladoras. Most previous research on Japanese (or any other) maquiladoras has relied on the reports of managers to measure the transfer of either Japanese or advanced labor-
management methods (Coronado, 1992; Echeverri-Carroll, 1988; Kenney & Florida, 1994; Rodriguez, 1990; Shaiken & Browne, 1991). Our research provides a shopfloor worker's perspective. This permits an examination of the characteristics of shopfloor workers in Japanese consumer electronics maquiladoras, the training they receive, and the work practices they use. In turn, this allows an assessment of the ways in which the labor-management practices employed in consumer electronics factories in Japan are being transferred and implemented in the maquiladoras.

This article is organized as follows. The first section delineates a stylized model of the labor-management practices of Japanese consumer electronics factories. The second section examines previous research on the transfer of Japanese labor-management methods to overseas consumer electronics factories in general, and the maquiladoras in particular. The third section describes the research methods used in the study. The fourth section describes the findings from the interviews with the production workers. Finally, the implications of the findings are discussed. We suggest that the consumer electronics maquiladoras are using a hybrid labor-management system that is similar to but differs in important ways from the system used in consumer electronics factories in Japan.³

THE JAPANESE LABOR-MANAGEMENT SYSTEM IN CONSUMER ELECTRONICS

Western understanding of the Japanese labor-management system has been heavily influenced by descriptions of the Toyota production system that is immortalized in Womack, Jones, and Roos's (1990) characterization of lean production. More recently, there have been some doubts as to whether this model is a universal description of the organization of Japanese industry. There can be little doubt that there must be some variation across industries according to the technical complexity of the production process and set of labor skills required, among other factors. Thus, it is reasonable that the labor-management system used in automobile assembly factories might differ from that used in television assembly plants. In comparison to automobile factories, there has been limited previous research concerning the labor-management system used by Japanese television and consumer electronics factories.⁴ Nonetheless, the context within which the Japanese consumer electronics industry developed was the same as that of auto industry and included long-term employment for regular employees; a complicated pay system based on seniority, skills, and job grade; enterprise unions; a blurred
white collar-blue collar role division; the use of temporary (contract) workers; and the use of relational contracting with supplier firms for requisite parts and supplies (Aoki, 1988; Dore, 1973, 1986; Koike, 1988).

The available literature and interviews by one of the authors suggest that an important dimension of the labor-management system of the typical Japanese consumer electronics factory is the stratification of production workers on the basis of the type of contract held with the firm. The lowest stratum of production workers consists of a group of fixed-term, contract (i.e., temporary) workers. Above the contract workers is a stratum of regular shopfloor workers who are hired on a long-term basis (Kenney, 1995; Nakamura, Demes, & Nagano, 1994). This distinction influences the type of testing administered to prospective workers during the hiring process.

In Japan’s long-term employment system, hiring is a very important function. Manufacturing employees are hired once annually through the recruitment of regular and industrial high school graduates. All regular employees receive written, oral, and medical examinations. The written examination includes surprisingly difficult algebra, contemporary economics, and English-language questions. The oral examination is meant to establish the worker’s personality and motivation and lasts between 30 and 60 minutes. There is also at least one medical examination.

The distinction between contract workers and regular workers influences the type of work performed, as well as wage levels. Contract workers tend to perform simple, routinized assembly tasks requiring minimal skills and are paid relatively low wages, whereas regular workers are paid higher wages and perform higher level work tasks (Kenney, 1995; Nakamura et al., 1994). In a study of a VCR factory, Nakamura et al. (1994) found that the assembly of VCRs was done almost entirely by contract workers and involved very routinized work tasks. Even though they were officially defined as contract workers, these employees were relatively permanent workers in practice because their contracts were almost invariably renewed. Although assembly work was organized on the basis of teams, regular workers did not typically perform any assembly tasks. Instead, regular workers primarily engaged in supervisory and control duties. Moreover, there were few or no contract workers engaged in jobs requiring greater skill and/or a broader range of knowledge such as those in the adjustment and inspection, engineering, materials supply, and parts subsections.

Trends in the broader Japanese economy indicate the use of contract workers is increasing in manufacturing (Ministry of Labor, 1996, p. 416). Recent interviews conducted by Kenney (1995, 1996a, 1996b) suggest, however, that the use of contract workers in Japanese television assembly factories has declined. For example, at one television assembly facility, nearly all
workers were found to be regular employees, although many were employed as contract assembly workers at an earlier point in time. Recently, due to the continuing transfer of television assembly offshore, increasing automation, and the unwillingness of Japanese workers to accept such jobs, the television assembly factories have begun to eliminate contract workers. This indicates that some regular employees are now performing assembly tasks.

The distinction between contract workers and regular workers influences opportunities for training and learning available to production workers. All regular employees receive a period of orientation of between 1 to 5 days of training after being hired, depending on the particular company. After beginning their jobs in a factory, production workers receive on-the-job training. An important aspect of Japanese on-the-job training mentioned in the literature is job rotation, whereby workers are trained to perform a broad range of work tasks. Different types of job rotation are used. Toyota, for example, employs short-term task rotation, in which each member of a work team (see discussion below) receives training in and performs all or most of the work tasks undertaken by the team, and longer term rotation (or transfer), in which workers are transferred between positions in entirely different work groups or units and receive training in and perform tasks within these different groups (Cole, 1989).

In Japanese consumer electronics factories, regular workers are exposed to longer-term rotation, or transfer, whereas contract workers are not. Upon entry into the factory, regular workers are transferred through various jobs during their first 3 months on the job. After this, they are assigned to a particular section in which the group leader is responsible for their further on-the-job training, although the actual training is largely provided by senior workers (Kenney, 1996a, 1996b). Thus, the scope of tasks undertaken by regular workers over time tends to be relatively broad, and cross training is used (Kenney, 1995; Nakamura et al., 1994).

Short-term task rotation is not typically used in Japanese consumer electronics factories. For example, at a Japanese television factory studied by Kenney (1995), assembly line contract workers perform the same work task each day. The lack of use of short-term task rotation in Japanese consumer electronics factories is not due to Western-style job control rights. Rather, Japanese managers believed it was better that personnel learn to do a particular job well (Kenney, 1995).

The use of longer term rotation, or transfer, is also part of an internal job ladder. Japanese consumer electronics firms fill all higher level shopfloor positions through internal promotion. Nakamura et al. (1994) describe an elaborate system by which regular employees enter the firm and gradually are promoted and transferred to different functions. Most begin in adjustment and
inspection and transfer through different posts in the sections as they receive steadily higher grades. After sufficient experience, some move into the first supervisory positions as team leaders; others move into the senior ranks of the maintenance, inspection, and quality control sections. During this entire process, regular workers are receiving on-the-job training across a broad scope of work activities. When organized and exploited, such learning can become a powerful mechanism for increasing a factory's capabilities.

During this process, regular workers also tend to receive opportunities for off-the-job training, whereas contract workers do not. Off-the-job training represents a more substantial investment compared to on-the-job training because workers are not producing for the factory while they are training. There are various levels of off-the-job training. First, there are plant-level training courses in robotics, integrated circuitry, and various other technical topics taught by senior factory personnel (Kenney, 1996b). There are also company-wide training courses. Finally, there are courses offered by outside organizations. Overall, the training component for regular production workers plays a central role in preparing these employees for the internal job ladder and represents a significant investment in these workers by the Japanese firm. However, the actual acquisition of a new skill (i.e., completing a course or receiving a national license) does not automatically guarantee a promotion, although such accomplishments are necessary to be considered for one (Kenney, 1996b).

In Japanese television assembly, just as in automobile factories (Cole, 1989), production workers are organized into work teams or groups (han). There are, however, qualitative differences in the role of groups in each industry. Due to the physical layout of the assembly line and the actual work activities, nearly all the individual jobs on a television assembly line can be done by a single worker. As a result, there is less need for tight within-group coordination and/or work sharing. Therefore, in contrast to the Toyota model, the work group in television assembly has less of a production management role and is more a supervisory institution. Other small-group activities, however, such as quality control circles and safety improvement groups, are also central to television assembly and include each factory worker. Small-group activities have a process improvement aspect and, perhaps more important, a social aspect. These activities are geared not only to technical improvement but to developing a social solidarity (Adler, in press).

Japanese manufacturing success centers on the ability of Japanese factories to manufacture efficiently and to continually increase productivity and product quality (see Adler & Cole, 1993; Fruin, 1992, 1997; Kenney & Florida, 1993). A factory has the potential not only to produce goods but to generate knowledge about production. As an organization, the factory learns and
innovates, thereby increasing productivity as part of its normal operation. This is exemplified in the role Nakamura et al. (1994, pp. 42-44) describe for production workers in the process of developing and introducing new consumer electronics products. In the early stages, their role is auxiliary and is confined to supplying data. However, in the pilot run and preproduction phases, they are actively involved in working “with production engineers on video assembly, adjustment and inspection, and they actively put forward their own ideas on how to improve work steps.”

The ongoing training and education promoted in the Japanese system provides the context for the production worker’s direct role in spearheading continuous improvement and quality control activities. An indirect factory output can be the development of new skills and capabilities. As Koike (1988) pointed out, many of these skills are partly firm specific and often tacit. As a result, such skills are not easily transportable (on the importance of tacit skills for Japanese firms, see Nonaka & Takeuchi, 1995). The factory evolves to higher levels of efficiency because it is populated by workers who continuously develop new capabilities.

THE ROLE OF GENDER IN THE JAPANESE LABOR-MANAGEMENT SYSTEM

An additional dimension of Japanese labor-management in consumer electronics is a system of gender stratification. First, the stratum of contract workers performing low-skilled work on the assembly line and receiving lower wages consists mostly of females, whereas the stratum of regular production workers tends to consist predominantly of males. Although there are no legal or formal distinctions, within the stratum of regular shopfloor workers, opportunities for promotion and training tend to be stratified on the basis of gender. Regular employees who are male typically have greater seniority and substantially better opportunities for training. Moreover, they also tend to have higher skills and their “duties are mainly maintenance-related” (Abo, 1994a, p. 157). Regular employees who are male are also more apt to be promoted to first-line supervisors and higher level positions. In these supervisory positions, they are responsible for managing employees, setting standard processing times, spearheading operational improvements, and evaluating performance (Abo, 1994a, p. 158).8

In contrast, opportunities are typically more circumscribed for regular employees who are female. For example, at most companies, promotions for women usually progress no higher than the group leader, although all Japanese consumer electronics firms have some females in supervisor positions.
There are inconsistent findings concerning whether the opportunity for transfer through a broad variety of jobs is stratified by gender. For example, Nakamura et al. (1994) found that all regular employees received this type of transfer, whereas Abo (1994a) found that this type of transfer was restricted to males. In either case, mobility and opportunities for participating in more skilled work activities tend to be limited for female workers.

Although female workers are treated differently than male workers, labor turnover for both sexes is low in Japanese factories. Hiramoto (1995, p. 246) found that annual turnover at a Hitachi television assembly facility in Japan was 1% for male workers and 4.2% for female workers. At one Japanese television assembly facility, male turnover was “almost zero except for retirement” and women’s turnover was 1% a year. Female turnover was usually due to marriage and pregnancy (but usually these women plan on returning). The inclusion of secretaries (office personnel) raises turnover to approximately 5% per year (Nakamura et al., 1994). In other words, even female workers on the assembly line do not tend to leave.

TRANSFER OF THE JAPANESE LABOR-MANAGEMENT SYSTEM

Research concerning the overseas transfer of Japanese labor-management methods has multiplied over the last decade. Most research has concentrated on the operations of Japanese firms in developed countries. These studies have concluded that the most comprehensive transfer of Japanese labor-management methods has taken place within the automobile and auto parts sectors (Abo, 1994a; Adler, 1993; Kenney & Florida, 1993). Although some studies have disputed this conclusion (Fucini & Fucini, 1990; Graham, 1995; Parker & Slaughter, 1988), there can be little doubt that Japanese firms in the automobile and auto parts sectors have implemented some Japanese-style labor-management practices in their offshore factories. At issue for most critics is the range of practices that have been transferred and the degree to which these practices have been accepted or viewed as desirable by workers.

The transfer of Japanese labor-management methods to transplants in consumer electronics has received less attention. Most studies of Japanese consumer electronics factories in the United States have found a more limited transfer compared to the automobile and auto parts sectors (Abo, 1994a; Hiramoto, 1995; Kenney & Florida, 1993; Milkman, 1991; Sato, 1991). This finding has been confirmed in studies of Japanese consumer electronics firms in the United Kingdom (Delbridge, 1995; Oliver & Wilkinson, 1988; Taylor, Elger, & Fairbrother, 1994).
There have been only two multinational (as opposed to binational) studies on the transfer of Japanese labor-management techniques in consumer electronics. Abo (1994a, p. 13) found that there was greater transfer of the Japanese system to Asian factories as compared to U.S. factories. Nomura (1992) compared Japanese consumer electronics plants with their transplants in Europe and other parts of Asia and concluded that they exhibited a high degree of similarity in terms of the use of internal promotion, employment of peripheral workers, and overtime. They also exhibited some similarity in the use of in-house union organizations, qualification systems, and personal evaluation, but exhibited little similarity with regard to turnover, wage systems, the use of subcontracting, and the degree of flexibility of the work system.

Koike and Inoki (1990) studied the skill formation systems of Japanese subsidiaries in Southeast Asia and found limited evidence of the transfer of Japanese skill formation practices. On the other hand, Kawabe (1991) found the development of a hybrid of local and Japanese management styles in offshore factories in Malaysia. Beechler and Taylor (1995) found a mixed record concerning the transfer of Japanese human resource management practices to the offshore factories of Japanese consumer electronics firms operating in Malaysia. Hiramoto (1995) compared two Japanese television assembly factories in Taiwan and Malaysia to those in Japan and found that the Malaysian factory was similar with regard to the use of internal promotion, performance evaluation, education and training, regular bonuses, and small-group activities.

It is difficult to summarize this broad range of studies adequately given the differing firms, nations, methodologies, and perspectives involved. However, the one conclusion that can be drawn with regard to consumer electronics assembly is that Japanese labor-management practices are transferred more to factories in Asian countries, especially transports meant to be export platforms, than to factories in other countries. It is interesting to study Mexico, since Mexico is a non-Asian country that receives large-scale Japanese investment and has established export platforms.

**RESEARCH ON THE MAQUILADORAS**

Research on the use of Japanese labor-management methods in Mexican maquiladoras has produced contradictory findings. Much of the research carried out in the 1980s concluded that the maquiladoras were only low-skill sweatshops that exhibited little if any evidence of using advanced manufacturing techniques (Carrillo & Hernandez, 1985; Fernandez-Kelly, 1983).
Several recent studies of Japanese-operated maquiladoras also found the extent of transfer of Japanese labor-management methods to be minimal at best. Using the framework developed by Abo (1994a), Kamiyama (1994) found that Japanese-operated maquiladoras are characterized by certain features of the Japanese system such as the lack of unions and the use of Japanese machinery. However, there was little evidence of job rotation, worker involvement in quality control circles, internal training, and other Japanese work organization characteristics. Consistent with this study, Kenney and Florida (1994) found little evidence of Japanese management techniques in the consumer electronics maquiladoras based on interviews with managers. They did find, however, that managers were trying to develop and retain a stable core of production workers that could be considered as analogous to the regular employees in Japanese factories.

In contrast to these studies, other recent research has found evidence that advanced manufacturing techniques are now being used more extensively in some maquiladoras (Gonzalez-Arechiga & Ramirez, 1992; Pelayo-Martinez, 1992; P.A. Wilson, 1992). Using samples not differentiated by the nationality of the firm, a number of researchers found that there are a significant number of maquiladoras using "flexible" organizational practices (Carrillo, 1993; Carrillo & Santibanez, 1993; P. A. Wilson, 1992). For example, Carrillo (1993) found in a sample of electronics maquiladoras that 33% use quality control circles, 39% have multiskilled workers, and 40% use some form of job rotation among operators on the production line. On the basis of this evidence, one would conclude that Japanese (or what many, such as Osterman [1994], now call "advanced") management techniques have been transferred to Mexico.

Based on managerial interviews, Shaiken (1990) found that advanced manufacturing techniques such as just-in-time delivery, continuous process improvement, and job rotation were already in use at three Japanese-operated electronics maquiladoras, although overall transfer remained limited. These findings were replicated in studies by Echeverri-Carroll (1988) and, to a lesser degree, Beechler and Taylor (1995). In response to these apparent differences, Gereffi (1994) theorized that there is a difference between the "old" and "new" maquiladoras regarding levels of training and skill upgrading. In this case, the old maquiladoras were those in the low-technology garment, footwear, and furniture industries. The new maquiladoras were in relatively higher technology fields such as consumer electronics assembly. It was expected that the newer maquiladoras would invest more in workers because of their more sophisticated production process. Thus, by Gereffi's definition, the firms studied would be included among the new maquiladoras.
In a recent study of factories of a major Japanese multinational television assembler in Japan, Mexico, and the United Kingdom (most probably Matsushita), Lowe, Morris, and Wilkinson (1996) found that the roles of supervisory-level personnel at the Japanese and Mexican plants were similar. At the Mexican plant, the supervisors and group leaders were able to "evaluate the industrial engineering implications" of a new product (Lowe et al., 1996, p. 16). Moreover, they found that in the maquiladoras, there was a seniority form of payment in an effort to reduce turnover. They theorize that in the nonunion environment, the Japanese found it much easier to transfer their supervisory system to Mexico. There was, however, one important difference. They found that in the Mexican factory, operators would only rarely be promoted to group leader and supervisor.

As indicated by this brief review of the literature, previous research has yielded inconsistent findings regarding the use of Japanese labor-management practices in the Japanese maquiladoras. From a methodological standpoint, the use of mail surveys as means of collecting data from firms can provide misleading results. For example, S. Wilson (1992, pp. 82-84) found that although many companies responded to his mail questionnaire asking whether they encouraged employee suggestions, follow-up interviews revealed that the use of these techniques was actually quite minimal. Additionally, studies that have employed interviews with managers as a sole or primary means of collecting data may yield misleading findings if managers believe that their responses could be scrutinized by higher level personnel and/or used for purposes that could be construed as being against the interests of the firm.

Previous research suggests that the maquiladoras in general, and Japanese maquiladoras in particular, may be in the process of beginning to use Japanese-style labor-management practices. If so, it is not surprising that inconsistent findings have been uncovered with regard to the transfer and implementation of these practices, simply as a result of the particular firms that were selected for examination. Thus, further research is needed to monitor this process as it unfolds over time and diffuses across a greater number of Japanese maquiladoras. There are several environmental conditions faced by Japanese factories operating in Mexico that could serve as obstacles to the full-scale implementation of Japanese labor-management practices.

First, labor turnover rates in the maquiladoras are high compared to the minimal turnover rates experienced by consumer electronics factories in Japan. In a 1994 study, turnover rates in Japanese maquiladoras were estimated to range between 5% to 10% per month (Kenney & Florida, 1994). In 1991, Abo (1994b, p. 185) found that Sanyo's Tijuana factory had the highest turn-
over (180% per year) of five Sanyo overseas television factories. The next highest turnover rate (25%) occurred in the factory in the United Kingdom. In comparing labor turnover rates in border cities, Alonso, Carillo, and Contreras (1996, p. 16) found that Tijuana had the highest turnover rates, with an average of 12.7% per month.

One reason that has been given for the high turnover rates is the oppressiveness of work conditions in the maquiladoras (Paik & Teagarden, 1995). However, some studies have found that high labor turnover has resulted in cases where employees report being satisfied with and committed to their jobs. For example, Beechler and Taylor (1995, pp. 177-180) report that the firm they found to have the highest level of employee satisfaction and commitment (probably Sony) had a relatively high turnover rate (9% per month).

Contreras and Fouquet (1995) contend that the high labor turnover can be attributed to the following: first, there are few opportunities for workers to develop a “job career” in the maquiladoras; second, there is a permanent labor shortage in local industrial labor markets, which provides ample opportunities to secure jobs (thus, there is little need to be concerned about finding employment); third, jobs are not very important for workers' fulfillment or self-expression, since their main goals are related to family and home. A more structural explanation rooted in Thompson's (1966) discussion of the creation of the English working class has been proposed by Kenney and Florida (1994): That is, Tijuana does not yet have a settled working class habituated to factory work.

These factors pose obstacles to the implementation of Japanese labor-management practices in the consumer electronics maquiladoras in that the Japanese system requires a stable core of production workers (e.g., the regular employees in the Japanese factories). As discussed above, such workers receive substantial training aimed at providing new skills and upgrading the quality of their job performance. The justification for investment in worker training is that the skills learned will lead to greater productivity.\textsuperscript{10} It is here that longer term employment becomes important. If employees resign, the firm cannot recoup its training costs. Thus, there is little incentive to invest beyond minimal training if the firm does not expect to retain employees. The growth of Japanese maquiladoras suggests that this obstacle is not viewed as severe enough to prevent investment altogether.

Another factor to be considered beyond labor turnover and the development of the Mexican working class is the role played by maquiladoras in the technical division of labor of Japanese firms producing consumer electronics at an international scale. For example, Ohgai (personal communication, 1996) reports that consumer electronics factories in Japan are now oriented...
toward introducing new products into a firm's product line. This orientation has become more pronounced as firms have shifted production offshore, downsized their workforce, and eliminated contract workers. If offshore factories are used primarily for the routine assembly of mature products, then it is reasonable to assume that a different set of labor-management practices will be used in the offshore factories in Mexico compared to the factories in Japan, particularly given the high labor turnover rates and comparatively lower level of working-class development.

The following analysis will explore the ways in which the stylized model of Japanese labor-management practices employed in the consumer electronics sector is, or is not, being replicated in Japanese consumer electronics maquiladoras. This study differs from previous studies of Japanese consumer electronics maquiladoras in that data are collected from personal interviews with samples of production workers drawn from eight consumer electronics maquiladoras. Informal interviews were conducted with production workers in their homes in effort to encourage openness about their work experiences and minimize any perceived fear of managerial retribution as a result of their responses.

DATA AND RESEARCH METHODS

Data were collected in personal interviews with 75 production workers employed at eight Japanese maquiladoras located in Tijuana. Interviewees included 4 consumer electronics assemblers and 4 electronic parts suppliers. The interviews were conducted from October through December 1993. Tijuana has the largest concentration of Japanese consumer electronics assemblers and electronics parts suppliers in Mexico. At the time of the study, there were eight Japanese assemblers and more than 30 Japanese parts suppliers operating in Tijuana. The eight maquiladoras were selected for participation on the basis of their size and importance to the regional economy. As Table 1 indicates, at the time of the study, all the firms were relatively well established. The newest factory, a supplier, was 4 years old in 1993. The oldest factory was 13 years old, and all of the others were at least 5 years old. We believe all the plants were sufficiently mature to have developed a stable management system.

Management was not involved in selecting interviewees or administering the interviews. Rather, trained interviewers were dispatched to stand outside each factory at the time the day shift was ending. Workers were contacted by these interviewers as they walked out of the target factory at the end of day
shift and were asked to participate in the study. If they agreed to participate, arrangements were made to conduct the interview in the worker’s home the following weekend.

This method of selecting workers for participation ensured that different types of shopfloor workers would be represented in the sample and that management or any other party would not influence the composition of the sample or the responses. This sampling design also ensured that shopfloor workers from the largest, most important Japanese maquiladoras in Tijuana would be represented, and it also allowed the names of the firms employing these workers to be identified. This provides a benchmark for other researchers to compare their results. Firms examined in many studies are anonymous. As a result, researchers have no way of ensuring strict comparability.

The advantages of this strategy for selecting workers for participation were obtained at the cost of an inability to draw valid statistical inferences from the resulting data, since the strategy represents a nonprobability sampling design. The sample is, in essence, a convenience sample. As such, any conclusions drawn from this data can only be viewed as suggestive, because probabilities cannot be validly estimated concerning the accuracy of generalizations drawn from the sample data to the population of all production workers employed in Japanese consumer electronics maquiladoras in Tijuana. The data are adequate for the purposes of “analytical generalizability” (Yin, 1989), that is, for determining whether there is empirical support for the stylized model described above, and whether further testing and development of the model is warranted.

All interviews were conducted in Spanish in workers’ homes and were approximately 1 hour in duration. Workers were administered a structured questionnaire that contained both open-ended and close-ended questions. The questionnaire was designed to collect information on the extent to which a worker’s employment experience within a maquiladora involved elements of the Japanese system as identified in the research literature. This included questions designed to elicit information about a worker’s previous work experience, current job characteristics, the nature of the training received, and involvement in work teams and quality control activities, among other dimensions of employment. Usable interviews with 75 shopfloor workers from the eight maquiladoras were completed.11

THE SAMPLE: CHARACTERISTICS OF FIRMS AND WORKERS

The Japanese firms from which the sample of production workers was selected are listed in Table 1. As previously stated, the firms in the sample con-
TABLE 1: Maquiladoras Sample Firms, Number of Employees, and Date of First Operation

<table>
<thead>
<tr>
<th>Company Name</th>
<th>Number of Employees</th>
<th>Product</th>
<th>Date of Establishment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Matsushita</td>
<td>2,100</td>
<td>Televisions</td>
<td>1982</td>
</tr>
<tr>
<td>Sony</td>
<td>3,000</td>
<td>Televisions</td>
<td>1980</td>
</tr>
<tr>
<td>Mutsutech</td>
<td>100</td>
<td>Plastic parts</td>
<td>1989</td>
</tr>
<tr>
<td>Sanyo TV</td>
<td>2,000</td>
<td>Televisions</td>
<td>1982</td>
</tr>
<tr>
<td>Sanmex</td>
<td>270</td>
<td>Electric fans</td>
<td>1982</td>
</tr>
<tr>
<td>SMK</td>
<td>500</td>
<td>Remote controls</td>
<td>1988</td>
</tr>
<tr>
<td>Arcosa</td>
<td>300</td>
<td>Wire harnesses</td>
<td>1986</td>
</tr>
<tr>
<td>KSC</td>
<td>360</td>
<td>Remote controls</td>
<td>1987</td>
</tr>
</tbody>
</table>

Assist of both consumer electronics assemblers and suppliers. In Japan, the use of the Japanese labor-management system is more limited at supplier firms, particularly small supplier firms. The supplier maquiladoras included in the sample are subsidiaries of medium-sized companies and, as such, can be expected to use most features of the stylized Japanese system (Chalmers, 1989). In Japan, the factories of the assembly firms represented in the sample employ the labor-management practices described above.

Assuming that the term refers to the badly lit, dirty, dangerous, and crowded factories that characterize such industries as apparel and shoes, the maquiladoras operated by the consumer electronics firms in the sample could not be termed sweatshops. Rather, the Mexican factories appeared to be modern, well lit, and clean like their Japanese counterparts. However, some interesting differences were identified between the maquiladoras operated by these firms and the factories they operate in Japan. First, the maquiladoras did not produce the newest products developed by their parent firms. Second, the maquiladoras that were television assemblers were found to manufacture some routine components such as printed circuit boards in-house rather than being supplied by external vendors. Third, factories were not unionized, and none of the workers belonged to any union. Finally, maquiladoras did not hire contract workers on a temporary basis.

The sample of 75 production workers contained 48 workers who classified their work position as a direct operator responsible for work tasks such as assembly, welding, or painting (see Table 2). This represented approximately 64.9% of the sample. The sample also contained 26 production (i.e., nonmanagerial) workers who reported their jobs as higher level nonoperator work positions. In descending order of ranking, this included 3 supervisors or assistant supervisors, 2 line chiefs (jefe de linea), 2 technicians, 5 production assistants (assistants to the line chief, warehouse assistants), and 14 quality...
### TABLE 2: Characteristics of Workers in the Sample (n = 75)

<table>
<thead>
<tr>
<th>Variable</th>
<th>n</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Work position (n = 74)</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Operator</td>
<td>48</td>
<td>64.9</td>
</tr>
<tr>
<td>Nonoperator</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Supervisor</td>
<td>3</td>
<td>4.0</td>
</tr>
<tr>
<td>Quality inspector</td>
<td>13</td>
<td>17.6</td>
</tr>
<tr>
<td>Chief of the line</td>
<td>3</td>
<td>4.0</td>
</tr>
<tr>
<td>Production assistant</td>
<td>5</td>
<td>6.8</td>
</tr>
<tr>
<td>Technician</td>
<td>2</td>
<td>2.7</td>
</tr>
<tr>
<td><strong>Gender (n = 75)</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Males</td>
<td>33</td>
<td>44.0</td>
</tr>
<tr>
<td>Females</td>
<td>42</td>
<td>56.0</td>
</tr>
<tr>
<td><strong>Education (n = 74)</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1-6 years</td>
<td>18</td>
<td>24.3</td>
</tr>
<tr>
<td>7-12 years</td>
<td>55</td>
<td>74.3</td>
</tr>
<tr>
<td>+12 years</td>
<td>1</td>
<td>1.4</td>
</tr>
<tr>
<td><strong>Age (n = 75)</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>15-20 years</td>
<td>42</td>
<td>56.0</td>
</tr>
<tr>
<td>21-25 years</td>
<td>17</td>
<td>22.7</td>
</tr>
<tr>
<td>26-30 years</td>
<td>9</td>
<td>12.0</td>
</tr>
<tr>
<td>+31 years</td>
<td>7</td>
<td>9.3</td>
</tr>
<tr>
<td><strong>Marital status (n = 75)</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Single</td>
<td>58</td>
<td>77.3</td>
</tr>
<tr>
<td>Married</td>
<td>17</td>
<td>22.7</td>
</tr>
<tr>
<td>Divorced/separated/widowed</td>
<td>0</td>
<td>0.0</td>
</tr>
<tr>
<td><strong>Emigrated to Tijuana from other Mexican states (n = 75)</strong></td>
<td>54</td>
<td>72.0</td>
</tr>
</tbody>
</table>

NOTE: Weekly salary in new pesos for all workers = 213.8.

Of the sample of 75 shopfloor workers, I could not be assigned a work position due to a refusal to answer the question (see Table 2).

Although none of the production workers was hired on temporary contracts, many of the work tasks performed by the operators are similar to the tasks performed by contract workers in Japan. Moreover, the tasks performed by those in higher level nonoperator positions more closely resemble those performed by the regular workers and lower level supervisors in Japanese factories. If a labor-management system is being implemented in the maquiladoras that is modeled after that used in the Japanese factories, then it would be expected that these two groups of workers should exhibit differences in labor practices that correspond to the stylized model of the Japanese system in consumer electronics detailed above. More specifically, workers in nonoperator positions should engage in higher skilled work activities, be paid
higher wages, and receive more extensive training, both on the job and off the job, compared to workers in operator positions.

The gender composition of workers in the sample was 56% females and 44% males. Additionally, production workers in the sample predominantly (a) have between 7 to 12 years of formal education, (b) are less than 25 years old (56% were between 15 and 20 years), (c) are single, and (d) have immigrated to Tijuana from other states in Mexico. The average weekly wage for the entire sample was approximately $213 per week in new pesos (NP) (US$60). Also, none of the workers belonged to any union.

Substantial differences were found in the gender composition of the operator and nonoperator groups in the sample. Following the system of gender stratification in Japanese factories, the operator group consisted of 67% females and 33% males, whereas the nonoperator group comprised 61.5% males and 38.5% females. Also, wages were found to differ substantially on the basis of gender. Production workers in the operator group averaged NP$186.9 per week (US$53.40), whereas the nonoperator group averaged NP$264.5 (US$75.57) per week. This difference became more distinct when further divided by gender. Female operators were found to average NP$180.2 per week (US$51.49) compared to NP$200.3 per week (US$57.23) for male operators. Females in nonoperator work positions were found to average NP$216.6 per week (US$61.89) compared to NP$294.5 per week (US$84.14) for males in the nonoperator group.

Nonwage benefits were not differentiated on the basis of work position or gender with several exceptions. The majority of workers in the sample among both operators and nonoperators received paid vacations, medical insurance, on-site dispensary medical treatment, punctuality bonuses for arriving at work on time, and company-sponsored parties for Christmas and other holidays. Although not received by the majority of workers in the sample, a substantially greater percentage of workers in the operator group received subsidized cafeteria meals and food coupons and participated in a company-sponsored savings plan compared to workers in the nonoperator group.

FINDINGS

HIRING

In contrast to Japanese consumer electronics factories, the maquiladoras in the sample were found to continuously hire new production workers rather than hire workers once annually. This was the result of high labor turnover. A
1993 study found that maquiladoras in Tijuana experience turnover rates of between 5% and 15% per month (Kenney & Florida, 1993). Assuming this rate, companies such as Sony or Matsushita with 2,000 employees would be hiring 100-300 persons per month—a significant task. Hiring was found to be an ongoing activity for the firms in the sample, which contrasts sharply with the Japanese factories in which all hiring is undertaken once annually.

Additionally, unlike the Japanese factories, the consumer electronics maquiladoras did not extensively use screening and testing in hiring production workers. With the varied educational backgrounds of Mexican workers, it might be assumed that rigorous screening would be used in the hiring process. However, only 50% of the workers in the sample took a written examination prior to their employment and even fewer (36%) had oral interviews. The only examination that the majority of workers (72%) were required to take was a medical examination. Apparently, the existing capabilities of the operators was of limited interest in the hiring process. However, with turnover rates of 5% to 15% per month, it might be more efficient to allow new employees’ performances to undergo the winnowing function that an exam normally performs.

The policy regarding written examinations seemed to vary, even at the same company. For example, at Arcosa (the Onamba and Sumitomo Electric wire harness supplier joint venture), one respondent applying for an assembly job said she received a written examination asking her to do “some addition and logical thinking problems.” Another Arcosa assembler said she just had to complete an application. For the assembler position, it may not be worthwhile to use written and/or oral interviews in all cases. Even the larger companies had a similarly sporadic testing policy. This differs significantly from factories in Japan, where all regular workers received written, oral, and medical examinations.

**TRAINING**

Unlike workers in the Japanese consumer electronics factories, a substantial component of production workers in the maquiladoras did not receive any initial training. Approximately 68.6% of the production workers in the sample received some form of initial training, whereas 31.4% did not. When asked about her training experience, one worker said,

When I entered I also asked the [other] girls if they received any training, because they had never done this kind of work. But, they said no, they had only received a paper, which they also gave me. It had all the component names, the polarity and everything.
Whether a production worker received initial training, or whether a production worker was hired for a nonoperator work position versus an operator position, did not vary substantially by gender.

Of the workers in the maquiladoras who did receive initial training, the length of the training received was comparable to that in Japanese factories. On average, workers hired as operators received approximately 4.3 days of training compared to 7 days for those hired for nonoperator positions. The most predominant form of initial training for workers in the sample was related to the tasks and skills specific to their work positions. Approximately 65.7% of the workers in the sample reported receiving initial training of this type. In comparison, 41.4% of the workers received some initial training in safety procedures, 37.1% received initial training in quality control, and less than 15% received initial training in teamwork techniques and statistical process control. Most typically, initial training was administered by the workers’ immediate supervisor or fellow workers in the same work position.

Like the stratified system of training found in Japanese consumer electronics factories, workers in higher level nonoperator positions in the maquiladoras were found to receive a broader and more extensive scope of on-the-job training through the use of longer term rotation or job transfers. Nonoperators were found to have changed their work position an average of 1.7 times since being employed by their current firm compared to an average of 0.5 times for workers in the operator group. In total, 83.3% of the nonoperators had changed their work position at least one time compared to 30.4% of the operators. Furthermore, 33.3% of the nonoperators had changed their work position two or more times compared to 10.9% of the operators. Thus, nonoperators were transferred more extensively, and thereby experienced broader on-the-job training.

In contrast to Japanese consumer electronics factories, few production workers in the maquiladoras were found to receive off-the-job training. However, corresponding to the Japanese model, workers in higher level nonoperator positions were more likely to receive off-the-job training. Among all production workers in the sample, only 13.5% received any off-the-job training since being employed by their current firm. When broken down by type of work position, 34.6% of the nonoperators received off-the-job training compared to only 2% of the operators.

The allocation of off-the-job training was not stratified on the basis of gender in the maquiladoras, since equal numbers of males and females in both operator and nonoperator work groups were found to have received this type of training. Interestingly, those who received off-the-job training had changed their work position a greater number of times compared to those who did not receive this form of training. Also, a greater proportion of the
workers who received off-the-job training also had received initial training compared to the workers who were not given off-the-job training.\textsuperscript{16}

Of those nonoperators who received off-the-job training, only two received further training outside the plant in which they were working. One of these nonoperators, Mr. A, had a junior high school education and had been working at Matsushita for 10 years. He received training both in-house and twice attended quality control courses in Tijuana-area hotels. Mr. A said that his immediate supervisors had been sent to Japan to learn about the “company’s policies and quality control mainly, and about [the worker’s] work and to reinforce their knowledge about machines and robotics. The main reason they send them to Japan is to specialize in robotics.” The duration of these trips was as long as 3 months.

Interestingly, when asked whether these workers who received off-the-job investments in training stayed with Matsushita, Mr. A answered,

Usually, they [these trained workers] wait awhile and then go to work at other companies where they get paid better. . . . Because they are more specialized, they have other opportunities. . . . The company gets mad because they had [invested in the training of] the person, but it’s also the company’s fault. . . . The company, instead of saying “do not go, we are going to pay you same as the new firm will pay” [lets them go].

This suggests that, at least within Matsushita’s Tijuana factory, turnover remains a problem among those who receive significant corporate investment in off-the-job training.\textsuperscript{17}

In sum, the evidence suggests that unlike the Japanese consumer electronics factories, substantially less investment is made in training production workers in the maquiladoras. Moreover, training is allocated on a more selective basis. Corresponding to the Japanese model, workers in nonoperator positions receive broader on-the-job training through job transfers and are more likely to receive off-the-job training, particularly if they received initial training and were transferred more extensively.

**INTERNAL JOB MOBILITY**

In contrast to the Japanese model, a substantial component of the workers in higher level nonoperator positions was found to have been hired into these positions rather than being promoted via an internal job ladder. Still, more of workers in these higher level positions were internally promoted. Of those workers in nonoperator positions, 79.2\% (19/24) began their jobs with their present firm as operators, whereas 20.8\% (5/24) were initially hired in nonoperator positions (see Table 3). This suggests that the sample firms predomi-
nantly tend to fill higher level shopfloor positions by promoting from within rather than recruiting from the outside. As previously reported, the nonopera-
tor group comprised 54.6% males and 45.4% females. Thus, like the system
of gender stratification in the Japanese factories, males were more likely (but
emphatically not exclusively) to receive promotions.

Promotion is one of the most important motivations for workers and forms
the basis of an internal job ladder necessary to retain workers and establish
expertise in the factory. One of the most successful workers interviewed was
a junior high school graduate working for Matsushita. He began as an opera-
tor and moved up to technician assistant and then to technician; he was pro-
moted to junior supervisor and transferred to quality control. This pattern is
almost exactly the same as the one Nakamura et al. (1994) describe in the
Japanese VCR plant. There were other examples. At Videotec (Sony), a 17-
year-old woman was promoted to inspector and given off-the-job training
concerning inspection techniques. A female inspector at SMK (a parts sup-
plier) said vacancies are advertised internally. She said that those who wish to
apply are given a course and then tested; if they pass, they are considered for
the job. These findings suggest that there is a career ladder available to the
maquiladora operators.

The reasons given by nonoperators for their promotions were remarkably
similar. Of the nonoperators, 75% believed promotion was due to good per-
formance in their previous position and 12.5% believed their promotions
were due to seniority. This differs from the findings of Carrillo (1993, pp.
166-167), which indicate that the most important factor affecting a workers’
promotions in the electronics industry is their level of work discipline, fol-
lowed by seniority, knowledge of operations, and attendance. There are two
possible explanations for this: The Japanese electronics firms have different
criteria or the workers’ misunderstand the reasons for their promotions. The
findings of Carrillo (1993) also differ from those of Kenney and Florida
(1994), who report that Japanese managers in the maquiladoras stated that
seniority was not important for deciding promotions. Of course, in one sense,
seniority is a precondition for promotion because of the use of the internal job market for recruitment to higher level positions (i.e., if you do not stay you cannot be promoted).

The supervisors were responsible for deciding the lower level promotions (e.g., operator to quality inspector). This is interesting because these supervisors often are former shopfloor workers who have been promoted. Promotions to line chief or supervisor were made by the managers. In the Japanese factories, the group leader has the most important voice with regard to the promotion of subordinates, but the final decision rests with the factory manager and personnel office.

In sum, the evidence suggests that the maquiladoras both deviate from and conform to the idealized model with respect to the use of internal promotions. The maquiladoras deviate in that a substantial component of workers in higher level nonoperator positions are hired from the outside, although the majority are promoted internally. Also, workers reported that seniority is not used in promotions. The maquiladoras conform to the pattern of gender stratification in that women are less likely to get hired and/or promoted to a nonoperator position. Additionally, promotions are handled in a somewhat similar manner as they are in Japan. We were not able to assess the possibility that workers could be promoted to the managerial ranks. If this were true, the blurred blue collar-white collar role division would be indicated.

THE LABOR PROCESS

Unlike the idealized model, a small component of workers in operator positions in the maquiladoras did not engage strictly in assembly work, although the vast majority of operators did. A small component was found to perform maintenance on tools and machines in addition to assembly work, and a smaller component engaged strictly in the inspection of parts and supplies or assembled components. In total, 89.6% of the operators engaged in assembly work; 28.6% performed maintenance on tools and machines; and 10.4% were responsible for formally inspecting parts, supplies, or assembled components (see Table 4). Corresponding to the idealized model, the performance of maintenance work by operators was stratified on the basis of gender, because male operators were more than twice as likely to perform such work.

Conforming to the Japanese model, the majority of nonoperators engaged in the formal inspection of parts, supplies, or assembled components (i.e., control activities). In total, 65.4% of the nonoperators were engaged in these types of inspection (see Table 4). Also consistent with the idealized model, a much higher percentage of the nonoperators in the maquiladoras engaged in
TABLE 4: Characteristics of Work Activity by Type of Work Position and Gender (in percentages)

<table>
<thead>
<tr>
<th>Variable</th>
<th>Total Operators</th>
<th>Female Operators</th>
<th>Male Operators</th>
<th>Total Non-operators</th>
<th>Female Non-operators</th>
<th>Male Non-operators</th>
</tr>
</thead>
<tbody>
<tr>
<td>Does the worker's current position involve the performance of Assembly work</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>89.6</td>
<td>90.6</td>
<td>87.5</td>
<td>7.7</td>
<td>10.0</td>
<td>6.2</td>
</tr>
<tr>
<td>No</td>
<td>10.4</td>
<td>9.4</td>
<td>12.5</td>
<td>92.3</td>
<td>90.0</td>
<td>93.8</td>
</tr>
<tr>
<td>Formal inspection of parts, supplies, or assembled components</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>10.4</td>
<td>9.4</td>
<td>12.5</td>
<td>65.4</td>
<td>90.0</td>
<td>50.0</td>
</tr>
<tr>
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<td>90.6</td>
<td>87.5</td>
<td>34.6</td>
<td>10.0</td>
<td>50.0</td>
</tr>
<tr>
<td>Testing of parts, supplies, or assembled components</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
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<td>0.0</td>
<td>0.0</td>
<td>26.9</td>
<td>40.0</td>
<td>18.7</td>
</tr>
<tr>
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<td>100.0</td>
<td>100.0</td>
<td>73.1</td>
<td>60.0</td>
<td>81.3</td>
</tr>
<tr>
<td>Supplying materials and inputs to the production line</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
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<td>0.0</td>
<td>30.8</td>
<td>10.0</td>
<td>43.8</td>
</tr>
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<td>100.0</td>
<td>100.0</td>
<td>69.2</td>
<td>90.0</td>
<td>56.2</td>
</tr>
<tr>
<td>Maintenance on tools and machines</td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>28.6</td>
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<td>44.4</td>
<td>45.0</td>
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<td>54.6</td>
</tr>
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<td>No</td>
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<td>80.6</td>
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<td>55.0</td>
<td>66.7</td>
<td>45.4</td>
</tr>
<tr>
<td>Administrative work</td>
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<td></td>
</tr>
<tr>
<td>Yes</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
<td>34.6</td>
<td>20.0</td>
<td>43.8</td>
</tr>
<tr>
<td>No</td>
<td>100.0</td>
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<td>100.0</td>
<td>65.4</td>
<td>80.0</td>
<td>56.2</td>
</tr>
<tr>
<td>Is the worker authorized to reject parts that were not correctly assembled?</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>76.6</td>
<td>75.9</td>
<td>77.8</td>
<td>86.7</td>
<td>100.0</td>
<td>75.0</td>
</tr>
<tr>
<td>No</td>
<td>23.4</td>
<td>24.1</td>
<td>22.2</td>
<td>13.3</td>
<td>0.0</td>
<td>25.0</td>
</tr>
<tr>
<td>Does the worker's duties include checking his or her own work?</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>86.0</td>
<td>84.4</td>
<td>88.9</td>
<td>95.5</td>
<td>90.0</td>
<td>100.0</td>
</tr>
<tr>
<td>No</td>
<td>14.0</td>
<td>15.6</td>
<td>11.1</td>
<td>4.5</td>
<td>10.0</td>
<td>0.0</td>
</tr>
<tr>
<td>Does the worker have his or her work inspected by a higher level employee?</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>100.0</td>
<td>100.0</td>
<td>100.0</td>
<td>100.0</td>
<td>100.0</td>
<td>100.0</td>
</tr>
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<td>No</td>
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<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
</tr>
</tbody>
</table>

Technical work such as testing parts, supplies, and assembled components, or performing maintenance on tools and machines, compared to the operators. Furthermore, a much higher percentage of the nonoperators engaged in control activities such as administrative work and supplying materials and inputs to the production line. Very few nonoperators performed any assembly tasks (see Table 4).

Also conforming to the Japanese model was the pattern of gender stratification observed among the nonoperators in the maquiladoras with regard to the performance of higher level work activities. Female nonoperators were relatively more likely to be engaged in the inspection or testing of parts, sup-
plies, or assembled components, whereas male operators were relatively more likely to be engaged in supplying materials and inputs to the production line, administrative work, or performing maintenance on tools and machines (see Table 4).

Japanese firms are noted for delegating quality control responsibilities to individual line workers. However, they have also developed inspection systems to ensure quality. Quality control processes in the maquiladoras were found to differ from the idealized Japanese model in several respects. First, a substantial percentage of the operators (23.4%) reported that they were not authorized to reject parts that were not correctly assembled, although the majority did have such authorization (see Table 4). Moreover, a small percentage of the nonoperators reported not having this authorization (see Table 4). Second, a small percentage of both operators and nonoperators reported that their duties did not include checking their own work, although the duties of the vast majority of workers in both groups did. This was more likely to be true of operators than nonoperators. Finally, all workers in both groups reported that their work was also inspected by a higher level employee (see Table 4).

As reported earlier, most of the workers in the nonoperator group engaged in the inspection of parts, supplies, or assembled components. This position is often the first promotion from an operator and represents a second line of quality control. In the maquiladoras, the checking and quality control activities of the operators are reinforced with the liberal use of inspectors, as in the work of those in nonoperator positions. In-line inspection is also used in Japanese television factories. But we have no information on the density of inspection and the number of inspectors, although we believe that such inspection is used more extensively than in the Japanese factories.

The data suggest that the operators are not fully entrusted with the responsibility for quality control. However, the operators and nonoperators believed that the quality of the goods they produced was an important factor in their performance evaluations. Approximately 87% of the operators and 76% of the workers in the nonoperator group listed quality in their job performance as the most important criterion affecting their work evaluation; this is compared to other criteria such as speed, level of cooperation, and the provision of suggestions. Similarly, most of the respondents in both groups said that they were asked to provide quality improvement suggestions. Approximately 70% of the operators and 57% of the workers in nonoperator positions stated that they were asked to provide such suggestions. But suggestions were not mandatory as they are in every Japanese television assembly factory. Also, 69.2% of the workers in nonoperator positions and 60.4% of the operators
stated that their immediate supervisor discussed work-related quality control problems directly with them.

Some workers described their experiences as quality control inspectors. A female quality control inspector with 4.5 years at Sanyo described her responsibilities. She said she was responsible for three lines and her responsibilities included checking the entire production process, inspecting the final process, and inspecting all soldering. Upon being hired at Sanyo as a quality control inspector, she received training in statistical quality control. Every year she attends further quality control training and her supervisor has given her training in using and maintaining the equipment she uses. This was clearly an exception in the amount of training, but does not seem atypical of the quality control inspectors in our sample. Another inspector at SMK received off-the-job quality control training and described it as being conducted in a classroom (2 hours a day for 2 days) where instructors explained “theory and practice on a blackboard.”

These findings suggest that Japanese maquiladoras place a strong emphasis on quality and this emphasis is perceived by shopfloor workers. For operators, the emphasis on quality does not appear to be supported by formal training in quality control techniques. Thus, for the majority of shopfloor workers, any quality control techniques the operators know must have been learned on the job. Clearly, in Japan a far higher percentage of the operators would have had training in formal quality control techniques or have learned them through various activities such as quality control circle activities. Here, there seems to be a fundamental division between our operator and nonoperator groups.

WORK GROUPS AND SMALL-GROUP ACTIVITIES

The maquiladoras were also found to differ from the idealized Japanese model in that a substantial percentage of workers reported that they did not work as part of a work group or team, although the majority did. Of the workers, 65.7% reported that they worked as part of a work group whereas 34.3% did not. This was not found to vary substantially on the basis of the type of work position or gender. The majority of those working in groups reported that their groups met regularly to discuss production issues. Moreover, the majority of these groups had a designated leader, and group leaders were either supervisors (in the case of workers) or the chiefs of the line (in the case of operators). The responses regarding work groups suggest that they were used more as a channel for one-way communication to the workers than as a means of eliciting dialogue with workers. This is illustrated in the description of a daily group meeting provided by an operator at the Matsushita facility:
Q: You have a meeting everyday?
R: Yes. In those everyday meetings they tell us if the work is fine, or to hurry a little bit more, or that we need more production or that we are getting behind.
Q: And does he ask you for an opinion, or does he just tell you?
R: No, he sort of demands from us, because we do not make all the production we have to.

This type of response was quite typical of the operator's perspectives on work group meetings.

LABOR STABILITY AND TURNOVER

Like the Japanese consumer electronics factories, the maquiladoras were attempting to build a stable core of production workers via internal promotion, although they encountered constant turnover among both operators and nonoperators. Approximately 77% of the operators and 88% of the nonoperators had previously been employed by another firm. This is a reflection of the high-labor-turnover environment in the maquiladoras.

There were major differences between operators and nonoperators with regard to the average employment tenure at their present firm. The average employment tenure for operators was approximately 10 months, whereas the average employment tenure for nonoperators was 34 months. Thus, nonoperators (most of whom had been promoted via internal job ladders) tended to have relatively stable tenures at their current jobs compared to their jobs with their previous employer.

Given the longer job tenure, higher wages, greater training, and increased responsibility, it is expected that nonoperators will exhibit a higher level of work satisfaction than the operators. This pattern was observed: 65.4% of the nonoperators rated their job as "interesting and pleasant" compared to 35.4% of the operators. Level of work satisfaction also was stratified on the basis of gender. Among the operators, 56.3% of the male operators rated their job as interesting and pleasant compared to only 25% of the female operators. Moreover, among the nonoperators, 70% of the females rated their jobs as interesting and pleasant compared to 62.5% of the males. Thus, most of the females in nonoperator positions tended to evaluate their job positively or neutral.

Another indicator of work satisfaction is the desire of workers to continue working in the factory. This directly addresses the turnover issue that is central to the ability to build a knowledgeable labor force. Respondents were asked to specify how much longer they would likely work at the factory. Approximately 25% (n = 23) of the sample stated that they did not know how
long they would continue working at the factory. Thus, there was no clear expected length of tenure for these workers. Of these respondents, 12 rated their jobs as interesting and agreeable, which indicates that they might be relatively stable. Another 10 rated their jobs as fine, but not interesting. Of these 10, 2 said they would stay “as long as they could stand it” and 2 said they would stay “until they fire me.” One worker stated that the job was “easy, but sometimes boring.” These responses suggest that these workers might be unstable.

For workers who did provide a valid response to their expected length of tenure, important differences were observed in the expected tenure of workers on the basis of type of work position and gender. Operators expected to stay in their jobs an average of 6.4 additional months compared to an average of 11.1 additional months for workers in nonoperator positions. However, female operators expected to stay in their jobs an average of 5.3 additional months versus 8.8 additional months for male operators, 8.4 additional months for female nonoperators, and 12.5 additional months for male nonoperators. These findings suggest that the female operators are the most fluid component of the shopfloor workforce in the Japanese maquiladoras and are most likely to resign from their jobs. However, the average expected tenure for male operators, female nonoperators, and male nonoperators was not long either. These data must be treated with some caution because of the large number of workers who liked their jobs but gave no estimate of how long they would stay.

These findings suggest that there is likely to be immanent turnover among the workers, particularly the female operators. There were important exceptions. Mr. A at Matsushita was a junior supervisor with 10 years’ experience and intended to stay with the firm until retirement. Few other workers expressed an interest in staying so long with a single firm. However, some other senior workers also had either long-term plans or no clear intention to leave. Generally, the operators, especially the women, had a short tenure and were intending to leave soon. In Japan, the tenures of the vast majority of both regular workers and contract workers tend to be stable for long periods of time.

DISCUSSION

The findings from this research suggest that a hybrid labor-management system is being employed in the Japanese consumer electronics maquiladoras that is similar to but yet differs from the labor-management system of consumer electronics factories in Japan. The maquiladoras are different from the
home plants in that they tend not to produce new products and produce some routine components in-house that often would be contracted out in Japan. This means that much of the work that would be done by contract workers in Japan is done by regular workers in Mexico. Furthermore, the maquiladoras do not employ any contract workers on a temporary basis. At the same time, however, the labor-management system employed among production workers in the maquiladoras exhibits similarities to that used in Japanese factories.

First, a similar pattern of stratifying shopfloor work positions on the basis of gender was observed in the Japanese maquiladoras. Workers who performed assembly and production tasks similar to those of the contract workers in Japanese factories (i.e., the operators) were predominantly female, and workers who performed higher level production tasks similar to the regular workers in the Japanese factory (i.e., the nonoperators) were predominantly male. This pattern of shopfloor stratification appears to be less distinct in the maquiladoras in that males were also operators. Second, although wages are substantially lower and nonwage benefits less extensive, the pattern of wage stratification on the basis of gender in the Japanese maquiladoras was similar to that in Japanese consumer electronics factories. Males in nonoperator positions were paid substantially higher wages and had more seniority than females in nonoperator positions.

Additionally, similar patterns of stratification were observed in the Japanese maquiladoras in terms of work activities, training, and promotion. Like the regular workers in the Japanese factory, workers in higher level nonoperator positions typically did not engage in assembly work and were much more likely to perform higher level control and technical tasks (i.e., inspection, administrative tasks, machine maintenance and testing of parts, supplies and assembled components) compared to workers in operator positions. Furthermore, specific types of control and technical work tasks in the nonoperator group did tend to be stratified by gender in that male nonoperators were more likely to be involved in administrative work, machine maintenance, and the supply of materials and inputs to the production line. There was also evidence of an internal job ladder as the majority of workers in higher level nonoperator positions were recruited internally and experienced transfer through a variety of work positions. There were also cases of off-the-job training for workers in higher level nonoperator positions. Finally, the majority of workers at all levels work as part of a team, and a strong emphasis is placed on quality control as part of the labor process.

The evidence from this study suggests that the hybrid labor-management system of Japanese maquiladoras exhibits a number of additional characteristics that make it different from the hybrid labor-management system of Japanese consumer electronics factories. First, the maquiladoras do not use
the extensive screening and testing in hiring that is used in Japan. Second, the initial training provided to workers is much less extensive, and a significant proportion of production workers do not receive any formal, initial training for their jobs. Furthermore, with the exception of the nonoperator group, little off-the-job training is given to production workers. This differs dramatically from the situation of regular workers in Japan, but conforms quite closely to the situation of contract workers.

As previously mentioned, the findings suggest that gender stratification in the maquiladoras is somewhat less distinct than in Japan. This difference can be summarized along the following dimensions. First, many males are hired as operators to directly perform assembly tasks in the maquiladoras, whereas these tasks are performed by female workers in factories in Japan. Second, among the workers in nonoperator positions, the allocation of off-the-job training was not highly stratified on the basis of gender.

Differences were also found in the Japanese maquiladoras in relation to the quality control process. Like Japanese consumer electronics factories, a strong emphasis was placed on quality control in the maquiladoras as part of the labor process. However, a sizable number of operators and some nonoperators were not authorized to reject parts that were not assembled correctly, some workers were not mandated to check their own work, and all workers in both operator and nonoperator groups reported that their work was inspected by higher level employees. This suggests that production workers in the maquiladoras are not highly entrusted with the responsibility of quality control. Additionally, the majority of production workers received no formal training in quality control. One possible explanation for this is that the routinization of production is so advanced that the necessary quality control techniques can be learned on the job or are embedded in the design of the production process. Another difference was that a sizable component of workers in the maquiladoras did not work in teams. One possible explanation for this is that certain parts of the labor process may be routinized to the point that teams are not necessary, or that some parts are organized more in the American style (where workers report to a foreman).

The findings suggest that, at best, the Japanese consumer electronics maquiladoras are only in the process of implementing the labor-management system used in Japanese factories. Central to this process seems to be the establishment of a stable core of production workers who are selectively identified and developed. The vast majority of higher level production workers began as operators. Some workers received formal, initial training concerning the specific tasks involved in their jobs, although it is difficult to be sure whether this was critical for their future employment trajectories. A subset of workers receives extensive training in such areas as plant safety, quality
control, teamwork, and statistical control processes. Among these operators, a select group is promoted to higher level positions and receives more extensive on-the-job training. Among this core group, a select few are provided with additional off-the-job training. This core group of production workers is paid higher wages and is engaged in higher level, supervisory, and maintenance tasks including the provision of initial training to new operators. The findings suggest that some workers may begin engaging in tasks of these types while still at the operator level.

Through this process, the Japanese maquiladoras seem to be trying to establish a stable, core group of production workers with longer employment tenure at the factory. As a result, the firm-specific knowledge and skills acquired by these workers can be retained (at least for longer periods of time). And yet, as one interviewee suggested, these trained employees also are often lost after receiving significant training. This is reasonable because at the moment, there is a shortage of higher level production workers and supervisors. This is in contrast to the bottom of the shopfloor hierarchy that consists of the lowest paid workers (likely to be females), who receive no formal initial training and engage in routine assembly tasks. This component of the shopfloor workforce is the most fluid and experiences the highest turnover rates. The findings concerning job satisfaction can be viewed as being supportive of this conclusion in that female operators tended to have the shortest expected job tenure and very few female operators viewed their jobs as interesting and pleasant.

In conclusion, the findings of this study indicate that the labor-management system of Japanese consumer electronics factories has been only partially transferred the maquiladoras examined in this study at the time of data collection. It remains to be seen whether the hybrid labor-management system employed by these maquiladoras will be transformed over time to correspond more closely to the system used in the Japanese factories. It would seem that the perpetuation of the high-labor-turnover problem and the role of the maquiladoras in producing mature, routinized products and components would work against this occurrence. More extensive investments in transferring the Japanese system would appear to be risky under conditions in which a stable workforce cannot be maintained. Moreover, a more extensive transfer of the Japanese system may not be necessary in the production of routinized products.

However, the findings suggest that even in the manufacture of routinized products, certain elements have been transferred. This is understandable, since even routine production requires equipment that must be maintained, line-based decisions on product quality, and operator supervision. These tasks require higher level skills that can only be learned through practice. A
more extensive transfer of the Japanese system to a larger number of workers may be based on decisions by Japanese firms to transfer higher order activities (e.g., product design and development, systems engineering) to the maquiladoras that are currently undertaken in Japan. This would require the development of the capacity to introduce and stabilize production of these new products in Mexico. This would be facilitated by the development of a stable working class in the maquiladora region that is habituated to factory work. The evidence uncovered in this study suggests that at the present time, the consumer electronics maquiladoras do not primarily represent "learning" factories as described by Fruin (1992). Rather, they may be more appropriately viewed as "reproduction" factories, in which most workers have simple standardized tasks to fulfill in assembling routinized products.

NOTES

1. The term maquiladora refers to factories established under a special Mexican government program. These factories are licensed to import parts and components for assembly on the proviso that the finished goods be exported. In other words, the factories are treated as free trade zones. For further discussion, see Sklair (1989).

2. In 1995, there were approximately 3,000 maquiladoras employing nearly 600,000 Mexicans (Alonso, Carrillo, & Contreras, 1996). It is difficult to be absolutely sure how many Japanese maquiladoras are operating in Mexico, but Szekely (1991) estimates the number of maquiladoras to be 70. There are clearly more factories currently in operation, although no definitive roster exists.

3. For a discussion of Japanese hybrids overseas, see Abo (1994a).

4. To supplement our limited access to Japanese-language materials, we asked a Japanese-speaking graduate student, Shoko Tanaka, to search the literature, but few useful references were found. Inquiries about Japanese-language references were made of Professor Michio Nitta, labor relations expert at the Institute of Social Science, University of Tokyo; Atsushi Hiramoto, a professor of economics and expert on the Japanese television industry; and Professor Shuichi Hashimoto, a labor relations expert at Kokugakuin University—who provided us with some of the most important references. Curiously, most of the Japanese literature on television assembly studies transplants in great detail, but provides little discussion of the factories in Japan.

5. The Nakamura, Demes, and Nagano (1994) study and the interviews conducted by Kenney (1995, 1996a, 1996b) concentrate on the same Japanese consumer electronics firm. The authors recognize that each Japanese firm is different, so generalizations should be drawn carefully. However, there are also many similarities between companies.

6. At the firm studied by Kenney (1995, 1996a, 1996b), these contract workers are represented by the company union.

7. According to an informant, there were previously three strata of workers: male permanent employees, female permanent employees, and female contract workers. Because of the recession and restructuring of the company's global television production, now only 25 of the 450 female workers are contract workers. This pattern has been repeated at nearly every firm's television assembly facility in Japan.
8. Until recently, these tasks were normally reserved for industrial engineers and managers in the typical U.S. firm.

9. Just-in-time refers to the industrial practice of having components arrive at the point of production when needed. This technique eliminates buffers, shrinks inventories, and assists in locating problems that would affect quality.


11. Interviewers were instructed to secure participation from 15 workers at each of the eight Japanese maquiladoras. The initial goal was to complete interviews with 10 of the workers at each factory for a total of 80 interviews. However, due to inability to find the domiciles of subjects because of lack of street signs, faulty addresses, or a lack of time before nightfall, only 75 interviews could be completed.

12. This is significant because in Japan, printed circuit board production, though highly automated, still requires some laborious hand insertion, a task often relegated to lower paid suppliers.

13. Supervisors are included as nonoperators because in Japan and in Mexico they are not considered managers. In Japanese television factories, the managerial ranks begin at the kacho (section manager). When employees are promoted to kacho, they then leave the union and are considered managers. Therefore, although a supervisor is no longer a direct worker, he or she is not a manager.

14. In dollar terms, wages in Tijuana increased at a rate of approximately 10% per annum from 1990 to 1994 (Alonso et al., 1996). Ten percent per annum is a relatively high rate of increase, particularly when compared to wage increases in most advanced industrial nations. In interviews conducted with Japanese managers in Mexican maquiladoras, Kenney and Florida (1992) found that they were trying to hold down wages, but recognized and accepted wage increases of 10% per annum in dollar terms. Of course, with the Mexican devaluation in 1994, these gains were eliminated as wages decreased nearly 40% in real terms.

15. All conversions are made at the prevailing November 1993 exchange rate of NP$3.5 = US$1.

16. In total, 80% of the workers who received off-the-job training also received initial training compared to 69.2% of the workers who did not receive off-the-job training. Furthermore, workers who received off-the-job training had changed their work position an average of 2.6 times since they were employed with their current firm compared to an average of 0.6 times for workers who did not receive off-the-job training.

17. Labor turnover rates are lower for the nonoperators than for the operators. This is not surprising, since generally the highest turnover for maquiladora workers occurs in the first month after hire.

18. Our interviews were conducted in October and November. This is immediately before the December Christmas holidays, when large numbers of workers return to their homes in Central Mexico. Many return, but others do not. Thus, the length of service may be underestimated because many workers already plan to leave in December. If the interviews had been conducted in January, many workers might have responded that they intended to stay until December. For example, of the 10 respondents (all operators) at the Sony plant, 5 said they would be leaving in December. Often, if and when, these workers return to Tijuana they find another employer. To help mitigate these losses, Sony now dispatches buses to various cities in Southern Mexico to collect its workers and return them to Tijuana.

19. This was found to vary according to the firm involved. For example, Arcosa provides initial training to the majority of its workers, whereas Matsushita seems to be less uniform in its initial training regimen.
20. A number of Korean firms have recently established large production facilities in Tijuana and are actively hiring trained personnel. This provides an excellent environment for job hopping.

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